



Contextual and individual factors facilitating and legitimizing harm toward laboratory animals: a social psychological perspective

Kevin Vezirian

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THÈSE

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Étude des facteurs contextuels et individuels facilitant et légitimant les préjugés envers les animaux de laboratoire : une perspective psychologie sociale

Contextual and individual factors facilitating and legitimizing harm toward laboratory animals: a social psychological perspective

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*“Ask the experimenters why they experiment on animals, and the answer is: ‘Because the animals are like us.’ Ask the experimenters why it is morally okay to experiment on animals, and the answer is: ‘Because the animals are not like us.’
Animal experimentation rests on a logical contradiction.”*

– Charles Magel

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Résumé

En règle générale nous sommes préoccupés par le bien-être animal et nous considérons la souffrance animale comme étant moralement injustifiée. Cependant, dans certaines circonstances, l'exploitation et la souffrance animale nous apparaissent comme étant nécessaires afin de satisfaire certains buts, et cela pourrait représenter un réel dilemme moral. C'est notamment le cas de l'expérimentation animale médicale et pharmaceutique, qui implique l'utilisation d'animaux pour évaluer la toxicité et garantir la sécurité des médicaments destinés à la consommation humaine. L'expérimentation animale oppose parfaitement les considérations que nous avons pour un endogroupe (i.e., les humains) à celles que nous avons pour un exogroupe (i.e., les animaux), et alors que les différences d'opinions quant à cette pratique ne sont encore pas réellement comprises, il se pourrait qu'elles ne soient que le reflet de tendances attitudinales et comportementales en matière de relations intergroupes. En outre, les avantages en matière de santé que présente cette pratique se font au détriment d'animaux qu'en temps normal nous désirons protéger de la souffrance, et des stratégies devraient exister pour rationaliser et faciliter la conduite des expérimentations. L'objectif de cette thèse est d'examiner quels sont les déterminants individuels et contextuels des attitudes et des comportements envers l'expérimentation animale et les animaux de laboratoire. Nous émettons l'hypothèse que des dispositions individuelles (i.e., la personnalité) prédictives des relations interpersonnelles et intergroupes informent et orientent les attitudes et les comportements envers l'expérimentation animale et les animaux de laboratoire. Nous faisons aussi l'hypothèse et que des mécanismes facilitant la conduite de comportements problématiques envers autrui puissent également apparaître dans le contexte de l'expérimentation animale et légitimer l'utilisation d'animaux de laboratoire. Treize études mobilisant un éventail large et diversifié de méthodes de collecte de données ont été réalisées et sont exposées à travers six manuscrits. Les résultats confirment que des dispositions et caractéristiques individuelles, telles que le genre, l'orientation à la dominance sociale, ou les dispositions spécistes et empathiques, prédisent d'une part les attitudes envers l'expérimentation animale et les animaux de laboratoire, mais aussi l'engagement comportemental à les utiliser dans le cadre d'une recherche

pharmaceutique leur causant de la souffrance. Par ailleurs, ces résultats mettent aussi en évidence l'utilisation d'une stratégie motivationnelle de désengagement moral telle que le dénigrement des capacités d'esprit des animaux de laboratoire pour palier et rationaliser le paradoxe que représente l'utilisation d'animaux à des fins de recherche. Enfin, dans la lignée des travaux de Milgram, nos résultats démontrent également que des attitudes pro-scientifiques comme trait individuel ou induites via une manipulation expérimentale, conduisent à un plus grand soutien de l'expérimentation animale, à la fois dans des mesures auto-rapportées et comportementales. Cette thèse défend que les attitudes à l'égard de l'expérimentation animale et des animaux de laboratoire manifestent la façon dont les gens perçoivent le monde social dans lequel ils vivent et la façon dont ils perçoivent autrui. L'étude de l'expérimentation animale semble ainsi heuristique pour l'analyse des relations entre humains-animaux et les dynamiques intergroupes qui les traversent.

Mots clés : relations humains-animaux ; désengagement moral ; soumission à l'autorité ; orientation à la dominance sociale ; empathie ; spécisme

Abstract

As a general rule, we care about animal welfare, and we consider animal suffering to be morally unjustified. However, in certain circumstances animal exploitation and suffering appear to us as necessary to meet certain goals, and this could represent a real moral dilemma. This is particularly the case for medical and pharmaceutical animal experimentation, which involves the use of animals to assess the toxicity and ensure the safety of drugs intended for human consumption. Animal experimentation perfectly contrasts the considerations we have for an in-group (i.e., humans) to the ones we have for an out-group (i.e., animals) and although the inter-individual differences in opinion about this practice are not yet truly understood, they may simply reflect broader attitudinal and behavioral tendencies in intergroup relations. In addition, the health benefits of this practice come at the expense of animals that we would normally be motivated to protect from suffering, and therefore strategies should exist to streamline and facilitate the conduct of experiments. The aim of this work is to examine what are the individual and contextual determinants of attitudes and behaviors toward animal experimentation and laboratory animals. We hypothesize that individual dispositions (i.e., personality) effectively predicting interpersonal and intergroup relations may also guide attitudes and behaviors toward animal experimentation and laboratory animals. We also hypothesize that mechanisms that facilitate the conduct of harmful behaviors toward others may also appear in the context of animal experimentation and legitimize the use of laboratory animals. Thirteen studies using a wide and diverse range of data collection methods have been conducted and are displayed within six manuscripts. Results confirm that individuals' characteristics and dispositions, such as gender, social dominance orientation, speciesist and empathic dispositions, predict not only the attitudes toward animal experimentation and laboratory-animals, but also the behavioral commitment to use them in the context of a harmful pharmaceutical research. Furthermore, our results also highlight the use of a motivated moral disengagement strategy such the denial of mind of laboratory animals to cope and rationalize with the paradox that represent the use of animals for research inquiries. Finally, in line with Milgram's work, our results also demonstrate that scientific mindset, whether as a trait or experimentally induced, leads to a greater support for animal-experimentation in both in self-reported and behavioral measures. This thesis argues that the attitudes

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toward animal experimentation and laboratory animals merely reflect the way people perceive the social world in which they live and the way they perceive others. The study of animal experimentation thus seems heuristic for the analysis of human-animal relations and the intergroup dynamics that run through them.

Keywords: human-animal relations; moral disengagement; obedience to authority; social dominance orientation; empathy; speciesism

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Introduction

The noun “*Animal*” comes from the Latin *anima* which means having breath, having soul, and has been used since the fourteenth century to describe any sentient living creature. *Humans* are animals, but since in this dissertation we especially focus on the frontier between *them* and *us* and the special relation we maintain with them, from now on when we refer to *animals*, we refer to non-human animals.

For millennia, we have maintained relationships with animals; they were painted in our caves, hunted, domesticated as pets or means of transport, glorified, or even bred for agricultural works or livestock. Nowadays, our relationships with animals are evolving incredibly fast and we start to ask ourselves questions that haven’t occurred to us for decades. For instance, since 2015 in France pets are considered as sentient beings and therefore owners expose themselves to sanctions in case of abuse (LOI n°2015-177 - art.2), we see the rise of animal-advocate political parties (Morini, 2018) and of meat-less diets (i.e., Leitzmann, 2014), and we even start to wonder whether some species should not be granted special legal rights (Glendinning, 2008; Grimm, 2014; Rosenblatt, 2017). Jointly, most polls indicate that the population is increasingly opposed to all forms of animal-exploitation and animal suffering (Broad, 2018; Johansson-Stenman, 2018; Pratviel, 2017, 2018, 2020) and is more and more concerned about animal welfare (Riffkin, 2015; Weathers et al., 2020). We are witnessing a switch in our relationships with animals, due to a general infatuation for animal welfare.

Yet, despite this increasing concern for animals, we (in)directly rely on them for our own benefits in a wide range of domain, and this is particularly the case for animal experimentation. Animal experimentation is age-old and the earliest reference to this practice dates back to early Greek philosophers, Aristotle (384-322 BC) being one of the first to have dissected animals and reported his observations (Loew & Cohen, 2002). This practice has continued over the centuries, timidly, until being popularized by French physician Claude Bernard (1813-1878), considered as the father of the modern vivisection. Interestingly, with the popularization of animal experimentation, at the end of the nineteenth century we also see the rise of the first anti-vivisectionist movements, particularly in France and in England (e.g., Hamilton, 2004), and of the first legislation to better regulate this practice (which managed to slow down its growth). However, the outburst of relying on animal-models happened

after the Nuremberg Trials. To prevent as much as possible the use of humans in experiments and to condemn the horrific experiments committed on people under the Third Reich¹, it was decided within the Nuremberg Code to facilitate animal-experimentation and even make it mandatory in certain cases (Greek et al., 2012). Modern animal-experimentation consists of relying on animal models to conduct experiments, most of the time for scientific purposes. We find this practice in many fields such as biology, medicine, toxicology, or agronomy (Monamy, 2017). In fact, regardless of the discipline, in most cases the goal of animal experimentation remains to test and develop on animals, things that cannot be done directly on humans². Anecdotally, while most countries start to forbid animal testing for cosmetics (Dharmagadda et al., 2020; J. Knight et al., 2021), independently testing the chemicals composing these products is entirely possible and very widespread (J. Knight et al., 2021).

Nowadays, approximately 125 million animals die each year in laboratories worldwide (A. Knight, 2011; K. Taylor et al., 2008), the vast majority of animals used are small rodents (i.e., mice, rats), fish (i.e., zebra), birds (i.e., quail), but also dogs, cats, cattle, and primates, to a lesser extent (European Commission, 2021; Home Office, 2019, 2020, 2021). Tests conducted on laboratory-animals vary from being minimally invasive (i.e., product application on the skin) causing superficial harm such as irritations or burns, to much more invasive tests (i.e., exposition to infectious disease, toxic inhalation) causing higher degree of harm such as internal bleeding, paralysis, or death (Monamy, 2017; Orlans, 1993). Conversely with our increasing concerns over animals, animal experimentation is seen as less and less acceptable by the population that rejects this practice (Clemence & Leaman, 2016; Crettaz von Roten, 2008, 2013), and is concerned about the plight of laboratory animals (Crettaz von Roten, 2013; Gallup & Beckstead, 1988). At the same time, both professionals and the general population see this practice as being a necessity because important human health benefits are at stake (Cressey, 2011; Garattini, 1990; Garattini &

¹ It is interesting to note that under the Third Reich, Hermann Goering passed strict animal protection laws particularly to regulate animal experimentation, to introduce pain management or mercy killing of the animals (A. Arluke & Sax, 1992; Cockburn, 1996), although evidently this goodness did not apply to people that they considered at the time as animals or pest.

² It is true that sometimes animal experimentation can take place for the goods of animals (i.e., finding a cure for a disease affecting animals), or that the human benefits may be indirect (e.g., study the digestion of cows with portholes), but in this dissertation, we will focus on animal experimentation related to human health specifically, and particularly within the context of pharmaceutical and medical research.

Grignaschi, 2016; Garattini & van Bekkum, 1990; Joffe et al., 2016; Piazza et al., 2020). In fact, many factors influence people's attitudes toward this practice and its perceived legitimacy, as a strong inter-individual variability exists. (i.e., survey tools, population Hagelin et al., 2003).

Animal testing is very common in our daily lives, as it is a mandatory practice in the development of all pharmaceutical drugs (Greek et al., 2012; Wax, 1995) and half of the experiments are conducted to satisfy the legislative requirements (European Commission, 2021). Jointly, animal suffering appears justified to us if it can improve human health (Braithwaite & Braithwaite, 1992; European Parliament and the Council of the European Union, 2010; Lund et al., 2014), while in normal circumstances it repulses us (e.g., Weathers et al., 2020). Animal experimentation thus balances on the one hand our health ambition and on the other hand our very positive attitude towards animals, and a strong ambivalence exists between the disapproval of this practice and its perceived importance (Tamir & Ramo, 1980). Highlighting these paradoxical attitudes, a large survey indicates that while the public and the medical students somehow agree with the arguments based on the health benefits associated with animal-based research, they find this practice immoral and disagree with arguments demeaning animals and supporting the idea that humans are superiors (Joffe et al., 2016). Anecdotally but going in the same direction, when people of Switzerland have the possibility to vote to ban animal-experimentation through referendums, these initiatives systematically fail (Crettaz von Roten, 2008; Romy, 2022). At this point, we must ask ourselves how do we legitimize relying on animal-models for our own sake while evidently it disturbs us, how do we rationalize this paradox, and is it really a paradox for everyone?

Since psychological sciences took an interest in studying Human-Animal relations (e.g., Amiot & Bastian, 2015), social psychology has proven to be very relevant in understanding this interaction (see Dhont et al., 2019). Precisely but non exhaustively, theoretical scopes such as social identity theory (e.g., Amiot & Bastian, 2017), cognitive dissonance (e.g., Bastian, Loughnan, et al., 2012), or generalized prejudice (e.g., Dhont et al., 2016) have brought very insightful contributions to better understand human-animal relations. With major theoretical frameworks of intergroup relations applying equally well to the understanding of human interactions as to human-animal relations, the literature agrees that *animals* are now a new social group of interest for the study of intergroup dynamics (e.g., Dhont et al., 2019) and

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for social psychology in general (Adams, 2018). In fact, the literature is unequivocal in regards to the social status of animals, and because we intensely rely on them at their expense for our own benefits, beyond being a full-fledged social group, *animals* might particularly represent the “quintessential low-status group” (Dhont et al., 2020, p. 31). From this perspective, animal experimentation no longer appears as solely a scientific exercise of testing and developing drugs, but also as the reflection of a much broader system where a higher status group (i.e., the humans) reaps benefits and exploits a lower status group (i.e., the animals) at their expense, and social psychology could shed light on understanding issues related to animal experimentation. At this point, it must be particularly examined whether general psychological trends to discriminate, harm or rationalize oppression toward others also dictate our attitudes and behaviors toward animal-experimentation and laboratory-animals.

The present work

The aim of this work is to examine animal experimentation as a new social object of interest for our understanding of Human-Animal relations, but more broadly as reflecting tendencies to behave toward others in the context of intergroup relations. Through a social psychology lens, we will scrutinize whether major frameworks used to interpret our interactions with our fellow humans also predict how one behaves toward the paradox that animal-experimentation represents.

In the same way the psychological understanding of another animal-exploitation situation (i.e., meat-eating) requires a tripartite overview (i.e., the eater, the eaten, and the eating, Loughnan et al., 2014), we believe that the same perspective is needed for a better understanding of what animal-experimentation is and what surrounds it (i.e., the experimenter, the experimented, and the experimentation). Therefore, within this dissertation we will review 1) the individuals' characteristics that might predict pro-animal experimentation attitudes and behaviors, 2) (lab)animals' characteristics that underpin how we perceive and behave toward them, 3) and contextual effects that affect our perception of animal-experimentation and laboratory-animals.

Debate whether person or situation approach is better to predict intergroup relations is as old as social psychology (e.g., Allport, 1954; Epstein & O'Brien, 1985; Fleeson & Nofle, 2008), but nowadays, we are seeing a resurgence of contemporary discussions claiming that these two perspectives are complementary, and particularly that social psychology needs to better integrate individual differences into its research questions (e.g., Hodson & Dhont, 2015). Therefore, within this research program both these perspectives will be considered, sometimes independently with works exclusively framed around personality or exclusively framed around experimental effect, but sometimes also together in interactive designs, which can be very relevant in understanding intergroup relations (see Choma & Hodson, 2008).

In the **first part** of this dissertation, we will present the major theoretical frames that will underpin the foundations of our research program and present directions to examine whether attitudes and behaviors toward animal experimentation could reflect broader intergroup processes. In the first axis, we will focus on individual dispositions affecting our relations with others, animals included, and will consider whether they can also predict our perception of animal

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experimentation and laboratory animals. In this axis, we will mainly focus on the importance of ideological attitudes such as social dominance orientation and speciesism. We will then review the role of empathic dispositions and of gender differences on human-animal relations, and finally look at how the self-regulation abilities might also predict harmful commitment toward animals. In the second axis, we will pay special attention to *animals* and see how some of their characteristics make them morally relevant to us, and how individuals may be motivated to set up upstream strategies to forget these characteristics and facilitate their exploitation. Then, in the third axis we will scrutinize the role of the context on the perception of (laboratory)animals and see that individuals may also be motivated to implement downstream strategies to rationalize with the harm animals undergo. Then, we will focus on the most famous social psychology's experimental paradigm and examine how Milgram's experiments can help us to understand animal-experimentation, and more precisely examine the role of scientific authority in this process.

In the **second part** of this work, we will rely on our theoretical foundations to present clear guiding directions to examine, and in the subsequent parts of this dissertation we will answer to the raised questions by presenting our own empirical research.

In the **third part** of this work, we will present our first manuscript examining the interrelation between gender, personality traits, and the attitudes toward animal experimentation. In this research, we will examine if the well-known gender-gap into the support toward animal experimentation is merely the product of underlying individual differences.

In the **fourth part** of this dissertation, we will see that the concern toward animals varies depending on individuals, but interestingly also depending on the context. In the second manuscript, we will examine how personality, more particularly the adhesion to a hierarchical ideology, influences the mind attribution of animals and how this relates to the moral concern toward them. Next to that, in the third manuscript we will examine whether the perceived mind abilities of laboratory-animals would not be the mere result of a motivated moral disengagement strategy

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consisting of denying mind to animals, to cope with the disturbance that represents our responsibility in the harm they underwent.

Then, in the **fifth part** we will scrutinize how the context and particularly pro-scientific mindset can predict both the support toward animal-testing and the behavioral commitment in a situation harming a laboratory-animal for science. In the fourth manuscript we will rely on a very immersive and ultra-realistic Milgram-like paradigm reproducing an animal-experimentation situation to inspect whether the scientific authority can predict the sacrifice of an animal for science and try to understand what underlies the relationship between pro-scientific attitudes and the support of animal experimentation.

Next, in the **sixth part** we will examine more precisely how individual dispositions can predict the behavioral use of a laboratory animal in the context of lethal biomedical experiments, and if some strategies can ever be set upstream to facilitate this harmful behavior. In the fifth manuscript, we will inspect if personalizing a laboratory animal influences the willingness to run a harmful experiment on it and if it predicts the stress associated response. We will finally close this section with our sixth and last manuscript, presenting a meta-analysis which aggregated how personality relates to the behavioral use of a laboratory-animal within our realistic environment.

In the **seventh, final and last part** of this dissertation, we will discuss the main results of our research, address the general limitations of our work, and before closing this dissertation with a conclusion and a very personal thought, we will present promising future directions.

PART 1. Theoretical Frames

The Persons' Characteristics and Dispositions

In this section, we will review major individual disposition affecting intergroup relations and examine how they affect human-animal relations, and whether they could ever affect our perception of laboratory animals as well.

Framework of generalized prejudice (e.g., Akrami et al., 2011) clarifies how individual dispositions influence attitudes and behaviors toward others. In “The Nature of Prejudice”, Allport (1954) asserts the role of individual characteristics and ideologies on attitudes and behaviors toward others, that he commonly refers to as *prejudice* “an aversive or hostile attitude toward a person who belongs to a group, simply because he belongs to that group, and is therefore presumed to have the objectionable qualities ascribed to the group.”³ (Allport, 1954, p. 7). The role of individual characteristics is undoubtable in prejudice (Ekehammar et al., 2004; Ekehammar & Akrami, 2003; but see Hodson & Dhont, 2015), and examining which personality traits predict forms of prejudice is of major importance and gained huge interest for social psychology.

Moreover, the idea that personality influences attitudes toward animals is not new (Furnham et al., 2003; Mathews & Herzog, 1997), and whether individual dispositions could dictate the way we perceive very particular animals as the ones used in laboratories should be examined. In fact, looking at personality to understand human-animal relations is crucial as it could tell us that not all individuals are equally predisposed to have prejudicial attitudes and behaviors toward animals.

Besides, one might argue that from a very reductionist point of view, animal-experimentation is merely a scientific practice in which non-experts' opinions should not be considered, same as if we were asking people to judge the perceived legitimacy of the study of stratigraphic layers or the revolution of planets. But the difference with animal-experimentation is that it harms living creatures *for the sake of* people (unlike the other scientific practices previously mentioned), therefore people's opinions on the subject matter and might even mirror inclinations to express empathy toward others or legitimize the domination of some by others. In fact, it may be that

³ This definition seems somehow incomplete (see Sibley & Barlow, 2017), and in this dissertation when referring to prejudice we will prefer another definition, describing prejudice as “those ideologies, attitudes, and beliefs that help maintain and legitimize group-based hierarchy and exploitation” (Sibley & Barlow, 2017, p. 4).

personality predicts the perceived legitimacy of animal-experimentation and the degree of sensitivity toward lab-animals.

Through this axis, we will review major dispositions known to be major predictors of intergroup relations (see Amiot & Bastian, 2015) and examine whether they could also predict attitudes and behaviors toward laboratory-animals and animal experimentation. First, since animal-experimentation catalyzes a relationship between two groups of varying status (i.e., humans and animals), we will focus on hierarchical ideologies and examine the role of adhesion to social dominance orientation and speciesism in the perceived legitimacy of animal-experimentation. Next, as we will see that empathy could be defined as nothing else but the ability to be touched by the plight of others, we will examine to which extent this individual disposition translates to the plight perception of laboratory-animals. Then, since gender “is one of the most stable factors that predicts attitudes and empathy toward animals” (Amiot & Bastian, 2015, p. 26), and since a very dense literature exists on the topic (see Herzog, 2007), we will scrutinize the role of the gender in the way people perceive a scientific practice harming animals. Finally, to vary our angles of observation and because this indicator has been proven to be a good index of self-regulatory abilities in harm-inducing situations, we will examine how heart rate variability could predict the involvement of individuals in an animal experimentation situation.

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Chapter 1. Hierarchical Ideologies

In this chapter, we will review how the adhesion to hierarchical ideologies (that can also sometimes be referred to as ideological beliefs) affect intergroup relations in general, and even predict human-animal relations. Since animals are bred for our own benefit and since their welfare always comes after ours, animals are labelled as a low-status social group and there is no reason that hierarchical ideologies do not predict the way we perceive and interact with them (see Dhont et al., 2020). Then, as animal-experimentation is a hierarchized situation where a dominant group (i.e., *humans*) takes advantage of a lower group (i.e., *animals*) for their own interest, we will examine how these hierarchical ideologies could be related to the support of animal-experimentation. We see the examination of animal-experimentation through the lens of hierarchical ideologies as being stimulating, since after all this practice is something that could be beneficial for our ingroup (i.e., humans), but very detrimental for an out-group (i.e., animals).

A brief look to Right-Wing Authoritarianism

Right-wing authoritarianism (RWA, i.e., Altemeyer, 1981, 1998) is a derivative of the authoritarian personality (Adorno et al., 1950) and describes individuals who are committed to conventional and conservative values, express strong deference to authority, and are particularly aggressive toward subversive individuals that challenge it, especially if they are from low status groups. According to the DPM (see Figure 1, Duckitt, 2001; Duckitt & Sibley, 2010b), adhesion to RWA takes its origins in personality backgrounds and in the perception of a dangerous world that would ignite in individuals the perception of social threats, consequently leading to prejudice and discrimination (e.g., Duckitt & Sibley, 2009). Through the lens of a threatening world, approval of a policy where conformity and conventionality prevail and endorsing a system that grants authority full powers to deal with threats allows regulating perceived insecurity (Duckitt & Sibley, 2009).

In intergroup relations, RWA is systematically associated with political conservatism (e.g., Dhont et al., 2016; but see Altemeyer, 1996), support of traditional value (i.e., anti-abortion, L. E. Duncan et al., 1997) over social reform (e.g., Jost et al., 2003), in short as being a reactionary position (Becker, 2020). RWA is

particularly related to negative and prejudicial attitudes toward migrants (Cohrs & Stelzl, 2010; Duckitt & Sibley, 2010a), but also to all discriminated people in general (Dhont et al., 2016; Ekehammar et al., 2004), as for instance it predicts racism (e.g., Hiel & Mervielde, 2005), sexism (Ekehammar et al., 2004), or transphobia and homophobia (Nagoshi et al., 2008). Non-surprisingly the same pattern is observable in anything that is related to human-animal relations. For instance, adhesion to RWA predicts the reject of new diets or lifestyles that avoid animal-based products as they represent a threat to culinary traditions (i.e., the “vegetarianism threat”, Dhont et al., 2016; Dhont & Hodson, 2014). When it comes to animals, the adhesion to this ideology predicts how individuals will react facing the threat of wild animals (i.e., wolves, bears, Becker et al., 2019), predicts the support of animal-exploitation (e.g., Dhont & Hodson, 2014), predicts meat-consumption (e.g., Allen et al., 2000), and is associated to the expression of a lower moral consideration toward animals (i.e., speciesism, which we will describe in more detail shortly, Dhont et al., 2016). To summarize, individuals’ endorsement of RWA predicts negative attitudes toward outgroup members, whether they are human or not, if their existence -or the support of their rights- may represent a threat to traditional values or strays too far from the lines of the existing system.

Although it is almost a moral deference to spend a few words describing this concept considering its classical importance in intergroup prejudice-related models (Duckitt & Sibley, 2010b), recent theoretical model clearly indicates that other ideological dispositions better explain the interrelation between human intergroup and human-animal relations than RWA (Dhont et al., 2016). For this reason, the importance of RWA in our context had to be reconsidered; and we decided to put aside this concept, and not to collect empirical data about it. From now on, we will not address RWA anymore and priority will be given to concepts of higher importance, starting with social dominance orientation (SDO, Sidanius & Pratto, 1999).

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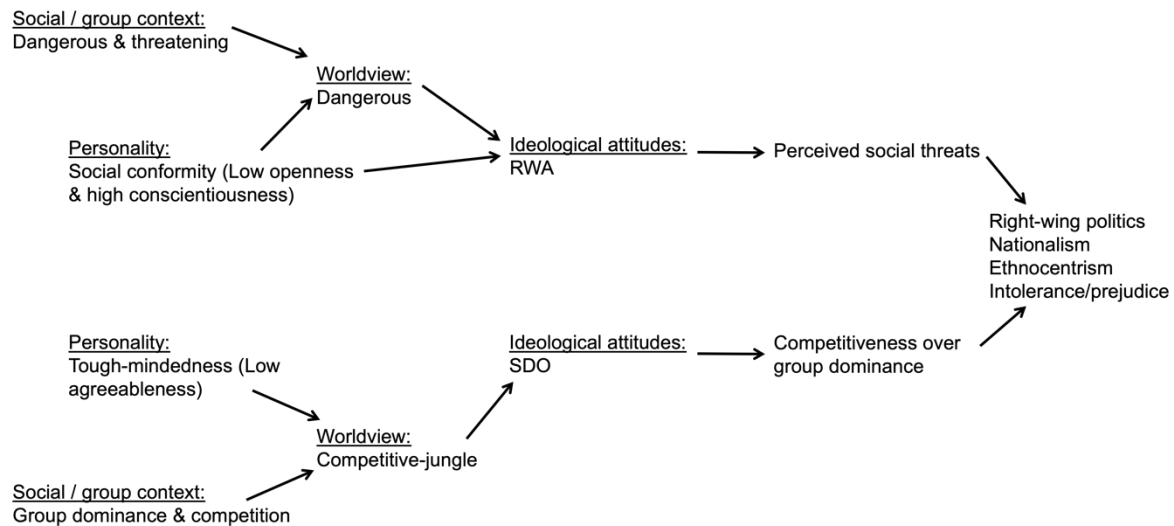


Figure 1. Schematic representation of the roots of Right-Wing Authoritarianism (RWA) and Social Dominance Orientation (SDO) and their effect on prejudice. Figure reproduced from A Dual-Process Motivational Model of Ideology, Politics, and Prejudice (p. 101), by J. Duckitt & C. G. Sibley, 2009, *Psychological Inquiry*, 20(2-3), p. 101. Copyright 2009 by Psychological Inquiry.

Social Dominance Orientation, a hierarchical groups-based ideology

SDO is a sociopolitical ideology that represents “the degree to which individuals desire and support group-based hierarchy and the domination of ‘inferior’ groups by ‘superior’ groups” (Sidanius & Pratto, 1999, p. 48). Unlike RWA, SDO is not the result of the perception of a threatening world, but rather of the feeling of living in “a dog-eat-dog world”, where competition prevails (e.g., Duckitt, 2001, see Figure 1). According to social dominance theory, the feeling of living in a very competitive jungle would in some people ignite the need to preserve their privilege by discriminating groups each other, and particularly to hold negative attitudes toward low status groups (Sidanius & Pratto, 1999). SDO is a key predictor of intergroup relations (e.g., Duckitt, 2001), and crystallizes the will of individuals to hierarchize social groups, to find legitimacy in a system where higher status groups dominate lower status groups.

Origins of SDO

Within the lines of the DPM, the fertile ground of the competitive world beliefs from which SDO emerges would be the result of an interaction between personality and social context.

On the one hand, the perception of this competitive world would take its roots in empathic deficiencies (e.g., Sibley & Duckitt, 2008), such as coming from a lack of affectionate socialization (Duckitt, 2001). According to McFarland, SDO is “rooted in an absence of childhood affection, which created cold-heartedness and striving for superiority” (McFarland, 2010, p. 457). In other words, a strong part of SDO would be the outcome of a “tough-minded” personality (e.g., Duckitt, 2001).

On the other hand, according to the DPM the perception of a competitive world leading to SDO beliefs would also directly emerge from the context accentuating the perception to live in a “dog-eat-dog world”, for instance from scarcity of resources or competition between individuals. The tougher the environment, the stronger the need of individuals to be tough to survive, and in fact a few research tend to indicate that SDO could indeed be experimentally induced by reinforcing people’s sense of superiority or their strive for competition (e.g., Guimond et al., 2003). To summarize, according to the DPM, if individuals’ predispositions play a role into the development of SDO, the context seems to allow its greater expression.

However, even if this view of the SDO being the resulting outcome of both personality and environment is overwhelmingly supported, it is also discussed that SDO would be such a strong and stable disposition that it would also in turn shape and influence the personality of individuals. For instance, a longitudinal study of Sidanius and colleagues (2013) found out that the effect of SDO on Empathy over time would at least be the same (if not more) as the effect of empathy on SDO over time, defending the very strong stability of this trait and questioning the role of personality in its formation. Additionally, recent research demonstrate that SDO is mostly hereditary and that the effect of the environment on SDO development is very negligible (de Vries et al., 2022; Klepepestø et al., 2019), diminishing the role of social context in the formation of this ideology. Still nowadays, the origins of SDO are not yet completely clear, and it remains to be understood whether SDO is only a sociopolitical ideology that emerged because of individual predispositions and

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context, or a personality trait on its own (e.g., Sidanius et al., 2017; but particularly see de Vries et al., 2022).

Gender invariance hypothesis

Relative to the inter-individual variance of SDO due to different dispositions, it really matters to highlight that while gender-differences on other ideological attitudes are equivocal and seem to be mostly country-dependent (i.e., RWA, see Brandt & Henry, 2012), a very robust gender-gap exists on SDO and is not explained by cultural variations (e.g., Lee et al., 2011; Sidanius & Pratto, 1999). In fact, gender differences in SDO with men always scoring higher than women are so common and widespread that this effect is unambiguously called “the invariance hypothesis” (Pratto, Stallworth, & Sidanius, 1997; Pratto, Stallworth, Sidanius, et al., 1997; Sidanius et al., 1994, 1995, 2000; Sidanius & Pratto, 1999). Even if the explanation of this gender gap goes far beyond the scope of this dissertation, let us nevertheless emphasize that it might originates mainly in the evolutionary field, with men always more inclined to dominate than women, all other things being equal (see Sidanius et al., 1995; Sidanius & Pratto, 1999), and that this should be considered in our work.

SDO as a key predictor of intergroup relations

On one hand SDO comes from a lack of empathy and may eventually affect backward empathy dispositions, and on the other hand it comes from the perception of living in a competitive world where domination over others prevails. This quite unsympathetic portrait echoes to Sidanius and Pratto when they argued that “[individuals] scoring high versus low on SDO were less concerned by the well-being of others” (Sidanius & Pratto, 1999, p. 76), and we can imagine that strong SDO dispositions may not favorably predispose to hold positive attitudes and behaviors toward others, particularly outgroup members.

Indeed, it turns out that SDO is robustly and negatively linked to peoples’ empathic dispositions (e.g., Hodson, 2008; McFarland, 2010; Pratto et al., 1994; Sidanius et al., 2013), and that it is a key predictor of prejudice and discrimination toward out-group members (Altemeyer, 1998; Costello & Hodson, 2010; Pratto et al., 1994; Sibley & Duckitt, 2008). In particular, same as RWA, it predicts negative attitudes toward migrants (Cohrs & Stelzl, 2010; Duckitt & Sibley, 2010a) and is

related to their ascription of lower humanizing traits and emotions (Costello & Hodson, 2010), it predicts racism (Hiel & Mervielde, 2005), antisemitism and islamophobia (e.g., Imhoff & Bruder, 2014), sexism (Bäckström & Björklund, 2007; Christopher & Mull, 2006), homophobia (e.g., Cohrs et al., 2012). In fact, SDO is the common denominator of the generalized prejudice (Dhont et al., 2016; Ekehammar et al., 2004; Ekehammar & Akrami, 2003; Hodson et al., 2017).

SDO and human-animal relations

Adhesion to SDO supports the idea that not all social groups deserve the same considerations and privileges, and therefore that differences of treatments between groups are legitimate depending on their status. Moreover, one might ask whether the support of this ideology could also predict relations with non-human social groups.

Since SDO is linked to prejudice toward human social groups, and prejudice toward social groups relates to prejudice toward animals (e.g., Dhont et al., 2014; Dhont & Hodson, 2014), there is no reason to believe that adhesion to this ideology is limited to inter-humans' groups and does not predict relations with other social groups, such as animals. The Social Dominance Human-Animal Relations Model (SD-HARM, Dhont et al., 2016) clearly examines this interrelation between prejudice toward humans and toward animals, and beyond confirming that they are indeed strongly related, this model indicates SDO as the common denominator between these two forms of prejudice. Roughly said, the SD-HARM demonstrates that SDO is the binder between prejudice toward humans and toward animals. It highlights the importance of this ideology in understanding human-animal relations as a main predictor of attitudes and prejudice toward animals.

Besides, if SDO captures the propensity of individuals to hierarchize social groups, this ideology might affect how individuals hierarchize animals each other. Unfortunately, we are lacking evidence indicating that SDO predicts a difference of treatment between animals according to their species. For instance, while the belief that humans as a species dominating others plays a role in the moral consideration of animals depending on their status (i.e., companion or food animals), SDO appears to be of lower importance (Krings et al., 2021).

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Similarly, SDO fails to predict attitudes of individuals for the control of animals according to the threat they represent (i.e., extermination, Becker et al., 2019). However, and more importantly, zooming in on the interaction between humans and animals, SDO relates to the will to widen the gap between humans and other animals (Costello & Hodson, 2010), with the underlying thought that humans are superior creatures (Costello & Hodson, 2010; Dhont & Hodson, 2014). After all, the refusal of equity so that high status groups keep advantage over lower status groups translates well in human-animal interaction with SDO being strongly related to human supremacy beliefs (Dhont & Hodson, 2014; Graça et al., 2018). It is also noteworthy to report that the anti-egalitarianism facet of SDO is negatively linked to animal rights support while the dominance facet gives inconsistent results (Hoffarth et al., 2019), and that SDO is strongly associated to human supremacy beliefs (Dhont & Hodson, 2014; Graça et al., 2018). As explained, SDO relates to the underlying legitimization of the dominance of high-status groups toward lower status groups, and here again it translates well to human-animal relations as it predicts the acceptability of animal-exploitation (Hyers, 2006; Jackson & Gibbings, 2016). Despite the important role of SDO in predicting how one behaves toward others depending on their social groups, it has yet to be shown it applies to animal species as well, but it is a predictor of choice in human-animal interactions, as it is strongly related to the need to differentiate humans from other animals.

Moreover, how does adhesion to this ideology transfer to the perception of, and attitudes toward animals? SDO is overall linked to negatives attitudes (Hoffarth et al., 2019) and less solidarity toward them (Amiot et al., 2020; Amiot & Bastian, 2017), and a lower attribution of cognitive abilities (Bilewicz et al., 2011). Even if there is no longer any need to demonstrate that the perception of others influences how we behave toward them, one might ask whether SDO echoes to behaviors toward animals beyond attitudes. To answer this question, it may be interesting to look at a proxy of behavior harming animals, meat-consumption, as it -indirectly- implies harm toward animals (see Loughnan et al., 2014). By all accounts, SDO is strongly related to meat eating and liking (Dhont & Hodson, 2014; but see Loughnan & Davies, 2020), as individuals high in SDO are less often vegetarian (Allen et al., 2000; Bilewicz et al., 2011). Witnessing the strong relation between SDO and the willingness to dominate (and eat) animals, when in the context of an experiment individuals are asked to state to which extent they would be able to eat an animal of

a non-mentioned species, only described by its status, intelligence, and brain size, the higher the SDO, the higher the willingness to eat it (Becker et al., 2019)! In the same vein, it is also reported that the more people are high on SDO, the more they justify relying on animals for their own ends (i.e., clothing, Hyers, 2006). However, to our knowledge there is little evidence indicating that SDO predicts behaviors directly harming animals.

SDO and animal-experimentation

SDO is “the extent to which one desires that one’s in-group dominate and be superior to out-groups” (Pratto et al., 1994, p. 742), it captures the will of individuals to support and preserve a hierarchical system where low status groups are dominated for the sake of groups of higher status. Since SDO is a major predictor of intergroup relations and provides insight on prejudice toward social groups, including animals, it is very relevant examining whether this ideology could predict adherence to animal-experimentation. After all, seeing animal experimentation as nothing else but a situation where low-status groups (i.e., lab-animals) are manipulated and harmed for the sake of higher status groups (i.e., humans), this context should be a fertile ground to examine the resurgence of a hierarchic ideology based on the domination of some groups over others for the greater good. Considering the strong predictive effect of SDO on animal-exploitation, there are little doubts about its predictive effect on animal-experimentation, but we must consider that, to our knowledge, there is no literature on this. Furthermore, if laboratory animals are nothing more than servants of Human health ambition, then while they are a prototypical low-status group we are a prototypical high-status one, and we should examine how SDO relates to the attitudes toward them and whether it ever translates into individuals’ involvement in animal-experimentation.

Speciesism, a hierarchical species-based ideology

Speciesism was first formalized by the psychologist Richard Ryder in the early 1970s when he was part of a group of scholars from Oxford advocating for moral consideration of animals -particularly laboratory animals- (Ryder, 2011), this term was later popularized by Singer in *Animal Liberation* (Singer, 2009), meeting a much wider audience. This word, formed with the prefix “*species*” and the suffix “*-ism*”,

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refers semantically to animal-directed discrimination on the sole basis of their species. Speciesism is another very relevant hierarchical ideology to scrutinize within our framework. It assumes that not all species weigh the same, particularly that humans are of a higher intrinsic value (Caviola et al., 2019). Along these lines, we can see two different -but much related- meanings.

First, speciesism supposes that not all animals are equal and that our attitudes, behaviors, and moral considerations toward them depend on their species. This biased perception of animals according to their species seems to happen automatically. For instance, the closer animals are to us, phylogenetically speaking, the more we attribute mind abilities to them (Batt, 2009; Plous, 1993). Additionally, we daily discriminate between different animals and grant them moral considerations or affection depending on more arbitrary criteria (i.e., pet ownership culture, culinary practice), such as whether some animals are welcome in our homes, some constitute the main course, and others disgust us (Herzog, 2010; Leite et al., 2019). In fact, we find discrimination of animal species at institutionalized levels, for example a difference of legal rights to animals depending on whether they are pets, cattle, or wild animals (e.g., Grimm, 2014), or the acceptance of animal experimentation depending on the species of laboratory animals (e.g., Plous, 1996). In many ways, directly or indirectly, all individuals may have speciesist attitudes or behaviors and grant different values or considerations to animals according to their species or to the context.

“All animals are equal, but some animals are more equal than others.”⁴

George Orwell, 2003, p. 112

⁴ Although in its original context Orwell uses this quote to refer to socio-economic disparities within a society, it perfectly captures what speciesism is, at least its horizontal meaning.

Besides treating animals differently according to their species, speciesism particularly supports the underlying idea that of all animal species humans are the most valuable and can use other animals at their expense for our own good. This philosophy relates to the concept of human-superiority and grants the right to humans, exclusively because they are humans, to dominate and exploit other species. In other words, speciesism can be seen as an in-group preference. In fact, the conception of humanity as a very special entity that can dispose of other animals as it pleases is an age-old idea. Aristotle argued that animals have been created for the purpose to serve our human needs (I. J. H. Duncan, 2019), and this idea is present in most monotheist religions⁵. Speciesism is above all an ideology that is shaped by the culture, but reciprocally shapes our cultures as the adherence to this ideology directly guides how we perceive animals. Notwithstanding the high interest we find into the differences of considerations we have toward animals depending on their species, within this dissertation we will particularly focus on speciesism as the reflection of the adherence to human superiority and to the legitimacy of exploiting other animals, simply because we believe that animal-experimentation perfectly reflects this dimension.

Origin(s) of (vertical) speciesism

From our perspective, this tendency to place humans at the top of a species-based hierarchized system might also be due to social construction. For instance, it fluctuates significantly across the lifespan. Children have a weaker tendency to prioritize humans over animals than adults do (Wilks et al., 2021), and pet ownership in childhood has a strong predictive effect of attitudes toward animals and empathy toward exploited animals at adulthood (e.g., Pagani et al., 2007; but see Amiot & Bastian, 2015). It seems that experience with animals shapes our (non)speciesist dispositions, that quite support the idea of the role of social construction into its fluctuation.

⁵ In the book of Genesis (1:26) one can read “Let Us make man in Our image, after Our likeness, to rule over the fish of the sea and the birds of the air, over the livestock and over all the earth itself and every creature that crawls upon it”. A quite similar idea of humanity being above all other species is presented in the Qran (45:13) “And He has subjected to you what is in the heavens and what is in the earth, all together, from Him”.

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However, at a more evolutionary level, seeing *humans* as in-group and *animals* as out-group, speciesism could in some way a natural in-group preference related to our species, as in fact, the will to prioritize our own kind before all the other animal-species seems to be general tendency (e.g., Awad et al., 2018; Topolski et al., 2013). Therefore, under the form of human prioritization speciesism might also take its roots in biological-based and evolutionary behaviors related to the survival of the species. Jointly, since some political attitudes related to the discrimination of outgroups seem to be mostly defined by genetic and hereditary components (i.e., RWA, Kandler et al., 2012, 2015), one could speculate that it could also be the case for speciesism, especially since species discrimination may have occurred evolutionary before group discrimination. Nevertheless, even if this track is very intriguing and interesting, this development is purely speculative as it lacks evidence and is quite unrelated to the aim of this dissertation.

Speciesism and intergroup relations

Speciesism supposes that because of an arbitrary hierarchy of the species, there is legitimacy for humans to benefit from animals at their expense, it is not surprising seeing its strong association with SDO (Dhont et al., 2016; Dhont & Hodson, 2014). It is also worth mentioning than Sidanius and Pratto already described speciesism as an example of a legitimizing myth justifying group-based social inequality (1999, p. 46), and therefore by adhering to the idea that humans are intrinsically superior to all other animals, people would in fact legitimize the *status quo* and the oppression of humans over animals. Interestingly, 20 years after the first theorization of Sidanius and Pratto about the role of speciesism as a legitimizing myth, the interrelations between adhesion to system justifications and speciesism were indeed assessed (Hoffarth et al., 2019).

Along these lines, same as SDO, speciesism is an ideology that relates to the legitimacy one finds in the support of a system where high-status groups (i.e., humans) dominate a lower group status (i.e., animals) for their own interests. Expressing adherence to a system of domination regardless of the animal suffering that may be caused, it is also not surprising seeing speciesism linked to a lower dispositional empathy (Caviola et al., 2019), and consequently relating positively to prejudice toward humans (i.e., racism, sexism, homophobia, Caviola et al., 2019).

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Additionally, gender-gap also exists on speciesist attitudes, women having lower scores (Caviola et al., 2019; Hoffarth et al., 2019), and having lower utilitarian views of animals (Kellert & Berry, 1987), than men, but we will come back to this phenomenon in another chapter.

Witnessing the interrelation between human and animal prejudice is somehow corroborating Allport's thought according to which discriminatory attitudes show little interest in the nature of the discriminated groups, as far as they are *out-groups*⁶ (e.g., Allport, 1954; Bergh & Akrami, 2017), and it is quite interesting to notice the extent to which it also applies to a non-human out-group.

Speciesism and human-animal relations

As for other hierarchical ideologies, a substantial variability exists among individuals endorsing speciesism, and not everyone is equal toward the legitimacy they recognize in the domination of other animals. While some individuals are motivated to widen the gap between humans and animals to find legitimacy in their exploitation, others may want to narrow it, rather looking to improve animal welfare.

Consequently, speciesism is related to a lower perception of intelligence and suffering abilities in animals, as well as less moral concern toward them (Caviola et al., 2019), that consequently facilitates their exploitation. Corroborating the slightest consideration for animals, it turns out that the higher the speciesism, the higher the meat consumption (Hoffarth et al., 2019), and the lower the interest in prosocial actions helping animals (i.e., charity, time investment, Caviola et al., 2019, Study 4, 5) or animal welfare support (Hoffarth et al., 2019).

Speciesism and animal-experimentation

In summary, speciesism crystalizes human's perception as a superior entity and witnesses the acceptance of animal-exploitation for the greater good of humans. In fact, the essence of speciesism is so related to the general purpose of animal-experimentation that in several scales measuring this concept, questions on animal

⁶ "If a person is anti-Jewish, he is likely to be anti-Catholic, anti-Negro, anti any out-group" (Allport, 1954, p. 68).

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testing are recurrently assessed⁷ (e.g., Caviola et al., 2019; Herzog et al., 1991). Since speciesism is associated with the perceived legitimacy of human domination over animals because of a supposed natural superiority on the food chain⁸ (e.g., Hyers, 2006; Jackson & Gibbings, 2016; Piazza et al., 2015), we will examine whether it also predicts the perceived legitimacy of animal-experimentation. Besides, we will also examine whether speciesism directly echoes to the *act* of experimenting on an animal and scrutinize whether speciesist attitudes facilitate the use of laboratory-animals for the good of science.

“If it is immoral to make an experiment on a human as soon as it is dangerous for him, though the result may be useful to others, it is essentially moral to make experiments on an animal, though painful and dangerous for it, as soon as they may be useful for human.”⁹

Bernard, 1865, p. 178

⁷ For instance, in Caviola et al.’s scale (2019) one can read “It is morally acceptable to perform medical experiments on animals that we would not perform on any human” or “I do not think there is anything wrong with using animals in medical research”, in Herzog et al.’s one (1991).

⁸ Since we rarely experience the threat of a predator, it is a common and popular opinion that humans are apex-predators at the top of the food chain. However, when it comes to the *science* examining animals’ positions in the “food chain” (or “trophic level”), a PNAS finding indicates that humans are in fact way closer to pigs or anchovies, than polar bears or white sharks (Bonhommeau et al., 2013). Considering the prevalence of pork or anchovy consumption, it is chucklesome to note that indeed, we *are what we eat*.

⁹ This quote perfectly captures to which extent animal-experimentation has always been the perfect illustration of speciesism.

Chapter 2. Empathy

In this chapter, we will review what empathy is¹⁰ and the primordial role it plays in intergroup relations. We will then scrutinize to which extent it translates to human-animal relations, until perhaps it even affects our perception of animal experimentation and laboratory-animals.

Dispositional empathy, a personality trait

Empathy refers to the innate propensity of individuals to be emotionally affected by the plight of others and it is described as an important personality characteristic (Davis, 1983; Mehrabian & Epstein, 1972).

Since Hoffman's works (1982) it has been supposed that empathy would reside in ontogenetic levels and should go along individuals since birth, and research confirmed that empathic manifestations appear during the first year of life (e.g., Roth-Hanania et al., 2011). Similarly, there is growing evidence indicating that roots of this disposition may be buried in biological and genetic fields, as it has a strong hereditary component (Davis, 1996; Davis et al., 1994; Matthews et al., 1981; Melchers et al., 2016; Zahn-Waxler et al., 1992; but for a review see Hastings et al., 2006). Additionally, this trait is rather stable across the lifespan (e.g., van Lissa et al., 2014), even if the plausible evolution of empathy across the age is quite a matter of debate (for a review see: Uzefovsky & Knafo-Noam, 2017).

Alternative way to see empathy is as a psychological construct that would come from socialization (Hoffman, 2001, 2008). Empathy would therefore be acquired and stable across the lifespan. For instance, it is reported that the affective quality in the family, the parental education style, or the empathic dispositions of parents can influence empathic dispositional level of children (see Davis, 1996), and that friendship in youth also contributes to an increase or a decrease in individual

¹⁰ Understanding empathy is cryptic and complex as it has a plurality of meanings (Cuff et al., 2016; Decety & Jackson, 2004; Hall & Schwartz, 2019). Empathy can either refer to the capacity “to put oneself in someone's shoes” and experience the emotional states resulting, or it can be an individual disposition, likewise a personality trait, relating to one's sensibility toward others' misfortune or emotions (Davis, 1996, p. 9; Waal, 2012, p. 87). Fortunately, within the framework of this dissertation we will cut the debate short as we will discard the situational component of empathy, and only focus on dispositional empathy. However, because situational empathy remains a very interesting way to facilitate intergroup relations (see Todd & Galinsky, 2014), and that we believe that this track lack of developments in human-animal relations, futures directions will be discussed.

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empathic dispositions (Miklikowska et al., 2022). Besides, empathic dispositions may also be a component of individuals' adhesion to hierarchical ideologies, more particularly to SDO (Hudson et al., 2019; McFarland, 2010; Sidanius et al., 2013) and individual differences on the preference for hierarchical and dominance-based ideology predict neural responses associated with empathic dispositions (Chiao et al., 2009).

As to whether adhesion to hierarchical ideologies leads to a decreased empathy or the opposite, according to the dual-process model (Duckitt, 2001; Duckitt & Sibley, 2010b), SDO would be a product of a "lack of empathy" (Duckitt & Sibley, 2010b, p. 1869), but some dissenting evidence has exposed the opposite relation (e.g., Sidanius et al., 2013).

Empathy as a predictor of intergroup relations and prejudice

Literature focusing on the effect of empathy on the relation with others is extensive. Empathy is strongly related to prosocial, altruistic, and helping behaviors (Batson et al., 1991; Eisenberg & Miller, 1987; Litvack-Miller et al., 1997; Paciello et al., 2013) and negatively linked to aggression (e.g., Mehrabian et al., 1988; but for a contradictory meta-analysis, see Vachon et al., 2014). Additionally, dispositional empathy is related to more tolerance and more positive attitudes toward members of discriminated and stigmatized outgroups (Bäckström & Björklund, 2007; Batson et al., 1997; Sheehan et al., 1989), and is thereby negatively linked to racism, sexism (Nicol & Rounding, 2013; Pedersen et al., 2004), and homophobia (Johnson et al., 1997). To summarize, literature is unequivocal as for its importance in intergroup relations and its major predictor role of generalized prejudice (Bäckström & Björklund, 2007; McFarland, 2010).

Empathy and human-animal relations.

Empathy predicts attitudes and behaviors toward humans, but could empathic dispositions also predict attitudes and behaviors toward other living creatures? It is documented that empathy is not only human-related and that it is also directed toward animals of other species (e.g., Phillips, 2009). This is not surprising as the same brain dispositions allowing us to express empathy toward humans are also activated when facing animals in suffering (Filippi et al., 2010; Mathur et al., 2016).

Chapter 2. Empathy

Greater empathic dispositions are linked to more positive attitudes toward animals (e.g., Eckardt Erlanger & Tsytsarev, 2012; N. Taylor & Signal, 2005), and are also linked to the greater recognition of their mind abilities (Hills, 1995), and interestingly a lack of empathy seems to be linked to animal-cruelty (McPhedran, 2009). Empathic dispositions are also indirectly linked to animals as individuals high in empathy are less engaged in animal-based diets (Kessler et al., 2016; Rothgerber & Mican, 2014), less endorsing ideologies supporting human superiority over animals (Caviola et al., 2019; Graça et al., 2018), and are more opposed to the utilitarian view of animals (Eckardt Erlanger & Tsytsarev, 2012). Referring to the gender-gap mentioned previously, women are described as having higher empathy toward animals than men (Hills, 1995; Taylor & Signal, 2005).

Empathy and animal experimentation

Regarding animal testing, one could hypothesize that empathic people may be more sensitive to the need of finding new cures and treatments for others, and thereby would support animal-experimentation as it is “for a greater good”. However, in the dilemma opposing the plight of laboratory animals to the development of drugs, empathy is negatively related to animal-experimentation support, might this be in medical or cosmetic context (Broida et al., 1993; Furnham et al., 2003). Overall, we presume that dispositional empathy is a strong and very relevant predictor of attitudes toward animal-experimentation and laboratory animals, particularly because animal-experimentation is a very vivid situation that emphasizes that animals suffering for our own benefit.

Chapter 3. Gender Differences in Human-Animal Relations

In this part of our dissertation, we will review how gender¹¹ shapes our attitudes and behaviors toward others, animals included. The aim of this chapter is not to determine where these differences come from, as they may take their roots in biological, social construct, or even evolutionist fields (for a review see Eagly et al., 2004), but rather to take these differences as existing and incorporate them into our reasoning. It is indeed often pointed out that gender differences exist in dispositional empathy (e.g., Christov-Moore et al., 2014; Hoffman, 1977; but for a dissenting thesis, see Hardin, 2016) or in the adhesion to hierarchical ideologies (i.e., SDO, Pratto et al., 1997). Since this gender-gap is particularly noticeable and unequivocal in the way we perceive and behave toward animals (e.g., Amiot & Bastian, 2015; Herzog, 2007), this phenomenon should be scrutinized to understand *what* in these gender-differences influences human-animal relations.

Gender in intergroup relations

Previously, we established that gender differences exist on individual dispositions closely related to intergroup relations (i.e., empathy, SDO), therefore it is reasonable to hypothesize that gender differences may also predict attitudes toward others, particularly toward outgroup-members. It is sometimes reported that men hold more prejudice attitudes toward others than women do (Altemeyer, 1998), whether in implicit or self-reported measures (e.g., Nosek et al., 2007; but for dissenting evidence see Ekehammar et al., 2003), or that they are more discriminatory (e.g., more racist, Sidanius et al., 1994). Nevertheless, we should be cautious with these results as some individual differences (i.e., adhesion to hierarchical ideologies) explain those attitudes better than solely gender differences (see Roets et al., 2012). Therefore, in the understanding of gender-differences in attitudes and behaviors toward outgroups it seems that relying uniquely on gender may be misleading as different underlining individual dispositions -induced by gender differences- may be involved and explain the discrepancy better.

¹¹ From now on, to differentiate men and women we will refer to the term “gender” that is described as a social construct and that refers to personal identification, and we will discard the term “sex” as it is biologically based. Besides, we acknowledge that gender-identification extends much beyond the binary vision of being a man or a woman, but we did not pay attention to all gender identities for pragmatical reasons (i.e., statistical power, methodological ease), and we regret it.

Gender in human-animal relations: a case of invariance?

There is no reason to believe that these gender-gap discrepancies are restricted to human-interaction as for example and from a wider scope we know that men also have less concern for the environment and wildlife than women do (Amiot & Bastian, 2017; Kellert & Berry, 1987; Mohai, 1992; Xiao & McCright, 2012, 2014).

It has already been suggested that “gender is among the most important demographic influences on attitudes toward animals in our society” (Kellert & Berry, 1987, p. 365), and indeed, literature on gender-differences toward animals is considerable, and consensually women have greater attitudes toward animals than men do (for a review see Herzog, 2007). In fact, they are usually reported to be more concerned about animal-welfare, more sensitive to animal-suffering (Furnham & Pinder, 1990), and more opposed to activities harming them (e.g., Rasmussen et al., 1993), than men are. In fact, as we have seen that gender differences exist on ideologies hierarchizing human social groups, this gender-gap also happens in the same direction in utilitarian ideologies that assume that humans can exploit and dominate animals at their expense (Graça et al., 2018; Kellert & Berry, 1987). However, following the pattern mentioned previously (i.e., Roets et al., 2012) lets stress that Graça and colleagues (2018) demonstrated that these beliefs were not solely caused by gender differences, but rather by individual differences based on gender (i.e., empathy, SDO).

However, do those gender-dependent attitudes toward animals translate into difference of behavior toward them? One could extrapolate a gender-difference of treatment toward animals by looking at animal-based products consumption as women eat less meat than men (Hoffarth et al., 2019) and more often adopt meatless diets (Modlinska et al., 2020; Ruby, 2012). Yet, since a long tradition of social myths and advertising campaigns have associated meat to virility and masculinity (i.e., Rothgerber, 2013; Rozin et al., 2012), it must be acknowledged that meat consumption may not be a very good indicator of the gender gap in animal behavior. However, looking at more direct behaviors toward animals, it is also reported that men are more directly engaged in situations harming animals, such as hunting or fishing (Bjerke & Østdahl, 2004; Heberlein et al., 2008; Kellert & Berry, 1987) or in animal-cruelty cases such as torture, bestiality, or fighting (but not hoarding, Gerbasi, 2004). Inversely, women are more engaged in animal-welfare support and activism

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(Galvin & Herzog, 1998; Herzog, 1993; Hoffarth et al., 2019; Peek et al., 1996, 1997; Plous, 1991). Very interestingly, women attribute more mind abilities (Herzog & Galvin, 1997) to animals, and as we will later explain, since mind attribution of animals is closely related to behaviors toward them (e.g., Bastian et al., 2012), it is plausible that the greater “tenderness” of women toward animals may lie in a different perception of their abilities (see Herzog & Galvin, 1997).

Gender and animal experimentation

Anecdotally, important women and feminist figures marked the first anti-vivisectionist movements. For example, Frances Power Cobbe founded the National Anti-Vivisection society in England in 1875, Caroline Earle White founded the American Vivisection society in 1883, and Marie Huot the Popular League against Vivisection in France in 1887. In the late 19th century, seeing earliest *suffragettes* holding strong positions against a practice hegemonically led by men vivisectionist seems to bear witness to the premises of a gender-gap in the perception of this practice. Nowadays, presence of gender-gap in attitudes toward animal-experimentation is indubitable, and women are always more opposed to this practice than men are (Broida et al., 1993; Crettaz von Roten, 2008, 2013; Driscoll, 1992, 1995; Eldridge & Gluck, 1996; Furnham et al., 2003; Furnham & Heyes, 1993; Furnham & Pinder, 1990; Hagelin et al., 2003; Hussar & Harris, 2018; Moore, 2003; L. K. Pifer, 1996; R. Pifer et al., 1994; Wuensch & Poteat, 1998; but for a review, see Ormandy & Schuppli, 2014). Additionally, when it comes to laboratory animals, women attribute more pain abilities to them (Furnham & Heyes, 1993), are particularly more disturbed by their suffering (e.g., Gallup & Beckstead, 1988; Heleski et al., 2006), and at first glance this greater sensibility of women toward the suffering of laboratory animals may explain why they hold so strong positions against animal-testing.

All other things being equal, women report being more affected by the plight of others, including animals. Intending to understand why individuals react differently toward animal experimentation and toward laboratory-animals, gender is a variable of a high interest that has a very strong predictive power. Within this context, this gender-gap must be better understood and we will examine by which mechanisms women happen to show more opposition toward animal experimentation. We believe that this gender differences should not only be the results of whether one is man or

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woman, but that underlying inter-individual differences might play a crucial role too. In this thesis, we will scrutinize whether gender differences in empathic dispositions and adhesion to hierarchical ideologies might explain women's traditional opposition to animal experimentation.

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Chapter 4. Heart Rate Variability: Looking Through the Heart to Explain Differences Facing Suffering

Whether one is interested in ideological dispositions, personality, or attitudes toward social objects or groups, most of the time we capture our construct of interest using declarative measures, with individuals self-reporting how they perceive others and themselves, or the world they live in. If these measures are as widespread and commonly used, it is probably because they are easy to use and to analyze, allow to sample many observations easily, are non-intrusive, with many references to rely on, and that they have acquired over time a certain legitimacy and credibility. However, it is sometimes highlighted that these measures may be tainted by biases inherent to the fact that they are precisely *self-reported* (e.g., Schwarz, 1999), and that also brings the problems that come with it (i.e., positive bias attribution, Mezulis et al., 2004; social desirability, Sigall & Page, 1971). In fact, relying on self-reported measures to predict prosocial behaviors sometimes fails (Aydinli et al., 2014; Böckler et al., 2016), and if one would be motivated to understand how people could behave in front of laboratory animals, relying solely on self-reported measures may prove to be limited. To examine what someone has in mind, other measures emerged trying to fill this gap, such as for instance the implicit measures (e.g., Greenwald et al., 1998), but particularly physiological measures that are sometimes categorized as being more objective than self-reported ones (e.g., Yetton et al., 2019).

Relying on physiological measures consists of monitoring physiological constants of individuals to bring new explanations of their attitudes or behaviors. First, it assumes that the psychological dispositions influencing attitudes and behaviors may be caused by biological or neurological differences, and looking directly into the physiology background of individuals may bring interesting insights in understanding human cognition. Then, it also assumes that in specific situations, contexts, or facing some stimuli, physiological changes may occur, and that the degree or the interindividual variability of these changes may be informative to understand underlying cognitive mechanisms.

In this dissertation, and to vary the operationalizations and examination tools of animal experimentation, from the wide range of physiological constants that can be monitored (e.g., electrodermal activity, blood pressure), we will focus particularly on heart rate.

The relation between the heart and the brain

Anecdotally, jointly with his preponderant role into the development of the modern animal experimentation, Claude Bernard is also at the origin of the first theory formalizing the effect of the brain over the heart (see Thayer & Lane, 2009). In his famous treatise “*Leçons sur les propriétés des tissus vivants*”, he particularly describes an animal-experimentation on a living dog demonstrating that stimulation of the pneumogastric nerve causes fluctuations in heart rate (Bernard, 1866, p. 458-459). Nowadays, we know much more about the interaction between the heart and the brain, and indeed, the role of this nerve, more commonly known as the vagal nerve, plays a major role in heart rate regulation (e.g., Levy, 1990).

The vagal nerve is a cranial nerve of the parasympathetic nervous system that has been identified as a good index of the parasympathetic nervous system activity (Porges, 1991), and monitoring its activity may be very informative to understand self-regulatory mechanisms (e.g., Porges, 1991, 2007). In fact, the principal functions of this nerve contribute to the autonomic nervous system by regulating the metabolic homeostasis through for instance controlling the visceral functions (i.e., gastrointestinal motility), immune response, but more importantly through the control of heart rate.

The polyvagal theory and social engagement

According to the polyvagal theory (e.g., Porges, 1995, 2001, 2007, 2009), during evolution we underwent pressures to survive in life-threatening environment, and it was crucial to quickly detect if one is friend or foe, or to evaluate the threat associated to our environment. This theory supposes that, as time goes by and with the emergence of social groups, our nervous system has adapted into three different systems¹² to optimize our behavioral strategies to promote or limit our social behaviors (e.g., fight-or-flight system leading to an increase in heart rate). One of those systems would be specifically committed to social engagement and would be

¹² This theory does not seem to be unanimously accepted by the scientific community (for an informal discussion, please see Grossman, 2016), and it is sometimes pointed out that the phylogenetic origins of these three different systems are unsupported by evidence (Grossman & Taylor, 2007). In this dissertation, we only refer to this theory to introduce that the vagal nerve could reflect physiological activities related to social behaviors.

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specialized into social communication, self-soothing and calming of individuals (Porges, 2007). In this system, during a social interaction depending on whether someone is identified as friend or foe, the vagal nerve would either serve to calm behavioral states acting as a brake on the heart rate, or support mobilization (e.g., Porges, 2001; Porges et al., 1996). Quoting Porges “the vagal brake provides a mechanism to support the metabolic requirements for mobilization and communication behaviors” (Porges, 2001, p. 130), the vagal nerve can thus be seen as a mediator of the relation between the affective regulation taking place in cortical regions and the resulting increase or decrease of heart rate (Porges, 1991). Since measuring the heart rate variability (HRV) is a very good marker of the cardiac vagal tone (Malik et al., 1996), it may directly inform about self-regulation and pro-social behaviors abilities (Porges, 2007), and “individual differences in vagal tone might provide a physiological marker of an individual’s ability to regulate affective state” (Porges, 1991, p. 117).

HRV and intergroup relations

Monitoring HRV is thereby of a great interest for the understanding of intergroup relations and for the aim of this dissertation, as it may represent a biological marker of one’s abilities to regulate their emotions and interact with others (e.g., Fabes & Eisenberg, 1997). For instance, it has been raised that high HRV at rest (or high basal vagal tone) is associated with greater emotion regulation (Porges, 2007,) social functions (Porges, 2007), cooperation with others (Beffara et al., 2016), compassion (Di Bello et al., 2020), empathy (Lischke et al., 2018), or cognitive flexibility (Thayer et al., 2009).

Interestingly, some studies examined the behavioral strategies at work when individuals see pain in others or face emotionally disturbing stimuli and the relation with HRV (e.g., Fabes et al., 1993). Overall, this literature suggests that the lower the HRV, the greater the negative emotional responses during a stressful task (Fabes & Eisenberg, 1997), that somehow witnesses lower self-regulation abilities. Interestingly, this literature also indicates that the lower the HRV, the greater the emotional flexibility to avoid being emotionally disturbed and the greater the focalization on non-affective information, such as the completion of a task (Fabes et al., 1993; Grol & De Raedt, 2020). This mechanism would be a coping mechanism to

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overcome the negative emotional response resulting from the perception of the suffering in others, and rather than focus on the aversive stimuli, low-HRV individuals may look away and focus on the completion of the task. Facing someone in suffering, individuals with low self-regulation abilities -and thus a low HRV- would adopt strategies to avoid being emotionally disturbed, and it is conceivable that de-centering from a victim to cope with an internal stress may therefore facilitate the adoption of harmful behaviors toward them. Directly in this direction, HRV is predictive of the level of obedience and of the destructive behaviors in Milgram-like paradigm, such as the lower the HRV, the higher the destructive obedience (Lepage et al., 2019).

Finally, HRV is also related to personality traits (e.g., Shepherd et al., 2015; Zohar et al., 2013), but particularly to hierarchical ideologies (Lepage et al., 2020). For instance, low resting HRV is associated to a higher RWA (Lepage et al., 2020, study 1), and low HRV in a stress-recovering phase is associated to higher SDO and RWA (Lepage et al., 2020, study 2). RWA and SDO relate to the perception of threats, either because of cultural shock or 'progressive' trends for the former, or because of the urge of safeguarding privileges in a competitive jungle for the latter. Considering the vagal nerve is directly related to the stress regulation, it is not surprising that HRV somehow predicts the endorsement of these ideologies. *In fine*, high RWA and SDO dispositions, and low basal HRV dispositions, all seem to witness a cognitive state of hyper-vigilance to potential threats.

HRV and animal experimentation

To examine to which extent inter-differences in cardiac variability may predict human-animal interactions, a good start would be to look on the relation between HRV and the general attitudes of individuals toward animals. We have already introduced speciesism as a hierarchical disposition that shares numerous similarities with RWA and SDO, but while the links between those two latter dispositions and HRV are well-established, there is no such evidence on the link between HRV and speciesism, and this track will be examined in detail. Speciesism is often described as a legitimizing-myth (Jackson & Gibbins, 2016) and relates to a greater perceive of legitimacy in animal-exploitation. Therefore, hypothetically, we can imagine that endorsing speciesist dispositions could be related to perceiving threat of losing privileges

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resulting from the domination and exploitation of animals (i.e., ban of meat-eating), and therefore, likewise SDO and RWA, higher speciesism dispositions could relate to lower HRV.

Additionally, we mentioned that HRV was related to obedience in Milgram studies (see Lepage et al., 2019), supposedly because individuals low in HRV would have greater abilities to look away from the suffering of others, perhaps helped by their lower empathy for others (Lischke et al., 2018). In the context of experimenting on animals, it is likely that these self-regulatory abilities also play a role and facilitate a destructive behavior toward a laboratory-animal.

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The (lab)Animals' Characteristics

In this section, we will try to understand which characteristics in animals make them important to us to the point of having moral concern for them and will understand why the harm animals undergo disturbs people, as a rule. Later, we will examine whether what makes animals morally relevant could be erased prior to certain behaviors to facilitate the conduct of harm toward them.

Chapter 5. Animals' Determinants in Human-Animal Relations

Our interest in animals varies, for example, we consider some of them as pets and are fascinated by others, some we find repulsive, and we even consider some animals as food or models for research. It goes without saying that caring for some animals but slicing others shows slight differences of treatments toward them.

In this chapter, we will examine where our consideration and love for animals comes from, and why do they vary depending on animals. This chapter is crucial, as we will later develop that those reasons that motivate us to have considerations for animals, can under certain circumstances motivate us to disengage from them and close our eyes on their suffering.

Animals' mind and moral considerations

What predisposes us to have moral concern toward others? Since we have been captivated by this question, different philosophical traditions have differentiated themselves and propose two different sources for our moral consideration toward entities, their *Agency* and *Experience* (also known as *patency*) abilities (see Gray et al., 2007; Sytsma & Machery, 2012). Thus, while the latter approach stresses the crucial importance of being able of reason, having cognitions and thinking to deserve moral considerations¹³, the former places greater emphasis on the fact that experiencing pain and pleasure and feeling emotions must grant entities moral considerations by default¹⁴. However, do animals possess these characteristics, and are they eligible in our moral considerations circle?

The feeling that animals may have *agency* abilities such as being able to reason and have mind is not anew, for instance early Greek philosophers such as Pythagoras or Theophrastus already defended the idea not to eat animals because they had souls and reasons (A. Taylor, 2003, pp. 34–35). In the middle of the twentieth century, we started to report the first evidence of animals having a personality (e.g., Hebb, 1946; Yerkes, 1939), and nowadays a growing literature confirms animals from a very wide range of species have a personality (Gosling, 2008; Gosling & John, 1999; Sih et al., 2020; Weiss, 2021; but for a review, see

¹³ That can be referred as a Kantian vision of morality

¹⁴ That can be referred as a utilitarianism view of morality

Gosling, 2001). For what refers more to *experience*, identically there is little doubt about that, as extensive literature exists on animals' sentience (Morris et al., 2008; Proctor, 2012; Proctor et al., 2013). In that spirit, Darwin once said, "the lower animals, like man, manifestly feel pleasure and pain, happiness and misery" (1871, p. 448), stressing that no matter the species, all animals seem to be able to *feel*. For instance, but non-exhaustively, they can feel all kind of emotions (see Bekoff, 2000, 2007), emotional distress such as grief (King, 2013a, 2013b), depression, and pain (e.g., Bateson, 1991; Bekoff, 2007).

Within the foregoing development on the origins of moral consideration, it appears that no matter the scope, whether this be *Agency* (i.e., having reason) or *Experience* (i.e., feeling emotions), we should have moral concerns toward animals (e.g., Goodwin, 2015; Gray et al., 2007; Waytz et al., 2010). Interestingly, it also seems that characteristics based on *Agency*, such as knowing that animals have cognitive skills, affects to a lesser extent our moral considerations toward animals than *Experience*, particularly knowing if animals can feel pain (Leach et al., 2020). In fact, the animal suffering question is at the center of our considerations toward animals, and whether it is through one of the founders of utilitarianism Jeremy Bentham (1843)¹⁵ or more contemporary philosopher Peter Singer (Singer, 1990, 1995), no matter the animals; the sole fact that they can experience pain should grant them moral considerations and protection from harm.

What they are: Phylogenetic proximity, anthropomorphism, and identity

Since animals have minds and are sentient, this should by default grant them moral considerations, yet are we able to recognize to the same extent these characteristics in animals?

An initial line of thought would be to examine if the phylogenetic proximity influences those recognition abilities, and we could imagine that the proximity with animals could predict both the attribution of some abilities and our moral considerations toward animals. In fact, data provided by Stephen Kellert (1985)

¹⁵ His famous citation perfectly describes the importance of protecting animals *because* they can suffer "It may come one day to be recognized, that the number of legs, the villosity of the skin, or the termination of the os sacrum, are reasons equally insufficient for abandoning a sensitive being to the same fate. What else is it that should trace the insuperable line? Is it the faculty of reason, or perhaps, the faculty for discourse?...the question is not, Can they reason? nor, Can they talk? but, Can they suffer?" (Bentham, 1843, p. 143).

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supports this claim and indicates the phylogenetic relatedness to humans as being one of the factors predicting public preferences for animals (p. 91). Similarly, when asking individuals to rate the cognitive abilities of a list of 30 different animals, it happens that the perception of their phylogenetic similarity with us perfectly matches their attribution of cognitive function (Eddy et al., 1993). In in-depth research, Plous (1993) indicates that people's concern toward animals, their willingness to protect them, or the perception of their suffering abilities, also relates to this phylogenetic component. More recent findings also indicate that the closer the animals, the greater the attitudes toward them, and the solidarity with them (Amiot et al., 2017, study 3), but particularly the greater the empathy and compassion toward them (Miralles et al., 2019). Interestingly, it is worth mentioning that those different considerations depending on the species seem to be rooted at a deep level as they even appear beyond self-reported measures, and our physiological activities reflect a general tendency to be more disturbed by the sight of suffering in animals more similar to us (Westbury & Neumann, 2008).

The perception of "human-like characteristics" in animals may explain this phenomenon of discrimination between the species and therefore explain that we prefer animals that look like us. If our moral considerations are grounded on the perception of mind and pain experience abilities of others, we may imagine that the closer the animals are to us, the easier our recognition of these abilities in them and the perception of them as our fellow. In the direction of this claim, anthropomorphism -the recognition of human features in animals- relates indeed to more positive attitudes toward them (e.g., Preston & de Waal, 2002). Beyond the actual perception of visual human-like features, the simple fact of doing the experimental exercise to think about the similarities we share with animals increases the moral concern toward them and reduces the perception of human superiority and speciesism (Amiot et al., 2017; Bastian, Costello, et al., 2012).

The rely on euphemism to erase what they are

On the other hand, we can easily imagine that upstream strategies can be set up to make it easy to forget that animals are *animals*, to facilitate the conduct of harm. The moral disengagement theory specifies that the use of euphemistic labelling is one of those strategies that facilitate the pursuit of reprehensible conduct toward others

(Bandura, 1986, 1999, see Figure 2). Euphemisms are words or sentences that are used to minimize phenomenon or to avoid using disturbing words. Relying on euphemisms in context of wars or extreme violence is well documented, particularly for describing military actions. For instance, instead of a bombing raid one can say 'surgical strike', 'collateral damage' if civilians are wounded by mistake, or even 'mercy death', the action of ending the suffering of a soldier by killing them (Holder, 2008).

However, the use of euphemism to diminish discomfort is not especially limited to situations causing harm to humans in context of wars. For instance, we say 'depopulation' if many farm-animals must be killed because of a spread of a disease (e.g., American Veterinary Medical Association, 2019). Similarly, we can 'harvest' deer or fish instead of killing them (Holder, 2008), and to refer to the machine that is used to debeak live chickens, farmer refer to the very equivocal term of "Poultry Service Processor". Interestingly, we can also notice the same use of euphemisms in the context of animal experimentation, as lab-researchers prefer using 'sacrifice' or 'terminate' instead of 'kill' (see A. B. Arluke, 1988).

Besides minimizing the behaviors, other euphemistic strategies exist to forget that we are dealing with a sentient entity and that harming them might cause a moral conflict. For example, in the context of meat-consumption, from meat-industry to meat-eaters, everything is made to make sure to avoid thinking about the animal-nature of food or the need to kill to produce meat (e.g., Grauerholz, 2007). Animals' body parts are specially removed on meat (i.e., head on a roasted pork, foot on chicken thigh) as their presence increases the empathy toward animals and reduces the willingness to eat meat (Kunst & Hohle, 2016; Kunst & Palacios Haugestad, 2018). In fact, even the language we use to categorize animals varies depending on whether they are alive and *animals* (i.e., hen, pig, and cow) or (to be) *meat* (i.e., chicken or broiler, pork, and beef), and "the words we use for meat helps us avoid thinking about the ethical implications of our diet" (Herzog, 2010, p. 44).

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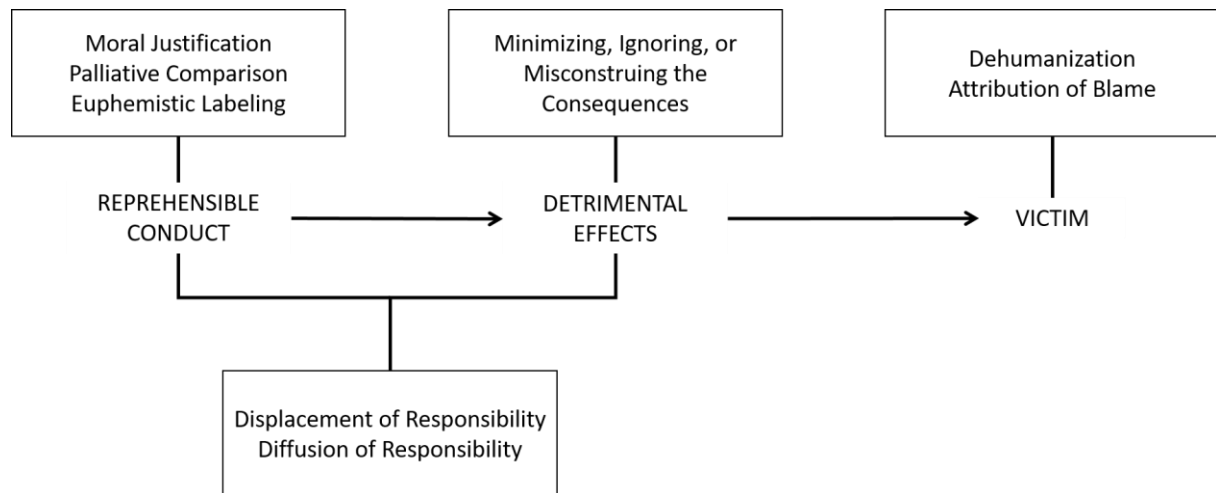


Figure 2. Mechanism through which moral self-sanctions are selectively activated and disengaged from detrimental behavior at different points in the self-regulatory process from the cause of a reprehensible conduct through the perception of the victim. Figure reproduced from *Social Foundations of Thought and Action: A Social Cognitive Theory* (p. 376), by A. Bandura, 1986, Englewood Cliffs, NJ: Prentice Hall. Copyright 1986 by Prentice Hall.

The erasure of their identity and animal experimentation

In the context of animal testing, it is to an extreme extent that we can observe different considerations toward animals depending on what they represent to us. For instance, using animals that we can easily identify as pets (i.e., dogs and cat) disturb us to a greater extent than using other animals (Herzog et al., 2001), and similarly experimentations on animals that look like us the most are the ones we judge as being the most revolting and immoral (i.e., great apes, Aguilera et al., 2021)¹⁶.

Erasing animals' identities appears to be a strategy of downplaying our empathic considerations toward them and legitimizing their exploitations. For instance, it is widespread to avoid naming laboratory-animals to facilitate their objectification (A. B. Arluke, 1988; du Toit, 2020; M. T. Phillips, 1994). Laboratory-technicians report to do so to avoid thinking of animal-models as pets, to not think about their 'inner lives', and to make it less problematic in the case of a sacrifice

¹⁶ Paradoxically, one could point out that the closer the animals are to us phylogenetically, the more accurate the inferences that could be drawn from animal-experimentation, but it seems that relying on our fellow hominids immediately raises additional ethical questions and lead us to reconsider in a certain way our health ambitions.

Chapter 5. Animals' Determinants in Human-Animal Relations

(Phillips, 1994)¹⁷. Since naming animals encourages their perception as individuals (Sanders, 2003), it seems that it is better to avoid considering them as such to conduct a harming experiment toward them, but one might ask whether attributing a name to a laboratory-animal really goes against the objective of science and really affects lab-researchers. We will clearly examine whether testing on laboratory-animals with names leads to a greater discomfort and less willingness to complete a harming experimentation than testing with animals without names.

¹⁷ In another similar case, but anecdotal, it is reported that giving names to dogs that must be euthanized in animal-shelters generates a heavier emotional burden than having to euthanize dogs without names, and jointly that it is more frequent to always name dogs in shelters not practicing euthanasia (A. Arluke, 2006).

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The Situation

In this axis, we will not be interested in animals or individuals per se, but rather examine the extent to which the relationship between animals and individuals depends on the context in which these social agents find themselves.

From a more situationist perspective, we will focus on the effect of the relationships we have with animals in the perception of what makes them morally relevant. We will scrutinize whether the perception of what makes (lab)animals morally relevant fluctuates depending on the context, and particularly of the responsibility people hold in harming them.

Finally, to examine what undermines our behaviors toward (lab)animals, we will focus on Milgram's studies (Milgram, 1974) and explain why these studies are important for studying animal-experimentation. We will argue that animal-experimentation might rely on a specific form of engaged followership toward science, which could facilitate the conduct of harmful experiments on animals.

Chapter 6. The relationships with animals and their mind perception

The relationship we have with animals may dictate our perception of their mind abilities and our considerations toward them, and it is probably in the relationships we have with pets that it is most evocative. Having pets is a thousand-year-old practice and first evidence of humans bonding with animals relate to domestication of dogs, at least 15,000 years ago (Bergström et al., 2020; Lindblad-Toh et al., 2005). Nowadays, 70 percent of U.S households (American Pet Products Association, 2022)¹⁸, and 50.5 percent of French households report having pets (Facco/Kantar, 2021). We have very special relationships with our pets and tend to consider them as friends or family members (Cain, 1985; Carlisle-Frank & Frank, 2006; Siegel, 1993), we are attributing them personalities (Gartner, 2015), and that might explain why we always grant them more moral considerations than to other animals (Leite et al., 2019). Within these lines we understand that it is due to dogs and cats having objectively intrinsically higher value and special characteristics (i.e., mind, personalities), that we consider them as pets and have greater concern for them.

However, the fact that pet standards fluctuate depending on the cultures doesn't seem to be going that way at all, as for instance while it is unthinkable to eat dogs in occidental countries (i.e., France, US), it is current in others (i.e., Nigeria, China, South Korea, Vietnam)¹⁹, and similarly dogs can be considered as pest and forbidden in public spaces (i.e., Saudi Arabia). Conversely, some animals frequently eaten in occidental countries can in other countries be considered either as sacred with a strong duty to protect them (i.e., cows in India or Nepal), or uncleaned and forbidden (i.e., pigs in Saudi Arabia, Qatar, Sudan). Therefore, it does not seem that animals are only granted special status because of their characteristics, as evidently the same animals are attributed different status depending on the cultures, but what determines our perception and considerations toward animals then?

Looking specifically to meat eating to understand how the differences in moral considerations between animals are formed is very insightful. In a study conducted

¹⁸ Most reporting having dogs (69 million households), cats (45.3 million households), freshwater fishes (11.8 million households), or other kind of animals such as birds, horses, saltwater fishes, reptiles, or small animals (28.2 million households).

¹⁹ Anecdotally, let's highlight that in the middle of the nineteenth century there were still canine butcheries in France, and dog and cat-eating is still allowed in some cantons of Switzerland -even if the consumption of these animals remains very rare and anecdotal (BBC Newsbeat, 2014; Vogel-Misicka, 2013).

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by Bastian and collaborators (2012, study 1), researchers aimed to examine how we perceive both mind abilities and edibility of animals, and if the perception of mind abilities in animals leads to differences in consideration and behaviors toward them, this should translate into the edibility perception of animals. In line with Plous's research (1993) and the foregoing development on pets, this study shows strong mind attributions to pets, great apes, and animals known as intelligent (i.e., dolphin, elephant), and a very weak edibility perception associated with these animals. But a striking result in this study is the very strong negative correlation between mind attribution and the edibility associated with animals, and the lower animals are rated as having mind abilities, the higher their edibility...or is it the other way around?

A motivated mind perception of animals, the case of the Meat-Paradox

What if our behaviors and considerations toward animals are not driven by their mind abilities, but rather our perception of their mind abilities is just a mere product of our behaviors toward them? To examine this question of major interest, it might be very insightful to examine how we behave faced with animal exploitation and suffering.

Not causing harm and protecting sentient entities are the pillars of our moral foundations and causing suffering to sentient entities is perceived as being immoral and unacceptable (e.g., Haidt, 2007). In fact, since we are motivated to avoid causing harm to others (Graham et al., 2013; Haidt, 2007), seeing our fellow humans suffering repulses us at the highest degree (De Coster et al., 2013). The fact that animals are able to suffer also explains why we find their pain intolerable, why we are opposed to all kind of animal suffering (Weathers et al., 2020), and why we are motivated to protect them from harm (Moore, 2003). Yet sometimes animals must die or suffer so that we can reap benefits from them (i.e., meat eating), and our behaviors, whether they are direct or indirect, can sometimes run counter to our desire to protect animals from harm, thus challenging our moral foundations.

When it comes to ambivalence between cognitions, the cognitive dissonance theory is very relevant (e.g., Cooper, 2019; Festinger, 1957; Harmon-Jones & Mills, 2019). Overall, this theory postulates that when an inconsistency is salient between two or more cognitions, individuals will feel internal discomfort (i.e., *the cognitive dissonance state*, Vaidis & Bran, 2019) which they will be motivated to resolve. The perception of an internal conflict is central in the cognitive dissonance process, and

while according to Festinger (1957) this would mainly be explained by the intrinsic motivation of individuals having consonant cognitions, alternatives and complementary explanations have emerged (see Harmon-Jones & Harmon-Jones, 2007). According to the action-based model of dissonance, the cognitive dissonance state would emerge because an inconsistency between cognitions could interfere with a behavioral action, causing thereby a latency to act and diminishing the efficacy of an action (Harmon-Jones, 1999, 2000; Harmon-Jones & Harmon-Jones, 2019; Harmon-Jones et al., 2015). Therefore, if an ambivalence exists between some cognitions (i.e., moral concern toward animals), but our involvement into behaviors harming them, it is expected to be a source of discomfort and of cognitive dissonance. In fact, the cognitive dissonance framework is very relevant in studying human-animal relations (Dhont et al., 2019)

The *meat paradox* relates to a very specific case of cognitive dissonance relating to meat-consumption (e.g., Loughnan et al., 2014; for a recent review see Gradidge et al., 2021), and indicates that meat-eaters should experience a cognitive dissonance state and face a moral conflict, when it will be made salient that they are (indirectly) involved in harming animals. Perceived responsibility in behaviors harming animals and harm underwent by animals during their exploitation have been identified as very important triggers of this dissonance cognitive phenomenon and should theoretically accentuate the will of individuals to resolve this apparent paradox (Bastian & Loughnan, 2017). However, as far as we know people do not turn vegetarians or vegans as soon as the animal-origin of meat is made salient. Rather than changing their diet and behaviors, other less costly and faster strategies should exist to face the paradox eating animals represents.

Denial of mind and of suffering

Literature on the moral disengagement indicates that when the role of someone is salient in inhumane and harmful behavior toward others, individuals are motivated to disengage from that behavior to keep a positive image of themselves (e.g., Bandura, 1999). To reduce the moral burden that harm underwent by victims represents, individuals might be motivated to distort their perception of said victims, see Figure 2.

Diminishing the victims by denying their human characteristics or their suffering and mind abilities is an effective strategy to rationalize with their plights and

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promote their harm (e.g., Castano & Giner-Sorolla, 2006; N. Haslam & Loughnan, 2014, 2016; Leidner et al., 2010). Downplaying the victims allows rationalizing the harm they underwent as “we may have killed them, but if they are like animals, then surely we should not feel bad about our action” (Castano & Giner-Sorolla, 2006, p. 805). Therefore, if “Eating animals is morally troublesome when animals are perceived as worthy of moral concern” (Loughnan et al., 2014, p. 105), then an efficient way to address this moral conflict should be to take back what makes animals morally concerning. Findings of the meat-paradox indeed demonstrate that, when the relation between meat and animals is salient, people disengage from meat-consumption by directly denying animals their mind and suffering abilities (Bastian, Loughnan, et al., 2012; Bratanova et al., 2011; Loughnan et al., 2010). Therefore, if eating animals is morally concerning, it becomes of lower importance if a posteriori we demean animals of what makes them relevant for our moral considerations, namely their mind. Let’s say that we may have eaten them, but if they are mindless animals, then surely we should not feel bad about the meal we just had.

[Animal experimentation and the motivated perception of laboratory animals](#)

Looking at human-animal relations through the lens of cognitive dissonance and moral disengagement theories, it seems that we do not eat some animals because of their lower intrinsic values, but rather categorize them as having lower intrinsic values because we must justify eating them. However, meat consumption is not the only activity where humans reap benefits from animals at their expense, therefore there is no reason that denial of mind only occurs with food-animals. We will examine whether the mind denial of the meat paradox could translate into animal-experimentation and if the responsibility we feel in exploitation of laboratory-animals motivates us to deny their mind abilities to cope with our discomfort.

Besides, protecting others from suffering is central in our moral foundations but while it has been theorized that the harm underwent by animals is a key trigger of the moral disengagement process (Bastian & Loughnan, 2017), there are still no strict empirical demonstrations to support this claim. Therefore, through our new perspective we will try to fill this empirical gap by directly examining how the pain experienced by laboratory animal relates to the perception of their mind abilities. Since the greater the harm underwent by an animal should be the more morally

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disturbing occasion the higher the need to disengage from them, we will examine if it results in a greater mind denial.

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Chapter 7. The Obedience to (scientific) Authority

When individuals are involved in harm-causing behaviors, mechanisms facilitating the conduct of harm exist; otherwise, we would not be aware of any atrocities or cruelty conducted in context of wars or violence (see Bandura, 1999).

In this chapter, we will examine what allows individuals to inhibit their considerations toward others, focusing on one of the most influential social psychology frameworks that aimed to understand how ordinary people come to cause harm (see Benjamin & Simpson, 2009).

Obedience to authority or engaged followership?

In the 1960s, Yale university psychologist Stanley Milgram conducted a series of studies attempting to explain how Nazis could have committed so many atrocities in the Holocaust and was particularly seeking to understand if obedience to authority can turn the ordinary man into evil (Milgram, 1963, 1965, 1974).

Milgram's procedure consisted of recruiting participants in the context of a supposed research in learning and memory, and assigning them to assume the role of a *teacher*, having them administer shocks to another person, *the learner*, depending on its memorization skills and under the supervision of an authoritarian figure, the *experimenter*. Obviously, the *learner* was a confederate and never received any shocks, and the real purpose of the research was to examine to which extent the *teacher* will comply to the order of the *experimenter* and harm another person to such an extent to administer lethal shocks. Although they are not all as widespread in the literature (see Haslam et al., 2014), Milgram conducted 24 experiments where he varied a lot of parameters, such as the prestige of the environment where the study took place (experiment 23), the health condition of the *learner* (experiment 5), or the physical proximity between the *learner* and the *teacher* (experiment 4). In general the goal remained the same: studying how the obedience to authority leads an ordinary man to harm and eventually to kill.

According to Milgram, his studies witness the erasure of the individual in favor of an authority, and the more the authority is marked, the higher the level of obedient aggression toward the target (Milgram, 1974, but see Bandura, 1999, p. 197). For Bandura (1999), the displacement of responsibility greatly helped individuals to administrate shock in Milgram's experiments, particularly since during the

experiments the experimenters made it clear that in case of any problem, they would take full responsibility for it. Therefore, even though participants were aware that they were causing pain to others, Milgram explains that having an authoritarian figure by their side allowed them to relieve themselves of all responsibility as just bend to the demands of the authority (Milgram, 1974). This is what Milgram called the *blind obedience to authority* that turns an ordinary man into agentic state, acting like a robot and being willing to commit the worst atrocities if ordered to do so (Milgram, 1974, but for a review see Haslam & Reicher, 2017).

However, despite the strong media coverage and the huge impact Milgram's work had had on numerous social science disciplines, the original explanations of the results are widely discussed²⁰ and it seems that participants have not acted out of blind obedience to authority (e.g., Haslam et al., 2014; Reicher et al., 2014). A strong alternative line of explanations sits in the Engaged Followership Theory (S. A. Haslam & Reicher, 2017; Reicher et al., 2012) and proposes that participants administered shocks because they had identified themselves with the scientific objectives of the research and with the experimenters. Engaged followership theory finally explains that participants administering shocks were aware of the ins and outs of the research and voluntarily decided to stick to it because of the acceptance of the scientific goals and because of the leadership of the experimenter (e.g., Haslam & Reicher, 2012; Reicher et al., 2012). Thus, participants were not passive and obedient, but being framed around a scientific enterprise, an emergence of a new moral justification occurred (see Bandura, 1999, Figure 2), and at the time of the experiment they found it more important to reach the objectives of the research than to care about their fellows. Giving credence to these explanations, when people are asked these days to what extent they identify with the experimenters in Milgram's original studies, it strongly predicts the level of obedience and the administration of shock in those studies at the time (Reicher et al., 2012). In the same vein and drawing on material of Yale's Milgram archive, research that looks like a 'Cold Case' episode reports that participants were convinced they were participating in a noble cause by inflicting shocks, and that they were intimately sure it was the right thing to

²⁰ It is worth mentioning that Milgram's studies have been heavily criticized on ethical and methodological grounds (e.g., Baumrind, 1964; Nicholson, 2011; Perry, 2013). For instance it is likely that the level of shock administration had been inflated by participants that did not truly believe to the veracity of these shocks (see Perry et al., 2019), or that the general conclusions were not what Milgram claims they were (Brannigan et al., 2015).

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do (S. A. Haslam et al., 2015). Jointly, along with the importance of the research objectives, the participants also considered the suffering of others to a lesser extent and saw their participation as “contributing to a moral, worthy, and progressive cause” (Haslam et al., 2015, p. 60).

In fact, from the original ads to find participants that were framed around scientific research, to the lab coat worn by the experimenter, Milgram led participants believe that they will contribute to science. He explicitly reported, “The subjects have come to the laboratory to form a relationship with the experimenter, a specifically submissive relationship in the interest of advancing science.” (Milgram, Box 46, Yale archive; cited in Haslam et al., 2015, p. 60). In fact, he has specifically tested the role of scientific authority credibility, as for instance he manipulated if the orders to shock were given by a scientific or by an ordinary man (Milgram, 1974, experiment 13), or what would happen if two scientist-experimenters disagreed about continuing the task (Milgram, 1974, experiment 15). The new re-evaluations of Milgram's work indicate that by doing everything to produce “*obedience to authority*” in an experimental context, Milgram has in fact created the perfect situation to observe *engaged followership*.

Within the lecture of the engaged followership theory, if perpetrators commit harm, it is not out of blind obedience but “because they are convinced they are doing good.” (Haslam et al., 2016, p. 8), and thus working for science would be the perfect supraordinate goal that could lead to conduct harm for the greater good. Nevertheless, despite retrospective reanalyzes of existing data; we are somehow lacking confirmatory behavioral proof that this infatuation for science would cause engaged followership and consequently lead to inflicting harm to others. However, we have noted some evidence of this phenomenon; for example, during an aversive task consisting of using very negative stereotypes to characterized social groups increasingly pleasant, the scientific goals-oriented prods better facilitate the pursue of the task than order-like prods (S. A. Haslam et al., 2014). Based on the same protocol, it appears that requesting participants to think about the importance of science before the experiment motivates them to go further in the aversive task than participants that had to think about the problems existing in science (Reicher, Birney, & Haslam, unpublished²¹, quoted in Haslam & Reicher, 2017). These prior results

²¹ For a TedX video presenting this study, please see Haslam, 2016, 12:00

seem to confirm that the very idea of science motivates individuals to close their eyes on their considerations toward others to reach the aimed objectives, however, let's admit that it is still less telling and spectacular than Milgram's experiments.

"[...] what makes people willing to abuse to tyrannize to oppress to torture other people, well the first thing to know is it is very hard work it requires energy, application, and enthusiasm; it isn't something that you sleepwalking like a zombie, no, it's hard work, and ultimately perpetrators are people who do what they do because they see it to be a labor of love"

Haslam, 2016, 17:11.

The call of science and animal experimentation

The strong similarities between Milgram's experiments and animal-experimentation are striking. On one hand, ordinary people in Milgram's experiments came to administrate harmful shocks to their fellows in the quest of accomplishing research-related objectives. On the other hand, lab-technicians also must harm animals to develop drugs and products. In fact, there is no reason to believe that lab-technicians are no ordinary people. Harming animals is evidently not one of their primary motivations when they put on their lab coats. Facing the ethical dilemma that represents animal-experimentation, their desire to contribute to science and to work for the greater good may guide their arms and their reasoning.

Milgram's work is the perfect framework to examine the behavioral use of animals in medical settings, and having ordinary people conducting animal research could allow us to extend Milgram's findings to an animal target for the first time ever. Additionally, as one of the aims of this thesis is to examine the role of individual dispositions in attitudes toward animal-experimentation, a conceptual replication of Milgram's experiment could allow us to scrutinize which personal traits predict the behavioral use of a laboratory-animal.

Besides, Milgram's studies left some questions unanswered, and running replications raises ethical concerns (e.g., Baumrind, 1964, but for a recent replication see Doliński et al., 2017). Would it not be possible to benefit of a Milgram-like animal-

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research, to clearly test the role of engaged followership in the conduct of harm? Despite a strong sympathy for works that tried to fill the gap (Reicher, Birney, & Haslam, unpublished; Haslam et al., 2014), we must recognize that the experimental evidence of engaged followership is weak and that confirmation through Milgram-like paradigms is lacking (see Gibson, 2019, p. 62). Through this research program, we aim to fill this gap and provide experimental evidence of the role of science in the numbing of considerations for others, therefore facilitating and justifying the conduct of harm, especially toward laboratory-animals.

“The physiologist is not a man of the world, he is a scientist, he is a man who is seized and absorbed by a scientific idea that he pursues: he no longer hears the cries of animals, he no longer sees the flowing blood, he sees only his idea and sees only organisms that hide from him the problems that he wants to discover.”

Bernard, 1865, p.180

PART 2. Guiding questioning

PART 2. Guiding questioning

We have just reviewed some of major frameworks of social psychology and saw that some dispositions and some characteristics, whether they are nested in personality or context dependent, dictate the way we perceive others and the considerations we have in their regard, and can even predict our behaviors toward them. Moreover, we have even seen that those predictors of human interactions may even predict our relations with animals.

Through this dissertation we will push the reasoning a little further and scrutinize whether the attitudes and behaviors surrounding animal experimentation could be explained relying on the same frameworks. Precisely, we will study the roles individual dispositions, animals' characteristics, and contextual elements play in the way people perceive animal-experimentation and behave toward laboratory-animals.

First, we will scrutinize gender differences when it comes to animal-experimentation and try to explain them. Women have always had stronger positions against animal experimentation than men, but explanations of this gender-gap are lacking. We will examine whether this gender-gap could be explained by underlying differences in certain individual dispositions such as in SDO, speciesism and empathy.

Next, we will examine what makes animals have a mind, or rather what makes us perceive their mind. We have seen how much moral considerations should animals' mind grant them, and that their minds make their suffering unbearable, yet it remains to be clarified why animal-suffering and animal-exploitation are widespread and common. We will examine whether all individuals are equally predisposed to perceive mind in lab-animals, which would explain differences in consideration for them, specifically looking at the role of SDO in the mind perception of animals. Additionally, we will also examine whether the perception of mind in lab-animals could be a motivated strategy to reason out the harm they have suffered.

Then, we will try to figure out if the thrill for science could justify the view of animal-experimentation being justified, and whether it could facilitate the sacrifice of an animal for research. Some theorizations of Milgram's studies argue that people might be willing to cause harm to others if they adhere to the purpose of the research and identify themselves with the researcher, and animal-experimentation is the perfect situation to empirically test this idea. Therefore, we will scrutinize to which extent pro-scientific attitudes are associated with the perceived legitimacy of animal-

experimentation and if the thrill for science leads to the effective harm of a laboratory-animal for research.

After that, we will scrutinize whether the very widespread practice consisting of refusing to name laboratory-animals indeed allows researcher to repress their empathic considerations toward lab-animals and alleviates the stress generated by their suffering, thus helping them to conduct experimental procedures inducing harm. Additionally, we will also examine if inter-individual in self-regulation abilities, measured through HRV, could predict the willingness to kill an animal into an experimental context.

Finally, if some individual dispositions are indeed related to attitudes toward animals, we will scrutinize whether they could also predict the behavioral engagement in a situation causing harm to an animal. Precisely, focusing on major predictors of human-animal relations - gender, empathy, speciesism and SDO, we will examine to which extent they predict the lethal use of an animal for science.

PART 3. Empirical Evidence: Gender and Animal Experimentation

Looking at the gender-gap in animal experimentation and the role of SDO, speciesism, and empathy

Aim of the research

Gender is a critical determinant of attitudes toward animal-experimentation. Women being always more opposed to this practice than men are. For a long time, to explain this gender-gap, the population and defenders of animal experimentation relied on well-established stereotypical views of women as sensitive and men as tough, yet we lack *real* explanations for this gender-gap. This research aims to fill this gap, trying to determine what underlying personality traits may be involved when it comes to having an opinion on animal-testing, and if it really is a matter of sensitivity, to measure it properly.

In this research we will focus on three individual dispositions, known on the one hand to produce gender differences, and on the other hand to predict attitudes toward animals in general. We will thus first examine if we can find gender-differences on empathy, SDO, and speciesism, and then whether those individual dispositions predict attitudes toward animal experimentation. We hypothesize that women will score significantly lower on SDO and speciesism, and higher on empathy, than men. Next, we hypothesize that while the higher the empathy the lower the endorsement of animal experimentation, higher scores on SDO and speciesism will be associated to a greater support of this practice.

Additionally, we will scrutinize if gender differences in those individual dispositions explain the gender-gap in attitudes toward animal experimentation. More precisely, using mediation models we will examine if the inter-individual differences on empathy, SDO, and speciesism, related to the gender, are not affecting the perception that individuals have of animal experimentation. To summarize, this research aims to elucidate if gender-gap on attitudes toward animal experimentation is explained by empathy *and/or* SDO *and/or* speciesism gender differences.

PART 3. Empirical Evidence: Gender and Animal Experimentation

Manuscript 1

This manuscript was submitted to *Anthrozoös* and is currently under review. For any relevant material about this research, please see Appendices 1, 2, 3, and 4.

The gender gap in animal experimentation support: the mediating roles of empathy and speciesism

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Abstract

There is a strong gender gap in support for animal experimentation, men having always endorsed this practice more than women did. However, little is known on the psychological factors that are involved in these differences. Drawing on a diverse and large sample (N = 1005), we hypothesised that empathy, social dominance orientation (SDO), and speciesism would mediate gender differences in attitudes toward animal experimentation. Our results indicate that gender-differences in empathy and speciesism mediate the link between gender and support for animal experimentation, but not SDO. Besides, an integrative model also confirmed the role of gender differences on dispositional empathy into speciesist attitudes and animal-testing testing.

Keywords: gender studies; human-animal relations; empathy; speciesism; animal testing

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PART 3. Empirical Evidence: Gender and Animal Experimentation

1.1 A gender gap in attitudes toward animal experiment

Animal experimentation refers to scientific practices involving animals in a laboratory to develop procedures, drugs, or substances, and it takes place in a wide range of areas including biological research, medicine, and agronomy (Monamy, 2017). Since the late nineteenth century and the emergence of the first anti-vivisectionist movements, a stronger gender gap exists on attitudes toward animal-experimentation and women have been heavily engaged in animal advocacy, particularly in Great Britain (Hamilton, 2004). In the conservative Victorian era, this sudden increase in interest for the welfare of laboratory animals was not viewed very favorably, and while pro-vivisectionist positions were associated with '*manly*' or '*rational science*', anti-vivisectionist ones were seen as '*emotional*' or '*unscientific femininity*' (DeWitt, 2013, p. 135), and the latter advocates were described as being overly sensitive or even insane. Nowadays, although women are still considerably more opposed and critical towards this practice than men (Crettaz von Roten, 2013; Driscoll, 1992, 1995; Hagelin et al., 2003; Hussar & Harris, 2018; Ormandy & Schuppli, 2014), little is known about why such a gender gap exists in opinions on animal testing.

Overall, gender is a strong predictor of attitudes and behaviours towards animals, and women have been found to have greater positive attitudes towards animals (Amiot & Bastian, 2015; but for a review, see: Herzog, 2007) and greater concern for animal welfare (Phillips et al., 2010; Randler et al., 2021) than men do. For instance, women have more pets (Applebaum et al., 2020) and often reject meat-based diets (Modlinska et al., 2020; Ruby, 2012), and men are more involved in animal-harming situations (i.e., hunting, animal abuse; see Gerbasi, 2004; Heberlein et al., 2008) and a strong relation exists between meat eating and masculinity (Love & Sulikowski, 2018; Rozin et al., 2012). Additionally, these stronger commitments of women towards animals are directly noticeable in animal-welfare activism, as women are more engaged in animal protectionism and activism than (Galvin & Herzog, 1998; Plous, 1991). Still, the question remains of why this gender gap exists. In fact, this heterogeneity could be caused by as many factors as those which exist in relation to gender disparities generally (for a review, see: Eagly et al., 2004), such as gender stereotypes (e.g., being a woman is associated with caring for others). Nonetheless, if finding an explanation for the underlying cause is a multifactorial never-ending

quest, it remains to us to explain *how* this gender gap influences perceptions of animal experimentation and to identify the underlying individual dispositions involved.

First lead lies in differences in individuals' speciesist dispositions. *Speciesism* supposes that humans can use and exploit animals regardless of their will, because non-human creatures are of lower intrinsic value than humans are (Caviola et al., 2019). Because animal experimentation implies relying on animal models for the benefits of humans, the idea of speciesism relates strongly to this scientific practice (see Caviola et al., 2019; Herzog et al., 1991). Speciesism is directly related to the way we perceive animals, and for instance the stronger this disposition and the stronger the meat-eating behaviour and the lower the interest in animal welfare (Caviola et al., 2019; Hoffarth et al., 2019). Echoing the gender gap on attitudes towards animals, men are known to endorse more speciesist attitudes than women (Caviola et al., 2019; Graça et al., 2018; Hoffarth et al., 2019), and it might be that the gender-gap toward animal experimentation is explained by underlying gender-differences on speciesism. Additionally, and perhaps most importantly, gender disparities on speciesism have been explained by differences in underlying individual dispositions, and Graça and colleagues (2018) suggest that to fully grasp gender differences in human-animal relationships, a greater knowledge of underlying individual disposition differences is required.

Empathy, which is the ability to understand and to share others' affective and mental states (Davis 1996; Singer & Decety, 2011), is one of the two dispositions identified as mediating the relationship between gender and speciesism (Graça et al., 2018). Empathy is not limited to human-to-human interactions, as we have the brain and genetic dispositions to express it towards animals too (Filippi et al., 2010), and high empathic dispositions are related to a greater attribution of mental states to animals (Hills, 1995) and to better positive attitudes towards them (Eckardt Erlanger & Tsytsarev, 2012; Taylor & Signal, 2005). Empathy is the intrinsic tendency to care about people's plight, hence it is not surprising that this trait is associated negatively with support for animal testing (Broida et al., 1993; Furnham et al., 2003). Additionally, because there are gender differences in empathy (e.g., Christov-Moore et al., 2014; Hoffman, 1977), men and women differ on their empathy for animals (Hills, 1995), speciesist attitudes (Graça et al., 2018) and care for the well-being of laboratory animals (Gallup & Beckstead, 1988). In fact, this gender gap in animal empathy is noticeable even in veterinary and animal science studies, where women

PART 3. Empirical Evidence: Gender and Animal Experimentation

express greater concern for the suffering and anguish of animals than their male coworkers do (Heleski et al., 2006). At first glance, gender differences in empathy could directly explain gender-gap toward animal-experimentation, but also could explain indirectly the support toward this practice through an influence on speciesism.

Social dominance orientation (SDO, Sidanius & Pratto, 1999) is the second disposition discovered to explain the connection between gender and speciesism (Graça et al., 2018), and SDO measures “*the extent to which one desires that one’s in-group dominate and be superior to out-group*” (Pratto et al., 1994, p.742). SDO captures the will to hierarchize social groups and represents a group-based domination, hence it is a strong predictor of prejudice and discrimination toward others (e.g., Altemeyer, 1998; Ekehammar et al., 2004) and is generally associated with a lack of empathy (e.g., McFarland, 2010; Pratto et al., 1994; Sidanius et al., 2013). Additionally, it is linked to prejudice against animals (Hoffarth et al., 2019), to the belief that they have low cognitive abilities (Bilewicz et al., 2011), and is also linked to beliefs or actions that support using and exploiting animals for human benefit (Dhont & Hodson, 2014; Hyers, 2006; Jackson & Gibbins, 2016). In fact, SDO and speciesism are strongly related (Caviola et al., 2019; Dhont et al., 2016; Graça et al., 2018; Jackson & Gibbins, 2016), particularly because both constructs defend the idea of a hierarchical system, between social groups for the former, and between species for the latter. Since animal experimentation assumes that inferior groups (lab animals) are utilized for the benefit of superior groups (humans), adherence to SDO could capture the legitimacy one finds in this situation (for a quite similar situation see Loughnan et al., 2014). Additionally, the gender discrepancy toward animal testing may be explained by the fact that men often have higher SDO than women (Pratto et al., 1994; Sidanius et al., 2000; Sidanius et al., 1994; Sidanius & Pratto, 1999). Likewise empathy, it is plausible that SDO directly explains the gender-gap in animal-experimentation, but also indirectly as influencing speciesism.

1.2. *The present research*

At this point, the indirect effects of speciesism, empathy, and SDO should now be carefully considered to understand why men generally support animal testing more than women do. Graça and colleagues (2018) demonstrated that gender differences

in empathy and SDO could lead to different levels of speciesist dispositions, and this research aims to take the reasoning further and examine how this model could explain the gender-gap that exist when it comes to animal testing. An integrative model should therefore consider how gender variations in SDO and empathy, could influence speciesist dispositions and consequently explain attitudes toward animal experimentation. Overall, we see this research as an extension of an existing research to understand a practical issue that remains unanswered

First, we scrutinized how SDO, empathy and speciesism were interrelated, and how men and women differentiate in them. Then, we turned to the gender-gap in the support of animal experimentation and inspected whether gender-differences in our individual dispositions of interest could explain this heterogeneity one at a time, and then altogether in an interactive model. Overall, we hypothesized that the gender-gap toward animal experimentation would be, 1) explained by different levels of empathic, SDO, and speciesism coming from gender-differences, 2) but also be explained by different levels of speciesism that would be the result of gender-differences in empathy and SDO. Please see Figure 1 for the hypothesized model.

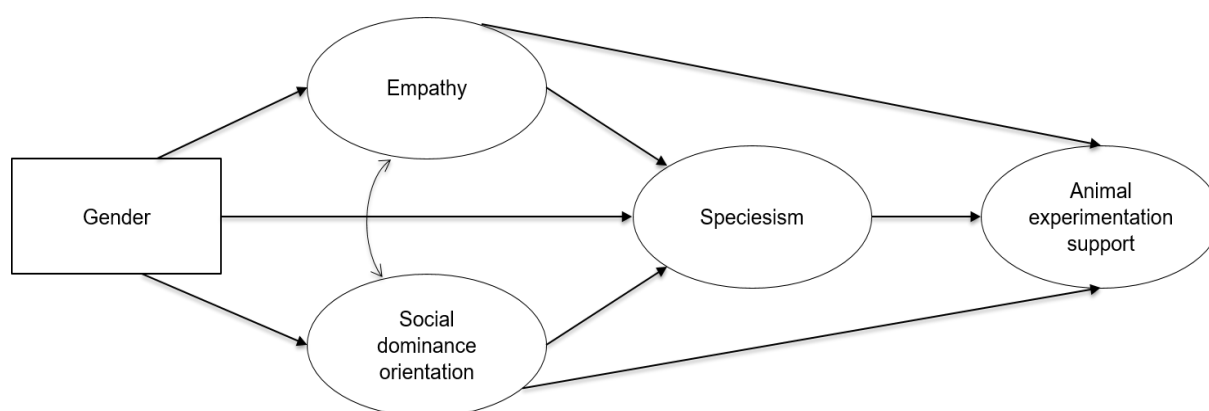


Figure 3. Hypothesized model explaining the gender-gap toward animal experimentation through gender differences in speciesism, empathy and social dominance orientation, and through speciesist differences resulting of differences in empathy and social dominance orientation.

2. Method

2.1 Open science

The original material, analysis code, and data are accessible on the Open Science Framework page of the project, as are the original planned analyses²². In this

²² For the project page, please see: https://osf.io/3x8hs/?view_only=b1ca72b287dd43bf9f262d07b25b8b0f; for the preregistration please see: https://osf.io/k4nvw/?view_only=6f286699f2294da6986058e12f2dc6f9

PART 3. Empirical Evidence: Gender and Animal Experimentation

research, another preregistered analysis was also conducted but is not presented here, but for the purpose of transparency is accessible on the project page.

2.2 Participants

We conducted an online survey using a LimeSurvey questionnaire that took approximately 10 minutes to complete. Participants were French all-comers and were recruited for payment by a company specializing in panel and data collection, that was asked to compile a gender-balanced sample, and 1005 participants were recruited (551 women, 1 other, $M_{age} = 49.1$, $SD_{age} = 9.94$, range: 35-70). Participants were from a wide range of socio-professional groups, the majority of whom (36.22%) were employees, 19.80% were retirees, 17.51% had intermediary professions, 12.14% had executive or high intellectual professions, 8.65% were workers, 4.18% were craftsmen or shopkeepers, and the rest respectively had another profession, were farmers, or decided to not answer on their occupation (1%, 0.3%, 0.2%).

2.3 Measures

We presented 7-point Likert scales ranging from *totally disagree* (1) to *fully agree* (7) for all our measures. First, the participants answered a 6-item scale developed in our lab to measure support for animal experimentation (e.g., 'It is acceptable to test drugs on animals to ensure that there are no risks to humans'; see supplementary material for the item list). Next, we measured SDO with an 8-item scale (e.g., 'Some groups of people are simply inferior to other groups', Ho et al., 2015). After that, we presented our speciesism measure with 5 items (e.g., 'Morally, animals always count for less than humans'), that was based on a 6-item validated scale (Caviola et al., 2019) from which we removed one item that referred to animal experimentation which was already presented in our animal experimentation support measure. Including this item did not affect the significance or the direction of the results. Finally, to measure the dispositional empathy level, we presented 7 items measuring the empathic concern from the Interpersonal Reactivity Index (e.g., 'When I see someone being taken advantage of, I feel kind of protective towards them', Davis, 1983; Gilet et al., 2013). Table 1 displays the reliability, descriptive statistics, and correlation matrix between the measures. Some demographics were assessed at the beginning of the survey (i.e., age, gender), and other at the end (i.e., socio-professional group).

Table 1.

Descriptive statistics and correlation matrix between measures.

| Measures | α | M | SD | Correlations | | | |
|---------------|-----------------|------|------|---------------------|---------------------|------------------|---|
| | | | | 1 | 2 | 3 | 4 |
| 1. AES | .94, [.93; .94] | 3.32 | 1.50 | - | | | |
| 2. Empathy | .80, [.78; .82] | 5.08 | 0.95 | -.15, [-.21; -.09]* | - | | |
| 3. Speciesism | .79, [.77; .81] | 2.74 | 1.18 | .61, [.57; .65]* | -.37, [-.42; -.31]* | - | |
| 4. SDO | .79, [.77; .81] | 2.99 | 1 | .21, [.15; .27]* | -.47, [-.52; -.42]* | .36, [.30; .41]* | - |

Note. Numbers in brackets are 95% confidence interval. Correlations are Bravais-Pearson's. * $p < .001$. AES stands for Animal Experimentation Support, SDO stands for Social Dominance Orientation.

3. Results

Four participants were excluded from the analyses as being outliers with studentised deleted residuals superior to 4 or inferior to -4 (Judd et al., 2017), leaving 1001 participants in the sample. Including these outliers in the analyses did not affect significantly the main conclusions.

3.1 Correlational and gender differences analysis

Overall, our preliminary results show consistent findings with the literature, such as empathy being negatively linked to SDO and speciesism, and that these two hierarchical ideologies are positively associated with each other (e.g., Caviola et al., 2019). Additionally, while empathy was negatively related to support for animal experimentation, both speciesism and SDO were positively related to it, reproducing existing patterns between personality and attitudes towards animal exploitation in general (e.g., Graça et al., 2018), see Table 1).

In addition, gender differences analysis reveals that men hold more speciesist attitudes and support more animal experimentation than women, but conversely that women endorse more empathic dispositions than men do. This analysis also reveals that men tend to endorse greater SDO than women, but this difference is barely significant ($p = .047$). See Table 2 for means and statistical tests.

Table 2.

Mean of gender differences among the measures and test of the differences.

| Measures | M_{men} | SD_{men} | M_{women} | SD_{women} | Key statistics | |
|---------------|-----------|------------|-------------|--------------|---------------------------|--------------------|
| | | | | | <i>t</i> -test | Cohen's <i>d</i> |
| 1. AES | 3.57 | 1.48 | 3.10 | 1.48 | $t(998) = 5.02, p < .001$ | 0.32, [0.19; 0.44] |
| 2. Empathy | 4.85 | 0.92 | 5.27 | 0.92 | $t(998) = 7.14, p < .001$ | 0.45, [0.33; 0.58] |
| 3. Speciesism | 2.97 | 1.18 | 2.53 | 1.11 | $t(998) = 6.01, p < .001$ | 0.38, [0.26; 0.51] |
| 4. SDO | 3.06 | 1.02 | 2.93 | 0.97 | $t(998) = 1.99, p = .046$ | 0.13, [0.00; 0.25] |

Note. Numbers in brackets are 95% confidence interval. AES stands for Animal Experimentation Support, SDO stands for Social Dominance Orientation.

3.2 Mediation analysis

Setting gender as a main predictor, empathy, SDO, speciesism as mediators, and animal experimentation support as the outcome, we computed a mediation serial model using the “lavaan” R package (Rosseel, 2012). Gender was recoded (Women = 0, Men = 1), the correlational relation between SDO and empathy was entered as a covariate in the model, and we used adjusted bootstrapping method (BCa) with 5000 iterations to estimate 95%CI of the effects. Because our model was over specified, it was saturated ($df = 0$). See Figure 2 for the model presenting the results.

In our model, men showed lower empathic ($b = -0.42, p < .001, 95\%CI [-0.53, -0.30]$), greater SDO ($b = 0.13, p = .045, 95\%CI [0.00, 0.25]$), and greater speciesist dispositions ($b = 0.31, p < .001, 95\%CI [0.17, 0.44]$), than women did. Controlling for participants' gender and SDO levels, empathy was still negatively related to speciesism, $b = -0.27, p < .001, 95\%CI [-0.36, -0.19]$, and reversely SDO was still positively related to speciesism after controlling for gender and empathic dispositions, $b = 0.28, p < .001, 95\%CI [0.20, 0.37]$. Controlling for empathy and SDO levels, men still endorsed greater speciesist dispositions than women did, $b = 0.31, p < .001, 95\%CI [0.17, 0.44]$, and controlling for participants' gender and speciesism levels, empathy and SDO were still strongly associated, $b = -0.43, p = .046, 95\%CI [-0.50, -0.38]$.

Interestingly, looking at our variables of interest one by one and controlling for the others, we see that while speciesism ($b = 0.92, p < .001, 95\%CI [0.87, 0.98]$) and empathy ($b = 0.23, p < .001, 95\%CI [0.15, 0.32]$) predict positively the support toward animal experimentation, SDO does not anymore, $b = 0.05, p = .24, 95\%CI [-0.03,$

0.13]. Importantly, while the total effect of gender on animal experimentation was significant, $b = 0.47$, $p < .001$, 95%CI [0.28, 0.65], the direct path was a lower strength and barely significant, $b = 0.14$, $p = .04$, 95%CI [-0.00, 0.28], which suggests a partial mediation pattern.

Consequently, our model indicates that the indirect effect of gender through empathy (not including speciesism) predicts significantly animal experimentation support, $b = -0.09$, $p < .001$, 95%CI [-0.15, -0.06], as well as the indirect effect of gender through speciesism, $b = 0.28$, $p < .001$, 95%CI [0.16, 0.41]. Moreover, the indirect effect of gender through empathy and through speciesism was also significantly predicting animal-experimentation support, $b = 0.10$, $p < .001$, 95%CI [0.07, 0.15]. However, the indirect effects of gender on the support toward animal experimentation through SDO were non-significant, whether they went through speciesism, $b = 0.03$, $p = .055$, 95%CI [0.00, 0.07], or not, $b = 0.01$, $p = .35$, 95%CI [0.00, 0.02].

Overall, this mediation model indicates that gender differences in empathy and in speciesism explain the gender-gap toward animal experimentation, but also that speciesist dispositions caused by gender-differences in empathy explain more precisely why men tend to support more favourably animal testing than women. However, our data does not support that gender differences in SDO play a role in attitudes toward this practice.

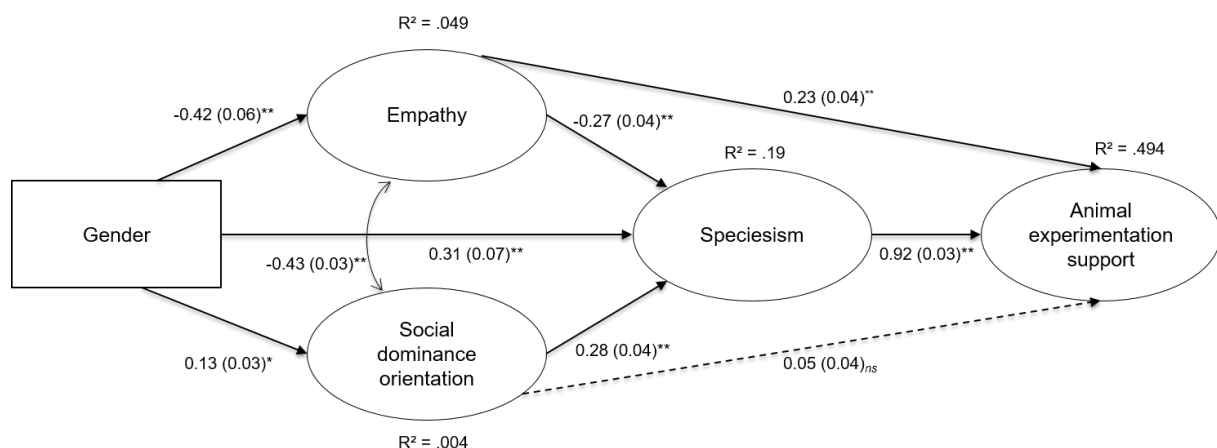


Figure 4. Mediation serial model showing standardized estimates of gender predicting the support for animal experimentation through empathy, social dominance and speciesism. Indirect paths predicting animal experimentation support through social dominance orientation are not significant. ** $p < .001$, * $p < .05$, *ns* non-significant

4. Discussion

This research undertakes to fill the gap on the lack of underlying dispositional explanations of the gender-gap in the support of animal experimentation by relying on Graça et al.'s model (2018), and by examining the interactive role of gender, SDO, empathy, and speciesism. Drawing on a large, diversified and gender-balanced sample, we particularly set out to examine the role of gender-differences into the formation of SDO, empathy, and speciesism, and the mediator roles of these dispositions into animal experimentation support.

First, our results bring more evidence about the interrelations between empathy, SDO, and speciesism, and their relations to pro-animal experimentation attitudes. These findings are in line with the prior human-animal relations literature (e.g., Caviola et al., 2019), indicating that holding strong hierarchical ideologies and/or having low empathic dispositions are associated with positive attitudes towards animal exploitation. Prior to examining the role of these dispositions as mediators, we looked at gender differences in relation to them, and while (consistently with the literature) we found that women and men had different levels of empathy and speciesism, SDO gender-gap were less pronounced in our data. While the former results are also consistent with the literature, the latter is surprising, as overall we reproduced existing patterns, and that gender-gap on SDO is known as a robust finding (e.g., Pratto et al., 2006). Descriptively, in our sample men have higher SDO than women (see Table 2) and we reason this absence of effect as a statistical failure (i.e., a Type-2 error), and we speculate that with a larger sample, the significant effect would have appeared. Anecdotally, even robust findings sometimes fail to emerge as for this gender-specific heterogeneity (Küpper & Zick, 2011, study 1; Pratto & Hegarty, 2000, study 4).

More importantly, we examined whether gender-differences in SDO, empathy and speciesism could not explain gender-gap in animal experimentation perception. Moreover, considering speciesism as the result of empathic and SDO dispositions (Graça et al., 2018), we also examined whether speciesism could not also play a mediator role into the predictive roles of empathy and SDO on animal experimentation support. First, our mediation model confirms that gender-differences in empathy and speciesism are mediators of the relation between gender and the support for animal experimentation, then, we extend Graça et al.'s findings by

showing that speciesist dispositions induced by a lack of empathy are also explaining this gender-gap. However, our results failed to find mediator roles of SDO, whether it is as directly mediating the relation between gender and attitudes toward animal experimentation, or through influencing speciesist dispositions, which is the consequence of the very weak SDO gender-gap in our data.

Our finding allows a better understanding of how gender predisposed people's attitudes about animal-experimentation and provide evidence that if a strong gender-gap exists in the way individuals perceive this practice, and then this is mostly due to underlying gender-differences in empathic and speciesist dispositions. Even though this research does not allow greater understanding of the roots of the gender heterogeneity that can lie in endogenous or social construction differences, it acknowledges that it is not directly a person's gender that affects their perception of animal experimentation, but more precisely the individual traits that are affected by their gender.

Limitations and futures directions

There are several limitations in this work. First, it must be underlined that it is surprising not having found a stronger gender-gap on SDO, and that this lack of results inevitably has been detrimental to our mediation models examining the role of SDO. Future research could try to replicate our study for a better appreciation of the role of SDO into the perception of animal experimentation. Besides, despite strong theoretical assumptions that make different directions unlikely in our model, we must recognize that this is a cross-sectional study and that experimental manipulations (i.e., manipulation of SDO) could reinforce our causal claims. Finally, although the focus of this study was on animal experimentation, we think that Graça et al.'s model could be extended in a similar manner to ours and explain precisely other gender-gap in related to animal exploitation and suffering (i.e., corridas, meat-eating, hunting).

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PART 4. Empirical Evidence: Perception and evaluation of (lab) animals

PART 4. Empirical Evidence: Perception and evaluation of (lab) animals

Dispositional differences in the perception of mind and cognitive abilities among (lab)animals

Social dominance orientation, and the perception of laboratory animals and animal-testing

Aim of the research

The main aim of this research was to clarify the role of SDO on attitudes toward animals, particularly on the moral concern toward them and on speciesist attitudes.

The relation between SDO and the lower moral concern toward animals is clear (Costello & Hodson, 2010; Dhont & Hodson, 2014) and evidence highlight the relation between SDO and support of animal exploitation situations also exists (e.g., Jackson & Gibbings, 2016). Yet, there is little explanation of these relations and we aimed to examine whether the mind perception in animals could explain them.

We know that in some context the perception of animals' mind is a motivated process (Bastian et al., 2012), but outside our preliminary work on the matter, we lack evidence indicating that the perception of animals might be personally related, particularly under the influence of hierarchical dispositions. In fact, because SDO is partly rooted in empathic deficiencies (Duckitt, 2001), this research aims at elucidating whether the lower abilities to see mind in animals could explain why SDO-oriented individuals show low moral concern toward them and are more strongly supporting animal-exploitation situations.

Additionally, while the relation between SDO and *vertical speciesism* is clear (e.g., Caviola et al., 2019), if SDO transcribes a general hierarchical vision of social groups, this research will directly examine if SDO also predicts the adherence to *horizontal speciesism* and to the philosophy that not all animal species are ranked equally.

Concisely, this research examines if the lower moral concern SDO-oriented individuals feel for animals could in fact be explained by their lower abilities or willingness to recognize mind in animals.

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Manuscript 2

This manuscript was submitted to *British Journal of Social Psychology* and is currently under review. For any relevant material about this research, please see Appendices 1, 3, and 5.

Who cares about animals? The relation between social dominance orientation and mind perception in animals

Kevin Vezirian, Anthony Durand, Laurent Bègue

Abstract

Mind abilities should guarantee moral considerations to any entity, yet large inter-individual differences exist in our relations with animals, and adhesion to social dominance orientation (SDO) particularly relates to the support of animal-exploitation. This research examines whether differences in perception of animals' mind could explain why SDO echoes to lower moral considerations toward animals. In a first study (n = 535), focusing on animal testing as a typical animal-exploitation situation, we showed that SDO related negatively to the recognition of mind abilities in a laboratory-animal and to the moral concern toward it, but positively to the support of animal testing. Mediation models indicated that the lower mind perception partially explained why SDO related to the low moral concern toward the lab-animal and to the support of animal testing. Second study (n = 274), showed positive relation between SDO and *speciesism* (an ideology supporting animal-exploitation), but negative relation of these two ideologies with the general belief in animals' mind. A mediation model indicated that the belief in animals' mind partially explained the relation between SDO and speciesism. This research indicates that the lower recognition of mind in animals, partially explain why SDO-oriented individuals show lower moral considerations toward animals.

Keywords: *social dominance orientation, speciesism, mind abilities perception, moral concern*

Introduction

We massively rely on animals at their expense for food (i.e., Godfray et al., 2018) or in the context of animal-research (i.e., Knight, 2011), and many individual disparities exist as for our relations with animals (e.g., Amiot & Bastian, 2015).

Because they are at the heart of exploitation situations, *animals* are often categorized in intergroup literature as a full-fledged low-status social group (Dhont & Hodson, 2020; Dhont et al., 2019), and therefore the attitudes toward them can be examined through the theoretical framework of social dominance theory (SDT; Sidanius & Pratto, 1999). SDT seeks to understand how different social groups coexist within the same environment, but especially whether their status dictate the attitudes and behaviors toward them if they are in a dominant or subordinate position. A core element of SDT stresses the existence of “legitimizing myths” and particularly of hierarchy enhancing myths that perpetuate group inequality (i.e., racism; sexism) to legitimize *status quo*. Social dominance orientation (SDO; Sidanius & Pratto, 1999) is the key individual disposition capturing the adhesion to these legitimizing myths and is a major predictor of intergroup relations and forms of discrimination and prejudice (e.g., Bäckström & Björklund, 2007; Costello & Hodson, 2010; Hiel & Mervielde, 2005; Pratto et al., 1994; Sibley & Duckitt, 2008).

Since animals represent a low-social status group that suffer from inequality and that SDO crystallizes nothing but “the extent to which one desires that one's in-group dominates and is superior to outgroups” (Pratto et al., 1994, p. 742), SDO should be related to the considerations we have for animals and the perceived legitimacy of their use. Indeed, it turns out that the higher the SDO, the higher the will to widen the gap between animals and *us* (Costello & Hodson, 2010; Dhont & Hodson, 2014; Graça et al., 2018) and the greater the support of their exploitation (Caviola et al., 2019; Hyers, 2006; Jackson & Gibbings, 2016). However, it remains to be understood by which mechanisms the adhesion to hierarchy-based ideology leads to widening the gap between humans and animals. For instance, *speciesism* is an ideology that legitimizes animal-exploitation by stressing that humans have by default higher intrinsic value than all other animals (Caviola et al., 2019) and is strongly related to SDO (Caviola et al., 2019; Dhont & Hodson, 2014; Dhont et al., 2016), but the underlying nature of this relation remains to be examined.

Plausible explanation sits in the lower recognition of what make animals morally concerning. From a long line of philosophical tradition, we have linked the

mind abilities of entities to the moral considerations they deserve (e.g., Sytsma & Machery, 2012), and the perception of mind in entities is the essence of morality and the origin of our moral judgments toward them (Gray et al., 2012). This relation between mind and moral protection translates to animals, as their minds motivate us to have moral concern for them and to protect them from harm (e.g., Singer, 1990, but see Goodwin, 2015; Gray et al., 2007). However, do all people perceive the mind in animals to the same degree, and may intra-individual differences ultimately account for the variations in moral concern for animals? According to the dual process-model (e.g., Duckitt, 2001), the adhesion to SDO is partly rooted in empathic deficiencies that result into tough-minded and cold-hearted personality (Duckitt, 2001; Sibley & Duckitt, 2008), and consequently SDO is negatively related to empathy (e.g., Hodson, 2008; McFarland, 2010; Pratto et al., 1994; Sidanius et al., 2013). Empathy can be described as the ability to share and understand others' affective and mental states (Singer & Decety, 2011) and a lack of empathy is associated to the dehumanization (that can refer to a form of mind denial) of others (Haslam & Loughnan, 2014). Similarly, SDO is related to psychopathy (Glenn et al., 2009; Hodson et al., 2009) and psychopathy is associated to deficiencies in the perception of mind abilities in humans and animals (Gray et al., 2011).

There seems to be converging evidence suggesting that SDO-oriented individuals may lack of abilities to see and share other mental states, and therefore, one could hypothesize that the relation between SDO and the lower moral concern toward animals can be explained by less underlying dispositions to see in animals which make them morally relevant.

The present research

SDO does predicts human-animal relations, yet, it remains to be examined by which mechanisms the support of this hierarchical ideology leads to less moral concern toward animals. The aim of the present research is to scrutinize whether lower mind abilities recognition in animals from SDO-oriented individuals is explaining their lower moral considerations for animals and the greater support of their exploitation.

In Study 1 we focused on a typical case of animal-use to examine the extent to which SDO relates to the support of this practice and to the mind perception and moral concern toward a target animal. More precisely, we examined if an underlying greater mind denial of a laboratory-animal was explaining the relations between SDO

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and both the support of animal experimentation and the lower moral consideration toward the laboratory-animal. In Study 2, we aimed to strengthen our reasoning by examining whether a lower belief in animal mind could explain the relation between SDO and speciesist attitudes.

Study 1

In this study, we focused on a practical example rather evocative of a domination situation over animals, animal experimentation. Animal-experimentation asserts that since we have greater moral considerations for humans than for animals, relying on animal-models to develop pharmaceuticals is more acceptable and legitimate. Therefore, this situation distinguishes well the considerations we have for animals and those we have for our fellow humans, and interestingly the developed measures of speciesism explicitly refer to this practice (Caviola et al., 2019; Herzog et al., 1991). Thus, in this research we examined the interrelation between SDO, mind perception and moral concern toward a laboratory-animal, and the general support of animal-experimentation.

Method

Open Science

This study relies on new analysis of data from an independent preregistered experimental study that did not lead to conclusive results²³. Material, data, and analysis script of the present study are available on the OSF page of the study: https://osf.io/2tyks/?view_only=55fa4362c4a041db9c7181c7dbd1817f

Participants

Given the prior aim of this study, we originally preregistered to collect data until reaching a complete sample size of 650 participants.

Six hundred and fifty-six participants completed our questionnaire and after excluding participants that failed the attention check²⁴, final sample size is composed

²³ For transparency purpose, for the original preregistration please see https://osf.io/9hsr4/?view_only=101bc9b2e6394af2968ffcc5eb9ca3f5, and for the original page of the project please see https://osf.io/msu7b/?view_only=c9014b51f68c4002966ebcf9ec1f86ae

²⁴ Including these participants in the analysis did not change the significance nor the direction of the results.

of 535 participants (435 female, 95 male, 5 other), with ages ranging from 18 to 85 ($M_{age} = 37.8$, $SD_{age} = 14.4$).

Procedure

On social media, we distributed a 10-minute questionnaire developed on LimeSurvey. Participants had to first answer to a few demographics (i.e., age, gender), and then to read a short text presenting a rabbit living in a laboratory and serving as an animal-model to develop pharmaceuticals, alongside a neutral picture of the above-mentioned rabbit²⁵. Then, participants had to rate to which extent they support animal testing, had to rate the perceived mind abilities of the laboratory-animal and the moral concern they express for it. Finally, we assessed SDO and displayed an attention check in the middle of this scale (i.e., “If you are reading this question, please answer *-agree-*”), and participants were debriefed and thanked.

Measures

To assess animal testing support, we used a 5-item scale (e.g., “It is acceptable to test drugs on animals to ensure that there is no risk for humans”, please see supplementary material), displayed on a 7-point Likert scale (1: *totally disagree*, 7: *totally agree*). Then we measured the mind perception of the laboratory-animal by presenting a list of 15 abilities (i.e., pleasure, pain, proud) and participant had to decide to which extent the animal possesses each of the abilities using a 7-point Likert scale (1: *definitely does not possess*, 7: *definitely possess*). This measure is known to provide a good index of mind perception (e.g., Bastian et al., 2012; Haslam et al., 2008). Then, to assess the moral considerations toward the laboratory-animal, we asked two questions (e.g., “How morally wrong do you find the use of this animal?” and “How much respect do you think this rabbit deserves?”), displaying two sliders (1: *a little moral concern*, 100: *a very strong moral concern*). We then measured SDO with a short 8-item scale (e.g., “No one group should dominate in society”, Ho et al., 2015), using a 7-point Likert scale (1: *totally disagree*, 7: *totally agree*)²⁶. See Table 1 for descriptive statistics.

²⁵ Within the context of the first original aim of this research, the animal was presented either from France (“in-group”), either from Congo (“out-group”), but this nationality label did not influence the ratings of the animal.

²⁶ As reported in online original page, five supplementary items were assessing solidarity with animals (e.g., Amiot & Bastian, 2017), but this measure is discarded in the present research.

Results

Correlations between measures

In Table 1, we present Pearson's correlations between our measures. Results indicated that SDO was negatively associated to both perception of mind abilities and to moral concern toward the laboratory animal, but positively related to the support of animal testing. Additionally, results indicated that perception of mind and moral concern toward the laboratory animal related positively to each other and that both echo negative relation to the support of animal testing.

Table 1.

Descriptive statistics and zero-order correlation among measures in Study 1.

| | Alpha, 95% CI | Mean | SD | 1 | 2 | 3 | 4 |
|---|------------------|------|------|---------------------|---------------------|---------------------|---|
| 1. Animal testing support | .94 [.94, .95] | 3.14 | 1.69 | - | | | |
| 2. Mind perception of the laboratory animal | .89 [.88, .91] | 5.76 | 0.85 | -.26 [-.34, -.18] * | - | | |
| 3. Moral concern for the laboratory animal | .58 [.52, .64] | 82.9 | 19.9 | -.66 [-.71, -.60] * | .27 [.19, .35] * | - | |
| 4. SDO | .81 [.78, .83] | 2.45 | 1.03 | .28 [.20, .36] * | -.24 [-.32, -.16] * | -.29 [-.36, -.21] * | - |

Note. Numbers in bracket are 95% confidence intervals around means. * $p < .001$

Mediation analysis

We hypothesize that a lower recognition of mind in animals from SDO-oriented individuals would lead to legitimize their exploitation and reduce the moral concern toward them. However, when it comes to defining whether it is the lower moral concern toward lab-animals that leads to a greater support of animal-experimentation, or the inverse, stating on a causal direction is less consensual (e.g., Jackson & Gibbings, 2016). Using the “lavaan” R package (Rosseel, 2012), we ran a mediational model examining the indirect role of the perception of mind in a lab-animal on the moral concern toward it, and on the attitudes toward animal experimentation. Additionally, we entered the correlational relation between the moral concern toward the lab-animal and the support for animal testing in the model. We

recoded our moral concern variable on the same metric than other measures to make our estimate more easily readable (i.e., on 7 points) and we used adjusted bootstrapping method (BCa) with 5000 iterations to estimate 95%CI of the effects.

First, we scrutinized whether lower recognition of mind in a lab-animal could explain the low moral concern SDO-oriented individuals feel for them. Echoing correlational results, SDO predicted negatively the mind abilities perception of the laboratory-animal (*path a*), $b = -0.20$, $p < .001$, 95%CI [-0.27, -0.13], and the relation between SDO and moral concern toward laboratory animals was significant, (*path c₁*), $b = -0.39$, $p < .001$, 95%CI [-0.45, 0.20]. Perception of mind abilities still predicted the moral concern toward the animal after controlling for SDO (*path b₁*), $b = 0.35$, $p < .001$, 95%CI [0.21, 0.49], and controlling for mind abilities perception happens to weaken the effect of SDO on the moral concern (*path c'₁*), $b = -0.32$, $p < .001$, 95%CI [-0.45, -0.20], that may suggest a partial mediation. Indeed, the indirect effect of SDO on the moral concern toward lab-animal through mind abilities perception was significant, confirming a partial mediation, $b = -0.07$, $p < .001$, 95% CI [-0.11, -0.04]. This first result indicated that the lower recognition of mind in a lab-animal, explains partly why SDO-oriented individuals express lower moral concern toward them (see Figure 1).

In a second mediation model, we examined whether a lower recognition of mind in a laboratory animal explains why SDO-oriented individuals support more favorably animal testing. In line with our correlational analyses, SDO was a significant predictor of the support of animal experimentation (*path c₂*), $b = 0.46$, $p < .001$, 95% CI [0.32, 0.59], and controlling for SDO, perception of mind abilities in laboratory animals still predicted support for animal-experimentation (*path b₂*), $b = -0.41$, $p < .001$, 95% CI [-0.59, -0.25]. More importantly, controlling for the perception of mind in the lab-animal weakened the relation between SDO and support for animal-experimentation (*path c'₁*), $b = 0.38$, $p < .001$, 95% CI [0.23, 0.52], suggesting again a mediation pattern. The indirect effect of SDO on attitudes toward animal testing through a lower recognition of their mind abilities was significant, $b = 0.08$, $p < .001$, 95% CI [0.04, 0.13], confirming partial mediation. This second mediation indicated that a lower mind recognition of mind in lab-animal explain partly why SDO-oriented individuals more favorably support animal-experimentation (see Figure 1).

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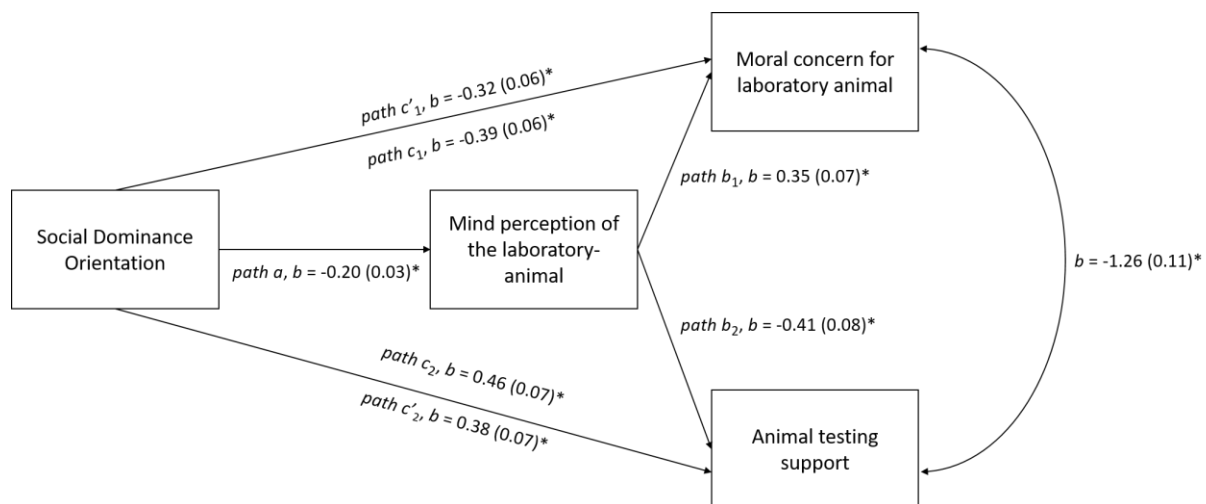


Figure 5. Mediation models indicating that the perception of mind in the laboratory animal partially explains the relation between SDO and both animal testing support and the lower moral concern toward an animal described in a laboratory context. Numbers in bracket are standard error. * $p < .001$

Discussion

In this study, we examined attitudes toward animal testing and toward a laboratory animal as good illustrations of a situation of inequality and exploitation between humans and animals.

Overall, this study allows examining the interrelation between the adherence to SDO, the perception of mind and the moral concern toward a target-animal, and the support of an activity harming animals for the benefits of humans. Our results indicated that SDO related to greater support of animal testing and to lower perception of mind in the laboratory animal and moral concern toward it. Inversely, we found that mind perception of a lab-animal is positively associated to the moral concern toward it and to the rejection of animal testing. Beyond these correlational results, mediation analyses indicated that the lower ascription of mind in a laboratory-animal partially explained why SDO oriented individuals express lower moral concern toward them and support more favorably animal-testing.

However, despite SDO being a strong and stable personality marker (e.g., Sidanius et al., 2013) that makes it quite unlikely to vary across the time or depending on the context, mediational results from correlational sample must be considered with caution, and only experimental design can attest causality (but see Grosz et al., 2020).

Study 2

First aim of the present study was to replicate and extend previous findings, and to bring more credit to the mediation model exposed in Study 1. To this aim, we used a different operationalization of the perception of mind in animals and rather to focus on a specific situation we directly assessed speciesist attitudes. *Speciesism* is a hierarchy enhancing legitimizing myth directed toward animals (Sidanius & Pratto, 1999, p. 46) and is strongly related to SDO (Caviola et al., 2019), and we hypothesize that a lower belief in animal's mind could explain this relation. Besides, we also aimed to manipulate SDO to clarify its role on mind perception in animals and to reinforce the causal inferences of our findings, but since these results were inconclusive, they are only presented in Supplementary Material.

This study also allowed us to examine whether the support of a group-based hierarchy normally used to categorize human groups, could transfer on our categorization of animals. Therefore, we examined how SDO relates to the tendency to hierarchize animals among themselves, which refers to a *horizontal* sense of speciesism. Horizontal speciesism stresses the idea that not all have the same intrinsic value, but this time excluding humans from the picture.

Method

Open Science

The material, data, analysis script and preregistration for the experimental results are available on the page of the project²⁷.

Participants

Given the approximate number of participants available to be surveyed (i.e., students in lecture halls), we preregistered to collect data from 300 participants. A sensitivity analysis ran on G*Power (Faul et al., 2007) indicated that the smallest detectable effect of our manipulation task on one of our measures (i.e., speciesism) would be $f = .18$ (Cohen's $d = 0.36$), given a three-between-subject one-way ANOVA, an alpha level of .05 and .80 power.

²⁷ https://osf.io/pw6fm/?view_only=8be5091d2f3745408ddbc9d9e3cb10e6; for the preregistration of experimental results, please see https://osf.io/2a76h/?view_only=3dbe783a4b10451e89897e992e6313ad

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Participants were 274 psychology students (238 female, 29 male, 7 other) with ages ranging from 18 to 42 ($M_{age} = 19.4$, $SD_{age} = 2.58$), and they were compensated through course-credit.

Procedure

We presented this study as being part of a research in economy and we asked participants to take part in a 10-minute paper-pencil survey during their course. First, we asked participants to read an essay entitled “*World Stratification and Health*”, supposedly written by an economist presenting his conception of a society in good health on several key socio-economic factors (i.e., Gross domestic product, child mortality), and we asked participants to be attentive during the lecture as questions will follow. We randomly assigned participants one of the three versions of the text, which reported different prerequisite to have a healthy society. In two experimental conditions, we varied the needed level of a structural hierarchy, and while in one version the economist defended the need of a strong hierarchized system (High-SDO induction), in another he defended the need of a strong egalitarian society (Low-SDO induction). We also presented a control condition where the supposed economist remained allusive as for the benefits of a hierarchical or egalitarian society (neutral induction). As part of the cover story, participants had to report three main arguments developed in the text and judge the credibility of the text after the reading task. Then, we presented our measures and participants had to answer to different scales assessing horizontal speciesism, SDO, speciesism, and belief in animal mind. Finally, we asked a few demographics (i.e., age, gender).

Measures

To measure the perceived credibility of our texts, we presented a single item (i.e., “Do you find this text well argued, convincing?”) and participants had to answer using a 7-point Likert scale (1: *not at all convincing disagree*, 7: *totally convincing*).

We presented our 4-item horizontal speciesism measure (i.e., “It is acceptable that not all animals have the same rights.” please refer to online material for the scale). Then, we measured SDO (Ho et al., 2015), speciesism (i.e., “It is morally acceptable to keep animals in circuses for human entertainment.” Caviola et al., 2019), and the general belief in animal mind (Hills, 1995; S. Knight et al., 2004; i.e., “Most animals are unaware of what is happening to them”). All these measures were presented in a

7-point Likert scale (1: *totally disagree*, 7: *totally agree*). See Table 2 for descriptive statistics.

Results

Correlations between measures

First, we observed that the general perception of mind in animals negatively related to the adherence to SDO and to both forms of speciesism. Additionally, we replicated a robust result of the literature (i.e., Caviola et al., 2019) according to which SDO echoed positively to speciesism. Interestingly, the relation between SDO and the specific item referring to animal experimentation in the speciesism scale (*“It is morally acceptable to perform medical experiments on animals that we would not perform on any human.”* Caviola et al., 2019) was of a similar strength the one between SDO and animal-testing support in Study 1, $r_{\text{pearson}} = .29$ [.18, .40], $p < .001$.

Besides, to our knowledge it is the first time that we observed SDO being positively associated to a measure capturing horizontal speciesism, and the higher the SDO, the stronger the belief that not all animals deserve the same considerations. This result is in line with the idea of SDO being a general phenomenon capturing support for hierarchy with little interest in the nature of targeted social groups (e.g., Kteily et al., 2015). Please see Table 2 for correlations between our measures.

Table 2.

Descriptive statistics and zero-order correlation among measures in Study 2.

| | Alpha, 95% CI | Mean | SD | 1 | 2 | 3 |
|--------------------------------------|------------------|------|------|---------------------|---------------------|---------------------|
| 1. Horizontal speciesism | .61 [.54, .69] | 3.01 | 1.17 | - | | |
| 2. Speciesism (Caviola et al., 2019) | .62 [.56, .69] | 2.07 | 0.71 | .41 [.31, .50] * | - | |
| 3. SDO (Ho et al., 2015) | .76 [.72, .80] | 2.22 | 0.78 | .48 [.38, .56] * | .49 [.40, .58] * | - |
| 4. Belief in Animal Mind | .54 [.46, .63] | 5.55 | 0.85 | -.35 [-.45, -.24] * | -.51 [-.59, -.42] * | -.34 [-.44, -.24] * |

Note. Numbers in bracket are 95% confidence intervals around means. * $p < .001$

Mediation analysis

We examined in a mediation model whether the relation between SDO as trait and speciesism was partly explained by an underlying lower belief in animal mind. To this aim, we run a mediation model using the “JS Mediation” R package (Yzerbyt et al., 2018).

Following our correlational results, SDO was a significant predictor of both speciesism (*path c*), $b = 0.44$, $SE = 0.05$, $t(272) = 9.33$, $p < .001$ and belief in animal mind (*path a*), $b = -0.38$, $SE = 0.06$, $t(272) = 6.12$, $p < .001$. Belief in animal mind still predicted speciesism after controlling for SDO (*path b*), $b = -0.32$, $SE = 0.04$, $t(271) = 7.55$, $p < .001$, and controlling for belief in animal mind appeared to diminish the relation between SDO on speciesism (*path c'*), $b = 0.32$, $SE = 0.05$, $t(271) = 6.98$, $p < .001$, indicating a partial mediation (see figure 2). The magnitude of this effect was estimated with Monte Carlo estimation (5000 iterations), $b = 0.12$, 95% CI [0.08, 0.18]. This model echoes results found in Study 1 and indicates that the lower belief in animal's mind from SDO-oriented individuals explains partly the relation between SDO and speciesism.

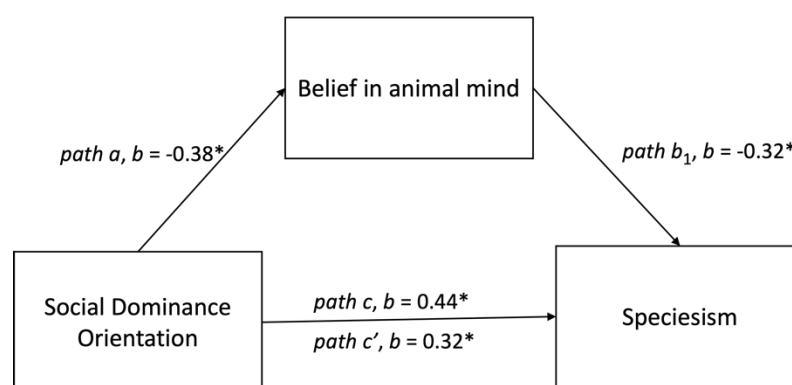


Figure 2. Mediation model indicating belief in animal mind being a partial mediator of the relation between SDO and speciesism. * $p < .001$

Discussion

In this study, we replicated patterns of study 1 that are congruent with the literature (e.g., Caviola et al., 2019), and we highlight that the belief in animals' mind is negatively related to the speciesist dispositions and to SDO, while speciesism and SDO are strongly related to each other.

Alongside extensive literature stressing the hereditary (de Vries et al., 2022; Kleppestø et al., 2019) and personality-related nature of SDO (e.g., Duckitt, 2001), there is little doubt about the place of SDO in causal chains examining the perception of social objects or any discriminatory attitudes. Therefore, we examined if the relations between SDO as a trait and speciesism can be explained by an underlying lower belief in animal mind. Our findings are congruent with Study 1 and indicate that the lower belief in animal mind partly explains why SDO-oriented individuals also have strong speciesist dispositions.

Finally, a side-result indicates that adhesion to SDO relates strongly to horizontal speciesism and to a lower belief in animal mind. A strong variability exists in the way we perceive and behave toward animals (e.g., Herzog, 2010), and their species dictates our behaviors toward them. However, this preliminary result seems to indicate that the extent to which this variability exists among individuals might depend on their adhesion to SDO, and further research of this path might be interesting.

General Discussion

Literature acknowledging SDO as a main predictor of intergroup relations is extensive (e.g., Duckitt, 2001), and the one indicating its crucial role in human-animal relations is expanding (Dhont et al., 2019). SDO stresses that not all social groups deserve the same privileges and that it is legitimate that high status group reaps benefits at the expense of a lower group, therefore it is not surprising that this ideological variable strongly relates to speciesism, an ideology specifically supporting the domination of humans over animals. Yet, it remains to be understood by which means the adhesion to SDO leads to lower concern toward animals and more support of their exploitation, and there must be mechanisms facilitating distancing ourselves from animals.

This research directly aimed to fill this gap by providing a very pragmatic explanation of this phenomenon. We propose that one route facilitating the lower moral concern toward animals and the speciesist dispositions from SDO-oriented individuals, is partly through their lower inclination to perceive mind in animals, or at least to report it. Perceiving mind in animals is the *sine qua none* of their inclusion in our moral circles and being motivated to protect them from harm, and it is understandable that if this crucial element is undermined, animals lose in moral

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considerations. However, whether it is a matter of saying where this lower report of mind abilities in animals comes from, this research does not provide a definite answer. Most parsimonious explanation would be to assert that SDO-oriented individuals report weaker perceptions and beliefs about the animals' abilities of mind, merely because of lower dispositions to see or to believe in these abilities in animals. Interestingly, this lack of sensitivity to see mind in animals echoes the certain cold-hearted and tough nature of SDO-oriented individuals (Duckitt & Sibley, 2010; Sibley & Duckitt, 2008) and their lower empathic dispositions (e.g., Hodson, 2008; McFarland, 2010; Pratto et al., 1994).

Limitations and future directions.

The main limit of this research is the use of mediation models on observational data that raises questions about the validity of our causal assumptions as *in fine* we rely on correlational data (but for a dissenting voice see Grosz et al., 2020). However, manipulating SDO is an important challenge and very little demonstrations exist (see Guimond & Dambrun, 2002; Guimond et al., 2003) and converging data seems to give credit to the model we propose by stressing the very stable deep-anchored nature of SDO (Sidanius et al., 2013; Sidanius et al., 2017; de Vries et al., 2022).

Alternative explanation for our findings may not lie in the inherent dispositions of individuals but rather in the mechanism of motivated mind denial. It has already been evoked that a lower perception of emotions in animals is the result of a moral disengagement process by SDO-oriented individuals to legitimize meat -consumption (see Bilewicz et al., 2011, study 3), and mind perception in animals can also be motivated (e.g., Bastian et al., 2012). Yet this direction is purely speculative until proven otherwise and this track need further examination, particularly with an experimental design.

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A motivated perception of mind among laboratory animals

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Responsibility and mind denial of laboratory animals

Aim of the research

In this research, we aimed to examine whether the mind attribution of animals could depend on the use and on the harm done to them. The idea that mind attribution of others can fluctuate depending on the situation and depending on the responsibility one holds into their harm comes directly from the moral disengagement literature that indicates that during an act of violence, such as wars or genocides, perpetrators tend to deny mind to victims to morally disengage from them, and to pursue the conduct of harmful behaviors or to rationalize them (Bandura, 1999).

Since animals have minds and are sentient (Proctor et al., 2013), we should be motivated to protect them from harm and have moral considerations toward them (Singer, 1975). However, we reap benefits from them at their expense, and our involvement into behaviors that harm them should be a source of disturbance that we should be motivated to avoid. The “meat-paradox” literature (e.g., Loughnan et al., 2010), indicates that when meat-eaters are reminded of their indirect involvement in the harm of animals, they deny mind to meat-animals (Bastian et al., 2012), but since laboratory-animals are also exploited for the benefits of humans, an “animal-experimentation paradox” is also likely to exist. This research examines if individuals are motivated to deny mind to laboratory animals when they face their implication in animal-experimentation because of their utilization of animal-developed products.

Additionally, beyond the responsibility of individuals, the harm felt by the animal has also been identified as an important trigger of the cognitive dissonance (Bastian & Loughnan, 2017). Suffering abilities have closely related to the mind perception for a long time, and getting individuals to focus on the suffering of a target should theoretically increase the need to disengage from it. The second aim of this research is to examine whether emphasizing the suffering experienced by a laboratory-animal leads to a greater denial of its mind abilities.

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This manuscript is to be submitted to *Personality and Social Psychology Bulletin* with an additional study, but unfortunately, we did not have the time to realize it yet within the time for this PhD. For the preregistration of the planned study, please see: https://osf.io/e7x8j/?view_only=22645a75f78f494e805c82756ca38a61. For any relevant material about this research or for the preregistration of the future study, please see Appendices 6.

Denying mind to laboratory animals: A moral disengagement strategy

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Abstract

Most people use products tested on animals daily, yet rarely consider the harm associated with animal testing. Across one pilot and three preregistered and high-powered studies (total N = 2406), we experimentally examined whether, when reminded of this harm and one's own use of animal products, people deny mind to laboratory animals to cope with cognitive dissonance. We also examined the role of perceived harm in amplifying this process. Findings confirmed when reminded of their own consumption of products tested on animals, participants consistently denied mind to animals used for product testing compared to those same animals presented outside of this context. Manipulating the perceived suffering experienced by laboratory animals, however, did not affect the mind denial. Our findings suggest, consistent with previous work, mind denial serves as a strategy for moral disengagement and serves to rationalize the use of animals for experimental purposes.

Keywords: Animal-testing, moral disengagement, denial of mind, human-animal relations

Introduction

The lower animals, like man, manifestly feel pleasure and pain, happiness and misery”

Darwin, “The Descent of Man” (1871)

Approximately 125 million animals are used each year in laboratories worldwide (Knight, 2011; Taylor et al., 2008) such as in biological research, genetics, medicine, or agronomy (Monamy, 2017). While animal testing for the purpose of cosmetics is prohibited in over than 40 countries, and judged as non-necessary for household products, this use of animal experimentation is in fact mandatory when it comes to the assessment of toxicity in the development of new drugs (Greek et al., 2012; Wax, 1995), and 45.5% of all animal experimentation is conducted to satisfy these legislative requirements (European Commission, 2021). The adverse effects of animal testing range from skin and eye irritations to internal bleeding or paralysis (Monamy, 2017; Orlans, 1993). Although when reminded of this, many people hold negative attitudes towards animal testing (Clemence & Leaman, 2016; Crettaz von Roten, 2008, 2013) and the suffering of laboratory animals (Crettaz von Roten, 2013), many also view this harm as justifiable in view of the benefits to research and development (European Union, 2010; Lund et al., 2014). Overall, animal testing is widespread and institutionalized, embedded not only in legislative requirements, but also in the common perception of justifiable cost. Yet, people are also sensitive to animal harm, and prefer not to consider concrete reminders of the impacts on animal welfare, and their own role (as consumers) in perpetrating this harm. In the current research, we examine the process by which people resolve this apparent dissonance inducing conflict (Festinger, 1957) between their use of animal-tested products and their concern for the welfare of animals on which these produces are tested.

Motivated mind-denial as moral disengagement

Consumers usually report finding important ethical attributes on products, yet it doesn't always translate into ethical purchasing behaviors (e.g., Bray et al., 2011; Chatzidakis et al., 2007), and similarly most consumers do not stop to contemplate whether the products they use are tested on animals (Madar et al., 2013). One reason for this is that animal experimentation is seldom made explicit at the point of

purchase, and at most may be part of the fine print that many consumers do not pay attention to. Of course, this does not mean these consumers are unaware of this possibly. Instead, they may be motivated to avoid reminders that their face-creams or medications have led to discomfort, harm, and ultimately the death of laboratory animals, in fact, it is quite well documented that consumers sometimes choose to remain 'wilfully ignorant' of ethical issues related to the product they are purchasing (e.g., Ehrich & Irwin, 2005). Yet, even with these avoidance tactics in place, sometimes people do become aware, and when they do, it probably elicits cognitive dissonance as it interferes with a purchasing behavior that has already taken place, or established behavioral routines (Harmon-Jones et al., 2015). However, what are the psychological strategies at their disposal that allow them to continue to use products that they need or like? To continue their consumption, people are likely to find ways to downplay the harm animal testing brings, thereby also reducing the psychological conflict they experience between their use of animal tested products and their concern for the welfare of laboratory animals (cf. Bastian & Loughnan, 2017).

One strategy for downplaying harm is to downplay the mental lives of people or animals that are subject to harm (e.g., Bilewicz et al., 2011). Possessing mental capacities is what makes something capable of experiencing harm, and therefore of relevance to ethical decision-making (Bentham, 1843; Gray et al., 2007, 2012; Haidt, 2007; Schein & Gray, 2018). This means people are more likely to feel a sense of discomfort when they learn that a person or animal has suffered or had its interests negatively affected, and this is especially so when they feel a sense of responsibility for this negative outcome. Minimising the extent to which that harm matters – that is, the extent to which someone or something would have been negatively impacted – presents one avenue through which people can disengage from the negative outcomes of their behavior. For instance, research has shown that when people feel responsible for past atrocities committed by their own group against other groups, they engage in a process of subtle dehumanization of the outgroup – denying the capacity for complex emotion – allowing them to re-establish a sense of psychological equanimity (Castano & Giner-Sorolla, 2006). Past atrocities of one's own group arouse less psychological conflict when the targets of those atrocities are less capable of experiencing harm.

Most relevant to the current research is work on the ‘meat-paradox’, which demonstrates when people experience psychological conflict between their meat-eating practices and the processes through which meat is produced, they change how they perceive animal minds. Specifically, meat-eaters are more likely to downplay the mental lives of animals relative to vegetarians, and especially when they are reminded of their own meat-eating behavior (Loughnan et al., 2010; Bastian et al., 2012). While meat-eaters may often be protected from considering this conflict (Bastian & Loughnan, 2017), when they *are* reminded they are motivated to find ways to resolve their discomfort (i.e., dissonance reduction; Harmon-Jones et al., 2015). Denying animals minds is an effective moral disengagement strategy within this context (Bandura, 1999), because it minimizes the harm animals experience during the meat-production process. Critically, it also allows for moral disengagement, therefore protecting against the potential for discomfort (dissonance) to arise in response to the harm-inflicting behavior (i.e., meat-eating). Given that most people are motivated to maintain their consumption of meat, this process is likely widespread and common.

We argue this same process is likely to play out in the case of animal-testing, and we therefore propose an extension of previous works on the meat-paradox. Many of the products tested on animals are considered important for human health. Most obvious are the many pharmaceuticals used to treat ill-health, but also people are often attached to other less essential products such as skincare or household goods. Finding ways to downplay the harm that laboratory animals experience is an effective psychological strategy which protects current consumption patterns, while reducing the experience of discomfort associated with knowledge that animal testing adversely impacts on laboratory animals’ welfare.

The current research

In the current research we examined whether raising consumer awareness regarding the use of animals in laboratories for product development and testing created ethical dissonance (cf. Barkan et al., 2015) – that is a conflict between their own use of these products and the apparent harm brought to laboratory animals. Consistent with prior research, in a pilot study we examined whether people engaged in a mind-denial strategy; that is, attributing less mind when they are reminded that rabbits and mice are used for laboratory testing, compared to when they consider the

mental lives of those animals outside of this context. In Studies 1a and 1b we aimed to replicate this effect and examine whether boosting the salience of the harm these animals experience under conditions of product testing might amplify this tendency.

Open Science Statement.

In this research, we report all confirmatory measures²⁸, analyses, and data exclusion. Preregistrations of the studies, original materials, analyses codes, and data are accessible on Open Science Framework²⁹.

Table 1.
Descriptive statistics per stimulus and per study

| Stimuli | n | M | SD | α | 95% CI |
|--|-----|------|------|----------|------------|
| <i>Study 1a</i> | | | | .88 | [.87; .89] |
| Rabbit, control condition | 329 | 5.38 | 0.78 | | |
| Rabbit, experimental condition, low suffering | 334 | 4.79 | 1.19 | | |
| Rabbit, experimental condition, high suffering | 305 | 4.72 | 1.11 | | |
| <i>Study 1b</i> | | | | .85 | [.84; .87] |
| Rabbit, control condition | 337 | 5.36 | 0.77 | | |
| Rabbit, experimental condition, low suffering | 322 | 4.84 | 1.01 | | |
| Rabbit, experimental condition, high suffering | 311 | 4.90 | 1.08 | | |
| <i>Study 2</i> | | | | .85 | [.82, .87] |
| Beagle, control condition | 75 | 5.53 | 0.85 | | |
| Macaque, control condition | 76 | 5.80 | 0.81 | | |
| Hamster, control condition | 89 | 5.42 | 0.80 | | |
| Beagle, experimental condition | 85 | 4.97 | 1.30 | | |
| Macaque, experimental condition | 72 | 5.57 | 1.02 | | |
| Hamster, experimental condition | 71 | 5.13 | 1.35 | | |

Study 1a

Study 1a³⁰ had two goals: investigate the denial mind of laboratory animals, and to examine whether manipulation of the suffering experienced by an animal could impact on mental capacity ratings³¹. Animal suffering is theoretically a trigger for dissonance within ethically relevant contexts (Bastian & Loughnan, 2017), and

²⁸ Other measures were captured but because they were not directly related to the focus on this paper, they are presented on the OSF page of the project on “Data and Analysis” components of Studies 1a and Study 1b. These measures were presented at the end of the survey and thereby could not have influenced our main dependent variables.

²⁹ https://osf.io/fcj8m/?view_only=bb1573661f504b1ba90f39ca8f75fe47

³⁰ Prior to this study, we conducted a pilot study, all details are available online: https://osf.io/wbxzh/?view_only=f470c2c803ef4dad820d0e6e63c244ab

³¹ For the preregistration, please see: https://osf.io/zwukq/?view_only=798056aaa17c45508364862ae82faa63

therefore emphasizing the suffering experienced by laboratory animals would be expected to increase discomfort, and in turn, motivate denial of mental capacities to reduce that discomfort.

Method

Participants

We ran an *a-priori* calculation in G*Power 3.1 (Faul et al., 2007) to estimate the number of participants needed to replicate our pilot study and to observe an effect of the suffering manipulation on mental capacity ratings. Setting an effect size of $f^2 = .01$ (Cohen's $d = .20$), an alpha error rate of .05, .80 power, and two predictors, the analysis indicated that 967 participants would be required. We aimed for a sample size of 970 participants.

Using Prolific, we first screened participants according to pre-selection criteria (i.e., omnivorous participants, approval rate 80-100%, computer users), and when launching the survey, we gradually excluded participants who did not meet our prerequisite selection criteria or failed our attention checks until reaching our targeted sample size. Overall, 1358 participants logged in our survey and the final sample comprised 969 participants with ages ranging from 18 to 83 years (528 female, 8 unknowns; $M_{age} = 36.2$; $SD_{age} = 14$). Participants were paid 0.75£ (\$1) for a 6-minute study.³²

Preregistered exclusion criteria

We decided to exclude participants who reported the use of any of the animal-tested products and participants who did not respond to the mind-rating task. However, for transparency, we present the analyses excluding participants that reported to be veg*ns and/or reported having a special relationship with the focal animal (i.e., pets, phobic) in footnotes. Importantly, applying these criteria did not substantially alter the pattern of results.

Materials

³² This is labelled as a good price on the platform. As preregistered, we refused payment to participants who used another device other than a computer, as it was a prerequisite explicitly mentioned in the advertisement of our study, as well as participants that failed the attention check, and we did not analyze data of unpaid participants.

Stimuli included a picture of a rabbit, either in a control condition and depicted with naturalistic elements (i.e., This rabbit is widespread the woods and forests. It is a four-legged nocturnal animal and digs burrows where it spends the day. Its pelage is generally greyish-brown and in natural conditions this animal can live up to 2 years), or either in two different experimental conditions with a common base (i.e., This rabbit lives in a laboratory to serve as an experimental animal for medial, personal care, and household products. For scientific purposes, it will be subject to tests and will experience organ failure, bleeding, irritation. At the end of the experiment, the rabbit will be euthanized.), but that varied in the amount of suffering emphasized. In one description, it was explicitly mentioned than the animal would not experience any suffering because *“it’s very specific gene coding for pain has been turned-off at birth”*. In the second description, the suffering experienced by the animal was made salient and it was explicitly mentioned that the animal would experience pain and distress.

The experimental manipulation was followed by the dependent variable on which participants rated to what extent they thought the presented animal possessed a list of 15 mental capacities (i.e., pleasure, fear, rage, tasting, joy, happiness, desires, wishes, planning, goals, pride, pain, hunger, seeing, hearing). However, we decided *a-priori* not to consider the item measuring the pain capacity as an item of our mind attribution measure, but instead used it as a manipulation check of the suffering experienced by the animal. These items measured mind attribution and covered several dimensions, including primary and secondary emotions, intentions, or thoughts (Haslam et al., 2008), and were presented on a 7-point Likert scale (1, *definitely does not possess*; 7, *definitely does possess*), see Table 1.

Procedure

Participants were asked to complete an online Lime Survey questionnaire and were told it was primarily focused on consumer behavior. Participants completed demographic questions (i.e., gender) and were then informed they would engage in a task regarding consumption behavior. Within this task, participants indicated, from a list of 15 pharmaceutical drugs, household and self-care products (i.e., Painkiller, anti-inflammatory, muscle relaxer, digestive medication, hand sanitizer, laundry powder, floor polish, bleach, detergent, dishwashing liquid, glass cleaner, shampoo, shower gel, sunscreens, deodorant), whether they had used the product, choosing from 3 options (*“Yes, I already used this product at least one time”*, *“No I have never*

used this product at all", and *"I prefer to do not answer"*). After this set of questions, the presentation of a text (set with a timer) made explicit that all these products were animal-tested for human safety. This was to emphasise the use of animal-testing in products that participants used themselves, and therefore was designed to make them aware of the link between their own consumption behavior and the negative impacts of animal testing. After the product-list and text presentation, participants were randomly assigned to one of the three conditions (naturalistic; laboratory low-suffering; laboratory high-suffering) and then evaluated the mental capacities of the animal, with attention check subtly displayed among the items (i.e., *"This question is an attention check, please respond with probably does possess"*). On a next page and after answering the last demographic questions (i.e., diet, phobias), participants were thanked and debriefed.

Results

Analysis

All participants reported the use of at least one animal-tested product, but one participant was excluded due to failing to provide a response to our main dependent variable, leaving 968 participants in this study.

First, we examined the differences in evaluation of the capacity for pain between our two experimental conditions. This revealed the laboratory-animal described in the high suffering condition was rated as being more able to experience pain ($M = 6.81$; $SD = 0.62$), than the animals in the low suffering condition ($M = 3.20$; $SD = 2.30$), $t(383.5) = 27.48$, $p < .001$, $d = 2.81$, 95% CI [2.52; 3.09].

Next, using regression analysis with two orthogonal contrasts, we examined whether the different descriptions influenced ratings of the mental capacities of the animal. Contrast 1 was employed to test whether the animals was rated has having more mental capacities in the control relative to the experimental conditions (control = 2, experimental low-suffering = -1, experimental high-suffering = -1). Contrast 2 was employed to examine whether the different emphasis on suffering in each of the experimental conditions impacted on ratings of mental capacities (control = 0, experimental low-suffering = +1, experimental high-suffering = -1). Analysis of contrast 1 revealed that animals in the experimental conditions were rated as possessing fewer mental capacities compared to control, $F(1, 965) = 80.11$, $p < .001$, $d = 0.58$, 95% CI [0.45; 0.70], thereby replicating our findings from the pilot study

(see Table 1 and Figure 1). Analysis of contrast 2 revealed no significant differences on mind attribution as a function of the differential emphasis placed on suffering across the two experimental conditions, $F(1, 965) = 0.81$, $p = .37$, $d = 0.06$, 95% CI [-0.07; 0.18].

Discussion

Our findings reveal that animals described as being used for laboratory testing are afforded less mind compared to when the same animal is described in its natural habitat. Importantly, this finding emerged for participants who had just been reminded of their own consumption behavior of animal-tested products. As we argue, one possible reason for this is that people experience discomfort (dissonance) when reminded that their consumer behavior negatively impacts on the lives of laboratory animals. To further examine this rationale, in Study 1b we also tested whether emphasizing the extent to which an animal feels pain, and therefore ostensibly increasing the level of discomfort (dissonance) that people feel, would impact on mental capacity ratings. The findings revealed that this differential emphasis did not impact on mental capacity ratings. We note, however, one limitation of our approach is that presenting an animal as unable to experience pain could have impacted global perceptions of the animal's mental capacities. We aimed to better account for this in Study 1b.

Study 1b

Study 1b³³ aimed to consolidate findings from Study 1a that laboratory animals are viewed as possessing fewer mental capacities relative to animals presented in their natural habitat. Study 1b also aimed to examine whether emphasising differences in the capacity for suffering might impact on this effect but using a different operationalization to avoid the potential confounds of Study 1a.

Method

Participants

We aimed to obtain a sample of 970 participants based on Study 1a, equally distributed across our three conditions (naturalistic; low suffering; high suffering). A sensitivity analysis in G*Power 3.1 indicated the lowest effect size we can detect

³³ For the preregistration, please see:
https://osf.io/u3f8k?view_only=e24b84436ae44d5aa82dd09fbb6221c9

given our design would be $d = 0.22$ (with 640 participants distributed in the two experimental conditions, .05 error alpha rate, .80 power, two tails).

In Prolific, we again set the same pre-selection criteria and the data collection procedure was the same as Study 1a, excluding participants who did not meet the selection criteria or failed our attention checks until reaching our targeted sample size. Overall, 1118 participants were recruited, and the final sample size comprised 970 participants with ages ranging from 18 to 74 years (527 female, 6 unknowns; $M_{age} = 34.97$; $SD_{age} = 13.68$). Payment and procedures were the same as Study 1a³⁴.

Preregistered exclusion criteria

Exclusion criteria were identical to Study 1a, and for indicative purposes we again present analyses excluding participants that reported to be veg*ns and/or reported having a special relationship with the focal animal (i.e., pets, phobic) in footnotes.

Materials

The control condition was identical to Study 1a, however the two experimental conditions differed. Both laboratory-rabbits were described as experiencing similar symptoms in response to laboratory testing (i.e., organ failure, bleeding, and irritation) and to eventually die in the laboratory, but the suffering experienced by the animals was differentially emphasised. In the “low suffering” condition, we described how the animal would not suffer from the experimentation and that the tests were painless. While in the “high suffering” condition, the tests were painful and the animal as suffering. The same mind attribution measure was presented as in the previous studies, see Table 1.

Procedure

The procedure was identical to Study 1a.

Result

Analysis

³⁴ We again followed the same decisions regarding the payment and the analysis of excluded participants.

All participants reported the use of at least one animal-tested product and provided answers on the mind attribution task.

Analysis of the manipulation check – the rated capacity to experience pain – revealed there was no effect of manipulation³⁵, $t(604) = -0.96$, $p = .33$, $d = -0.08$, 95% CI [-0.24; 0.08].

Next, we performed our regression analysis comparing our two orthogonal contrasts contrast 1 and contrast 2 (as in Study 1a). First, analysis using contrast 1 revealed that laboratory animals were rated as possessing fewer mental capacities relative to animals described in the control condition, $F(1, 967) = 57.17$, $p < .001$, $d = 0.49$, 95% CI [0.36; 0.61], see Table 1 and Figure 1. Like Study 1a, the manipulation of suffering did not impact on ratings of mental capacities across the two experimental conditions, $F(1, 967) = 0.59$, $p = .44$, $d = 0.05$, 95% CI [-0.08; 0.18].

Discussion

As with Study 1a, we observed in Study 1b laboratory-animals are viewed as possessing fewer mental capacities compared to when they are described in their natural habitats. This suggests that participants, who were primed to see their own consumer behavior as contributing to the harm experienced by laboratory animals, downgraded their perceptions of laboratory animal's mental capacities to reduce feelings of discomfort (dissonance). Importantly, however, we again did not find any evidence that emphasising the extent of suffering impacted on ratings of mental capacity. While Study 1a suffered from a potential confound – that describing animals as unable to experience pain may have downgraded global perceptions of their mental capacities – Study 1b only described the harmfulness of the laboratory processes. While hearing that animals would not suffer from these processes, may still have impacted on global mind attribution, we also think it is likely that the context of laboratory experimentation eclipsed these variations in our description. Hearing that an animal will be used for product testing likely already elicits a sense of discomfort, in view of which people adjust their perceptions of the laboratory animal's mind.

³⁵ We had the same hypothesis as in study 1a. However, after reflection, there is no reason in this study to believe that our modulation of the severity of the tests (i.e., painful vs. painless) may influence the perceived capacity of animals to experience pain, and therefore this rating may not have been the best manipulation check for this study.

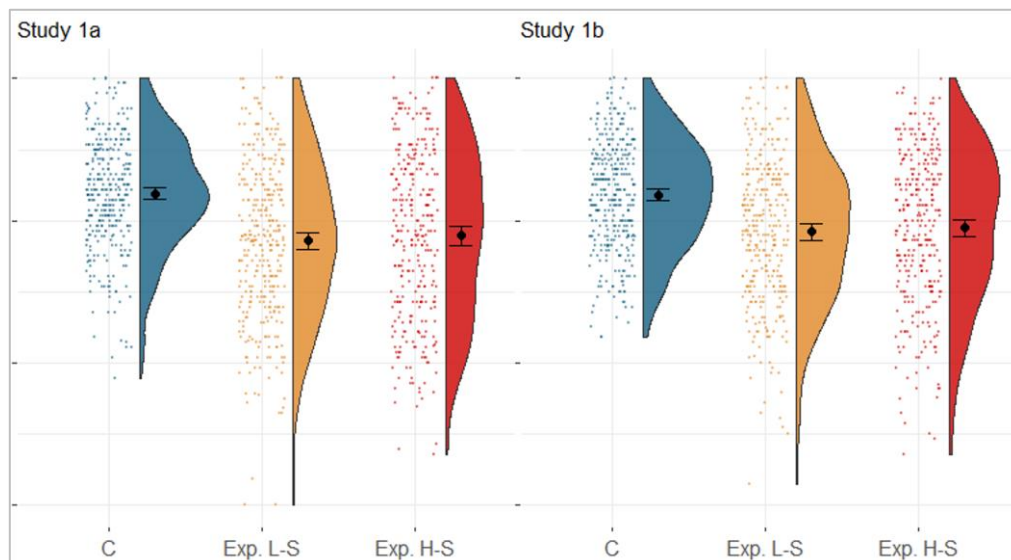


Figure 1. Raincloud plots showing the difference in means of mind attribution comparing control condition and experimental conditions for all studies. C stands for control condition, Exp for experimental condition, L-S for low-suffering, H-S for high suffering. Each point represents one observation, black points and errors bars represent the means and the 95% confidence intervals for the means.

Study 2

Even though rabbits are the third most used species for research (European Commission, 2021) and might constitute prototypical lab-animals (alongside mice and rats), we must acknowledge that extending the mind denial of laboratory-rabbits to other lab-animals could only strengthen our findings. Study 2³⁶ aimed to extend our previous findings to other laboratory animals very commonly used for research, as a macaque, a Beagle, and a hamster. A critical test to examine whether the mind denial of laboratory extend to different species would be to scrutinize whether this effect holds controlling for the animals.

Method

Participants

An a-priori analysis ran on G*power (Faul et al., 2007) indicated that to have 80% chance to find a Cohen's $d = 0.40$ using one-tailed test comparing an animal described in two different conditions, 156 participants would be necessary. Therefore, aiming to observe examine the mind denial on three different animals (i.e.,

³⁶ https://osf.io/uqw8a/?view_only=aecd100736af4fcf815a43b6e871a43d

a hamster, a beagle, and a macaque) and expecting a sight loss of participants (i.e., failed attention check), we preregistered to recruit data from 500 participants to achieve to a 470 sample (156 participants*3 animals).

Five hundred participants were recruited and completed our study on Prolific. After excluding participants that failed the attention check, as preregistered, final sample includes 468 participants (235 female, 1 unknown; $M_{age} = 40.9$; $SD_{age} = 15$). Participants were paid 0.80£ (\$0.96) for a 6-minute study, labelled as a good price on the platform.

Materials

We displayed one of three neutral pictures displaying an animal (i.e., a macaque, a Beagle, or a hamster) alongside a text presenting the animal. The texts of the control conditions were very identical to Study 1a (i.e., “This animal is a rodent and more especially a hamster. It is a four-legged animal, and the colour of its pelage is most of the time white, brown, or reddish. This hamster is a crepuscular animal, which means it is active at dawn and dusk and rests during the day”). We made small variations between the conditions to fit with the animals (i.e., colour of the pelage) and presented pictures of animals related to the description. The experimental conditions were also identical to Study 1a (i.e., This Beagle lives in a laboratory to serve as an experimental animal for medical, personal care and household products. For scientific purposes, it will be subject to tests and will experience organ failure, bleeding, irritation. At the end of the experiment, the Beagle will eventually be euthanized.)

Material is available online, and we relied on the same mind attribution measure than in the previous studies, see Table 1 for descriptive statistics.

Procedure

The procedure was identical to Study 1a.

Result

Analysis

One participant was discarded of the analysis as being an outlier on Studentized residuals and Cook’s distance but including this participant in the analysis did not significantly affect the results.

We launch a regression model to examine whether a mind denial occurs depending on the situation in which animals are described (control = 0.5, experimental = -0.5) and in this model we controlled for the nature of said animals. The analysis reveals that controlling for the nature of the animals, the laboratory-animals were still significantly rated as possessing fewer mind abilities compared to animals described in the control condition, $F(1, 464) = 18.56$, $p < .001$, $d = 0.40$, 95% CI [0.22; 0.58], see Table 1. This result corroborates the negligible influence of animal species into the mind denial of laboratory-animals.

Besides, we realized three independent one-tailed t-tests to examine how the label influenced the perception of the animals within the same species. Interestingly, while a mind denial is clearly observable on the laboratory-beagle, $t(146.35) = 3.29$, $p < .001$, $d = 0.54$, 95% CI [0.21; 0.87] and on the laboratory-hamster, $t(124.41) = 2.53$, $p = .006$, $d = 0.45$, 95% CI [0.10; 0.81], the difference between the laboratory-macaque and the control macaque is barely significant, $t(135.38) = 1.53$, $p = .06$, $d = 0.26$, 95% CI [-0.08; 0.60]. See Table 1, Figure 2. We discuss this absence of result below.

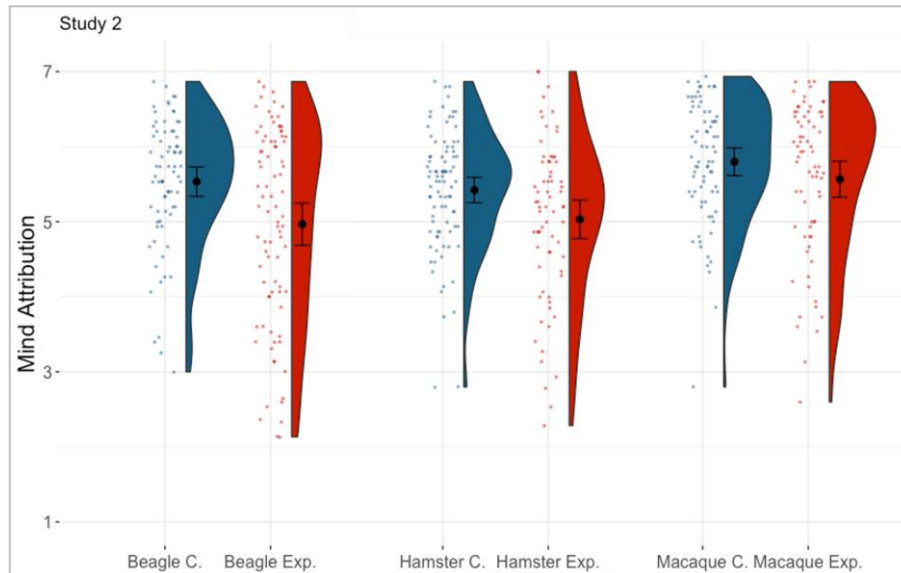


Figure 2. Raincloud plots of Study 2, showing the difference in means of mind attribution comparing control condition to the experimental condition and depending on the animals. C stands for control condition, Exp for experimental condition. Each point represents one observation, black points and errors bars represent the means and the 95% confidence intervals for the means. The difference between the Beagles is significant ($p < .001$) as well as between the hamsters ($p = .006$), but the difference between the macaques is not ($p = .06$).

Discussion

This study extends findings of studies 1a and 1b and indicates that when it comes to ascribe mind abilities to animals from the same species, the situation is which they are found weights more that their said species. Consequently, animals described in laboratory settings are ascribed as having lower mind than animals described in a natural context.

Besides, we also examined within the different species how the context influenced on the mind perception of the animals. Interestingly, while we found mind denial among the Beagles and the hamsters, it has not been found in macaques. We have two probable explanations which can be complementary. First, we are much closer phylogenetically from macaque than from the other animals and we know that the phylogenetical proximity plays a crucial role in mind perception in animals (Eddy et al., 1993) and in the considerations toward them (Miralles et al., 2019; Plous, 1993). In fact, we can easily imagine that it is easier to anthropomorphism animals that look like us rather than animals to which we are less close; and therefore, that it is easier to imagine what is it like to be a macaque rather than being another animal. This explains why we can observe a stronger ceiling effect regarding the macaque and producing a mind denial on this animal could be more complicated as this effect (if it exists) must be much smaller in animals from which we are similar. Which leads us to our secondary plausible explanation of the absence this effect, that simply stands at a too low a statistical power. Even though the difference is not significant ($p = .06$), descriptively we can see that the macaque in the laboratory condition is described as having lower mind abilities than the other macaque, but we believe that it would need a stronger statistical power to detect it and to make this difference significant.

Summarizing the evidence:

Complementary analyses on merged data

To provide a high-powered analysis of whether laboratory animals are denied mental capacities, we conducted supplementary analyses on our data.

Mini meta-analysis

As it is better to do so (see Goh et al., 2016), we conducted a mini meta-analysis on our data to have more precise and narrow estimation of the mind denial effect of laboratory-animals across our studies (see Cumming, 2014). We used “metaphor” R package (Viechtbauer, 2010) and the analysis of Studies 1a, 1b, and 2 (N = 2406 participants) revealed a significant meta-analytic effect, $Z = 11.81$, $p < .001$, $d = 0.51$ 95% CI [0.42, 0.59], see Figure 3. Heterogeneity tests indicates that there was no significant variation of effect sizes in our analysis, $Q(4) = 3.57$, $p = .46$, see Figure 2. This analysis shows the effect of mind denial for laboratory animals is consistent, with a medium-strength effect (Cohen, 1988).

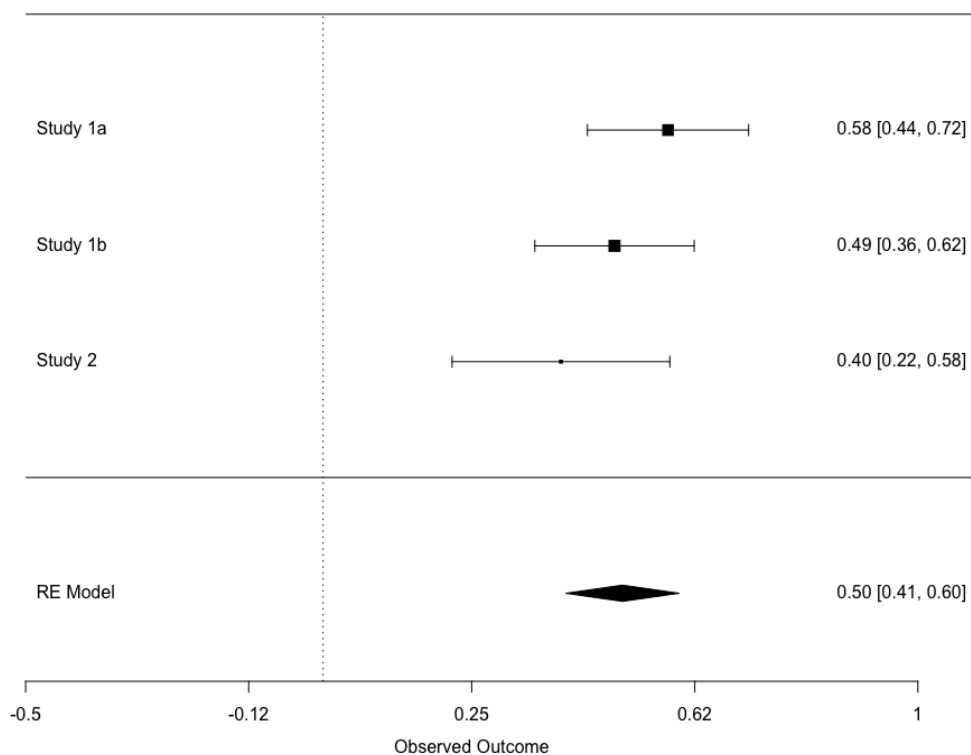


Figure 3. Forest plot presenting the mind denial of laboratory-animals across the studies. According to the contrast coding, a positive Cohen’s d indicates a negative effect of the laboratory situation on the mind perception of the animal. Dashed line indicates the null effect, black diamond indicates the meta-analytic effect.

General Discussion

Across 3 high-powered and preregistered studies totaling 2406 participants, we found that laboratory-animals are ascribed with fewer mental capacities relative to when those same animals are described in their natural habitat. A mini meta-analysis ran on our studies indicates that this effect is robust and of a medium strength effect. The findings demonstrate that, when people are reminded of the harm associated

with animal experimentation and their role as consumers in perpetrating that harm, they respond by downgrading their perception of laboratory animal's mental capacities

Consistent with past research and theorizing (e.g., 'the meat-paradox'; Bastian & Loughnan, 2017) we understand this effect as motivated by attempts to resolve personal discomfort (dissonance) associated with the moral conflict between one's own consumption and the upstream harmful consequences of that consumption for animals. By denying laboratory animals mental capacities, and therefore the capacity to experience pain and discomfort, people are able to morally disengage from the implications of their own consumption habits. The current research, therefore, provides an important extension on past work, showing that the process of moral disengagement through mind denial is not specific to one animal-exploitation context (e.g., meat consumption and production; see Piazza et al., 2020), but also adds a new stone to the edifice of understanding mind attribution when people's morality is threaten.

Given our predictions, we expected that perceived harm or suffering played an important role in the arousal of discomfort (dissonance) and the resultant minimization of laboratory animal mental capacities. To this end, in Studies 1a and 1b we also sought to manipulate the extent of suffering, predicting that (de)emphasizing how much pain the laboratory animal experiences as part of the product testing process would either increase or decrease the extent of mind denial. Using two different approaches, both studies failed to demonstrate any impact of these manipulations. There may have been several reasons for this. In Study 1a our manipulation, which focused on reducing perceptions of the animal's capacity to experience pain, may have also impacted on global perceptions of mental capacity. This meant that while de-emphasising the capacity for pain may have reduced discomfort, and any concomitant cognitive conflict or dissonance, it may also have reduced perceptions of mental capacities directly. We believe our Study 1b manipulation was less vulnerable to this confound, however here we still did not observe any effects of the manipulation.

While different or stronger manipulations may have produced the predicted effects, we also think our findings point to the power of framing animals as 'laboratory animals' and thinking of them being used in this way may create dissonance beyond whether they experience pain. For instance, using them for these instrumental

purposes, and the exploitation associated with laboratory testing is likely to also elicit dissonance, and to lead people to view the animal in ways which justifies this treatment, and in turn which allows them to morally disengage, not only from their pain and suffering, but also from their exploration more broadly.

Limitations and Future Directions

Although the current research presents consistent findings replicating past similar effects, there are some limitations worth noting. First, one goal was to test the theoretical claim that perceived suffering plays a central role in generating discomfort (dissonance) and therefore the predicted moral disengagement response. However, we failed to find this effect. As noted above, it may be that animal experimentation elicits discomfort for a range of reasons associated with perceived exploitation, which extend beyond the perception of suffering. Nonetheless, it may be that our stimuli were insufficient to produce the predicted effects. For instance, findings from the 'victim-derogation' literature (e.g., Lerner, 1971) suggest that to motivate individuals to disengage from victims; stimuli need to be sufficiently vivid and emotionally threatening to elicit ethical dissonance (Dawtry et al., 2020; Hafer & Bègue, 2005). One limitation of the current studies is that we cannot rule out that our suffering manipulation was insufficiently vivid or emotionally impactful to produce the desired effect.

To personally implicate participants in the harm animal testing can cause, we ensured that all participants were primed to consider that fact they use products which rely on animal-testing. While this is consistent with our theoretical model, it may also be the case that rather than deny mental capacities to animals, people may downplay their own role in the harm caused through animal-testing. This may take the form of focusing on their common use of products which do not employ animal testing (e.g., exonerative comparison; Bandura, 1999), or seeing their own consumption as only a small part of a much bigger process (e.g., diffusion of responsibility; Bandura, 1999). Indeed, as noted in related work (Piazza et al., 2015), people may rationalize their consumption patterns as necessary, natural, or normal, and these beliefs may easily justify their consumption independently of any mind-denial of laboratory animals. Future research could focus on whether these allowing consumers these other avenues of moral disengagement would impact on the extend

of mind denial, thereby showing evidence of multiple interacting routes towards moral disengagement in the context of animal experimentation.

Conclusion

The current work finds that, when reminded of their consumption of products which rely on animal testing, people deny mental capacities to animals used in laboratory-based experimentation. This reveals a motivated process of moral disengagement whereby people seek to justify their own behavior when the harm it causes animals is made salient. Our findings add to a growing body of work examining moral disengagement as linked to consumer behavior and provides an initial step in showing the breadth and commonality of this process.

Supplementary material

Study 1a

Because those characteristics may influence the perception of mind in animals (Bilewicz et al., 2011; Morris et al., 2008), we ran the same analysis excluding veg*ns and that have a special relationship with the focal animals (i.e., pets, phobic). The analysis yielded to very similar findings, C1 was still significant, $F(1, 468) = 36.74$, $p < .001$, $d = 0.56$, 95% CI [0.38; 0.74], and C2 still not, $F(1, 468) = 0.22$, $p = .63$, $d = 0.04$, 95% CI [-0.14; 0.22].

Study 1b

As for Study 1a, we ran the same analysis excluding veg*ns and that have a special relationship with the focal animals (i.e., pets, phobic). C1 yielded to congruent significant results, $F(1, 595) = 37.96$, $p < .001$, $d = 0.51$, 95% CI [0.34; 0.64].

Unexpectedly, C2 indicated that the low suffering animal was described as having less mind abilities ($M = 4.74$; $SD = 1.02$) than the high-suffering animal ($M = 4.97$; $SD = 1.06$), $F(1, 595) = 5.25$, $p = .02$, $d = 0.19$, 95% CI [0.03; 0.35].

Complementary analyses of study 1a and 1b

We ran second meta-analysis on study 1a and 1b focusing on the effect of the suffering (i.e., low vs. high; $N = 1262$ participants) revealed that different descriptions of the level of suffering experienced by animals did not influence ratings of mental capacities, $Z = 0.98$, $p = 0.33$, $d = 0.05$ 95% CI [-0.06, 0.17]. There was no significant variation of effect sizes in our analysis, $Q(1) = 0.008$, $p = .93$, see Figure 3.

Using the TOSTER R package (Lakens, 2017) and considering the lowest detectable effect in our meta-analysis (i.e., Cohen's $d = 0.16$), we ran a meta-analytic equivalence test (Lakens et al., 2018). The analysis indicated that the null-hypothesis test was not significant, $Z = 0.83$, $p = .40$ and that the equivalence test was, $Z = -1.83$, $p = .03$. This indicates that in our data the effect of the suffering on the mind denial of animals is statistically not different from zero, but also indicates that considering our operationalization of the suffering and the designs of the studies, even the lowest detectable effect is practically equivalent to zero and trivial.

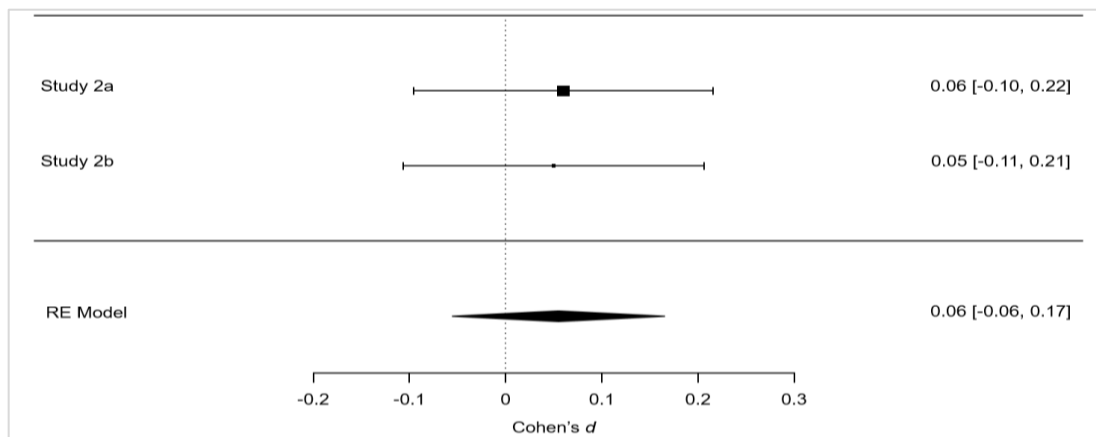


Figure 3. Second mini meta-analysis on the mind attribution of the animals depending on their suffering experiences. According to the contrast coding, a positive Cohen's d indicates a negative effect of the suffering experienced by the animal on its mind denial. Dashed line indicates the null effect.

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PART 5. Empirical Evidence: The Scientific Authority and Animal Experimentation

Aim of the research

This research is probably one of the most central pieces of this research program and aims to examine several points.

First, it aims to develop and validate a Milgram-like protocol to examine the behavioral commitment in animal testing in a controlled environment. To examine animal-experimentation, relying on attitudinal measures to assess the perceived legitimacy of this practice is fine, to evaluate the perception and moral considerations of laboratory-animals. However, beyond a social object where everyone can state their opinions by mentalizing the practice and imagining what it is like to experiment on animals, animal experimentation remains an existing behavioral situation that requires the physical use of animals. Besides, if attitudinal measures are very reliable and correlational relations between constructs are stimulating, the examination of the predictive role of attitudes on behaviors has always been at the heart of social psychology research (e.g., Ajzen, 1991; Ajzen & Fishbein, 2000; Bargh et al., 1996). Therefore, the development of an experimental protocol to scrutinize the real behavioral commitment in animal-testing, placing participants in the shoes of lab-researchers, is particularly relevant. We will see in a future chapter that the validation of this protocol and the several possibilities to adapt it could even help answer other related questions.

Then, this research aims to fill the gap on Milgram's studies and for the first time test the Engaged followership theory using an ultrarealistic and immersive environment (see Gibson, 2019, p. 62; Haslam & Reicher, 2017). We have already discussed that despite the huge interest and diffusion of Milgram's studies, it seems that the mechanism by which people under circumstance come to cause harm to others is not very well-known. An alternative line of explanations sits in the engaged followership theory (S. A. Haslam & Reicher, 2017) and states that Milgram's participants came to cause harm not blinded by some agentic state caused by an authority figure, but because they adhere to the objectives of the research and identified themselves to the goals of the experiment(er). However, and despite the very nice narrative even supported by seductive evidence (S. A. Haslam et al., 2014,


2015), it is sometimes pointed out that this theory has never been properly tested in a Milgram-like paradigm.

Finally, while it is certain that some individual characteristics (i.e., speciesism, gender) predict how people perceive animal-experimentation, it remains to be clearly examined whether the adhesion to science could influence the perceived legitimacy of this practice.

Manuscript 4

This manuscript is published in *Personality and Social Psychology Bulletin*. For any relevant material about this research or for the preregistration of the future study, please see Appendices 1, 2, 3, 7, and

Sacrificing Animals in the Name of Scientific Authority: The Relationship Between Pro-Scientific Mindset and the Lethal Use of Animals in Biomedical Experimentation

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Abstract

The present research investigated how scientific authority increases the lethal use of animals in biomedical experimentation. In two behavioral studies ($N = 151$ and 150), participants were required to incrementally administer 12 doses of a toxic chemical to a 53-cm fish (in reality, a biomimetic robot) for research on animal learning. Consistent with the Engaged Followership Theory on obedience, participants placed in a pro-scientific mindset more severely harmed the laboratory animal. In a cross-sectional study ($N = 351$), participants in medical fields endorsed a more pro-scientific attitude than those in paramedical fields, which mediated their support for animal experimentation. Drawing on a representative European sample ($N = 31,238$), we also confirmed the specificity of this link by controlling for potential demographic and ideological confounds. In a final study ($N = 1,598$), instrumental harm was shown as mediating the link between a pro-scientific attitude and support for animal experimentation.

Keywords

conformity, obedience, engaged followership, scientific authority, instrumental harm

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Introduction

Most people have firm moral inhibitions toward violating universal moral codes that prohibit unnecessary violence toward living beings (Graham et al., 2013). However, individuals are also fully able to disengage from their moral convictions when doing so is dictated by specific circumstances or by what they consider as the pursuit of higher goals (Bandura, 1999). Scientific inquiry represents a culturally valued goal that may require the killing of animals in the case of animal experimentation for biomedical purposes. Since the enactment of the Nuremberg code, animal experimentation has become a mandatory phase in most biomedical development (Annas & Grondin, 1992), and every year, approximately 125 million animals are used worldwide as experimental resources (Knight, 2011; Taylor et al., 2008). They are considered to play a crucial role in medicine, pharmacology, and biotechnology and are used as models for human disease, as sources of organs or cells, as well as in animal experimentation, xeno-transplantation, and cloning (Monamy, 2017).

This widespread use of animal experimentation raises a moral paradox. While the Cartesian view of animals merely

as insentient machines has been widely disproved by scientific studies showing how the cognitive, emotional, and behavioral lives of animals are complex (de Waal, 2016), and sometimes similar to human capacities (which justifies their use as models), in laboratories, animals are ultimately considered merely as scientific tools. This potentially induces moral dilemmas for laboratory staff who perform invasive or painful experiments, and who occasionally feel empathic reactions or distress (Birke et al., 2007; Filippi et al., 2010; Westbury & Neumann, 2008), the intensity of which is a direct function of the phylogenetic closeness of the animals involved (Miralles et al., 2019; Plous, 1993). For this reason, when scientists administer a harmful treatment to an animal during an experimental protocol, they may need to actively overcome or repress their personal affective reaction. Most of the time, this emotional disengagement is possible because

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the aim of the behavior is grounded in beliefs regarding the authority of scientific endeavor (Birke et al., 2007).

Motivated Obedience

The present research starts with the idea that a motivated obedience toward the authority of science lies at the core of an individual's moral disengagement when they are asked to perform biomedical animal experimentation. By motivated obedience, we mean that individuals do mainly follow extrinsic rules of conduct when they perform lethal operations on animals for scientific purposes in research institutions.

They do not personally choose to use and sacrifice animals, or to sometimes expose these animals to painful procedures, but they perform such acts as a part of their professional requirements. However, even if these potentially problematic behaviors are formally imposed by their role, they are genuinely and actively involved in consenting, and generally believe in the utility and the legitimacy of the professional rules and procedures which they apply. This commitment is grounded in the cultural authority of science, which represents a major pillar of the legitimization of animal experimentation (Bauer et al., 2019).

In the context of our research, obedience toward scientific authority is a specific type of motivated obedience. Motivated obedience should therefore be contrasted with the "blind obedience" that is generally associated with Milgram's (1974) studies on obedience. In the perspective developed in the present research, obedience is not conceptualized as a passive (or "agentic") state involving an "ideological abrogation" (Milgram, 1974, p. 145) but is, rather, a function of individual's identification with the scientific enterprise underlying experimental research (Haslam et al., 2014; Reicher & Haslam, 2011), and may therefore be more adequately understood as an engaged followership (see Haslam & Reicher, 2017, for review), that is "an active identification with the scientific project and those leading it" (Haslam et al., 2014, p. 473). We may consider that obedience toward scientific authority is a specific type of motivated obedience.

In the present study, our aim was to experimentally and cross-sectionally demonstrate that a pro-scientific mindset increased attitudinal and behavioral support for painful and potentially deadly experiments on animals. We also elaborated and tested the hypothesis that a pro-scientific mindset was related to a preference for a specific form of lay moral thinking, instrumental harm, defined as a "willingness to harm and even kill others when this is needed to achieve a better outcome" (Kahane et al., 2017, p. 135), that would mediate support for animal experimentation (more on this to follow).

Scientific Authority and Support for Animal Experimentation

The way in which scientific authority influences behaviors was explored 50 years ago in a series of classical experiments

conducted by Stanley Milgram, who observed that the electric shocks administered to a reluctant victim by laypersons were maximal in a scientific institution of high prestige (Yale University) and lowest in a commercial building in Bridgeport (Milgram, 1974, Experiment 10). In the same vein, Milgram (1974) showed that obedience was lower when the experimenter was presented as an "ordinary man" rather than a scientist (Milgram, 1974, Experiment 13), and considered potentially important in interpreting his results, in terms of "the prestige of the scientist, the prestige and worth of the research" (Reicher et al., 2012, p. 317). While the parallel between Milgram's obedience studies and animal use in laboratory experiments seems relevant here, the psychological process proposed by Milgram (1974) to explain the phenomenon of obedience as an "agentic state" in which "responsibility is cast off, and individuals become thoughtless agents of action" (p. 176) could be argued to be circular and does not properly capture critical aspects of the phenomenon (Gibson, 2019; Miller, 1986). Recent studies on obedience have increasingly focused on the social legitimacy and identity involved in obedience (Reicher et al., 2014). It is currently acknowledged that a participant's willingness to administer electric shocks cannot be properly explained purely by blind obedience. Instead, it may be a function of their active identification with the scientific enterprise underlying the experiment, and the perceived legitimacy of the experimenter's injunctions (Haslam et al., 2014; Reicher & Haslam, 2011). According to Engaged Followership Theory, participants follow the experimenter's directions because they believe themselves to be "contributing to a moral, worthy, and progressive cause" (Haslam et al., 2015, p. 60).

Despite the appeal of the Engaged Followership Theory, there is still no direct empirical demonstration of this theoretical perspective on obedience using Milgram-like behavioral measures. Instead, this perspective has mainly been based on qualitative studies based on Milgram's archives (Haslam et al., 2014, 2015) along with a study based on immersive digital reality, which showed that participants' relative identification with the experimenter and their scientific goals was a good predictor of the maximum level of shock they administered (Haslam et al., 2015; see also Reicher et al., 2012). However, a test of the Engaged Followership Theory with Milgram-like strong behavioral measures has been absent (Gibson, 2019). The present research therefore aims to fill this gap. It also intends to extend its scope and provide additional evidence on the specificity of the link between a scientific mindset and support for animal experimentation, and to conceptualize and empirically test the psychological process involved.

Overview of the Present Research

First, after the development and validation of a new realistic and involving biomedical protocol on animal experimentation (Study 1a), we experimentally investigate how the salience of scientific authority induces individuals to

administer painful chemical injections to an animal target (Study 1b). Then, in two cross-sectional studies involving a sample of medical and paramedical students (Study 2a) and a large and representative European sample (Study 2b), we assess the generalizability and specificity of the relationship between a pro-scientific attitude and support for animal experimentation. Finally, we further clarify the process by which a pro-scientific attitude possibly influences an individual's support for animal experimentation (Study 3). We elaborate and test the hypothesis of a mediating effect of a core dimension on utilitarianism, instrumental harm, which is conceptually and empirically distinct from motivated obedience and is defined as a "willingness to harm and even kill others when this is needed to achieve a better outcome" (Kahane et al., 2017, p. 135).

Study 1a: Development of a Behavioral Measure of Animal Objectification

This preliminary study aimed to develop a completely new experimental protocol in which participants were required to incrementally administer a noxious chemical substance to an animal (which they believed to be a fish, although in reality it was a biomimetic robot) involved in a learning experiment, leading to the death of the supposed animal. The administered substance was explained to the participants to stimulate learning in the context of a research protocol investigating Alzheimer's disease. However, an important side effect of the drug was its consequences on vital functions at high dosages. To validate this new experimental paradigm, we measured relevant inter-individual variables involved in destructive behavior toward animals (Amiot & Bastian, 2015, for review) and expected that individuals' reluctance to carry out the task would be contingent on these variables.

The first of these variables was social dominance orientation (SDO; Sidanius & Pratto, 1999), a pro-hierarchic orientation that represents the value that people place on non-egalitarian and hierarchically structured relationships among social groups. In the hierarchy of social categories, animals represent "the quintessential low status group" (Dhont et al., 2019, p. 31), which is why attitudes toward them are reported to be more negative among people with high SDO (Caviola et al., 2019; Hoffarth et al., 2019). Another validation measure was speciesism, defined as the "belief that humans are intrinsically more valuable than individuals of other species" (Caviola et al., 2019, p. 2). Speciesism predicts behavioral preferences toward humans and "superior" animals in relation to allocating money or time, and is related to the devaluation of the perceived intelligence and suffering capability of animals (Caviola et al., 2019). We also measured dispositional empathy, which is inversely related to support for animal experimentation (Broida et al., 1993), as well as gender and vegetarian or vegan diet (Amiot & Bastian, 2015; Broida et al., 1993; Ormandy & Schuppli, 2014).

In summary, we included a selection of relevant measures to check the validity of our new protocol measuring harm toward animals. We expected a positive relationship between SDO, speciesism, and the intensity of harm inflicted on the animal during the experiment, and a negative relationship with empathy, vegetarianism, and (female) gender.

Method

Data availability. Materials and data for the five studies are openly available on OSF.

<https://osf.io/6tvgz/>

Participants. Because of resource constraints (Lakens, 2021), we were willing to recruit 150 participants to this pilot study. Using G*Power 3.1 (Faul et al., 2007), we carried out a sensitivity analysis (setting an error alpha rate of .05, a power of .80, 150 participants, and one predictor). The analysis indicated that with this design, the minimum effect we could detect between the drug administration task and one of our predictors would be a Cohen's $d = .46$. In total, 152 participants (95 females, 55 males, and two people who did not indicate their gender) were recruited. Their ages ranged from 19 to 71 years, and the sample comprised 45.4% students, 32.3% workers, 14.6% unemployed, and 7.7% who omitted to indicate their activity. The percentage of vegetarians or vegans was 10.9%. Participants were recruited through the local press to take part in a 40-min experiment, which was presented as an observational study of animal behavior during a learning task. They would be paid 15 euros (US\$16.5) for their participation. They were first invited to complete an online questionnaire to measure inter-individual variables and to check their eligibility for inclusion.¹

Measures. SDO was measured using an eight-item scale (Ho et al., 2015) containing items such as "Some groups of people are simply not the equals of others" and "It is unjust to try to make groups equal" ($M = 1.93$, $SD = 0.55$, Cronbach's $\alpha = .72$). To measure speciesism, we used the six-item Speciesism scale by Caviola et al. (2019), which includes items such as "Morally, animals always count for less than humans" and "Humans have the right to use animals however they want to" ($M = 2.09$, $SD = 0.65$, Cronbach's $\alpha = .72$). We also used the seven-item Empathic Concern scale by Davis (1983), which includes items such as "When I see someone being taken advantage of, I feel kind of protective towards them" and "Other people's misfortunes do not usually disturb me a great deal" (reverse scored) ($M = 3.88$, $SD = 0.57$, Cronbach's $\alpha = .77$). The items from the three scales were presented as 5-point Likert-type scales. We imputed the median score of the distribution to sporadic missing values (less than 5%). Finally, we regarded participants as vegetarians if they replied positively to the following question: "I am vegetarian (or) vegan."

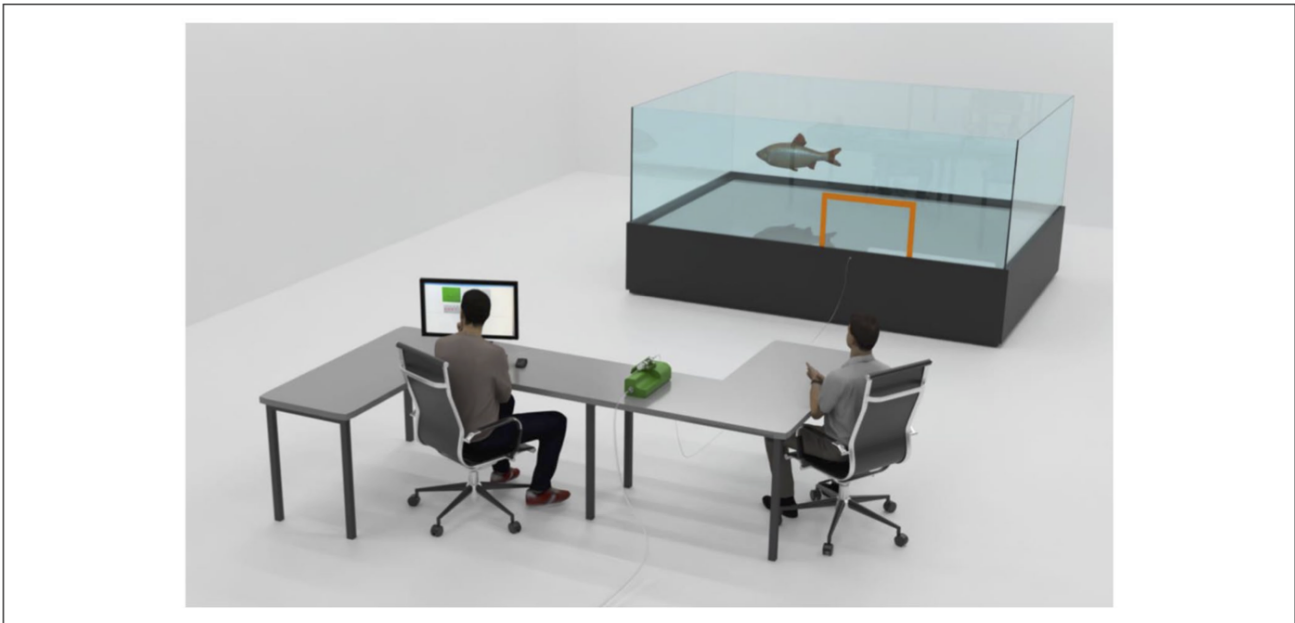


Figure 1. Schematic representation of the experimental setting.

Procedure

Learning protocol. Upon their arrival, participants were shown a short video containing various items of scientific and procedural information (Supplemental Material 2). Then, they were seated at a table in front of a screen. Three meters from the table was a large aquarium (200 cm × 200 cm × 80 cm, containing 3,000 L of water). Inside the aquarium, what appeared to be a 53-cm goldfish was moving around. This was actually not a real fish, but a biomimetic robot (Airo 9 model) covered by very realistic silicone rubber which had been modeled and painted by the designer Alain Quercia. The choice of the fish was consistent with the fact that most of contemporary laboratory research works are based on rodents and fish. Moreover, fish robots appear more realistic than mammal robots because of their less complex movements. Participants were instructed to click on the first of 12 buttons, which triggered the following sequence: (a) the injection via motorized syringe into the water of 10 mL of the toxic pharmacological substance (which was actually just water colored yellow), (b) the triggering of a spotlight which illuminated a specific perimeter of the aquarium for 12 s, and (c) the emission of bubbles during those 12 s from the floor of the aquarium. Then, the participants were asked to count the number of times the fish went behind an orange frame in a time window of 25 s. The participants were told that the fish had previously been trained to move toward this frame when the stimulation (i.e., light and bubbles) was delivered, and that it was expected that the treatment would increase its sensitivity to the stimuli. When the time window was over, they had to click on the next button and so on until the 12th and final button (see Figure 1).

Below some of the buttons, the expected probability of the death of the fish was written (Figure 2) as follows: 0% probability of death (Button 1), 33% (Button 3), 50% (Button 6), 75% (Button 9), and 100% (Button 12). Moreover, the cardiac pace of the animal was visualized via an oscilloscope, which also produced auditory feedback. Contingent to the number of doses injected, the sine wave and sounds became increasingly erratic, reflecting cardiac distress. A short video of the setting is available at <https://youtu.be/exNHKprKNwI>.

If a participant stated that they were unwilling to continue, then the experimenter stated as follows: “For our research, it is important that you go on until 12, but as was indicated in the consent form, you are allowed to stop at any time.” If the participant repeated their intention to stop, they were told by the experimenter, “you want to stop, are you sure?”

When the experiment was over, the participants were shown into another room for a filmed semi-directive funnel interview and to complete a final evaluation survey. Please see Figures 3 and 4, and Supplemental Material 4.

Post-experimental screening procedure and final sample. Two independent judges were asked to watch the videos of the debriefing sessions and assign codes to the participants based on their responses. Participants who expressed no substantial doubts about the aim of the experiment were coded 1. If a participant expressed slight doubts about the meaning of the experiment, but without threatening the overall credibility of the cover story, they were coded 2. The judges were instructed to assign Code 2 to a participant if they were unsure whether

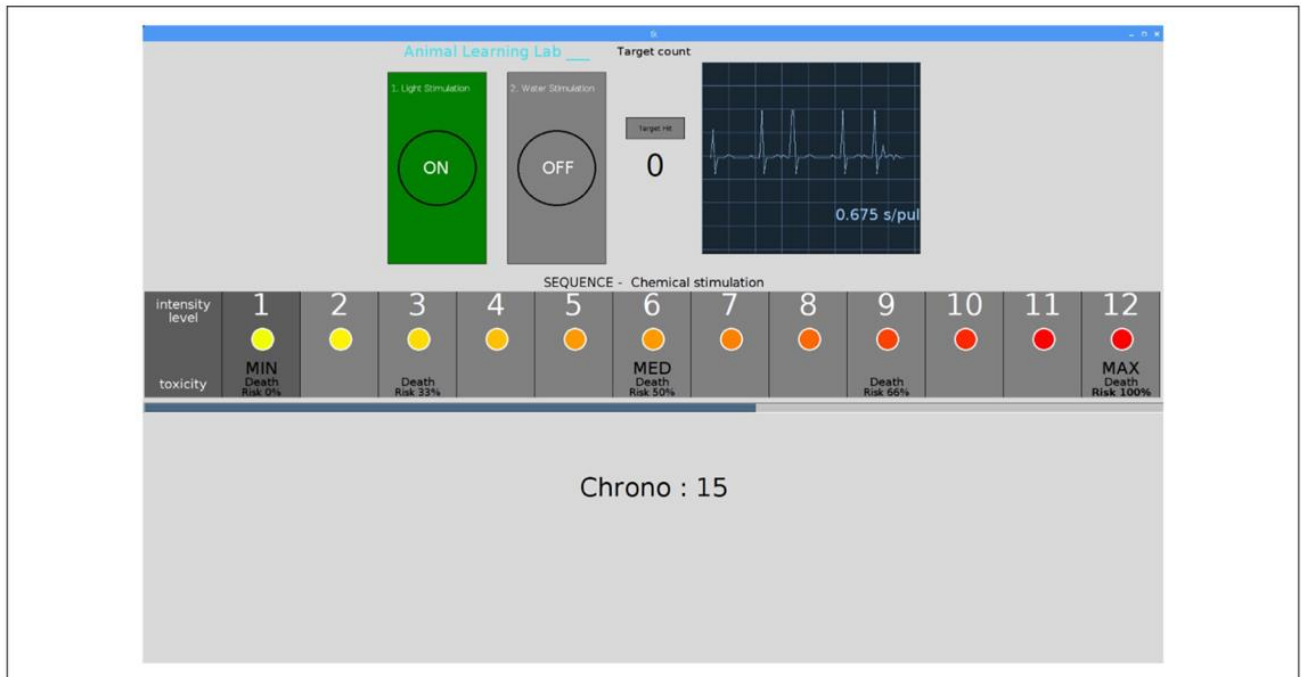


Figure 2. The numeric device.

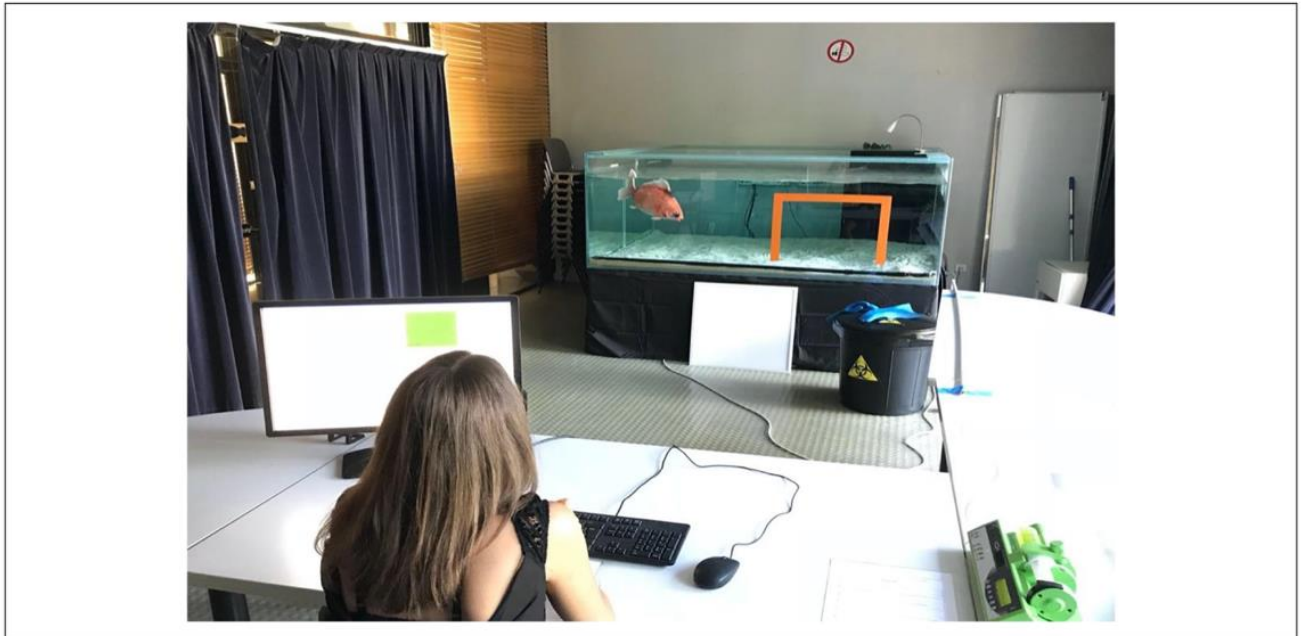


Figure 3. The full setting.

the participant believed what they were told during the experiment or not. Finally, participants who expressed clear doubts about core aspects of the study (e.g., if they suspected that the substance that they administered or the fish were fake) were coded 3.

Analysis of the coding indicated a 91.4% initial convergence among judges (139 cases out of 152), and 100% convergence was reached after discussion of the divergent cases. Ultimately, 73.7% ($N = 112$) of participants were coded 1; 11.8% were coded 2 ($N = 18$); and 13.8% ($N = 21$) were



Figure 4. The motorized syringe containing the supposed toxic substance.

coded 3. One participant in the latter category who was included by error in the study (a psychology student, see exclusion criteria) was excluded from the analysis. Only participants coded 1 or 2 were included in the main analysis ($N = 130$, 65.4% female, aged 19–71 years, $M_{\text{age}} = 31.74$ years, $SD_{\text{age}} = 13.73$ years, 10.3% vegetarians).² Finally, participants with missing values on gender ($N = 2$), vegetarianism ($N = 1$), or personality variables ($N = 3$) were listwise deleted.

Results

As shown in Figure 5, the shape of the distribution was bimodal. While 23.1% of participants refused to begin the task ($N = 30$), 54.6% fully completed the task through to the end ($N = 71$). Between 0.8% and 3.8% of participants stopped at one of the 11 remaining intermediary modalities. To analyze the relationships between individual variables and the number of injections, taking into account the bimodal distribution, we therefore compared those who were opposed to pressing the first button (0 injections, coded 0) to all of the others combined (coded 1). Please see Figure 5.

Main results. A logistic regression analysis was performed to estimate the odds ratio (OR) and 95% confidence interval (95% CI) of every variable in a single block (Table 1). The results showed that SDO, speciesism, and vegetarianism were significantly related to the quantity of toxic substance

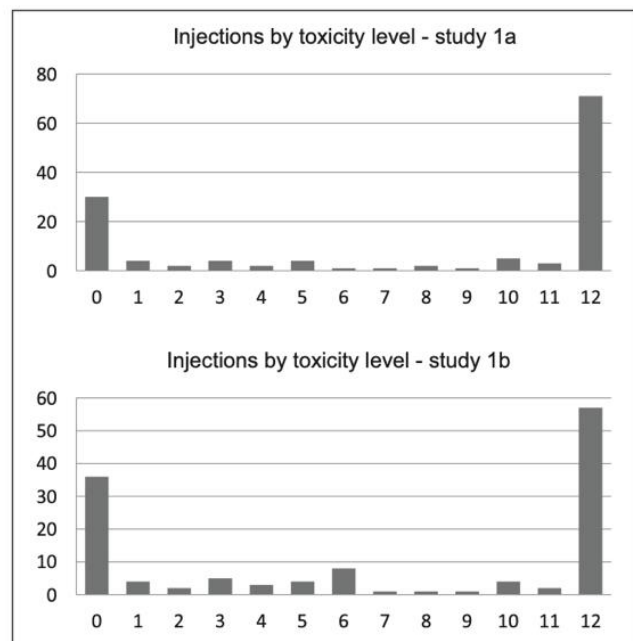


Figure 5. Bimodal relationship between harmful injections and the decision to stop participating in the experiment.

administered to the target, whereas it was not the case for age, gender, and empathy. The overall model accounted for 42% of the variance (Nagelkerke's pseudo R^2). Please see Table 1.

Table 1. Logistic Regression Results Contrasting Participants Who Did Not Press the First Button (Coded 0) to All of the Combined Others (Coded 1), Study 1a.

| Variable | B | SE | Exp(B) | 95% CI | Significance |
|---------------|-------|------|--------|---------------|--------------|
| Age | −0.36 | 0.01 | 0.96 | [0.93, 1.00] | .058 |
| Gender | −0.46 | 0.60 | 0.62 | [0.19, 2.04] | .441 |
| SDO | 1.57 | 0.57 | 4.83 | [1.55, 15.01] | .006 |
| Speciesism | 1.48 | 0.46 | 4.40 | [1.77, 10.93] | .001 |
| Vegetarianism | −0.68 | 0.24 | 0.50 | [0.31, 0.81] | .006 |
| Empathy | −0.02 | 0.47 | 0.97 | [0.38, 2.47] | .965 |
| Constant | −1.47 | 2.52 | 0.23 | / | .559 |

Note. CI = confidence interval; SDO = social dominance orientation.

Ancillary analysis. According to the Engaged Followership Theory (Reicher & Haslam, 2011), it was expected that participants in the experiment would positively rate their participation in the experiment (see Haslam et al., 2015). Overall, the participants were satisfied with the experiment ($M = 3.75$, $SD = 4.00$). Moreover, the more the participants injected the toxic product into the fish's tank, the more they were satisfied ($\rho = .32$, $p < .001$) and considered the task to be easy, interesting, and useful ($\rho = .23$, $.20$, and $.22$, respectively, $p < .05$). Please see Supplemental Material 4.

Discussion

We developed a new experimental protocol in which participants were required to incrementally administer a noxious chemical substance to an animal involved in a learning experiment, leading to the death of the animal. To check the validity of this new measure, we analyzed the relationship between relevant individual factors and the quantity of toxic substance administered to the laboratory animal. We observed that the credibility of the overall protocol was appropriate, as only a low proportion of participants had to be excluded because of suspicions regarding the experiment. As we had hypothesized, we observed that the administration of the lethal substance was positively related to SDO and speciesism, and that vegetarianism was inversely related to the completion of the protocol. In conclusion, our behavioral protocol provided consistent results and seemed fully appropriate to behaviorally measure the destructive use of an animal during a biomedical experiment.

Study 1b: The Influence of a Pro-Scientific Mindset on Animal Harm

If science represents a cultural authority, the mere priming of science should increase a participant's commitment to scientific expectations. In this study, the hypotheses were preregistered (<https://osf.io/6tvzg/>).³ We hypothesized that the salience of science would encourage the administration of the toxic substance to the target fish. We expected that a participant's increased adherence to the scientific goal and the

priming of their support for science would increase their conformity to scientific expectations, regardless of the psychological cost of inducing pain and killing the fish. This perspective was developed in line with the Engaged Followership Theory, which supposes that obedience is a function of identification with the scientific enterprise underlying experimental research (Haslam et al., 2014; Reicher & Haslam, 2011). The same inter-individual measures as in Study 1a were included, with the same hypothesis.

Method

Participants. Based on the conclusive previous study, we recruited 150 participants to this study. The sensitivity analysis we ran on G*Power indicated that our design allowed us to detect a minimal effect of the priming task on the toxic substance administration of Cohen's $d = .40$ (in the t -test component, one-tailed, setting an error alpha rate of .05, a power of .80, and 75 participants in each of the two conditions).

The sample of this study is composed of 150 participants (98 females, 51 males, and one who did not indicate his or her gender), with ages ranging from 18 to 65 years. The sample included 48.7% students, 35.3% workers, 13.3% unemployed, and 2.7% who omitted to indicate their current activity. Moreover, 16.3% of the participants were vegetarians. We relied on the same recruitment procedure and the same exclusion criteria that were used in Study 1a.

Measures. The same scales were selected as in Study 1a: SDO ($M = 1.88$, $SD = 0.64$, Cronbach's $\alpha = .68$), speciesism, ($M = 1.90$, $SD = 0.68$, Cronbach's $\alpha = .78$), and empathic concern ($M = 3.92$, $SD = 0.58$, Cronbach's $\alpha = .75$). All the items were presented using 5-point Likert-type scales. The mean score of the distribution was imputed to missing values (less than 5%).

Procedure

Induction of pro-scientific salience. Following the completion of the consent form, the participants were randomly placed either in a science promotion condition or in a science critical condition. Following a previously established

procedure (Haslam et al., 1999; Reicher, Birney, & Haslam, unpublished, quoted in Haslam & Reicher, 2017), the participants in the *science promotion condition* were asked to write down three things that were important about science, to indicate what they liked about science, and to state what they felt they had in common with scientists. In the *science critical condition*, they were asked to list three things they believed to be problematic about science, what they disliked about science, and what differentiated them from scientists. The experimenter who handled the salience instruction with the participants (and who remained next to them during the experiment) was blind to the experimental conditions. To check for the effectiveness of the manipulation, participants were then asked to answer a 5-point Likert-type scale composed of five items adapted from Gonzalez-Franco et al. (2018), including items such as “I fully share the aims of science,” and “I feel close links with people to whom science is the most important thing in their life” ($M = 3.63$, $SD = 0.67$, $\alpha = .79$).

The development of the overall protocol was almost identical to that described in Study 1a, with only slight modifications made to it to improve its realism and impact (please see Supplemental Material 6).

Post-experimental screening procedure and final sample. All the participants were coded 1, 2, or 3 by independent judges following the same criteria used in Study 1a. The procedure used to achieve the final categorization was slightly different from that of the first study, as five judges watched the whole or some of the videos, and the final code was chosen following the modal categorizations of those judges. Three participants were excluded because they had to leave the experiment before the end for independent reasons, or did not fully understand the instructions. Finally, 70.1% ($N = 103$) of participants were coded 1, 17.0% ($N = 25$) were coded 2, and 12.9% ($N = 19$) were coded 3. As in Study 1a, we only included participants coded 1 or 2 ($N = 128$, 65.6% females, aged 19–65 years, $M_{\text{age}} = 29.67$ years, $SD_{\text{age}} = 12.83$ years, 19.2% of vegetarians), and we excluded all participants coded 3.⁴ Finally, participants with missing values for gender ($N = 1$) and vegetarianism ($N = 3$) were listwise deleted.

Results

Manipulation checks and preliminary analysis. Participants in the pro-science condition scored significantly higher than the participants in the anti-science on the scale measuring their attitude toward science ($M = 3.51$, $SD = 0.64$ vs. $M = 3.75$, $SD = 0.66$), $t(122) = 2.09$, $d = .38$, 95% CI = [0.02, 0.74], $p = .03$. The distribution of the injection number was bimodal, and similar to Study 1a (Figure 5, see also Supplemental Material 8). While 28.1% participants refused to begin the task ($N = 36$), 44.5% fully completed the task through to the end ($N = 57$). Between 0.8% and 6.3% of the participants stopped at one of the 11 remaining intermediary modalities. Please see Figure 5.

To analyze the relationships between the individual variables and the target behavior, we therefore created two groups, as we did in Study 1a: those who stopped before the first injection (i.e., no injections, coded 0) were therefore compared with all the others combined (coded 1).

Primary analysis. A logistic regression analysis was performed to estimate the OR and 95% CI of every selected variable in a single block. The results showed that participants in the pro-science condition (Code 2) administered a higher quantity of the toxic substance than participants in the anti-science condition (Code 1), OR = 2.81, 95% CI = [1.09, 7.22], $p = .03$. Furthermore, age was inversely related to the administration of the toxic substance to the fish (OR = 0.96, 95% CI = [0.93, 1.00], $p = .05$), and substance administration was lower among vegetarians (OR = 0.25, 95% CI = [0.08, 0.74], $p = .01$). The administration of the toxic substance was not significantly related with speciesism, SDO, or empathy. The overall model accounted for 28% of the variance (Nagelkerke's pseudo R^2). Please see Table 2 and Supplemental Material 7.

Discussion

In this study, we showed that participants who had been placed in a scientific mindset were more willing to follow scientific instructions by inflicting pain and harming a target animal involved in a pharmacological experiment. To our knowledge, this represents the first direct behavioral confirmation of the Engaged Followership Theory, which considers that obedient behavior is fully motivated, and is based on an active identification with the scientific enterprise underlying experimental research (Reicher & Haslam, 2011).

However, one may consider that a generalized pro-authoritarian attitude could have been made salient by scientific priming. While such an interpretation would seem on the surface to be inconsistent with surveys showing that pro-scientific attitudes are inversely related to the support of pro-authoritarian institutions and worldviews (Rutjens et al., 2018), additional studies should more directly demonstrate that support for science specifically caused the observed effect, not support for authority in general. Future research should also seek to clarify whether or not the observed link between a pro-science mindset and support for animal experimentation can similarly be observed on a larger scale and in a more diverse and representative sample.

Study 2: Survey Studies on Pro-Scientific Attitude and Support for Animal Experimentation

Study 2a

In the previous study, we experimentally showed that people who were primed toward scientific authority were more inclined to administer a lethal substance to an animal during

Table 2. Logistic Regression Results Contrasting Participants Who Did Not Press the First Button (Coded 0) to All of the Combined Others (Coded 1), Study 1b.

| Variable | B | SE | Exp(B) | 95% CI | Significance |
|---------------|-------|------|--------|--------------|--------------|
| Age | −0.03 | 0.01 | 0.96 | [0.93, 1.00] | .050 |
| Gender | −1.04 | 0.54 | 0.35 | [0.12, 1.03] | .057 |
| SDO | 0.73 | 0.50 | 2.08 | [0.78, 5.57] | .142 |
| Speciesism | 0.41 | 0.41 | 1.51 | [0.67, 3.42] | .316 |
| Vegetarianism | −1.37 | 0.55 | 0.25 | [0.08, 0.74] | .013 |
| Empathy | 0.06 | 0.43 | 1.06 | [0.45, 2.49] | .878 |
| Science Prime | 1.03 | 0.48 | 2.81 | [1.09, 7.22] | .032 |
| Constant | 0.33 | 2.53 | 1.39 | / | .896 |

Note. CI = confidence interval; SDO = social dominance orientation.

biomedical research. If this phenomenon is the consequence of the cultural authority of science, it should also be observable outside the laboratory and assessable by direct and explicit verbal measures. To assess the generalizability of our results, we therefore designed a correlational study on a larger sample and tested for cross-sectional relationships between pro-scientific mindset and support for animal experimentation among both medical and pharmacy students (medical group) and physical therapy and midwifery students (paramedical group). The sampling of participants in contrasting disciplinary fields with unequal support for animal experimentation enabled us to investigate the structural relationship between our constructs. We expected to find a positive association between pro-scientific attitudes and support for animal experimentation. Moreover, we also explored how differences in pro-scientific attitudes in these contrasting samples mediated their attitude toward animal experimentation.⁵

Method

Sampling procedure and participants. We benefited from the context of another independent study to distribute a paper-and-pencil survey during a university course. The sample comprised 313 students (73.6% females, aged 19–37 years) taking first-year medicine ($N = 157$), pharmacy ($N = 67$), physical therapy ($N = 52$), and midwifery ($N = 37$) courses. One participant who did not reply to the gender question ($N = 1$) was excluded from the analysis. Missing data (<5% for every variable) were imputed means.

A sensitivity analysis which we ran on G*Power indicated (setting an error α rate of .05, a power of .80, 313 participants) that our design allowed us to detect a minimum correlation of $r = .16$ (Cohen's $d = .31$), if it existed, on the link between pro-scientific attitudes and support for animal experimentation.

Measures. A 5-point Likert-type survey was given to participants, with options ranging from 1 (*Totally disagree*) to 5 (*Totally agree*) for all the scales. Pro-scientific attitude was

measured using two items (“I believe that science can contribute to making the world better” and “I feel at home in the scientific field,” $M = 3.16$, $SD = 0.62$, Cronbach's $\alpha = .60$). Participants' attitude toward biomedical animal experimentation was also measured via two items (“When it comes to finding the best treatments for illnesses, doing experiments on animals is justified” and “Sacrificing animals like mice or rats for scientific research is normal”). A 5-point Likert-type survey was proposed, with options ranging from 1 (*totally disagree*) to 5 (*totally agree*) ($M = 1.95$, $SD = 0.97$, Cronbach's $\alpha = .82$).

Results

As we expected, support for animal experimentation was significantly related to pro-scientific attitudes ($r_{\text{Pearson}} = .27$, 95% CI = [0.16, 0.37], $p < .001$). The relationships were similarly observed among males and females. We then reasoned that knowledge in the fields of medicine and pharmacy was more intrinsically related to animal experimentation than knowledge in the paramedical fields of physical therapy and midwifery. We therefore expected that medicine and pharmacy students would be more supportive of animal experimentation, so we pooled medical and pharmacy students and physical and midwifery students into two separate groups and performed a univariate analysis of variance, with the two groups as independent variables and attitude toward animal experimentation as a dependent variable. Gender and age were also introduced as a control in the model because of the relevance of these variables in the prior literature on animal experimentation (Broida et al., 1993; Ormandy & Schuppli, 2014), as well as the unbalanced distribution of the gender variable in the two groups (medicine–pharmacy, $n = 224$; physical therapy–midwifery, $n = 89$). The results showed that animal experimentation was more supported by males than females ($M = 2.40$, $SD = 1.00$ vs. $M = 1.79$, $SD = 0.91$), $F(1, 312) = 13.14$, $p < .001$, $d = .41$, 95% CI = [0.19, 0.63]. More importantly, the students in the medicine-pharmacy group more strongly supported animal experimentation than those in the physical therapy-midwifery

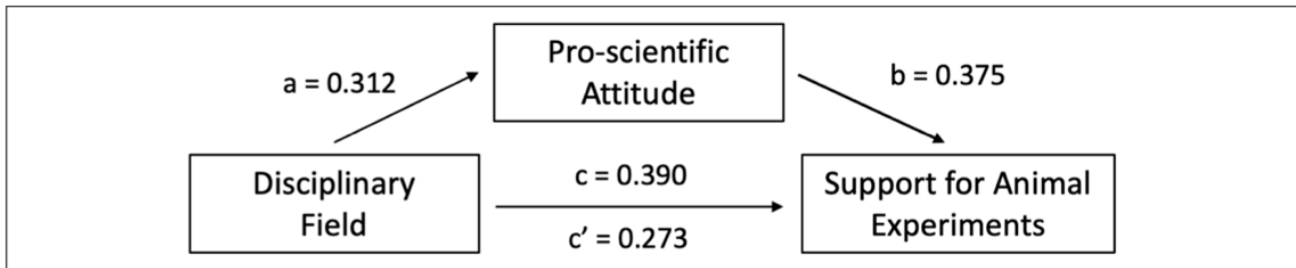


Figure 6. Path diagram for c. The total effect of disciplinary field on support for animal experiment c' . The indirect effect of disciplinary field on support for animal experiments through pro-scientific attitude.

group ($M = 2.06$, $SD = 0.97$ vs. $M = 1.66$, $SD = 0.92$), $F(1, 312) = 6.86$, $p < .01$, $d = .30$, 95% CI = [0.07, 0.52]. The interaction between participants' gender and their disciplinary field was not significant, $F(1, 312) = 0.24$, $p = .62$.

To explore the possible mediator status of pro-scientific attitude, we then analyzed the relationship between the disciplinary field and attitude toward animal experimentation. We performed multiple regressions in the components paths (Baron & Kenny, 1986) with the "JSmediation" R package (Yzerbyt et al., 2018) and found that the disciplinary field represented a significant predictor of attitude toward animal experimentation (*path c*), $b = 0.390$, $SE = 0.120$, $t(311) = 3.24$, $p < .001$, and also of pro-scientific attitude (*path a*), $b = 0.312$, $SE = 0.077$, $t(311) = 4.07$, $p < .001$. These results indicate that students on medical courses hold significantly more positive attitudes toward science and animal experimentation than students on paramedical courses. Our analysis also indicated that while controlling for the university course, attitudes toward science still significantly predicted attitudes toward animal experimentation (*path b*), $b = 0.375$, $SE = 0.086$, $t(310) = 4.34$, $p < .001$. Controlling for the attitude toward science, our model indicated that the disciplinary field remained a significant predictor of the attitude toward animal experimentation (*path c'*), $b = 0.273$, $SE = 0.120$, $t(310) = 2.28$, $p = .024$, confirming a mediation. Upon analyzing the magnitude of this effect using the Monte Carlo sampling method (5,000 iterations), the indirect effect was estimated, $b = 0.12$, 95% CI = [0.05, 0.20]. Please see Figure 6.

Discussion

In this study, we showed that students in medical fields endorsed more pro-scientific attitudes than students in paramedical fields, and that this was related to their support for animal experimentation. This finding suggests that pro-scientific attitudes, albeit obviously distinct from support for animal experimentation (as indicated by the low correlation coefficient between the constructs) were linked in a fundamental way to this attitude, and that the experimental results previously observed therefore cannot be reduced to an experimental artifact. Moreover, relying on students in contrasting

fields, the finding shows that a pro-scientific attitude seemed to mediate the effect of disciplinary preferences or socialization (see Guimond & Palmer, 1990) on a relevant attitude. However, we did not control for some potential confounds related to ideological variables in this study. Moreover, the sample of medical and paramedical students was specific, and not representative of the general population. Study 2b was consequently devised to assess the solidity of the relationship between support for scientific authority and support for animal experimentation, and to rule out the possibility that this link represents an artifact of ideological overlap.

Study 2b

The aims of this study were twofold. First, we intended to consolidate the previously observed relationship between pro-scientific attitude and support for animal experimentation through a large and representative European sample ($N = 31,238$). We also aimed to introduce some necessary controls to check for the specificity of the observed relationship. Previous studies have shown that attitudes toward science as well as toward animal experimentation were related to demographic variables (Crettaz von Rotten, 2008; Hagelin et al., 2003), and to ideological factors such as political orientation, authoritarian values, and religion (Furnham & Heyes, 1993; Hagelin et al., 2003). We therefore intended to assess whether or not the observed link between pro-scientific attitude and support for animal experimentation still holds when five key variables are taken into account: age, gender, political orientation, religious attendance, and authoritarian values.

Method

Sampling procedure and participants. The Special Eurobarometer (EB) on Science and Technology served as the data source for this project. This large survey provides representative information on the populations of the 28 European Union member states, as well as on Turkey, Switzerland, Iceland, and Norway ($N = 31,238$, $M_{\text{age}} = 47.35$ years, $SD_{\text{age}} = 18.23$ years, 53.2% female). A multistage random

Table 3. Linear Regression Model Predicting Support for Animal Experiment (Study 2b).

| Variable | B | SE | Beta | t | Significance | 95% CI |
|-------------------------|--------|-------|-------|--------|--------------|----------------|
| Age | 0.005 | 0.000 | .078 | 12.44 | .001 | [0.004, 0.006] |
| Gender | −0.289 | 0.014 | −.126 | −20.15 | .001 | [−0.31, 0.261] |
| Pro-scientific attitude | 0.498 | 0.011 | .28 | 45.54 | .001 | [0.47, 0.519] |
| Political orientation | 0.019 | 0.003 | .037 | 5.91 | .001 | [0.013, 0.026] |
| Authoritarian values | 0.056 | 0.014 | −.02 | −3.89 | .001 | [−0.08, 0.020] |
| Religious attendance | 0.009 | 0.003 | .017 | 2.63 | .008 | [0.002, 0.015] |
| Constant | 1.98 | 0.57 | | 34.96 | .001 | [1.87, 2.09] |

Note. CI = confidence interval.

(probability) sampling was applied. All the interviews took place in 2010, face-to-face in people's homes, and in the appropriate national language. For the sake of not losing information, when missing values were below 10% (which was the case for age, attitude toward science, religious attendance, and attitude toward animal experimentation), we imputed means for items requiring ordinal or continuous answers. Listwise deletion was applied for the remaining variables (gender and political orientation).

We ran a sensitivity analysis with the same design as the previous study, but the adopted sample size indicated that the smallest size that we could detect was of $r = .01$ (Cohen's $d = .03$). Even setting the lower bound to the previous found effect ($r = .16$), a post hoc analysis indicated that the power of this large sample study was estimated to be 1.

Measures

Pro-scientific attitude. Pro-scientific attitude was measured using eight EB items with a 5-point Likert-type scale, with options ranging from 1 (*totally disagree*) to 5 (*totally agree*). Example items included the following: "Science should have no limits to what it is able to investigate"; "The benefits of science are greater than any harmful effects it may cause" ($M = 3.19$, $SD = 0.65$, Cronbach's $\alpha = .71$).

Attitude toward animal experimentation. Attitude toward the use of animals in biomedical research was measured using two EB items with a 5-point Likert-type scale, with options ranging from 1 (*totally disagree*) to 5 (*totally agree*). Example items included the following: "Scientists should be allowed to do research on animals like mice if it produces new information about health problems"; "Scientists should be allowed to experiment on animals like dogs and monkeys if this can help sort out health problems" ($M = 3.39$, $SD = 1.15$, $\alpha = .72$).

Social and political measures. Political positioning was measured using the following standard question: "In political matters people talk of the 'left' and 'the right'. How would you place your views on this scale?" (1 = *Left*, 10 = *Right*; $M = 5.33$, $SD = 2.20$). We also measured religious attendance, which is considered as the single most relevant indicator of religious commitment (Gorsuch & McPherson,

1989). Participants were therefore asked the following question: "Apart from weddings or funerals, about how often do you attend religious services?" (1 = *never*, 8 = *more than once a week*, $M = 3.68$, $SD = 2.21$).

Authoritarian-related values. A single-item measure on value prioritization in relation to opposing the protection of freedom of speech versus fighting crime and terrorism was used as a proxy measure for authoritarianism (see Altemeyer, 1998; Hendricks, 2019): "Which of the following do you think is most important? Protecting freedom of speech and human rights (1) or fighting crime and terrorism (2)" ($M = 1.45$, $SD = 0.49$).

Results

All the variables were introduced simultaneously in a single block in a linear multiple regression model.⁶ As is indicated in Table 3, pro-scientific attitude was positively related to support for animal experimentation after controlling for gender, age, religious commitment, political orientation, and authoritarian-related values. Animal experimentation was significantly more strongly endorsed among males, older, religious, right-wing participants, and participants holding authoritarian-related values. The overall model (adjusted R^2) accounted for 11.1% of variance.

Discussion

In Studies 2a and 2b, we showed that pro-scientific attitude was cross-sectionally related to attitude toward animal experimentation, confirming with the survey studies the results we had experimentally observed in the previous study. The results confirmed that the relationship between pro-scientific attitude and support for animal experimentation was not reducible to confounds such as political orientation, authoritarian-related values, or religious commitment.

Study 3: Testing a Mediation Model

In the previous studies, we showed that a pro-scientific mindset and support for animal experimentation were causally and cross-sectionally related to each other. One possible

process explaining this relationship lies in the instrumental mindset that may be inherent to the scientific perspective, and which may numb participants' attitude to the consequences of experimental practices on animals. Through the objectification process intrinsic to scientific rationality, most of the time animals are considered as tools or "models," and the expected knowledge outcome is considered sufficient justification for their use. This logic echoes a core dimension of lay utilitarianism: instrumental harm (Kahane et al., 2017). In a recent conceptual analysis of proto-utilitarian tendencies in moral judgment, Kahane et al. (2017) substantiated a fundamental distinction between two dimensions: impartial benevolence, which is a positive dimension of utilitarianism involving "instructing moral agents to sacrifice their own well-being" (p. 134), and instrumental harm, defined as "a willingness to harm and even kill others when this is needed to achieve a better outcome" (p. 135). As an individual difference measure, these authors found that instrumental harm was inversely related to empathic concern and environmental protection, and positively linked to psychopathy (Kahane et al., 2017). It also appears that people who endorse instrumental harm (estimated with the trolley dilemma; see Foot, 1967) are more inclined to consider animals merely as things, with no intrinsic value (Bègue & Laine, 2017).

Our hypothesized relationship between instrumental harm and support for animal experimentation is also derived from previous studies on ethical ideologies (Forsyth, 1980), which have shown that people with low moral idealism (who believe that an action that could harm an innocent other may nonetheless be justified to gain some outcomes) also tend to believe that "scientific concern sometimes justifies potential harm to participants" (Schlenker & Forsyth, 1977; see also Forsyth & Pope, 1984), and tend to be less concerned about the use of animals in scientific experiments (Su & Martens, 2018; Wuensch & Poteat, 1998). Finally, the scientific mindset may numb participants because of the intrinsic effects of statistical reasoning on their perceptions of victims. For example, in a previous study, participants who were induced to follow calculation-based thought (contrasting with a feeling-based mode of thought) were reportedly less generous toward an identifiable victim (Small et al., 2007).

In the present preregistered study (<https://osf.io/6tvgz/>), we expected that instrumental harm would mediate the link between a pro-scientific attitude and support for animal experimentation.⁷

Method

Sampling procedure and participants. To define the sample size of this study, an a priori calculation on R was carried out, using the "PowerMediation" package and the following guidelines (Perugini et al., 2018). To detect a minimum effect size of $r = .10$ in each of the three paths of the mediation model, the analysis indicated that a total of 1,550

participants would be needed. The sample of the study comprised 1,598 participants, 50.3% female, aged 20 to 58 years ($M_{age} = 34.8$ years, $SD_{age} = 9.55$ years). All the participants were recruited by the Toluna Panel and were screened for the following eligibility criteria: aged 18 years or older and French speaking. We imputed means to missing data (<5% for every variable).

Measures. A 5-point Likert-type survey was proposed for all the measures described below, with options ranging from 1 (*totally disagree*) to 5 (*totally agree*).

Pro-scientific attitude. Pro-scientific attitude was measured using the five-item scale adapted from Gonzalez-Franco et al. (2018) which had previously been used in Study 1b ($M = 3.45$, $SD = 0.89$, Cronbach's $\alpha = .88$).

Attitude towards animal experimentation. Attitude toward animal biomedical experiments was measured using the same two items as in Studies 2a and 2b, to which two supplementary items were added to increase the scale's reliability: "I don't think that there is anything wrong with using animals in scientific research," and "Scientists should be allowed to perform any animal experiment without constraining ethical rules if this can benefit medicine" ($M = 2.41$, $SD = 1.08$, Cronbach's $\alpha = .86$).

Instrumental harm. We used the Instrumental Harm subscale of the Oxford Utilitarianism Scale (Kahane et al., 2017), which consists of four items measuring willingness to cause harm to bring about a greater good (e.g., "Sometimes it is morally necessary for innocent people to die as collateral damage—if more people are saved overall," $M = 2.41$, $SD = 1.04$, Cronbach's $\alpha = .86$).

Results

Main analysis. We analyzed the relationship between a pro-scientific attitude and support for animal experimentation and the mediating effect of instrumental harm by carrying out a multiple regression analysis on component paths using the JSmediation R package (Yzerbyt et al., 2018). We found that the pro-scientific attitude represented a significant predictor of support for animal experimentation (path c), $b = 0.25$, $SE = 0.03$, $t(1,596) = 8.39$, $p < .001$, and that it was a significant predictor of instrumental harm (path a), $b = 0.18$, $SE = 0.03$, $t(1,596) = 6.17$, $p < .001$. We also observed that instrumental harm was a significant predictor of support for animal experimentation (path b), $b = 0.50$, $SE = 0.02$, $t(1,595) = 21.93$, $p < .001$. Controlling for instrumental harm, we found that pro-scientific attitude remained a significant predictor of support for animal experimentation, but more weakly (path c'), $b = 0.16$, $SE = 0.02$, $t(1,595) = 6.17$, $p < .001$, thus confirming a mediation (see Figure 7). By analyzing the range of the mediation using the Monte Carlo

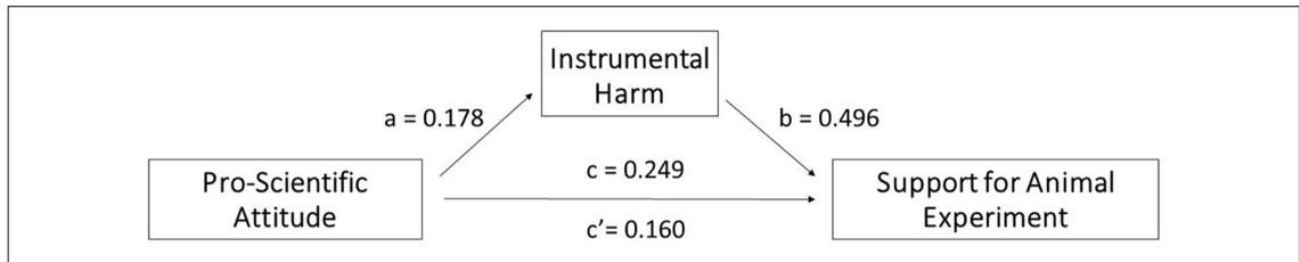


Figure 7. Path diagram for c. The total effect of pro-scientific attitude on support for animal experiment c' . The indirect effect of pro-scientific attitude on support for animal experiment through instrumental harm.

sampling method (5,000 iterations), an indirect effect was estimated, $b = 0.08$, 95% CI = [0.06, 0.11].

Discussion

In this study, we found that a core dimension of lay utilitarianism, instrumental harm (Kahane et al., 2017), mediated the link between a pro-scientific attitude and support for animal experimentation. This result suggests that a pro-scientific attitude was related to the endorsement of a utilitarian arithmetic, which may facilitate the justification of harm to animals. To a certain extent, the objectification inherent to scientific research seems to induce an instrumental view of the object of science itself, even when this involves a sentient being.

General Discussion

Across five independent samples, we have shown that a pro-scientific mindset was related to increased attitudinal and behavioral support for lethal biomedical experiments on animals. The overall triangulated evidence from our studies is consistent with the theoretical prediction that the cultural authority of science shapes an individual's attitude toward the biomedical use of animals. First, as shown in Study 1, when experimentally primed, a pro-scientific attitude underpinned the commission of a painful treatment to, and the killing of, a sentient animal target. This result, based on a consequential behavioral measure, represents the first direct demonstration of the relevance of the Engaged Followership Theory on obedience (Haslam et al., 2014; Reicher & Haslam, 2011). According to this perspective, which departs from the agentic or blind obedience interpretation (Milgram, 1974), an individual's active identification with the scientific enterprise underlying research represents a critical cause of the behavior. In our study, individuals who had been primed toward the positive features of science by writing down three things that were important about science, indicating what they liked about science, and stating what they felt they had in common with scientists, were more willing to follow scientific instructions by inflicting pain and killing what they believed to be a target animal involved in a pharmacological

experiment. In his own research, Milgram (1974, p. 159) himself considered that "the idea of science as a legitimate social enterprise provides the overarching ideological justification for the experiment." However, he did not develop this important idea further, and his agentic state perspective departed from the complex notion of legitimacy which he incidentally referred to. We believe that the Engaged Followership Theory introduces a more complex and heuristic understanding of everyday obedience, which should be understood as a dynamic transaction involving individual goals and situational features rather than as a passive conformity. As in previous studies carried out in the Milgram paradigm (e.g., Bègue et al., 2015), we also observed that individual predictors such as SDO or speciesism were relevant factors able to predict behavioral conformity in Study 1a. However, this was not observed in Study 1b. When we aggregated samples of Studies 1a and 1b, they were related to the target behavior.⁸

The observed link between a pro-scientific attitude and support for animal experimentation was dealt with in depth in a cross-sectional study showing that participants in medical fields endorsed a more pro-scientific attitude than those in paramedical fields, which mediated their support for animal experimentation. Moreover, using a large and representative European sample, the specificity and solidity of this link was shown by controlling for potential demographic and ideological confounds.

To clarify the psychological process involved, we then introduced a core dimension of utilitarianism, instrumental harm. Defined as "a willingness to harm and even kill others when this is needed to achieve a better outcome" (Kahane et al., 2017, p. 135), this dimension of lay utilitarianism was conceived as an intermediary psychological variable connecting an individual's pro-scientific attitude and support for animal experimentation. We observed that this hypothesized mediation was supported by our data in a final study. This result was consistent with the idea that through the scientific process, animals are transformed into commodities to be used to obtain data (Lynch, 1988).

In conclusion, by introducing a new obedience paradigm involving an animal victim, this study refreshes the classical investigation of obedience and provides a psychological

view on the contemporary dilemma of animal experimentation. It suggests that the authority assigned by laypeople to science is a powerful source of legitimacy that may in some instances overtake their core human moral principles in relation to how to treat animals.

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Supplemental Material

Supplemental material is available online with this article.

Notes

1. Please refer to Supplemental Material 1 regarding the exclusion criteria.
2. Analyses were also performed which included Code 3 participants, which did not produce substantially changed results. See also Supplemental Material 5.
3. Some final analyses differ from the original plan, but the hypotheses remain the same.
4. Analyses were also performed which included Code 3 participants, which did not produce substantially different results.
5. The same participants also answered a survey 6 months later, but the data are not presented here.
6. Eurobarometer data are collected according to a very systematic protocol across countries. No cross-national differences were hypothesized, and analyses were therefore performed without standardizing within nations.
7. Although the tested hypothesis remained identical, the analysis presented here departs from the preregistration plan. Our initial aim was to test a mediation model by manipulating pro-scientific priming through an online experiment. As predicted, participants in the pro-scientific prime condition endorsed significantly more instrumental harm ($p < .05$). However, their support for animal experimentation was not significantly higher, whereas manipulation check items still suggested that the induction was efficient (see, however, Sigall & Mills, 1998, regarding the intrinsic limitations of manipulation check items). We believe that these unexpected results were possibly due to the online procedure, which may have impacted the quality of the experimental induction, as the data may be less consistent in online experiments than in lab-based experiments for the production task we relied on (see Finley & Penningroth, 2015). We

therefore tested our mediation effect using the five manipulation checks items as our independent variable, which was then invoked and not provoked.

8. Following cumulative science recommendations (see Asendorpf et al., 2013; Funder et al., 2014), we aggregated the two datasets from our experimental studies (which was made possible as they used the same protocol) to assess the relationships between SDO, speciesism, empathy, vegetarianism, age, gender, and the injection of the toxic substance. As in Studies 1a and 1b, only participants coded “1” and “2” by the judges were included, amounting to a total of 258 participants. A logistic regression analysis was performed following an identical procedure to Studies 1a and 1b. The following variables were related to toxic substance administration: SDO (odds ratio [OR] = 3.04, 95% confidence interval [CI] = [1.45, 6.37], $p = .003$), speciesism (OR = 2.40, 95% CI = [1.36, 4.22], $p = .002$), and vegetarianism (OR = 0.21, 95% CI = [0.09, 0.50], $p < .001$). Age was also inversely related to toxic substance administration (OR = 0.96, 95% CI = [0.94, 0.99], $p = .01$), whereas gender and empathy remained unrelated (OR = 0.50, 95% CI = [0.22, 1.12], $p = .09$ and OR = 1.07, 95% CI = [0.56, 2.03], $p = .82$). The overall model accounted for 34% of the variance (Nagelkerke’s pseudo R^2).

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PART 6. Empirical Evidence: Individual Dispositions and the Identity of Animals in Animal Experimentation

PART 6. Empirical Evidence: Individual Dispositions and the Identity of Animals in Animal Experimentation

Examination of the stress response associated to the personality and the prior attribution of identity to a laboratory-animal in experimental-settings.

Aim of the research

This research sits in the line of our research relying on an experimental design mimicking an animal experimentation to examine what facilitate the use of an animal-model and this research aims to answer to several questions.

First, the moral disengagement theory supposes that strategies can be set up upstream of a harmful behavior to facilitate its conduct, such as the use of euphemisms (see Bandura, 1999). We developed that the common practice to not attribute a name to laboratory-animals serves the same purpose than euphemisms (i.e., diminishing the moral threat that represent the harm of others). However, while lab-technicians indeed report avoiding to name animals so that their identity do not interfere with the objective of the research (A. B. Arluke, 1988), clear empirical evidence that it could affect their task, and that it generates a supplementary stress is lacking. The first objective of this research is to examine within our experimental protocol, if the prior name attribution to a laboratory-animal will diminish the will of individuals to experiment on it, and then to observe if indeed it generates a supplementary stress for the lab-technicians looking at their heart-rate variability.

Besides looking at heart-rate variable as an indicator of stress after the involvement into an animal testing situation (i.e., recovery phase), in this research we will also scrutinize if the cardiac dispositions of people (i.e., "HRV baseline level"), could be related to other individual dispositions (i.e., SDO, speciesism). More interestingly, since a low HRV is associated to the greater ability to close the eyes on aversive stimuli to focus on task (Grol & De Raedt, 2020) and since low HRV predicts a greater obedience in Milgram-like study (see Lepage et al., 2019), this research will also examine if individual dispositions in HRV could predict the use of an animal in laboratory settings.

Manuscript 5

This manuscript has not been submitted. For any relevant material about this research or for the preregistration of the future study, please see Appendices 1, 2, 3, 8, and 9.

PART 6. Empirical Evidence: Individual Dispositions and the Identity of Animals in Animal Experimentation

What predicts the use of an animal for research? A look at heart rate variability, personality, and the objectification of the lab-animal

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Abstract

To develop pharmaceutical drugs from which we benefit, lab-animals may undergo painful tests, and it might be that some factors numb the considerations we have for them to facilitate their objectification. Drawing on a single-study and using an ultra-realistic protocol mimicking an animal research ($n = 145$), we examined the roles of individual dispositions and of the identification of the laboratory animal in facilitating a harmful animal research being conducted. We hypothesized that high social dominance orientation and speciesist dispositions, low empathy, and the objectification of the lab-animal (compared to its personification) would increase the willingness to kill it for science, and that its objectification would reduce the stress-response associated with doing so. Crucially, because low self-regulatory abilities (i.e., low heart rate variability) are associated with less discomfort seeing other in suffering, we hypothesized it would also be associated to a greater willingness to kill the lab-animal. The results of this research were inconclusive and neither individual dispositions nor objectification of the lab-animal significantly predicted participant's behavior. Also, we could not determine whether objectification (or personification) of the lab-animal affected the stress response associated with its use in research. We argue that the weak statistical power of this research probably prevented us from reaching find any relevant findings and that future research should address this gap.

Keywords: heart rate variability, social dominance orientation, speciesism, empathy, personification, Milgram-like paradigm, animal-experimentation

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Introduction

When it comes to human health, animal testing is a mandatory practice and a legal requirement to ensure the safety and evaluate the toxicity and the efficacy of pharmaceutical drugs (e.g., Greek et al., 2012). This widespread practice can take several forms such as the administration of substance or the inhalation of aerosols (Monamy, 2017), but the bottom line remains very similar: rely on animals to gain knowledge or solve medical and biological problems (Loew & Cohen, 2002). As they constitute the main subjects of the experiments, laboratory animals are central in animal testing and approximately 125 million of them die each year in laboratories worldwide (Knight, 2011; Taylor et al., 2008), vast majority of them being fish and mice (European Commission, 2021).

Besides, with increasing evidence that most animals used in laboratory, such as mammals or fish, are sentient and experience pain (Braithwaite, 2010; Braithwaite & Boulcott, 2007; Proctor, 2012; Proctor et al., 2013), these animals should automatically be granted moral consideration and protection from harm (Bentham, 1843; Schein & Gray, 2018; Singer, 2009). Within these lines, relying on animal-modes for scientific purposes might represent an issue. Indeed, alongside polls indicating that animal suffering and animal-exploitation disturb the population (Broad, 2018; Johansson-Stenman, 2018), population non-surprisingly also shows increasing concern for the plight of lab-animals (Clemence & Leaman, 2016; Gallup & Beckstead, 1988). Beyond the public arena, considerations for the suffering of animal-models are also felt in laboratories, as guidelines stressing pain management policies for the laboratory-animals appear (see Smith et al., 2018), and even lab-technicians often report experiencing stress or feeling distressed by their jobs, particularly when it involves euthanizing animals (Bennett & Rohlf, 2005; Scotney et al., 2015).

In fact, causing harm, or being responsible for harming to living beings is a source of disturbance as it directly challenges moral foundations (e.g., Graham et al., 2013). In research inquiries, considerations toward animals must be inhibited to not represent a moral threat and a source of disturbance for laboratory technicians, but how do people overcome these considerations? When examining this issue, we believe that both individual dispositions and contextual frameworks could play a role, perhaps even interacting each other.

Heart Rate Variability

First, not all individuals may experience animal experimentation in the same way because of differences in the emotional and stress response it generates. Inter-individual differences in stress and emotion regulation abilities can be measured through heart rate variability (HRV). The non-invasive nature of HRV measures make it popular in psychology (Heathers & Goodwin, 2017; Mosley & Laborde, 2022) as it allows low interference within protocols and measures. HRV, more specifically high frequency HRV (HF-HRV), mainly grasps parasympathetic vagal activity (see Mosley & Laborde, 2022; Taylor et al., 2022), higher HF-HRV resting-state levels meaning higher parasympathetic activity. Hence, individuals with higher HRV levels generally show better self-regulation, better emotion regulation and more prosocial behaviors (Smith et al., 2020; Mosley & Laborde, 2022). Reversely, lower basal HRV levels have been observed in stressed people (O'Connor et al., 2021), are associated with lack of empathy (Lischke et al., 2018), anxiety (Chalmers et al., 2014) and social anxiety (Pittig et al., 2013). Consequently, it echoes to negative emotional responses facing disturbing stimuli, as for lacking abilities to regulate negative arousals (Faber et al., 1993; Fabes & Eisenberg, 1997). Because they have lower capacities to regulate their emotional arousals depending on the context, lower-HRV individuals have on the contrary greater abilities to ignore what is disturbing and to focus on the completion of a non-affective task (e.g., Fabes et al., 1993; Grol & De Raedt, 2020). Closer to the context of the present research, recent research relying on a computerized version of the Milgram experiment (see Dambrun & Vatiné, 2009) indicates that lower HRV dispositions relate to more destructive behavior toward a target (Lepage et al., 2019). The explanation is that participants with lower HRV levels were more focused on the goals of the task, rather than on the suffering experienced by the target. Therefore, if experimenting on animals represents a source of discomfort because of the moral threat it represents, it is possible that differences in HRV dispositions could predict the involvement in animal-experimentation, and the lower the HRV, the greater the propensity to ignore the suffering of the lab-animals to focus on the scientific goals.

Personality

Besides, with extensive literature stressing the crucial role of some dispositions in human-animal relations (e.g., Dhont et al., 2016, 2019), it is possible

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that attitudes toward animal experimentation and laboratory-animals also depend on personality-based individual characteristics. Social dominance orientation (SDO; Sidanius & Pratto, 1999) and speciesism (Caviola et al., 2019) should particularly predict the endorsement of this practice, as the former construct captures the adherence to a group-based hierarchical system and as the latter legitimizes the exploitation and domination of animals because humans have higher intrinsic values. Both constructs are strongly related to the support of animal-exploitation (Dhont & Hodson, 2014; Graça et al., 2018; Hoffarth et al., 2019; Hyers, 2006; Jackson & Gibbings, 2016), and with animal-experimentation being merely a situation where a high-status group (i.e., Humans) reaps benefits of a lower status group (i.e., lab-animals, see Loughnan et al., 2014), those ideological beliefs should predict its endorsement.

On the other hand, dispositional empathy is also particularly predictive of human-animal relations. The stronger the empathic dispositions, the more positive the attitudes toward animals (e.g., Eckardt Erlanger & Tsytsarev, 2012; Taylor & Signal, 2005). In fact, since empathy can be defined as the disposition to be emotionally affected by the plight of others (e.g., Davis, 1996), it is not surprising that this construct is negatively related to animal cruelty (McPhedran, 2009) and to the support of animal-testing (Broida et al., 1993; Furnham et al., 2003). Yet, to our knowledge very little evidence exist as for the predictive effect of empathy on the behavioral commitment to experiment on an animal, and the role of this disposition as truly producing moral concern for animals is even challenged (see Kasperbauer, 2015).

Objectification of lab-animals

In addition, moral disengagement literature indicates that in the context of inhumane behaviors, objectification of the victims and relying on euphemisms allow numbing and overcoming moral considerations perpetrators have for victims, to facilitate the pursuit of superordinate goals (Bandura, 1999). One might hypothesize that similar mechanisms take place in laboratories, and for instance while lab-technicians carefully choose the language they use by avoiding the term “kill” and rather use “sacrifice” or “terminate” (see Arluke, 1988), laboratory-animals are also objectified and considered closer to objects than to animals (Birke, 2003). Directly in line with this objectification purpose, the refusal to name laboratory-animals is a very common

practice in laboratories (Arluke, 1988; Phillips, 1994), but beyond a logistical ease that might be understandable, scientists report doing it intentionally, so it doesn't interfere with research activities. Therefore, researchers particularly confess doing so not anthropomorphize animals, to avoid thinking about their inner mental lives, or not create emotional attachments with them so as not to distract them from the goals of the research (see Phillips, 1994, as reported in du Toit, 2020).

The present research

Experimenting on animals should be a source of disturbance as it implies harming animals. However, not all individuals should be equally affected by the disturbance animal testing represents and strategies to downplay the considerations we express for lab-animals exist not to interfere with the scientific enterprise.

First, because low self-regulatory abilities are associated with greater abilities to ignore the suffering of others to focus on completing non-affective tasks, we will examine if they also predict commitment of individuals to an animal-experimentation situation. We hypothesize that individuals having lower self-regulation abilities (i.e., lower HRV) will more easily focus on the conduct of the experiment, even if it involves suffering.

Next, since a wide literature stresses the role of individual dispositions on human-animal relations, and even their predictive role in the behavioral commitment in animal testing, we will scrutinize this direction. Thus, we will examine whether SDO and speciesism relates positively to the behavioral willingness to kill an animal in the name of science, and whether empathy relate negatively to it.

Finally, even though this is a reason advanced by lab-researchers, to our knowledge, no studies directly examined if naming laboratory-animals truly impedes researchers to pursue their goals because of greater considerations for the animal-model. Empirical examination of the traditional routine consisting of refusing to name a laboratory animal could certainly show us whether it affects or not the pursuit of a research, but more interestingly could provide new insights in understanding how people disengage from a situation causing harm (see Bandura, 1999). Therefore, we will directly examine whether assigning a meaningless code (compared to a name) to a laboratory-animal increases the willingness to kill it in the name of science and diminishes the associated stress response.

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Method

Open Science

All the analyses we present were preregistered, data, and analysis script are available online³⁷.

This research took place in a wider research program where other analyses were preregistered and planned, and other measures were displayed. However, this article focus only on a selection of relevant measures.

Participants

Participants were recruited through local press, radio announcements, and social media to take part in paid-research (15€/16.5\$) consisting of observing an animal during a behavioral learning task. People interested in participating had to first complete an online questionnaire screening their eligibility for study³⁸ and assessing inter-individual dispositions (i.e., age, gender, personality traits).

One hundred and forty-five participants took part in this study (87 females, 8 that did not indicate their gender), ages ranging from 18 to 63 years ($M = 28$, $SD = 11$), 54% of participants reported being students, 34% workers, 9% unemployed, and 3% did not inform us about their activities.

Procedure

Eligible for the study came to the university for the second part of the study, and upon their arrival, first experimenter welcomed them in a quiet physiological data collection room. Experimenters explained to participants that we will record their cardiac activity for the purpose of the study and asked them to go to the toilet to empty their bladder (see Heathers, 2014). Next, participants had to equip themselves with electrodes following prior instructions and a schema stuck on a mirror. Once equipped, participants sat at a desk in front of a television, with knees at a 90° angle and arms resting on the desk, and they had to watch a 5-minute soundless video clip to reach a

³⁷ For the initial preregistration, please see:

https://osf.io/5qpfz/?view_only=827ec88b1725418bac6e3a5efcf6f576, for the extensions, please see https://osf.io/75gmV/?view_only=1f2f490bcb6348249b443169acc557d5. For the data and analysis script, please see: https://osf.io/w8a97/?view_only=2181cd1fa432482bbd1e8199f635cfae

³⁸ We systematically explained to participants with psychology or neuroscience backgrounds that for quotas reasons on some of their demographics they could not take part of this study. Having participants familiar with Milgram's studies in our experimental protocol would have significantly increased doubts about the veracity of our cover story.

quiet state (see Beffara et al., 2016). Then, participants listened to a 6-minute neutral audio extract presenting the first part of the giraffe's Wikipedia page (i.e., size, height, alimentation, Bertels et al., 2014) and we recorded baseline-HRV at this moment. Videos and audio documentary were used to standardize ECG recording (Piferi et al., 2000).

Afterwards we introduced our manipulation task, and after having specified that the fish with which they would interact was be female (to avoid possible issues such as participant's question to create the name), participants had to either attribute a name or a code to the fish, using an anagram task next to a schematic representation of the fish. In the "personification" condition we displayed a mix of vowels and consonants to compose a name (i.e., A-C-L-A-M-R-I-E-L-U-C-R) and a typical name was "Lucie", and in the "objectification" condition we replaced the vowels by numbers to compose a code (i.e., C-L-8-R-M-R-5-3-L-9-C) with a typical code being "CL53".

It was only then that participants watched a 7-minute video of a (supposed) professor in biochemistry wearing a lab-coat explaining that this research aims to examine the learning abilities of a fish under perceptual and biochemical stimulations. At this moment, we made it explicit that participants were taking part in biomedical research on Alzheimer disease and that during the task where they will have to administrate twelve doses of neurotoxic drug in the water of a fish tank, they will have to observe the fish's behavior. At the end of the video, if participants refused to continue, they had to stay in the room, but if they decided to take part in the research, they had to join the second experimenter in another room, the laboratory.

In this room, participants were seated next to a computer and a motorized syringe, in front of a large aquarium (200 cm × 200 cm × 200 cm) with a 53-centimeter fish swimming inside (which was in fact a robot), and with a plastic slate displaying the code/name of the fish taped on the glass-wall. Using a computer linked to a mechanical syringe, participants had to incrementally administrate twelve doses of a drug into the tank, and with increasing doses came increases of alarming vital signs (i.e., cardiac feedback of the fish displayed on the computer being increasingly erratic and fast)³⁹ and likelihood that the animal dies. Please see Figure 1 and Supplementary Material.

³⁹ This procedure is based on a validated protocol and is strictly identical to it, for more information about it please directly refer to Bègue & Vezirian, 2021 (study 1a).

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After the drug administration task (or if participants refused to start it), participants came back to (or just stayed in) the physiological data collection room and following the same dispositions as before had to watch a second 5-minute soundless film clip, and subsequently listen to the second part of the giraffe's Wikipedia page audio extract while recovery-HRV was recorded.

Finally, participants gathered in the interview room, where we conducted a filmed semi-directive funnel debriefing and they were thanked and compensated for their participation.



Figure 6. Schematic representation of laboratory room. Image reproduced from *Sacrificing Animals in the Name of Scientific Authority: The Relationship Between Pro-Scientific Mindset and the Lethal Use of Animals in Biomedical Experimentation* (p. 4), by L. Bègue & K. Vezirian, 2021, *Personality and Social Psychology Bulletin*. Copyright 2021 by Personality and Social Psychology Bulletin.

Measures

Pre-experimental survey

Within our pre-experimental survey, we assessed individual dispositions on 5-point Likert scales, ranging from *totally disagree* (1) to *fully agree* (5). First, we measured dispositional empathy with 7 items from the interpersonal reactivity index ('When I see someone being taken advantage of, I feel kind of protective towards them', Davis, 1983), then SDO using an eight-item scale (e.g., 'Some groups of people are simply inferior to other groups', Ho et al., 2015). Finally, we measured speciesist attitudes with a 6-item scale (e.g., "Humans have the right to use animals however

they want to”, Caviola et al., 2019). Please see Table 1 for descriptive statistics and zero-order correlational matrix of these personality traits.

Table 1.

Descriptive statistics and correlation matrix between individual dispositions.

| Measures | α | M | SD | Correlations | | |
|---------------|----------------|------|------|----------------------|-------------------|---|
| | | | | 1 | 2 | 3 |
| 1. Empathy | .74 [.67; .80] | 3.79 | 0.64 | - | | |
| 2. SDO | .82 [.78; .86] | 2.09 | 0.69 | -.55, [-.66; -.43]** | - | |
| 3. Speciesism | .81[.77; .86] | 1.98 | 0.71 | -.21, [-.36; -.05]* | .27, [.11; .42]** | - |

Note. Numbers in brackets are 95% confidence interval. Correlations between Empathy, SDO, and Speciesism are Bravais-Pearson's. ** $p < .001$, * $p < .01$.

Heart rate variability

We recorded ECG using PowerLab 16/35TM coupled with the FE132 Bio AmpTM ECG acquisition system device (ADInstruments) and running on LabChart 8. Participants were equipped with three electrodes: two of them were placed symmetrically below the clavicle in the upper parts of the right and left pectoral muscles, and the third electrode was on the left at the height of the 5th rib.

We extracted RR interval data from raw ECG and imported it into RHRV (Rodríguez-Liñares et al., 2011). We visually inspected the signal for artifact (Prinsloo et al., 2011; Quintana et al., 2012; Wells et al., 2012,) and discarded ectopic beats (Kemper et al., 2007) for participants presenting a corrupted RR interval series (Beats per minute shorter/longer than 25/180 and/or bigger/smaller than 13% compared to the 50 last bpm). We then interpolated the RR series by piecewise cubic spline to obtain equal sampling intervals and regular spectrum estimations and we relied on a sampling rate of 4 Hz, and we extracted the high frequency component of HRV from RR interval data (0.15-0.4 Hz) using an east asymmetric Daubechies wavelets with a length of 8 samples. Maximum error allowed has been set at 0.01 (García et al., 2013).

After HRV computation, we detected extreme data (Osborne & Overbay, 2004) inconsistent with resting-state recording conditions (owing to possible technical measurement problems, for example) by examining the distribution of raw HF-HRV levels. We considered a raw HF-HRV value as a resting-state outlier when

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greater/less than the upper/lower quartile \pm three times the interquartile range (Kogan et al., 2014; Pinna et al., 2007). Finally, we calculated the measure of resting-state HF-HRV as the natural logarithm of the raw HF-HRV power to correct the right-skewed distribution (Kogan et al., 2014; Pinna et al., 2007) and we centered to the mean to facilitate the interpretation of parameters. After discarding data having too many artifacts in the signal or participants having a HF-HRV being extreme compared, data from 128 participants was exploitable for both time measurement (i.e., baseline and recovery).

The whole method of processing the HRV signal as well as more details on signal processing are available online or on the preregistration plan. Please see supplementary material for descriptive statistics and correlation matrix between heart rate variability parameters.

Post-experimental screening procedure

Three judges blind to the data reviewed the interviews and categorized participants' detection level of the cover story on three different levels⁴⁰. Ninety participants were categorized into the first detection level (i.e., no detection at all, believed the cover story), 37 participants into the second level (i.e., slight doubts or misunderstanding, but did not affect the task), and 18 participants into the third level (i.e., high detection level and proven doubts about the reality of the fish and/or the harmfulness of the drug). First and foremost, we planned to analyze data from participants in the first two levels of detection (no detection and slight doubts) and to confirm the findings by repeating the analyses only on participants in the first detection level.

Preregistered exclusion criteria, and final sample

We preregistered to discard from analyses related to the administration task participants that did not believe to the veracity of our cover story, such as participants with high level of detection ($n = 18$) or the ones that indicated that the fish was not exposed to a toxic substance in the post-experiment questionnaire ($n = 8$), but present footnotes about analyses including them.

Excluding these participants, final sample size is composed of 123 participants (77 females, 6 that did not report their gender, $M_{age} = 28.4$, $SD_{age} = 11.1$), with 61

⁴⁰ For extensive details, please refer to Bègue & Vezirian, study 1a

participants in the “personification” condition and 62 in the “objectification” condition.⁴¹

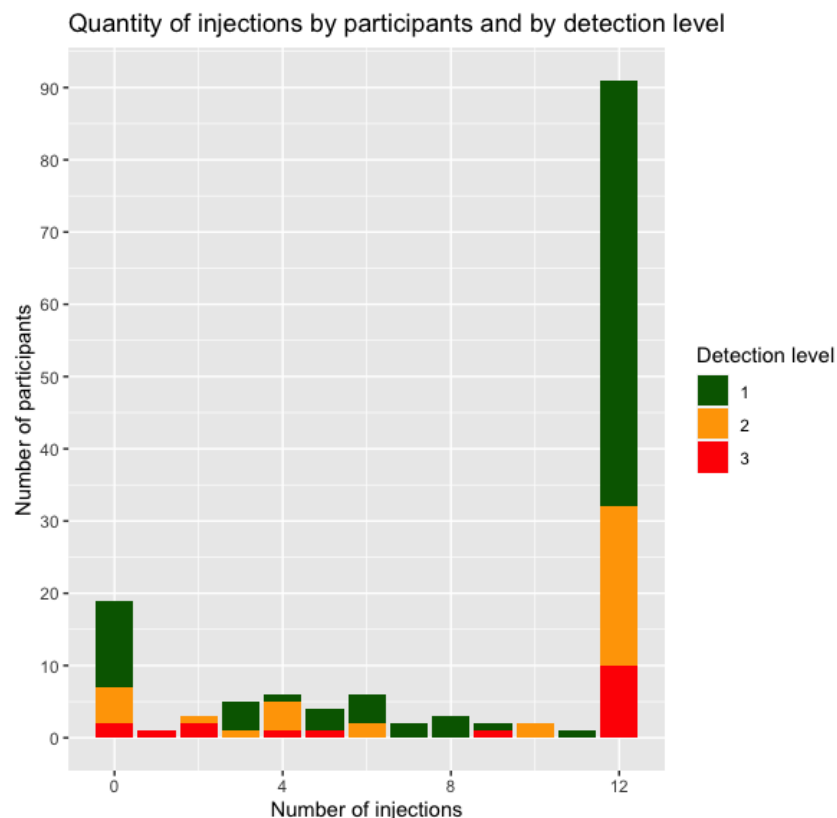


Figure 7. Bar plot indicating the number of injections on the drug administration task per participants and by detection levels ($N_{\text{total}} = 145$). 0 indicates participants that refused to do the task, 12 indicates participants that administrated all the doses. Detection level 1 stands for participants who had no suspicion about the cover story ($n = 88$), detection level 2 for participants who were having slight doubts ($n = 35$), and detection level 3 for participants who had high doubts about the cover story and had to be removed ($n = 22$).

Results

The distribution of the drug administration task was clearly bimodal which replicates studies relying on the same protocol (see Bègue & Vezirian, 2002, study 1a, 1b) and which is current in Milgram-like studies (e.g., Dolinsky et al., 2017). Overall and regardless of the participants’ detection levels, 13.1% of the participants refused to do the task ($n = 19$), 62.8% of the participants administrated the twelve doses ($n =$

⁴¹ For transparency purposes we will nevertheless present results including all participants.

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91), and the remaining participants are uniformly distributed between the first and the eleventh dose ($n = 35$), see Figure 1.

Personality, HRV, and identity of the animal

We first scrutinized the interrelation between individual dispositions and examined to which extent baseline HF-HRV was related to SDO, speciesism, and empathy, and examined whether the experimental task affected recovery HF-HRV. We hypothesized that higher adhesion to ideological beliefs (i.e., SDO and speciesism) and lower empathic dispositions would be related to lower baseline HRV, and that having had to administrate a drug on a personified fish would result in a higher stress response post experiment (i.e., lower recovery HF-HRV). For each of our linear regressions, as preregistered we statistically controlled for the age and gender of participants, and for the room temperature of where the recording happened (see Tang et al., 2021), we present our results in Table 2.

We were unable to see any robust significant relation between baseline HF-HRV and all the other individual dispositions (i.e., SDO, speciesism, and empathy). Besides, we were unable to find any evidence that the personification of the lab-fish would lead to higher stress in the recovery phase, whether it is on participants with the lowest detection level (detection level = 1), $F(1, 56) = 0.16$, $p = .69$, or including participants with slight doubts (detection level = 1+2), $F(1, 83) = 0.14$, $p = .70$.

Table 2.

Linear regression examining the predictor role of baseline HF-HRV on individual dispositions.

| Variable | Statistic | 95% CI | p |
|---------------------|-------------------|---------------|---------------|
| SDO | | | |
| Detection level 1+2 | $F(1, 91) = 1.04$ | [-0.20; 0.63] | .31 <i>ns</i> |
| Detection level 1 | $F(1, 63) = 0.72$ | [-0.28; 0.71] | .40 <i>ns</i> |
| Speciesism | | | |
| Detection level 1+2 | $F(1, 92) = 0.01$ | [-0.39; 0.42] | .90 <i>ns</i> |
| Detection level 1 | $F(1, 63) = 0.00$ | [-0.49; 0.49] | .97 <i>ns</i> |
| Empathy | | | |
| Detection level 1+2 | $F(1, 92) = 2.61$ | [-0.08; 0.75] | .11 <i>ns</i> |
| Detection level 1 | $F(1, 63) = 5.40$ | [0.08; 1.09] | .02 * |

Note. Detection level 1+2 refers to our first level of preregistered analysis including participants with no doubt and participants with a small doubt about our cover story. Detection level 1 refers to our second level of analysis focusing on participants with no doubt at all. Including all participants in the analyses

did not significantly affect the results. Effect size are Cohen's D , ns non-significant, $* < .05$. Age, gender, and Room temperature were statistically controlled.

Drug administration task

First, we examined whether low self-regulation abilities through baseline HRV would predict the drug administration task, but we were not able to find any significant result supporting this claim, $r_{spearman} = .02$, $p = .79$, and launching the analysis again only on participants with the lowest detection level (detection level = 1), did not change significantly the results, $r_{spearman} = .05$, $p = .66$.

We then ran an ordinal regression to examine the effect of SDO, the experimental manipulation, and of the interaction of these two factors on the drug administration task. In this model, we were unable to find significant effects of SDO, $B = 0.35$, $SE = 0.29$, 99%CI [-0.38; 1.15], $p = .22$, or of the experimental manipulation, $B = -0.19$, $SE = 1.25$, 99%CI [-3.48; 3.02], $p = .88$, on the drug administration task. We were also unable to find an effect of the interaction of these two factors, $B = 0.18$, $SE = 0.59$, 99%CI [-1.34; 1.74], $p = .76$. Launching the analysis again by including only participants in the first detection level (i.e., no doubt) did not significantly change the results⁴².

Following the same procedure, we ran a second ordinal regression but examining the effect of speciesism. Consistent with the previous model the analysis fails to find the experimental task main effect to be significant, $B = 0.60$, $SE = 1.15$, 99%CI [-2.39; 3.63], $p = .60$, or an interactive effect with speciesism, $B = -0.34$, $SE = 0.61$, 99%CI [-1.95; 1.21], $p = .57$. However, the analysis reveals the main effect of speciesism on the drug administration task, $B = 0.92$, $SE = 0.31$, 99%CI [0.17; 1.77], $p = .002$, but this effect remains somehow inconclusive including only participants in the first detection level since our 99% confidence interval includes 0, $B = 0.93$, $SE = 0.38$, 99%CI [-0.01; 1.99], $p = .01$ ⁴³.

Additionally, we also examined the role of dispositional empathy, and we were not able to find it in relation with the drug administration task, $r_{spearman} = -.11$, $p = .22$.

⁴² Nor did the same analysis including all participants.

⁴³ Including all the participants in the analysis did not significantly affect the results of the (non)effect of the manipulation task or of the interactive effect with speciesism, but it did again indicate the main effect of speciesism on the drug administration task, $B = 0.89$, $SE = 0.27$, 99%CI [0.21; 1.66], $p = .001$.

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Launching the analysis again, only on participants with the lowest detection level (detection level = 1), did not change significantly the results, $r_{\text{spearman}} = -.04$, $p = .70^{44}$.

Discussion

Causing suffering and harming sentient livings is considered as being morally disputable (Haidt, 2007). Since animal experimentation may harm animals, we witness that people outside of the scene particularly notice their disapproval of this practice in polls (Crettaz von Roten, 2008, 2013; Clemence & Leaman, 2016). There is no reason to believe that lab-technicians' moral foundations would be any different and they should also be affected by the plight of laboratory-animals, therefore predispositions or strategies might help them to overcome their considerations toward them to pursue the conduct of scientific experiments. Relying on a realistic protocol mimicking an animal-experimentation situation, we examined within a Milgram-like paradigm what helps individuals to overcome their concern toward a laboratory-animal in order to conduct experimental research.

When it comes to evaluating animal experimentation, inter-individual differences exist (e.g., Hagelin et al., 2003), and a first aim of this research was to examine whether some individual dispositions could also dictate the way people would behave in an animal-experimentation situation. Since SDO, speciesism, and empathy predict human-animal relation (e.g., Dhont et al., 2016; Caviola et al., 2019), they are reasonable predictors of attitudes and behaviors toward animal-experimentation, but in this research we also argued that self-regulatory abilities (i.e., inferred through baseline HRV) could predict the willingness to experiment on an animal. Unfortunately, we were unable to witness any significant predictive role of SDO, empathy and baseline HRV, on the drug administration task. However, speciesism tends to be predictive of the behavioral commitment to kill an animal for science, as the higher the adhesion to this ideology, the further participants went into the drug administration task, yet this result should be considered with caution since depending on the analysis it also appears to be inconclusive in our data. It would have been stimulating to see that attitudinal findings in SDO, empathy and speciesism transfer effectively onto the willingness to experiment on an animal, but this research failed to find such relations. Besides, it would also have been

⁴⁴ Nor did the same analysis including all participants.

interesting to witness that self-regulatory abilities captured through HRV predict the involvement in this situation inflicting harm to the animal, but again we failed to find this relation.

This research confirmed the interrelation between SDO, speciesism and empathy, with the former two being positively related to each other and both being negatively related to the latter. Moreover, this research also aimed to examine the relation between these individual dispositions and self-regulatory abilities (i.e., baseline HR), but again the results were inconclusive, and we failed to find any predictive role of SDO, speciesism or empathy on baseline HRV.

Denying animals their essentiality is a known strategy to justify the harm animals underwent for our own benefit (e.g., Bastian et al., 2012), but the moral disengagement theory (Bandura, 1999) also stresses that strategies can be set up upstream to facilitate the conduct of harm toward others. We reasoned that the common practice of refusing to name laboratory animals (see Arluke, 1988) is a form of euphemism that serves the purpose of diminishing animal essentiality to objectify them more easily and to not be threatened by their suffering (Phillips, 19994). The second aim of this research was therefore to examine whether attributing codes to laboratory-animals would strengthen their image as *furry test tubes* and facilitate the conduct of a harmful experiment, and alleviate the stress response doing so. Our results do not support these hypotheses since we were not able to detect that attributing a code or a name to a laboratory animal would affect both the willingness to experiment on it and the stress response associated. While qualitative research indicates that researchers admit using this practice to disengage from the lab-animal and to not create an affective bond that could affect the conduct of the research (du Toit, 2020), it is unfortunate that we found no empirical evidence of this in our research.

Limitations and future directions

Overall, the findings of this research were inconclusive, and this is the main limit of this work. We have plausible explanations for this, which might even be interactive.

First, it may be that poor variability within the drug administration task prevented us to find both inter-individual differences and experimental effect of our experimental task on the willingness to kill an animal for science. In fact, beyond the bimodality of the injection distribution, we also witnessed a sort of a ceiling effect on

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our data as two thirds of the participants finished the task and administrated the twelve doses. A recent meta-analysis presenting data from 748 participants that took part in this paradigm (and that includes these data) indicates that 53% of the participants completed the task entirely and administrated the twelve doses (Bègue & Vezirian, 2022, in press). Therefore, descriptively it seems that in the present research participants tended to go further in the task, and it might be that this is the cause of a specificity of this research. In this research, it is the first time that we relied on physiological measurement and relying on this implies electrodes, an electrocardiogram acquisition device, and a stricter procedure (i.e., postural instructions during the ECG recording). Altogether, all these factors might have unintentionally reinforced the scientific aspect of the research protocol, and consequently might have led to more willingness to kill the lab-animal for the research (see Bègue & Vezirian, 2021).

Finally, it is very likely that this research was underpowered and that it prevented us to find existing effects, since increasing the power in a meta-analysis relying on the exact same paradigm allows to find SDO, speciesism and empathy being predictive of the willingness to kill an animal in the context of a research (Bègue & Vezirian, 2022). We recommend other researchers that would like to answer the many unanswered questions relying on a similar paradigm not to skimp on statistical power to increase their chances to get it right.

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Supplementary material

Complementary analysis

In Table 3 we present the descriptive statistics and correlation matrix of several HRV parameters. Overall, this table shows that HRV baseline parameters strongly relate to each other and that recovery parameters relate strongly to each other.

Table 3. Descriptive statistics and correlation matrix between heart rate variability parameters.

| Measures | <i>M</i> | <i>SD</i> | Correlations | | | | | |
|-------------------|----------|-----------|---------------|----------------|----------------|--------|---------|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 |
| 1. HF - Baseline | 352 | 289 | - | | | | | |
| 2. HR - Baseline | 81.1 | 11.8 | -.29*** | - | | | | |
| 3. SD1 - Baseline | 22.1 | 10.6 | .90*** | -.53*** | - | | | |
| 4. HF - Recovery | 487 | 416 | .11 <i>ns</i> | .05 <i>ns</i> | .11 <i>ns</i> | - | | |
| 5. HR - Recovery | 75.9 | 9.73 | .00 <i>ns</i> | .30** | -.13 <i>ns</i> | -.33** | - | |
| 6. SD1 - Recovery | 27 | 13.5 | .11 <i>ns</i> | -.12 <i>ns</i> | .14 <i>ns</i> | .90*** | -.54*** | - |

Note. Correlations are Bravais-Pearson's. HF stands for High Frequency, HR for Heart Rate; SD1 means standard deviation of point perpendicular to the line of identity and captures a short-term HRV. SD1 is equivalent to RMSSD (Ciccone et al., 2017). *** $p < .001$, ** $p < .01$, * $p < .05$, *ns* non-significant.

Following previous procedure (see Bègue & Vezirian, 2021, study 1a, 1b) and for an indicative purpose, we conducted supplementary logistic regressions to examine the role of individual dispositions in the willingness to administrate the toxic drug and compared participants that refused to perform the task (coded 0) to all the other participants that at least administrated one dose (coded 1). In Table 2 we present the result of the regression examining within the same block the role of SDO, speciesism, empathy, and of the experimental task, depending on the level of participants' detection. As preregistered, we control for age, gender, but not for the valence of the name attributed to the animal since none of our participants reported having chose a negative-valence name. Within this model, results indicate that neither name attribution task, nor SDO, nor speciesism seem to affect the willingness to administrate at least one dose to the animal, however and unexpectedly, within these analyses empathy positively predicts this behavior.

Table 4.

Logic regression contrasting participants that refused to do the task (coded 0) to all the other participants that administrated at least one dose (coded 1).

| Variable | <i>B</i> | <i>SE</i> | 95% CI | <i>p</i> |
|----------------------|----------|-----------|---------------|---------------|
| Age | | | | |
| <i>detection 1+2</i> | 0.01 | 0.03 | [0.96; 1.07] | .72 <i>ns</i> |
| <i>detection 1</i> | .00 | 0.03 | [0.96; 1.07] | .97 <i>ns</i> |
| Gender | | | | |
| <i>detection 1+2</i> | -1.14 | 0.88 | [0.04; 1.55] | .20 <i>ns</i> |
| <i>detection 1</i> | -0.69 | 1.09 | [0.04; 1.55] | .52 <i>ns</i> |
| Exp. Task | | | | |
| <i>detection 1+2</i> | 0.13 | 0.61 | [0.33; 3.84] | .82 <i>ns</i> |
| <i>detection 1</i> | 0.17 | 0.84 | [0.33; 3.84] | .83 <i>ns</i> |
| SDO | | | | |
| <i>detection 1+2</i> | 0.40 | 0.51 | [0.57; 4.41] | .44 <i>ns</i> |
| <i>detection 1</i> | 0.79 | 0.75 | [0.57; 4.41] | .29 <i>ns</i> |
| Speciesism | | | | |
| <i>detection 1+2</i> | 0.90 | 0.55 | [0.91; 8.02] | .10 <i>ns</i> |
| <i>detection 1</i> | 1.23 | 0.75 | [0.91; 8.02] | .10 <i>ns</i> |
| Empathy | | | | |
| <i>detection 1+2</i> | 1.21 | 0.63 | [1.01; 12.60] | .05* |
| <i>detection 1</i> | 3.01 | 1.08 | [1.01; 12.59] | .005** |

Note. Detection 1+2 relates to our first level of preregistered analysis including participants with no doubt and participants with a small doubt about our cover story. Detection 1 relates to our second level of analysis focussing on participants with no doubt at all. When all participants are included in the analysis (detection = 1, 2, 3), empathy is no longer significant. Effect size are odds ratio, ** $p < .01$, * $p < .05$, *ns* non-significant.

Materials

For a video mimicking the experimentation, please see:

https://www.youtube.com/watch?v=exNHKprKNwI&ab_channel=MSHAlpes

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Figure 8. Picture presents the interface used to administrate the drug, with buttons ranging from 1 to 12, and displaying the (fake) fish cardiac feedback. Material reproduced from *Sacrificing Animals in the Name of Scientific Authority: The Relationship Between Pro-Scientific Mindset and the Lethal Use of Animals in Biomedical Experimentation* (p. 5), by L. Bègue & K. Vezirian, 2021, *Personality and Social Psychology Bulletin*. Copyright 2021 by Personality and Social Psychology Bulletin.

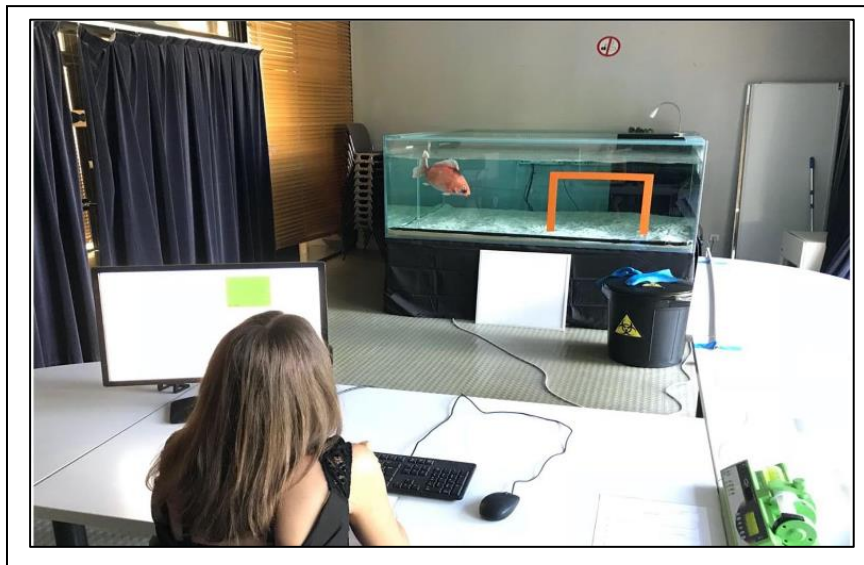


Figure 4. Picture presents the experimental setting with the mechanical syringe to the right side of the participant and with operating computer to her left side. Material reproduced from *Sacrificing Animals in the Name of Scientific Authority: The Relationship Between Pro-Scientific Mindset and the Lethal Use of Animals in Biomedical Experimentation* (p. 5), by L. Bègue & K. Vezirian, 2021, *Personality and Social Psychology Bulletin*. Copyright 2021 by Personality and Social Psychology Bulletin.

Meta-analytic evidence of the role of personality into the lethal use of animals in laboratory-settings

Aim of the research

This research examines the role of personality in the experimental use of an animal in the context of a research. This research fits has very pragmatic purpose as it merges all the data sets or our studies relying on the exact same protocol -including unpublished studies-, to more clearly examine the role of personality in the behavioral use of an animal. Therefore, not to stock data in an endless file drawer, this research presents a cumulative analysis of our personality-based findings.

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Manuscript 6

This manuscript is accepted for publication as a book chapter in a book entitled "*Animal Abuse and Interpersonal Violence: A Psycho-Criminological Understanding*". For any relevant material about this research or for the preregistration of the future study, please see Appendices 1, 2, 3, and 9.

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Instrumental harm toward animals in a Milgram-like experiment in France: The role of non-pathological personality traits

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Abstract

In most of the studies on animal cruelty, animal harm is considered as evidence of mental illness, a sign of psychopathology, or at least of some emotional deficits. We propose to widen the perspective on animal harm and to focus on an institutional context of violence toward animals: the research laboratory. In an experiment modeled on Milgram's methods, participants were required to incrementally administer a noxious chemical substance to a large (20-inch) fish as a part of a learning experiment, leading to the death of the animal. However, the fish was actually a biomimetic robot that swam in a tank across the room from the participant, who believed it was real. Participants were informed that the toxic substance would be painful and lethal at higher doses for the animal. We showed that most of the participants continued until the end of the experiment and killed the fish, and that interindividual differences predicted the maximum dose administered. Males, and participants with low empathy, high speciesism, and a high social dominance orientation went significantly further. These results indicate that non-pathological personality factors are relevant predictors of animal harm in an institutional context.

Keywords: Animal Harm; Social dominance orientation; Speciesism; Obedience; Milgram; Animal experiment; Empathy

“I weighed the mouse, calculated the appropriate amount of distilled water, poured it into beaker and turned on the heat. As the water approached the 180 degree mark, I realized that I just could not “do” the mouse. (...). In hindsight, I am struck by the similarity between my tasks that morning and the plight of the subjects in Stanley Milgram’s infamous obedience experiment.”

Hal Herzog, 2011, pp.206-207

Introduction

Most of the psychological studies on animal harm focus on animal abuse, defined as “socially unacceptable behavior that intentionally causes unnecessary pain, suffering, or distress to and/or death of an animal” (Flynn, 2012, p. 2). These studies analyze offenders histories and profiles (Levitt, Hoffer, & Loper, 2016), how violence may escalate, and reveal the way animal abuse relates to human aggression (Levin & Arluke, 2009; Monsalve, Ferreira, & Garcia, 2017) toward various targets like spouses, children, or other victims (Gullone, 2012). Animal abuse is therefore considered to be an expression of mental illness, a sign of psychopathology, or at least of some socioemotional deficits (Bègue, 2020). Dozens of psychological correlates have been investigated, including callousness, lifetime alcohol use disorders, conduct disorder, antisocial, obsessive-compulsive, and histrionic personality disorders, pathological gambling, and family history of antisocial behavior (Vaughn et al., 2009).

However, in many instances, harming animals is still considered legitimate, such as in an animal experiment context. In that case, the injury inflicted on a “living being who is motivated to avoid such treatment” (Baron & Richardson, 1994) does not fit the definition of abuse previously mentioned. In institutionalized practices such as animal experimentation, harm is a possible byproduct of research procedures and can be perceived as legitimate and necessary to improve human health (Piazza et al., 2020, study 2; Tamir & Ramo, 1980)

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In the case of animal experimentation, human behavior may have aversive consequences on many recipients, and may sometimes also raise difficulties for the agents who perform it (Birke, Arluke, & Michael, 2007). The aim of the present study is to analyze animal harm in a controlled institutional setting and to measure the extent to which some interindividual differences and non-pathological personality traits are involved in animal harm during a Milgram-like experiment.

Animal experiments as instrumental aggression

Some painful animal experiments may be considered as instrumental aggressions (Buss, 1961). They may induce pain, suffering, and death even though the goal of their author is not primarily aggressive. Every year, approximately 125 million animals are used as experimental resources and tools in universities and research centers globally (Knight, 2011; Taylor, Gordon, Langley, & Higgins, 2008), and some experiments are considered as severe. Animals are considered to play a crucial role in medicine, pharmacology, and biotechnology, and are used as models for human disease, as sources of organs or cells, and in animal experimentation, xeno-transplantation, and cloning. Despite the expected outcomes, killing and harming animals is *prima facie* considered as a problematic behavior more generally because it runs contrary to a moral code that prohibits violence towards living beings (Graham, Haidt, Koleva, Motyl, Iyer, Wojcik, & Ditto, 2013). When merely observing living organisms whose corporeal integrity is being degraded or who are experiencing pain, observers may feel empathic reactions, the intensity of which has been shown to be a direct function of the phylogenetic closeness of animals (Allen et al., 2002; Miralles, Raymond, & Lecointre, 2019; Plous, 1993). For this reason, when scientists administer a harmful treatment or euthanize a mammal at the completion of the experimental protocol, they may need to overcome or repress their affective reaction. Some sociological studies report that social rituals and technical procedures in laboratories help scientists to transform animals from subjects into objects. Lab animals are therefore “de-individualized”, and even “de-animalized” (De Mello, 2012). Qualitative data illustrate how institutional settings operate in shaping professional practice, and how the scientists involved in animal experiments deal with their professional identity and attempt to neutralize the disreputable aspects of their work (Arluke & Hafferty, 1996).

However, very little is known about the role of the inter-individual variables involved in animal harm. Studies on scientists who participate in experiments in which animals are harmed and killed have mainly focused on interviews and ethnographic data from laboratories (e.g., Birke, Arluke, & Michael, 2007), while examining the role of inter-individual factors clearly requires more systematic study.

Personality and animal killing

In an extensive review of the psychology of human-animal relations, the authors noted that “underlying factors that could produce conflictual and violent human-animal (...) relations involve the belief in a rigid hierarchical intergroup structure, low empathy, and possessing unemotional traits” (Amiot & Bastian, 2015, p. 44). From that perspective, animal species can be conceptualized as social categories (Fiske & Sevillano, 2016), and the ways in which people interact with these groups is moderated by the value ascribed to such categories. A recent development in the field of human-animal interactions is the introduction of two pro-hierarchic orientations. The first of these is speciesism, which is an inter-specific pro-hierarchic orientation defined as a “belief that humans are intrinsically more valuable than individuals of other species” (Caviola, Everett, & Faber, 2019, p. 2). Speciesism predicts behavioral preferences toward humans and “superior” animals in relation to allocating money or investing time (Caviola, Everett, & Faber, 2019). According to Caviola et al. (2019), speciesism is a form of intergroup bias that is linked to variables known to form part of generalized prejudices (Allport, 1954) such as outgroup discrimination (e.g., sexism, racism; see Caviola et al., 2019, study 3) or hierarchical ideologies (Dhont et al., 2014; Dhont et al., 2016; Graça et al., 2018). A previous cross-sectional study on speciesism among 12344 french adolescents showed that this dimension predicted self-reported harm inflicted on animals (Bègue, 2020).

Another pro-hierarchic dimension is social dominance orientation (SDO, Sidanius & Pratto, 1999). SDO represents the value that people place on non-egalitarian and hierarchically structured relationships among social groups. It expresses “general support for the domination of certain socially structured groups over other(s)... regardless of the manner in which these groups are defined” (Sidanius & Pratto, 1999, p. 61). It is recognized as one of the strongest and most important individual difference predictors of prejudice (Altemeyer, 1998; McFarland, 2010; Pratto,

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Sidanius, Stallworth, Malle, 1994; Sibley & Duckitt, 2008), and is involved in intergroup hostility (Gordon, 2021). People with a high level of SDO show a marked preference for enforcing and preserving existing hierarchical social systems and inequality between humans. In the hierarchy of social categories animals represent a low status outgroup and can even be seen as “the quintessential low status group” (Dhont, Hodson, Leite, & Salmen, 2020, p. 31), which is why attitudes towards them are more negative among people with high SDO (Hoffarth, Azevedo, & Jost, 2019; Caviola, Everett, & Faber, 2019). Moreover, solidarity with animals and the ascription of emotions to them (particularly secondary emotions) is reported to be inversely related to social dominance orientation (Amiot, Bastian, 2017; Bilewicz, Imhoff, & Drogosz, 2011). In line with the Social Dominance Human-Animal Relation Model (SD-Harm, Dhont, Hodson, & Leite, 2016), studies have shown that social dominance is a key factor explaining outgroup and speciesist attitudes, irrespective of other important ideological factors such as right-wing authoritarianism (Altemeyer, 1998) or general conservatism (Dhont, Hodson, Costello, & MacInnis, 2014). In conclusion, we expected in this study that speciesism and social dominance would independently foster the infliction of harm on a laboratory animal involved in an experiment.

Dispositional empathy

Empathy, the ability to share and understand others' affective and mental states (Singer & Decety, 2011), is often activated automatically. When individuals are exposed to (or even imagine) others in pain, the areas of the brain involved in the first-hand experience of pain are activated (Lamm, Decety, & Singer, 2011). However, empathy is not only human-directed, as the same neuronal circuit is activated when seeing human or animals in pain (e.g., Filippi et al., 2010). Empathic reactions therefore represent a disposition that must be subjugated by scientists, who cannot fail to be aware that animals experience harm in some research protocols, and that they also suffer from the conditions in which they are housed. According to ethnographic testimony, training in physiology means “undergoing a process of desensitization to the emotional response that many people have to the act of cutting into an animal body” (Birke, 1994). For lab workers, professional socialization entails working to “switch between objectification (keeping animals at distance) and identification with them” (Birke, Arluke, & Michael, 2007, p. 96). In the field of human-animal relationships, it has been shown that a positive attitude or attachment toward

animals is positively related to dispositional empathy (Eckardt Erlanger, 2012; Pagani, Robustelli, & Ascione, 2007; Taylor & Signal, 2005), while individuals with low empathy tend to harm animals (Mc Phedran, 2009).

Moreover, support for animal experimentation has been reported to be inversely related to empathy (Broida, Tingley, Kimball, & Miele, 1993; Hill, 1993; Hills & Lalich, 1998; Swami, Furnham, & Christopher, 2008). The present study therefore introduced a measure of empathic concern, with the expectation of an inverse relationship between this disposition and the commission of harmful behavior toward animals.

Gender

According to Kellert and Berry, “gender is among the most important demographic influences on attitudes toward animals in our society” (1987, p. 365), and the extensive literature examining gender differences on human-animal relations has confirmed that women have significantly more positive attitudes toward animals than men do (for a review see Herzog, 2007). For instance, women are more engaged in animal protectionism (Galvin & Herzog, 1998; Hoffarth et al., 2019), more likely to avoid a meat-based diet (e.g., Ruby, 2012), more against animal exploitation (e.g., Rasmussen et al., 1993), and less likely to engage in activities directly harming animals (i.e., hunting, fishing, Heberlein et al., 2008) than men are. This gender gap is particularly noticeable in everything related to animal experimentation, as women are more opposed to this practice (e.g., Broida et al., 1993; Crettaz von Roten, 2008, 2013), and/or are more concerned by the suffering of lab-animals (Gallup & Beckstead, 1988; Heleski et al., 2006). However, research is yet to examine if, beyond attitudes toward animal-experimentation, gender could also predict a person’s willingness to conduct animal experimentation.

In summary, we expected that male participants, participants with a high level of social dominance and speciesism, and those with low empathy, would administer a higher quantity of the toxic chemical substance to the animal in a Milgram-like paradigm.

Methods

Participants

We analyzed the datasets of five independent studies which included about 150 participants each. Four of the studies included experimental manipulations that are not detailed here. Among these five studies, two ($N = 297$) are already published (Bègue & Vezirian, 2021) and three have never been published ($N = 451$). We believe that their aggregation here is consistent with cumulative science recommendations (see Asendorpf et al., 2013; Funder et al., 2014). Participants were recruited through local press and flyers to take part in a 40-minute experiment presented as an observational study of animal behavior during a learning task. They would be paid 15 euros (\$16.5) for their participation. About 20% of the participants were paid 20 euros. This increase was supposed to compensate them for their extra effort in participating during the COVID-19 pandemic that started during the fourth experiment. They were first invited to complete an online questionnaire to measure their focal inter-individual variables and to check their eligibility for participation. Participants with backgrounds in fields such as psychology, sociology, cognitive neurosciences, or sport science were excluded because of the high probability that they would possess at least a basic knowledge of social psychological experiments. The eligible sample included 748 participants aged 18-71 years (460 female, 264 male, and 24 people who did not indicate their gender) from the metropolitan area of a French city (Grenoble, pop. 340,000) and surrounding communities, with various occupational and educational levels.

Measures

Speciesism

To measure speciesism, the assignment of different moral value based on species membership, we used the six-item speciesism scale by Caviola et al. (2019) comprising items such as “Morally, animals always count for less than humans” and “Humans have the right to use animals however they want to”, Cronbach’s $\alpha = .72$.

Social Dominance Orientation

Social Dominance orientation, which is someone’s degree of preference for inequality among social groups, was measured using an eight-item scale (Ho et al.,

2015) comprising items such as “some groups of people are simply not the equals of others” and “It is unjust to try to make group equal”, Cronbach’s Alpha = .72.

Empathic concern

We also used the Empathic Concern Scale by Davis (1983), which enquires about a respondent’s feelings of warmth, compassion, and concern for others via seven items, such as “When I see someone being taken advantage of, I feel kind of protective towards them” and “Other people’s misfortunes do not usually disturb me a great deal” (reverse scored), Cronbach’s Alpha = .68

The items of the three scales were presented with 5-point Likert-type scales (1 to 5). We imputed the median score of the distribution to sporadic missing values (less than 5%).

Procedure

Learning protocol

To ensure the credibility of the protocol, two criteria had to be met. First, the task expected from the participants had to look like a real laboratory task. To this end, various pieces of apparatus were introduced to build experimental realism (Wilson, Aronson, & Carlsmith, 2010). The participants were asked to inject a pharmacological substance into what they believed was a laboratory animal (a fish) using an injection machine consisting of a numeric interface controlling a motorized syringe. A colored liquid was to be fully injected into the aquarium via 12 successive shots. Moreover, the cardiac pace of the animal was visualized via an oscilloscope, which also produced auditive feedback. Based on the number of doses injected, the sinusoid and sounds became increasingly erratic, reflecting cardiac distress. Finally, the death of the animal inherent to the procedure echoed a common practice in pharmacological testing: the LD50. In this procedure, an experimental group is exposed to a toxic substance and the amount of substance is gradually increased over time. The amount of the substance required to kill half of the animals in the experiment is called the LD50 (meaning the lethal dose for 50% of the population). The overall credibility of the procedure was checked with a biologist specializing in fish experiments.

Upon their arrival the participants were welcomed by a first experimenter, and then asked to sign a formal consent form to participate which indicated that they could stop their participation at any time before the end of the experiment with no

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consequences on their remuneration. They were then shown a short video containing the following information, delivered by a 45-year-old man dressed in a lab coat:

“Hello, you are about to take part in a research study dealing with the difference between experts (with backgrounds in biology and zoology) and non-experts in the way they observe animal behavior during a learning task involving neuronal stimulation. The study deals with the effects of the administration of a chemical component, piracetam, on learning behavior among fish. This “nootropic” substance has the property to stimulate neurotransmitter functioning. It is currently prescribed to treat cognitive and neurosensorial deficit and dizziness among elderly human subjects. Piracetam is known for its effects on memory. However, a debated question relates to maximum dosages without risk. This protocol will enable us to test a high concentration level of piracetam. Your task will consist of injecting into the water successive doses of piracetam then to code the behavior of the fish. The fish used for the experiment are giant carassius auratus (commonly called goldfish). This species lives in freshwater and today there are about twenty varieties obtained by selective breeding. In natural circumstances, an adult carassius auratus can reach a size of 40 cm, and his life expectancy is about thirty years. An insufficient water quantity is associated with smaller size and a reduced life expectancy.

Despite common preconceptions, this animal has a long-term memory, is capable of elaborate learning, and can feel pain. He can construct complex spatial representations of his environment and orientate in various types of labyrinths to find food. Your task will consist of administering a standard dose of piracetam to the fish in the aquarium. Regarding that aim, you will only have to click on the round buttons (from the first to the last), which will automatically trigger two sensorial and hydraulic stimulation: lights and bubbles. You will then have to count as precisely as possible the number of times the fish goes into the orange frame by clicking on the counter every time you observe it. When the time is over, it stops. Please repeat the operation twelve times. When you have finished, inform the technical assistant. Warning: inform the assistant in the following cases: in case of dysfunction of the numeric interface or the motorized syringe, in case of dysfunction of sensorial stimulators (lights,

bubbles). In this protocol, the piracetam causes death by overdose among half of the animals tested at level 5, and close to ninety-five percent at level 12 (maximum) immediately or within the two following hours. During the experiment, it may occur that the fish experiences paralysis or abnormal movements induced by the treatment. If you notice that the fish has stopped moving, inform the assistant to let him remove it and put another into the basin to continue the experiment with another fish".

After that, the participants were accompanied to another room where a second experimenter was waiting. They were seated at a table in front of a screen. Three meters from the table was a large aquarium (200 x 200 x 80 cm, containing 3000 liters of water) which was supported by a frame 40 cm above the floor. The sides of the aquarium were hidden by a black cover that was removed when the participants were ready to start. Inside the aquarium, what appeared to be a 53 cm goldfish was moving. This was actually not a real fish, but a biomimetic robot (Airo 9) covered in a very realistic silicone rubber which had been modeled and painted by a designer. In order to initiate the task, the participants were instructed to click on the first of twelve buttons, which triggered the following sequence: 1. the injection into the water of 10 ml of piracetam (which was actually water colored yellow); 2. the lighting of a spotlight which illuminated a specific part of the aquarium for 12 seconds; and 3. The emission of bubbles during those 12 seconds which emanated from the floor of the aquarium. Then, the participants were asked to count the number of times the fish went behind an orange frame in a time window of 25 seconds. The participants were told that the fish had previously been trained to move towards this frame when the stimulation was delivered, and that it was expected that the treatment would increase its sensitivity to the stimuli. In fact, the behavior of the fish remained the same across the whole experiment. When the time window was over, the participants had to click on the next button, and so on until button twelve. Below some buttons, the expected probability of death of the fish was written as follows: 0% probability of death (button 1); 33% (button 3); 50% (button 6); 75% (button 9); and 100% (button 12), Figure 1.

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Figure 1: The numeric device

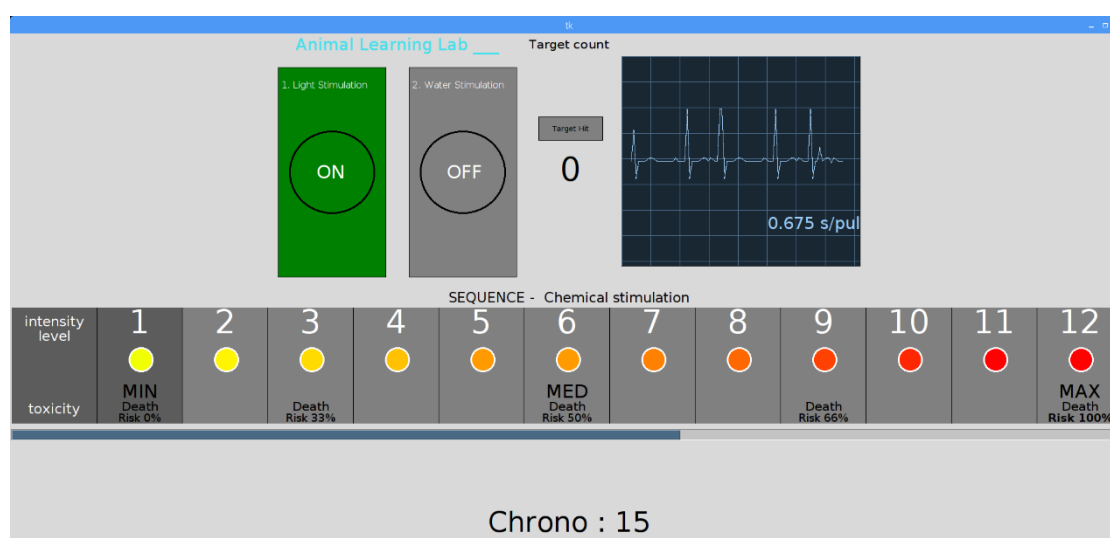
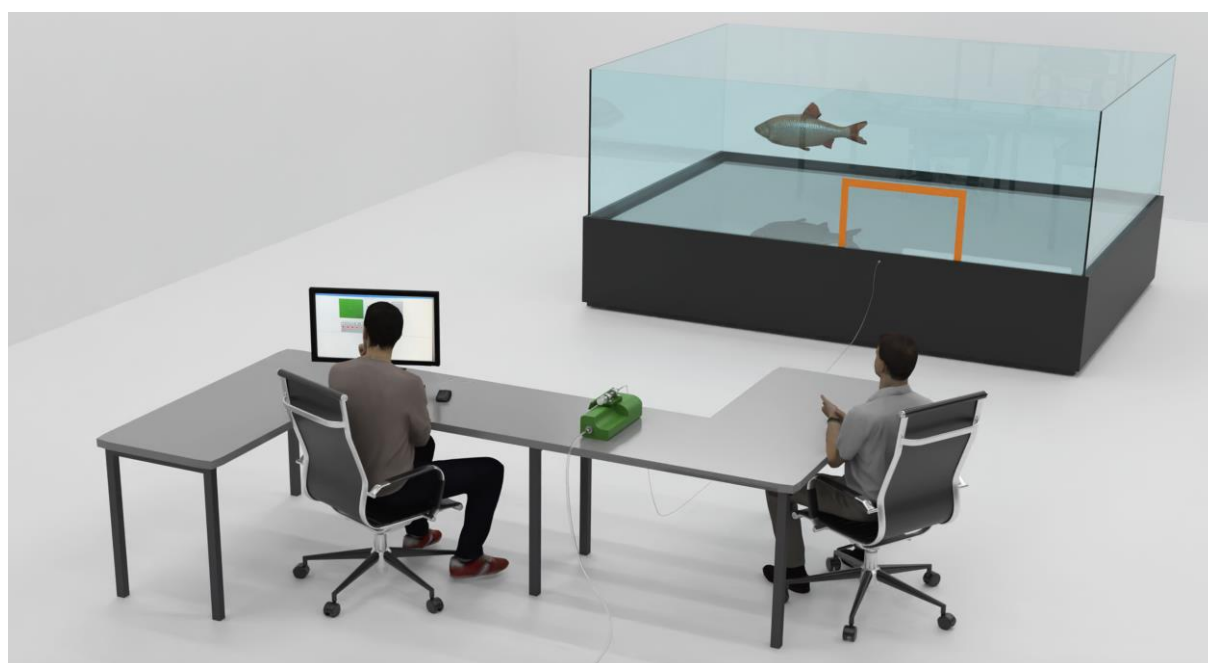
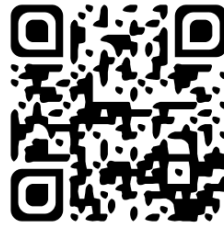


Figure 2: The setting



During the experiment, the cardiac pace of the fish was visualized by means of an oscilloscope, which also produced audio signals (beeps). The sinusoid and the sounds became increasingly erratic, which conveyed the impression to the participants of a cardiac issue with the fish. If a participant stated that they were unwilling to continue, the experimenter replied: “for our research it is important that you go on until 12, but as was indicated in the consent form, you are allowed to stop at any time”. If the participants again expressed their intention to stop, they were

asked by the experimenter: “you want to stop, are you sure?”. A short film of the setting is available by flashing the following code⁴⁵.



When the experiment was over, the participants were shown into another room for a filmed debriefing and study evaluation. Finally, two open-ended questions asked the participants to write down the aim of the study in a few sentences, and if they believed that some features of the experiment were particularly interesting, or had surprised them. Then, a non-directive funnel interview was carried out. To guarantee the sincerity of the participants regarding their evaluations of the experiment, the debriefing was not performed by the laboratory assistant, but was instead carried out by the first experimenter. The participants were verbally asked the following questions: “Was everything fine during the experiment?”; “Did you meet any difficulties during the experiment?”; and “What did you feel during the experiment?”. This interview allowed the participants to express any doubts they had regarding the meaning of the procedure. When the interview was over, they were informed that the substance contained in the syringe as well as the cardiac feedback were fake. We explained to every participant that the true aim of the study was to understand how stress induction modified the interpretation and categorization of behavior in a research situation. They were then paid and invited to participate in a forthcoming meeting dealing with important aspects of the study (including the fact that the fish was a robot), and informing them of the full rationale behind the study.

Post-experimental screening procedure and final sample

To identify any participants who did not fully understand the instructions, or who had doubts regarding critical aspects of the procedure which may have biased the results (see Perry, 2012; Perry et al., 2019), independent judges were asked to

⁴⁵ This link may also be used: <https://www.youtube.com/watch?v=exNHKprKNwI>

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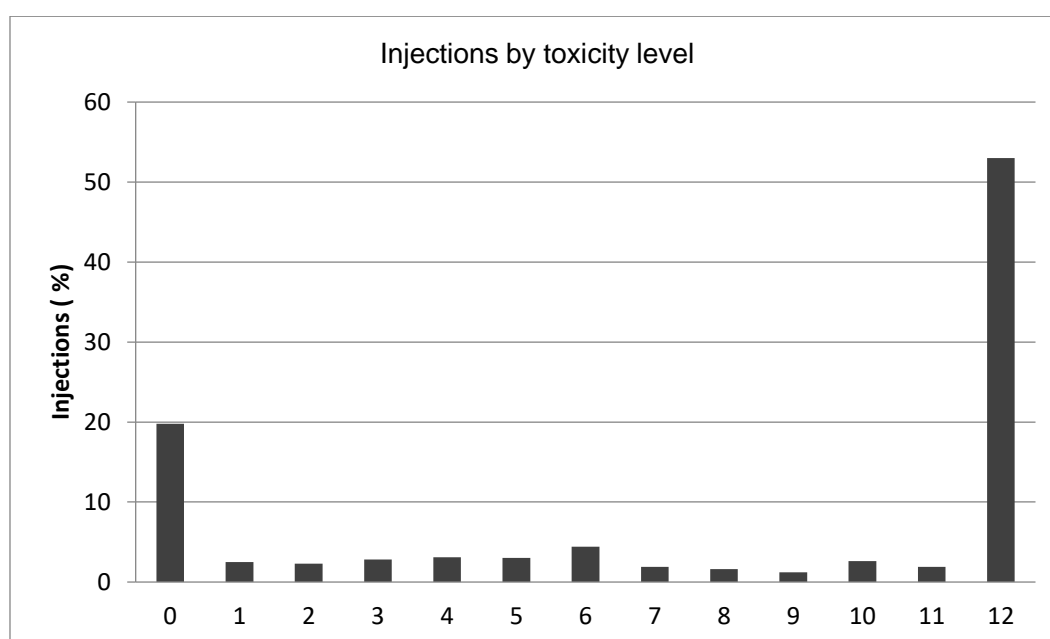
watch the videos of the debriefing sessions. Participants who expressed no substantial doubts about the aim of the experiment and seemed to fully adhere to the scenario that was conveyed during the experiment were coded 1. If a participant expressed slight doubts about the meaning of the experiment, but these doubts did not seem to be critical regarding the credibility of the cover story, then they were coded 2. The judges were instructed to assign code 2 to a given participant if they themselves were unsure whether the participant believed what they were told during the experiment or not. Any participants who expressed clear doubts about core aspects of the study (for example, if they believed that the experiment was not really on animal learning but was in fact on themselves, or if they suspected that the substance that they administered (or the fish) were fake) were coded 3. Analysis of the coding indicated more than 90% initial convergence among judges, and 100% convergence was reached after discussion of the divergent cases. Ultimately, 68.4% ($n = 512$) of the participants were coded 1, 17.4% were coded 2 ($n = 130$), and 14.2% ($n = 106$) were coded 3. In the following analysis, only participants coded 1 or 2 ($n = 642$, 66.5% female, aged 18-71, $M = 31.08$, $SD = 12.94$) were included, and all participants coded 3) were excluded.

Results

As shown in Figure 1, the shape of the distribution was bimodal, as in most of Milgram's experiments (Packer, 2008). While 19.8% of the eligible participants refused to begin the task ($n = 127$), 53% fully completed the task to the end ($n = 340$). Between 1.2% and 4.4% participants stopped at one of the 11 remaining intermediary modalities. The mean score was 7.88 ($SD = 5.07$).

A Mann Whitney U was calculated to compare males and females, with the results indicating that males injected a significantly higher quantity of toxic substance to the fish ($U = 35157$, $p < .001$) (see Table 1). The participant's age was unrelated to the number of injections they administered. We then correlated each scale with the number of injections, and the results showed that empathy, social dominance orientation, and speciesism were all positively related to the number of injections.

Figure 3: Proportion of observed injections for every toxicity level



| Measures | <i>M</i> | <i>SD</i> | Correlation with no. of injections (Spearman's rho) |
|------------|----------|-----------|--|
| Empathy | 3.70 | 0.63 | -.15*** (n = 614) |
| SDO | 2.26 | 0.80 | .21*** (n = 609) |
| Speciesism | 2.15 | 0.83 | .25*** (n = 615) |

Table 1: Descriptive statistics and correlation with number of injections for each variable (Bonferroni correction threshold: $p = .016$), *** $p < .001$.

Conclusion

Since the early studies on animal abuse by McDonald (McDonald, 1963; see also Parfitt et al., 2020), cruelty toward animals has mainly been analyzed through a psychopathological lens. We proposed to widen understanding of animal abuse by exploring how non pathological individuals harm an animal in a Milgram-like experimental setting. As had been hypothesized, we observed that the administration of the lethal substance was positively related to pro-hierarchic orientation, as shown by the positive relationship between social dominance orientation, speciesism, and the administration of the toxic substance. These results confirmed those of previous

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studies that found that ideological factors influenced the ways in which humans deal with animals (Dhont, Hodson, & Leite, 2016; Dhont et al., 2019; Caviola, Everett, & Faber, 2019). Moreover, gender and empathy were also found to be related to the target behavior.

In line with the Social Dominance Human-Animal Relation Model (SD-Harm, Dhont, Hodson, & Leite, 2016), we found that people who valued nonegalitarian and hierarchically structured relationships among social groups were more prone to animal objectification. This result provides additional confirmation that a social dominance orientation promotes what some scholars describe as “anthroparchy” (Cudworth, 2011). Speciesism also independently predicted the harmful behavior administered to the fish.

We also reasoned and showed that empathic concern influences the tradeoff between the scientific necessity of using animals for biomedical research and the reluctance many people feel towards harming an animal (Ormandy & Schuppli, 2012). As we previously indicated, when they must administer harmful treatment to, or euthanize, an animal during an experiment, scientists may have to overcome or to repress their affective reaction, as killing animals contradicts the moral imperative prohibiting violence towards living beings (Graham, Haidt, Koleva, Motyl, Iyer, Wojcik, & Ditto, 2013). Such a repression was hypothesized to be harder for participants with higher levels of empathic concern to apply. While we observed a link, it was not a strong one. It is possible that by using a fish, the calibration of cues eliciting empathy among participants was sub-optimal, as empathy is strongly modulated by perceived species similarity (Batson, Lishner, Cook, & Sawyer, 2005; Krebs, 1975; Gruen & Mendelson 1986). In human-animal relationships, the similarity principle fully applies (Amiot, Sukhanova, Greenaway, & Bastian, 2017; Bastian, Costello, Loughnan, & Hodson, 2012; Borgi & Cirulli, 2015; Hills, 1995), in that the higher the similarity between an animal species and humans, the higher the expected empathy towards the animals in question. Among vertebrates, fish are considered dissimilar to humans (Knight, Vrij, Bard, & Brandon, 2009). Phylogenetic similarity has even been found to be related to physiologic reactivity among participants who watch videos of animals experiencing harm (Plous, 1993; see also Batt, 2009; Hobbins et al., 2002). Recently, empathy towards species was found to be strongly correlated with the evolutionary divergence time separating them from humans (Miralles, Raymond, & Lecointre, 2019). Excessive psychological distance between the participants and the animal in

the present experiment may have contributed to the low relationship between empathic concern and the target behavior. If we had replaced the fish with a mammal, then the links are likely to have been stronger. As a scientist explained in an interview, “it’s different working with mice than goldfish” (Birke, Arluke, & Michael, 2007, p. 96). To conclude on this point, in our experiment, the dissimilarity between fish and humans may have been a significant impediment to the development of strong empathic reactions.

Overall, the present study has shown that, as in Milgram’s studies (Bègue et al., 2015), some non-pathological individual traits are related to the administration of the lethal substance, as indicated by the positive relationship between social dominance orientation, empathy speciesism, and the administration of the toxic substance. As underlined by Flynn (2012), understanding animal abuse should include institutional settings. In this study, we have shown that the psychological traits that are involved in hostile cognitions and behaviors toward human groups are also involved in aversive behavior toward animals.

Some limitations should be mentioned. First, our sample was self-selected, and two thirds of it comprised women. Second, we do not know how these findings would apply to other national or cultural contexts. While further studies should explore these issues, our current results suggest that about half of all individuals agree to mistreat and kill a large fish for research purposes, even when the distress of the animal is salient. While this behavior is influenced by the cultural authority of science and the expected medical outcomes (Bègue & Vezirian, 2022), we have shown that the individual traits generally influencing intraspecific behavior such as low empathy and social dominance also predict interspecific destructive behavior. This suggests that the way that humans consider other sentient beings, even when they are phylogenetically distant like fishes, is related in some ways to the manner they relate to their fellow humans.

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PART 7. General Discussion, Conclusion, and a Final Thought

General Discussion

Reminder of the background

Relying on animal models to learn physiological basis of organisms is age-old, and over the centuries this practice has been implemented in a lot of different fields. For instance, we find this practice in veterinary science, agriculture science, genetics, pharmacology, biochemistry (e.g., Monamy, 2017), or even psychology with for instance those famous research that examined the effect of social isolation on monkeys (Harlow et al., 1965), operant conditioning on dogs (Pavlov & Thompson, 1902), or superstition in pigeons (Skinner, 1948). Nowadays, using laboratory-animals to evaluate the toxicity of chemicals or substances is common and is even mandatory in the development of drugs and pharmaceuticals.

We love animals, and with people reporting being increasingly concerned about their welfare and wanting to improve their conditions by alleviating their suffering, we are consequently seeing major societal shifts in our relationships with them (e.g., Grimm, 2014; Morini, 2018; Rosenblatt, 2017). One could say that there is little doubt about what the population thinks of a scientific practice that harms animals, but in fact the public opinion on the matter is mixed (see Hagelin et al., 2003). Indeed, even though most polls indicate that the public acceptability of animal-experimentation has decreased over the years and over the countries (e.g., Clemence & Leaman, 2016; Crettaz von Roten, 2013), sometimes paradoxical results emerge as people find this practice a necessity (Joffe et al., 2016; Piazza et al., 2020) or refuse to ban it (e.g., Romy, 2022). Similarly, even if we find animal-experimentation cruel and we are motivated to protect animals from harm, we see their suffering in laboratories as legitimate if it could improve human health (Braithwaite & Braithwaite, 1982; Lund et al., 2014; Tamir & Ramo, 1980).

But how can this variability be explained? Is it that there is a split in the population and while some people would know the huge benefits associated to this practice and would therefore be willing to close their eyes on animal suffering and support this practice, others would totally ignore those benefits and oppose animal

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use by default? We doubt it's that simple. Particularly because big benefits for humans do not necessarily make something legitimate or moral, but also because an opinion on something does not automatically imply being aware of the state of the research of it⁴⁶.

However, it might be that people form an opinion about animal-experimentation not because of what they know about it or its associated challenges, but rather because of the legitimacy they accord to it depending on their values and depending on extent to which they are affected by the plight of lab-animals. Animal experimentation is very evocative and we can very picture or imagine the animals in suffering when we evoke these words. This is a very hierarchical situation in which we harm other animals for our own good, animals that under normal circumstances, we should be motivated to protect from suffering. Therefore, it might be that people's perception of animal-experimentation and laboratory-animals may just be the reflection of broader considerations of animals and others, and that people see this phenomenon through the same glasses that they see the world they live in.

Within this dissertation, we decided to scrutinize animal-experimentation with theoretical tools from social psychology to answer numerous questions revolving around this phenomenon. This involves examining what predicts people's opinions about this practice, what predicts their considerations toward lab-animals to the point of facilitating harmful behavior toward them, and how people resolve the apparent paradox that animal-experimentation represents. To this aim, we relied on theoretical frameworks from social and personality psychology that had already been judged to be very relevant to understand Human-Animal relations (Amiot & Bastian, 2015; Dhont et al., 2019), but also on innovative approaches such as the obedience to (scientific)authority.

Recall of the main results

In this discussion section, we will go back to the main findings of this thesis by reviewing the most important results of our manuscripts. Since each of these

⁴⁶ And even if people would be aware, they would realize that animal-experimentation is very limited (e.g., Atkins et al., 2020; Hartung, 2017, 2019; Ioannidis, 2012) and that it might be complicated to objectively defend it tooth and nails (e.g., Pound et al., 2004).

manuscripts already has its own discussion, to summarize this research as succinctly as possible we may overlook some results or present them very briefly.

Gender and animal experimentation

Our first manuscript reports a single study with a gender-balanced sample ($n = 1005$), that aimed to understand how gender differences were characterized when it comes to the perceived legitimacy of animal experimentation. From the very beginning of existence of anti-vivisectionist movements, positions of men and women have greatly diverged, completely in line with the known gender-gap in human-animal relations in general (e.g., Herzog, 2007). Within this research we aimed to find finer predictors capable of explaining this gender-gap, rather than whether one is a man or a woman, and particularly scrutinize whether it could be explained by gender differences in empathy, SDO, and speciesism.

Results indicate that indeed, we find gender differences in speciesism and in empathy between men and women, with women having greater empathic dispositions and lower speciesist attitudes than men. However, and surprisingly, we do not observe the well-known gender-gap on SDO (e.g., Pratto et al., 1994). Additionally, in our data we replicate the effect according to which women endorse stronger positions against animal-experimentation than men do. Results indicate this gender-gap is partly explained by gender-difference on empathy and on speciesism, and the effect of empathy over speciesism has a huge influence on the support of animal-experimentation resulting.

This research brings new leads in understanding the adhesion or the opposition to animal-testing and attests that empathy and speciesism are major predictors of the acceptability of relying on animal-models for research.

Perception and evaluation of (lab)animals

The second manuscript presents two studies ($N_{\text{total}} = 809$) that examined the association between the adherence to ideological beliefs, the perception of mind in animals, and the moral concern for them. Mind abilities in animals should grant them protection from harm and moral status, yet not all individuals are equal toward the support of animal-exploitation situations, nor toward the moral values they attribute to animals. SDO measures the refusal of egalitarianism between social groups and the perceived legitimacy of the domination of high-status groups over the lower ones (e.g., Sidanius & Pratto, 1999), and non-surprisingly SDO happens to be an important predictor of the support for animal-exploitation (Jackson & Gibbings, 2016). This research aimed to examine whether lower recognition of mind in animals from SDO-oriented individuals could explain their lower moral considerations for them and their lower support for activities harming them.

First study relied on animal-testing context and results indicate that the adherence to SDO is positively associated to a lower perception of mind in a laboratory animal, a lower moral concern for it, and to a greater support of animal-testing. Interestingly, this first study confirms the positive association between the perception of mind in an animal and the moral considerations regarding it, and how these both constructs are negatively related to the support of animal-testing.

Second study aimed to manipulate SDO but this was not conclusive. However, results indicate that while SDO as a trait is positively associated with speciesist attitudes, it is negatively associated with the belief in animals' mind. Additionally, it seems that the relation between SDO and speciesism is partially explained by the lower inclination of SDO-oriented individuals to the belief in animals' mind.

This research consistently shows the same pattern of results with varying operationalizations; while SDO is positively associated with the support of animal-exploitation and with lower moral concern toward animals, it is also negatively associated with perception and belief that animals have minds. We believe that if SDO-oriented individuals strongly endorse animal-exploitation and have lower moral concern toward animals, it is because they are less inclined to see or to believe that animals have minds. However, because of the correlational nature of the data, we cannot really rule out other alternative explanations for this meditational claim.

The third manuscript describes three studies ($N_{\text{total}} = 2,406$) that scrutinized whether the mind perception of animals could be embedded in the context in which they are found, and particularly in the responsibility we hold in their harm. As a rule, we have positive attitudes toward animals and we should be intrinsically motivated to protect them from harm, yet they suffer from the many activities that exploit them and from which we benefit. This paradox should be a source of discomfort from which we should be motivated to extract ourselves, particularly since it is made salient that some of our regular behaviors are associated to it and that it can create latencies to act (e.g., Harmon-jones & Harmon-Jones, 2019). If animals are worthy of our moral considerations because of their minds, a very pragmatical way to cope with their harm represents is to deny what makes them morally relevant (see Bandura, 1999). Since we rely on animal-experimentation for our medicines or household products, this research aimed to examined whether we could be motivated to deny mind to lab-animals to cope with the threat that the harm they underwent represent.

The first two studies ($n = 968$ and 970) indicate that in line with our predictions, individuals ascribe lower mind abilities to laboratory-rabbits compared to the same animals but described with naturalistic element. Besides, we tried to manipulate the degree of the suffering experienced by the laboratory-rabbits two times, to see if it would influence the need to deny their minds (see Bastian & Loughnan, 2017), but this was not conclusive.

Relying on the same design, the third study ($n = 468$) shows that this mind denial effect of laboratory-animals holds even after controlling for other species (i.e., Beagle, hamster, macaque), improving the generalizability of our claim. Interestingly, pairwise comparisons demonstrate that while this mind denial of laboratory animals applies to Beagles and to hamsters, this effect is on the edge of detection for macaques. We believe that a low sample size, coupled with anthropomorphism of the animal producing a ceiling effect, made the effect more difficult to detect.

With consistent findings, it seems that laboratory-animals can indeed experience mind denial in the same manner as other animals described in other animal-exploitation situations (i.e., meat-animals, Bastian et al., 2012). However, since we failed to find an effect of the suffering, it is not yet well understood what triggers this moral disengagement process. A fourth study is planned but we have not yet had time to conduct it, and we plan to further investigate the role of responsibility in moral disengagement. Precisely, we plan to manipulate the degree to which

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individuals will feel responsible of the plight of laboratory-animals and observe whether it results in stronger motivation to deny mind to them.

The scientific authority and animal experimentation

The fourth manuscript presents five studies ($N_{\text{total}} = 33,488$) that investigated the role of science authority and of pro-scientific dispositions in the support of animal-testing and in a behavioral engagement in animal experimentation. *How do people come to conduct harm?* This is the starting point of Milgram's studies that examined how people come to electrocute someone as part of a learning task (1965, 1974), but evidently it should not be limited to inter-human relations, and one might ask how lab-technicians come to kill an animal for research purposes. As once there was the need to find what guides the hand on an electric console, there is still the need to find what guides it on a syringe administering a toxic drug to an animal. A plausible explanation of Milgram's experiments sits in the "Engaged followership theory" (e.g., Reicher & Haslam, 2011), which highlights the crucial role of adherence to the purpose of the research to inhibit our considerations toward others, but strict empirical and behavioral demonstrations are lacking. Interestingly, 150 years ago, the father of modern animal-experimentation already defended the claim that during animal-experimentation, the experimenter could no longer see the suffering in the eyes of animal-models as he was blinded by the scientific goals to achieve (Bernard, 1865, p. 180). The aim of this research is to seek whether the scientific enthusiasm (as a disposition and induced) increases the will and the acceptability to kill an animal for science.

The first two studies ($n = 151$ and 150) report the development of a very immersive and realistic environment which reproduces an animal-experimentation to develop a drug, that is unfortunately increasingly toxic for the animal (a fish). First study validates the reliability of the paradigm by providing evidence of its veracity (i.e., low detection level by the participants), and the main results indicate a clear bi-modal distribution of the drug administration task, but speciesism seems to predict the involvement in the task. Additionally, a positive relation exists between the quantity of the drug administrated to the fish by the participants and their reported satisfaction with the experiment, that echoes the engaged followership theory. Main results of the second study demonstrate that pro-science induction prior to the

experiment leads participants to administer more drug to the animal. To our knowledge, this study is the first empirical test of the engaged followership theory within a Milgram-like behavioral paradigm, difference being that we swapped the electric console and the learner for a motorized syringe and a robotic fish.

The third study ($n = 351$) was a survey conducted within a medical course, but with students from varied fields of study (i.e., medicine, pharmacy, physical therapy, and midwifery), and results indicate that if students in medical disciplinary fields support more animal-experimentation than students in paramedical fields, it is because they hold greater pro-scientific attitudes.

Fourth study ($n = 31,238$) relies on a European large dataset and main results confirm that the strong relation between pro-scientific attitudes and the support of animal-testing is not explained by numerous socio-demographic or political confounds.

Finally, fifth study ($n = 1,598$) presents results that indicate that the stronger support of animal experimentation by individuals having greater pro-scientific attitudes is partly explained by their stronger utilitarian dispositions that justify harm toward animals for the greater good.

Overall, this extensive research with varying operationalizations, designs, and samples, brings evidence that the scientific authority and pro-scientific dispositions are related to the support for, and the engagement in animal-experimentation, because underneath it provides justification to numb our considerations toward animals. Somehow, and paradoxically, this research echoes Claude Bernard's vision of experimenters insensitive to the suffering of animals because they are far too focused on the super-ordinate goals of the research.

Individual dispositions and identity of animals in animal-experimentation

The fifth manuscript presents a single study (n = 145) that relied on our Milgram-like paradigm we described earlier, reproducing a very immersive and realistic animal-experimentation situation. The aim of this study was to examine whether prior-personalization or objectification of an animal-model before its utilization for research could influence individuals' willingness to experiment on it, and the experimenter's resulting distress. The use of euphemisms is a well-known strategy to diminish the threat that the harm underwent by others represents (Bandura, 1999), and we reason that the very widespread practice of refusing to name-laboratory animals (M. T. Phillips, 1994) might serve the same purpose and would facilitate the conduct of harmful experiments and alleviate the distress doing so. Besides, this study also aimed to confirm the role of some individual dispositions in the involvement in a lethal- drug administration task (i.e., SDO, speciesism) and to examine the relation with a physiological disposition known to be a marker of self-regulatory abilities related to prosocial behavior (i.e., HRV).

Results indicate that whether the animal is personified or objectified, it does not significantly affect the administration of the harmful substance to it, nor the distress response associated. Besides, we do not replicate the predicted roles of SDO and speciesism on the administration task, nor find that the individuals' inherent HRV dispositions could predict it.

Within this research we aimed to bring empirical evidence that objectification of laboratory-animals helps lab-researchers to reach their goals by alleviating the threat that the suffering that is done to them represents, and that self-regulatory abilities could also predict the extent to which individuals participate into a situation inducing harm to an animal. However, all the results were inconclusive.

The sixth manuscript presents integrative analyses on merged data (n = 748) from all the conducted studies that relied on our main behavioral experimental task. This manuscript therefore presents the data of five independent studies, from which two have been published (see fourth manuscript), one is aimed to be (see fifth manuscript), and two other studies that have never been presented to date. The aim of this research was to scrutinize the role of some individual dispositions (i.e., SDO, empathy, speciesism) and gender into the engagement in animal-experimentation in

a more in-depth manner. There are strong theoretical assumptions that those individual dispositions would be related to a behavior harming animal for science, for instance while SDO and speciesism are strong predictors of the perceived legitimacy of animal-exploitation (Jackson & Gibbings, 2016), empathy and being a woman relate to caring for animals (Amiot & Bastian, 2015; Taylor & Signal, 2005). Therefore, if some previous studies gave inconsistent results (see fourth and fifth manuscripts), we believe that merging our datasets and therefore increasing our sample size and our power, will increase our chances to get it right.

Results indicate that as expected, gender, empathy, SDO, and speciesism are related to the involvement of individuals in an animal-experimentation situation, such as that being a man, having low empathy, and having high SDO and speciesism dispositions predict greater administration of a toxic drug to an animal.

This research summarizes the predictive role of some individual dispositions (i.e., gender, empathy, SDO, and speciesism) in the behavioral engagement in an animal-experimentation situation. Literature was already very dense as for the relationships between individual dispositions and attitudes toward animals (e.g., Amiot & Bastian, 2015), but if one is looking for behavioral effects, this manuscript presents clear demonstrations.

Limitations and Future Directions

Since we have already discussed the various limitations of our research in different manuscripts, for the sake of brevity we will not go back to them, however, let us spend a few words on a general limitation of this research program before focusing on future directions.

A general limit

The extent to which this research program is widespread and goes in all directions is striking since we have at the same time examined the role of gender, personality, physiological dispositions, and even the effect of scientific authority and moral disengagement on attitudes and behaviors in the context of animal-experimentation. One could say that multiplying approaches, varying operationalization and mixing points of view is the best way to examine a phenomenon as a whole, and in fact we recognize and support the interest in this approach. However, even if some works are part of a cumulative approach with a clear vertical development (i.e., manuscripts 3, 4), we must acknowledge that this program remains a very horizontal work that sometimes did not go as deep into the understanding of the phenomenon as it should have. For instance, here and there we find that the gender-gap in animal experimentation is related to underlying individual dispositions (i.e., manuscript 1), or that if SDO relates to lower moral considerations toward animals it is because of a lower recognition of animals' mind (i.e., manuscript 2), yet for these two demonstrations we don't really know what mechanisms are at work. Similarly, the role of SDO has been central within this work and we find it predictive of attitudes toward animal-experimentation and lab animals (manuscripts 1, 2, 4, and 6), yet we do not answer the question whether it is the strive for domination or the anti-egalitarian dispositions that dictate people's attitudes and behaviors the most. Perhaps the biggest flaw of this work is that it was too dispersed, and perhaps that in a cumulative science spirit, to refine our theories and move forward on a solid basis, it might have been necessary to concentrate our efforts in one direction and around a more precise and delimited research question. Let's hope that the future directions we propose will help other researchers to fill this gap and may even guide our own future research.

Future directions

While this work has answered some interesting questions, it has also raised some exciting new questions that may guide future research, including aspects that we have under-explored.

Therefore, we have raised some limitations as for the somewhat raw way in which we have studied the SDO within this work, and future directions might try to better understand some of the mechanisms at work, and we believe that one direction is particularly exciting. One of our findings clearly shows that SDO relates negatively to the perception and the belief of mind in animals (manuscript 2), and with varying operationalizations and samples, this relation between SDO and the report of mind abilities in animals seems robust. It might be interesting for future research to pursue this direction and examine whether this relation is really the result of lower abilities to perceive mind in animals, as one could observe in the case of lack of empathy, or whether it is merely an outcome of a moral disengagement process in high-SDO oriented individuals, as they would be more involved in behaviors causing harm to animals (see Bilewicz et al., 2011). Both directions are attractive and getting things clear on this point could contribute to different theoretical frameworks.

Besides, while there is little doubt about the existence of mind denial of animals described in animal-exploitation situations (see Bastian et al., 2012 and manuscript 3), it would really be interesting to understand how it works. Theoretical triggers of moral disengagement process in the context of animal-exploitation have already been identified (Bastian & Loughnan, 2017), yet we believe that they lack clear empirical demonstrations. While we tried to empirically test the role of the harm underwent by animals, we failed (manuscript 3). Of course, this does not call into question this theoretical trigger, but it shows the need to properly operationalize this construct for further study and to test it. In the same direction, future research should try to test other triggers that might modulate the need to disengage from animals described in an animal-exploitation situation. For instance, we plan to further examine the role of responsibility into this process (this research will perhaps be carried out at the time of the oral defense of this thesis).

Finally, we would like to return to a detail that was raised in the theoretical part of this work. Through this research program we focused on empathy as an individual disposition and we have set aside a promising component of empathy which, in our opinion, is underdeveloped in the study of Human-Animal relations; perspective

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taking (see Davis, 2005). Perspective taking refers to situationist empathy and has strong effects on intergroup relations (Todd & Galinsky, 2014). While some research focusing on environmental issues demonstrated that taking the perspective of endangered animals would increase the will of individuals to give money to environmental activist group (Swim & Bloodhart, 2015) and would increase general environmental concerns (Berenguer, 2010; Schultz, 2000; Sevillano et al., 2007), to our knowledge no studies examined whether taking the perspective of an animal in an exploitation situation could influence the perception of the situation causing harm to perhaps even modify behaviors. What is really interesting about taking a perspective on animals is that it would bring us much closer to the research field of anthropomorphism, and there is probably a lot to be done in that direction (see Young et al., 2018). Beyond being disturbed by seeing animals suffer, perhaps what could be most predictive of human-animal relations is to imagine ourselves in their place and to make this suffering our own, and this track is very stimulating.

Conclusion

Within this research program, we looked at animal-experimentation through a lens which has only rarely been used to scrutinize this phenomenon, and through a social psychology perspective we examined precisely what shapes and predicts people's attitudes and behaviors toward this practice and all that surrounds it. Therefore, the purpose of this research program, was not to assess the validity of animal experimentation, nor to argue the pros and cons of this practice, but to examine whether theoretical frameworks from social psychology could help us better understand this subject that divides society, from understanding individuals' opinions, to predicting behaviors harming animals for science.

With evidence gathered from paper-and-pencil questionnaires, online surveys and experiments, but also immersive experiments in laboratory, in this research program we used data from 38'055 participants, that have been reported in 6 manuscripts and 13 studies, and we believe answered the following guiding questions:

1. Individual dispositions known to predict intergroup relations and human-relations dictate the way we perceive animal-experimentation, but also predict the involvement in an animal-experimentation situation. It is particularly the case for gender, empathic dispositions, and the adherence to ideological beliefs such as speciesism and SDO. While being a woman and having high empathic disposition is related to stronger positions against animal-testing and less willingness to kill an animal for science, being a man and having high SDO and speciesist dispositions relate to more support for this practice and a stronger behavioral commitment in an animal-experimentation situation.
2. Perception of what makes animals morally concerning, which is their mind abilities, depends on the characteristics of the person being asked but also on the context in which the animals are found. First, the stronger the adherence to SDO, the lower the recognition of animals' mind, and it partially explains why high-SDO oriented individuals have fewer moral considerations toward animals and support their exploitation. Then, people are motivated to deny mind to laboratory-animals when reminded of their (in)direct implication in animal-testing

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and we see this phenomenon as a motivated moral disengagement strategy to cope with the threat the exploitation of lab-animals represents.

3. Scientific thrill inhibits moral considerations for laboratory animals. On the one hand, it legitimizes animal experimentation, and on the other hand it directly facilitates the conduct of harmful behavior for science. This effect is both part of the individual dispositions of people and can be induced. We reason that being pro-science oriented enhances the acceptability to harm an animal for greater good.

Beyond examining whether existing theoretical models could fit a new phenomenon or running conceptual replications of meat-paradox literature (see Bastian et al., 2012, study 2), through this dissertation we aimed to use animal-experimentation and lab-animals as pretexts to bring new empirical contributions to the field. Therefore, we see our work as contributing, evidently, to the study of human-animal relations, but also to wider and more varied field of research such as the gender-studies, generalized prejudice and moral disengagement literature, or to the field of obedience to authority and engaged followership theory.

Finally, we already knew that major theoretical frameworks of social psychology can predict human-animal relations, but this research program demonstrates that the way we perceive an animal-exploitation situation and the way we behave toward the fate of lab-animals is intimately related to the way we behave toward our fellow humans. It has been stressed that knowing more about human-animal relations would not only be helpful to satisfy our increasing concerns for animals but could also allow us to understand more about Human nature and our interaction with our fellow humans (e.g., Bastian & Amiot, 2019; Lévi-Strauss, 1962). Therefore, we call researchers to continue to expand social psychology theories to the understanding of human-animal relations, because perhaps the future major theoretical advances of our field are hidden there, in social groups that we are just beginning to take an interest in (see Adams, 2018).

A Final (and personal) Reflection

Animal-experimentation is age-old, but despite being widespread, the use of animals for research raises questions, particularly within the scientific community itself. In fact, it is often pointed out that even if animal experimentation led to great discoveries in the past (e.g., Royal Society, 2004)⁴⁷, this approach to inquire research questions is an old model in which the flaws and flaws are felt (e.g., Akhtar, 2015; Hartung, 2017, 2019; A. Knight, 2019; van der Worp et al., 2010).

Social psychology is not the only black sheep when we talk about the reproducibility crisis, as reproducibility in animal-based research is estimated to be between 10-25% (Begley & Ellis, 2012; Prinz et al., 2011), and in a best-case scenario this means that the conclusions of 3 out of 4 studies relying on animal-models are false. Moreover, this lack of reliability of animal research is not limited to the reproducibility ratio of experiments, and it is even more striking to look at what happened in the specific area of animal-based research that aims to translate findings on animals to humans, translational research. When a drug or a treatment shows evidence of effectiveness on animals, it turns out that depending on the examined pathology the human trials fail in 80% to 99% of the cases (Arrowsmith, 2011; Cummings et al., 2014; Garner, 2014; Hartung, 2013; Hutchinson & Kirk, 2011; A. Knight, 2011, 2019). It is for instance reported that in 20 systematical reviews analyzing what may have utility for human-clinical trials, relying on animal-models shows a potential interest in only 2 reviews, with one of the reviews being questionable (A. Knight, 2008, 2019). Rephrasing, this means that at least 18 systematical reviews failed to find utility of animal-experimentation for clinical trials.

Many researchers agree that the concordance between preclinical animal studies and clinical trials on humans is very limited (Atkins et al., 2020; Ioannidis, 2012; Leenaars et al., 2019; Perel et al., 2007; Pound et al., 2004; Pound & Ram, 2020; Van Norman, 2019), and because animal testing may lack results and has very high associated costs, there are increasing calls from the scientific community to greater scrutinize alternative research methods that look promising (e.g., Gruber & Hartung, 2004; Niazi, 2022; Van Norman, 2020).

⁴⁷ Even though relying on anecdotal evidence is especially pointed out as providing a biased view of the real benefits of animal-research (Pound et al., 2004).

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In fact, the question is not whether experimentation will ever be abolished, but rather when, and we could very well see the end of animal experimentation within the next two decades (e.g., Cookson et al., 2022), as we already see some governmental and political agencies moving progressively towards the end of animal experimentation (de Ávila & Valadares, 2019; European Parliament, 2021; Grimm, 2019a, 2019b). Moreover, it is interesting to note that if animal research seems to be living its last moments, it does not seem that an increasing care for animal welfare is the main cause.

Since animal-experimentation is the reflect of our considerations toward animals, perhaps with evolution of mentalities in our interactions with animals it will even accentuate the end of this practice, the sooner the better. Claude Levi-Strauss had those very striking words⁴⁸ in which he explains that our behaviors toward animals are time-embedded, and that we might not really realize that future generations will probably look at us with disgust when they think of the way we have behaved toward animals. I firmly believe that this will apply to animal experimentation and that one day we will realize our inhumanity when we are confronted with the fact that we have legitimized and justified harming hundreds of millions of animals for research, and at that time, it is not for laboratory animals that the pill will be hard to swallow.

⁴⁸ "The day will come when the idea that, to feed themselves, men of the past raised and slaughtered living beings and complacently displayed their tattered flesh in showcases will undoubtedly inspire the same repulsion as the cannibalistic meals of American, Oceanian or African savages did to travelers in the 16th or 17th century." (Lévi-Strauss, 2001, p. 2).

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Appendix 1

Speciesism scale (Caviola et al., 2019)

Depending on the research, participants had to quote to which extent they agree with

1. Morally, animals always count for less than humans.
2. Humans have the right to use animals however they want to.
3. It is morally acceptable to keep animals in circuses for human entertainment.
4. It is morally acceptable to trade animals like possessions.
5. Chimpanzees should have basic legal rights such as a right to life or a prohibition of torture. (r)
6. It is morally acceptable to perform medical experiments on animals that we would not perform on any human

each of the statements either to answer to this scale using a 5-point Likert scale or a 7-point Likert scale.

Appendix 2

Empathic concern scale (Davis, 1983)

1. When I see someone being taken advantage of, I feel kind of protective toward them.
 2. When I see someone being treated unfairly, I sometimes don't feel very much pity for them. (r)
 3. I often have tender, concerned feelings for people less fortunate than me.
 4. I would describe myself as a pretty soft-hearted person.
 5. Sometimes I don't feel sorry for other people when they are having problems. (r)
 6. Other people's misfortunes do not usually disturb me a great deal. (r)
 7. I am often quite touched by things that I see happen.
-

Participants had to state for each statement to which extent they represent them well, either using a 5-point Likert scale or a 7-point Likert scale depending on the research.

Appendix 3

SDO-7 scale (Ho et al., 2015)

1. An ideal society requires some groups to be on top and others to be on the bottom.
 2. Some groups of people are simply inferior to other groups.
 3. No one group should dominate in society. (r)
 4. Groups at the bottom are just as deserving as groups at the top. (r)
 5. Group equality should not be our primary goal.
 6. It is unjust to try to make groups equal.
 7. We should do what we can to equalize conditions for different groups. (r)
 8. We should work to give all groups an equal chance to succeed. (r)
-

Depending on the research, participants had either to answer to this scale using a 5-point Likert scale or a 7-point Likert scale.

Appendix 4

Animal testing support scale

1. It is morally acceptable to perform medical experiments on animals that we would not perform on any human
 2. It is acceptable to test drugs on animals to ensure that there are no risks to humans
 3. It is acceptable to develop vaccines on animals to be able to prevent epidemics
 4. Animal testing should be banned (*r*)
 5. I am in favor into the use of great apes (chimpanzees, bonobos...) for research on virus and their transmission
 6. When it comes to finding better treatments for diseases, experimenting on animals is justified, even if it can cause them pain
-

Participants had either to rate to which extent they agree with each of the statements using a 7-point Likert scale (1 = totally disagree, 7 = totally agree).

Appendix 5

Horizontal speciesism scale

1. I think some animal species have more value than others.
 2. It is acceptable that not all animals have the same rights.
 3. Some animals deserve more our attention than others.
 4. It is normal that some animals are destined to be in our homes and others in our plates.
-

Belief in animal mind scale (Knight et al., 2004)

1. Most animals are unaware of what is happening to them
 2. Most animals are capable of experiencing a range of feelings and emotions (e.g., pain, fear, contentment, maternal affection)
 3. Most animals are able to think to some extent to solve problems and make decisions about what to do.
 4. Most animals are more like computer programs, i.e. mechanically responding to instinctive urges without awareness of what they are doing
-

For both measures, participants had to rate to which extent they agree with each statements using a 7-point Likert scale (1 = totally disagree, 7 = totally agree)

Appendix 6

List of over-the-counter drugs and household products, manuscript 3

1. Painkiller
 2. Anti-inflammatory
 3. Muscle relaxer
 4. Digestive medication
 5. Hand sanitizer
 6. Laundry powder
 7. Floor polish
 8. Bleach
 9. Detergent
 10. Glass cleaner
 11. Shampoo
 12. Shower gel
-

For each of the product, participants had to rate whether they had already purchased the product at least one time, or never.

Mind perception attribute (Haslam et al., 2008)

1. Pleasure
2. Fear
3. Rage
4. Joy
5. Happiness
6. Desires
7. Wishes
8. Planning
9. Goal
10. Pride
11. Pain
12. Hunger
13. Tasting
14. Seeing
15. Hearing
16. Pleasure
17. Fear
18. Rage
19. Joy
20. Happiness
21. Desires
22. Wishes
23. Planning
24. Goal
25. Pride
26. Pain
27. Hunger
28. Tasting
29. Seeing
30. Hearing

Participants had to rate to which extent the presented possess one of the 30 attribute, on a Likert scale (1 = definitely does not possess, 7 = definitely possess)



This rabbit is widespread in the woods and forests. It is a four-legged nocturnal animal and dig burrows where it spends the day. Its pelage is generally greyish-brown and in natural conditions this animal can live up to 2 years.



This rabbit lives in a laboratory in order to serve as an experimental animal for medical, personal care and household products. For scientific purposes, it will be subject to tests and will experience organ failure, bleeding, irritation. However, because its very specific gene coding for the pain has been turned off at birth, the rabbit will not experience suffering. At the end of the experiment, the rabbit will be euthanized.



This rabbit lives in a laboratory in order to serve as an experimental animal for medical, personal care and household products. For scientific purposes, it will be subject to tests and will experience organ failure, bleeding, irritation. The rabbit will experience a really high level of suffering and distress due to the experimental situation. At the end of the experiment, the rabbit will be euthanized.



This rabbit is widespread in the woods and forests. It is a four-legged nocturnal animal and dig burrows where it spends the day. Its pelage is generally greyish-brown and in natural conditions this animal can live up to 2 years.



This rabbit lives in a laboratory in order to serve as an experimental animal for medical, personal care and household products. For scientific purposes, it will be subject to tests and will regularly experience organ failure, bleeding, and irritation. The level of suffering induced by the tests and the side effects will be very slight and almost insignificant, the rabbit will not suffer. At the end of the experiment, the rabbit will be euthanized.



This rabbit lives in a laboratory in order to serve as an experimental animal for medical, personal care and household products. For scientific purposes, it will be subject to tests and will experience organ failure, bleeding, irritation. The level of suffering and distress induced by the tests and the side effects will be very high, the rabbit will suffer. At the end of the experiment, the rabbit will be euthanized.

Experimental material, manuscript 3, study 3

*



This animal is a dog and more especially a Beagle. It is a four-legged animal, and the color of its coat can be composed of several colors such as white, brown, or dark. This Beagle is a diurnal animal, which means that it is active during the day and rests at night.

*



This animal is a monkey and more especially a macaque. It is a four-legged animal, and the color of its coat is most of the time grey, brown, or black. This macaque is a diurnal animal, which means that it is active during the day and rests at night.

*



This animal is a rodent and more especially a hamster. It is a four-legged animal, and the color of its pelage is most of the time white, brown, or reddish. This hamster is a crepuscular animal, which means it is active at dawn and dusk and rests during the day.

*



This Beagle lives in a laboratory in order to serve as an experimental animal for medical, personal care and household products. For scientific purposes, it will be subject to tests and will experience organ failure, bleeding, irritation. At the end of the experiment, the Beagle will eventually be euthanized.

*



This macaque lives in a laboratory in order to serve as an experimental animal for medical, personal care and household products. For scientific purposes, it will be subject to tests and will experience organ failure, bleeding, irritation. At the end of the experiment, the macaque will eventually be euthanized.

*



This hamster lives in a laboratory in order to serve as an experimental animal for medical, personal care and household products. For scientific purposes, it will be subject to tests and will experience organ failure, bleeding, irritation. At the end of the experiment, the hamster will eventually be euthanized.

Dissonance reminder text

* In the product list we presented you, all the items are tested on animals in laboratory for human's safety and benefits. The overwhelming majority of household and personal care products are tested on animal to avoid any risks of intoxication, irritation, burning or toxic emanation for humans while every pharmaceuticals are always animal-tested to check for the efficacy of the drug or to avoid side effects. There is massive chance that you are using products developed on animals regularly.

Please, take to some time to read again the text and to think about it. You will be able to go at the next question after a second reading. Moreover, remember that we can ask you later a few questions to check for your attention, thereby it is very important that you understand everything.

Please, take to some time to read again the text and to think about it. 00:00:48

Preregistration of the fourth planned study, manuscript 3

Preregistration study “does the responsibility matter”

Title *

Is the mind denial of laboratory animals really depending on the responsibility people hold into their harm?

Description *

Extending findings of the meat-paradox (see Bastian et al., 2012), we consecutively found in 2 previous studies that when individuals are exposed to laboratory-animals, a denial of mind occurs compared to the same animals described in a control condition. Aiming to understand what is triggering this phenomenon, this study will examine whether the responsibility people hold into the harm of the animals *really* modulates this mind denial, because very little empirical evidence exist on the subject.

Hypotheses*

LR = Low Responsibility condition

HR = High Responsibility condition

C = Control condition

We will examine whether the mind attribution of an animal depends on the context in which it is find and depends on the responsibility people hold into the harm the animal underwent.

First, we hypothesize that mind denial of a laboratory animals is stronger when it is made salient that individuals hold a high responsibility, compared to when it is made salient that individuals hold a lower responsibility.

- H1: Participants will rate a laboratory-animal as having lower mind abilities in the High Responsibility condition than the laboratory-animal presented in the Low Responsibility condition.

Then, we hypothesize that a mind denial occurs on animals described in laboratory-settings compared to the same animal described in a control description.

- H2: Participants will rate an animal described in the control condition as having greater mind abilities than the same animals but described in laboratory settings.

Study design*

This study is a 3 conditions between-subject design.

We will present this study as being a study examining consumer behavior and when participants will log on our questionnaire, we will present them a consent form and a brief but vague explanation about the tasks they will have to do. We will tell

participants that within this study, we will review some of the products they commonly purchase and provide them a feedback about them.

We will then ask them to inquire few demographic questions, and then will take place our fake consumer survey where participants will have to indicate which products from a list they use regularly. After this task, a blank screen will appear displaying a GIF mimicking a loading process and we will tell participants that our survey is analyzing their answer to provide a short feedback. It is right after this loading page that our experimental manipulation will take place as we will present to participants one of three different feedbacks about the products they reported to purchase. One feedback will stress that participants hold a low responsibility (LR) into animal-experimentation and into the harm of lab-animals, because their products are mainly developed on alternative method research (i.e., in vitro cell, computer modeling). Another feedback will stress that because of their consumer choices, participants hold a high responsibility (HR) into animal experimentation because their products are tested on laboratory-animals (i.e., mice, rats, dogs). Third feedback (C) will present a text presenting the average price of the products, and where they can be found (i.e., drugstore, pharmacy). We believe that this task will elicit different level of cognitive dissonance as manipulating the responsibility people will feel into animal-experimentation and the harm of animals.

We will then present to participants an animal (a Beagle), and for 2/3 of the participants (HR + LR) the text depict the animal as being a laboratory animal and experiencing suffering during experimentations. For the other 1/3 of participants, this text will just present the animal with naturalistic elements (i.e., color of the pelage). Below the presentation of this image, participants will have to rate the perceived mind abilities of the animal using a list of 15 mental capacities, known to be a good indicator of mind perception. An attention check will be displayed at this moment.

Finally, at the very end of the questionnaire, we will present to the participants the debriefing regarding our study.

Randomization

Participants will be randomly assigned to one of the six conditions. We will implement in our questionnaire a hidden question that will attribute a random code to participants [1-3] and that code will assign participants to one of the three conditions.

Limesurvey:

```
{if( is_empty(RandomGenerator), rand(1,3), RandomGenerator)}
```

Sample size*

1000 participants are going to be recruited

Sample size rationale

The main effect this research aims to find is a difference of mind rating between HR and LR. We believe that this effect exists, but that its effect size is relatively small, and we conducted an *a priori* power analysis to estimate the number of participants needed to have 80% chance of finding it. Setting a one-tailed test, an effect size of $d = 0.20$, an error alpha rate of .05, .80 power, the analysis indicates that 620 participants would be needed to find an effect between HR & LR (310×2).

Therefore, since we aim to have the same proportion of participants within our 3 conditions, 930 participants would be needed (310×3). Considering a slight loss of participants due to online data collection (i.e., failed attention check), we will collect data from 1000 participants.

Stopping rule

We will stop the data collection once 1000 participants will have completed the survey.

Manipulated variables

In this study, we will present three different feedbacks regarding our supposed consumer task, 1 will stress that the participant holds a strong responsibility in animal-experimentation (HR), 1 will stress that the participant holds a low responsibility in animal-experimentation (LR), and 1 will present neutral information about the products (N). Besides, one picture of a Beagle will be presented to participants and the description of the picture will match the previous feedback, as for 2/3 of the sample it will present the animal as living in a laboratory and being subject of scientific experimentations (HR & LR), while for 1/3 of the sample the animal will be described with naturalistic elements (N).

Example of naturalistic description for the Control Beagle:

"This animal is a dog and more especially a Beagle. It is a four-legged animal, and the color of its pelage is composed of several colors such as white, brown, or dark. This Beagle is a diurnal animal, which means it is active during the day and rests at night"

Example of laboratory description for the Experimental Beagle:

"This Beagle lives in a laboratory to be used as an experimental animal for medical, personal care and household products. For scientific purposes, he will be tested and experience organ failure, bleeding, irritation. At the end of the experiment, the Beagle will eventually be euthanized."

Measured variables*

At the beginning of the questionnaire, we will ask participants to assess their gender and age. We will then present to participants a list of pharmaceutical drugs, over-the-counter drugs, personal and household products and ask participants to tick a case if they ever used one of the presented items. With this task, we want to make salient in participants minds that indirectly they are "actor" of the animal experimentation while consuming animal-tested products, and this is not clearly speaking a 'measure'. For our main dependent variable, we will ask participants to rate the animals on a set of 15 mind capacities (pleasure, fear, rage, joy, happiness, desires, wishes, planning, goals, pride, hunger, tasting, seeing, hearing, pain) on 7-point Likert scale (1 = definitely does not possess, 7 = definitely does possess). We will present these questions after the first picture presentation. An attention check will also be displayed in this part of the survey.

Statistical models*

- We will launch a regression analysis comparing two orthogonal contrasts: C1 ($C = 2$, $HR = -1$, $LR = -1$), to investigate the replication of an higher mind denial in laboratory conditions than in control animal, and C2 ($C = 0$, $HR = -1$, $LR = +1$), to examine the effect of the responsibility on the mind denial of the laboratory animal.

Transformations

NA

Inference criteria

$p = .05$

Data exclusion

Will be excluded of the analysis participants who failed the attention check: 'This question is an attention check, please choose the "probably does possess" answer.'

Moreover, we clarify than we will use pre-screening criteria in this study such as:

- Being omnivorous ("I do not follow any diet")
- English as a first language
- Device = computer
- Approval rate = 80-100%
- We will also block participants that participated to the previous study, using their Prolific IDs

Missing data

We will exclude participants that did not answer to our main variable "mind attribution".

Exploratory analysis

An interesting point was raised by a reviewer in a previous examination of our work, and it was suggested that we examine whether the denial of mind fluctuates with the categories of products reported to be used by participants, and with the amount of products used reported. The underlying idea is that the stronger the purchase behaviors, the stronger should be the felt responsibility. Even if this idea is stimulating, we do not think to pursue in this direction as 1) it would lead us to theorize why the use of certain products raises more dissonance than others and it is beyond the scope of this research, 2) we thought our "consumer task" as an experimental induction and we have little confidence in the quality of what it could measure, for example, some very common animal-tested products may have been overlooked. However, we are not entirely closed to the idea of this analysis if the reviewer requests it.

Other

Participants will be paid £0.63 for a 5-minute study, labelled as a low price on the platform. This study will cost £840 (997€).

Appendix 7

Experimental material, manuscript 4

Observation Animale 2019/2

CODE personnel :

Avant de démarrer, nous aimerions recueillir votre avis au sujet de la recherche scientifique en général. Prenez bien votre temps pour cela.

Pour commencer, veuillez énumérer trois choses **qui selon vous sont importantes** au sujet de la science :

1. _____
2. _____
3. _____

Veuillez énumérer trois choses **que vous aimez** au sujet de la science :

1. _____
2. _____
3. _____

Veuillez énumérer trois choses que vous **avez en commun** avec les scientifiques :

1. _____
2. _____
3. _____

CODE personnel :

Avant de démarrer, nous aimerions recueillir votre avis au sujet de la recherche scientifique en général. Prenez bien votre temps pour cela.

Pour commencer, veuillez énumérer trois choses **qui selon vous posent vraiment problème** au sujet de la science :

1. _____

2. _____

3. _____

Veuillez énumérer trois choses que **vous n'aimez pas du tout** au sujet de la science :

1. _____

2. _____

3. _____

Veuillez énumérer trois choses **qui vous différencient nettement** des scientifiques :

1. _____

2. _____

3. _____

Appendix 8

Experimental material, manuscript 5

ExpObservationAnimale04_2

Code participant (*merci d'indiquer votre code*) :

Date :

Heure :

Les participants à notre protocole sont amenés à observer le déplacement d'un poisson et à indiquer à chaque fois que le poisson passe dans un endroit précis de l'aquarium. Les poissons que nous utilisons pour cette étude sont des cyprins dorés. Le cyprin doré est une espèce sociale qui se déplace en banc et qui a une alimentation très variée.

Pour le suivi du protocole, veuillez *attribuer un nom de suivi* à l'animal.

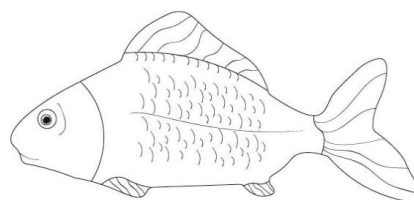
Pour vous aider à créer ce nom, utilisez la séquence de caractères aléatoires ci-dessous et composez avec ceux-ci un nom de voyelles et de consonnes.

Vous n'êtes pas obligé-e d'utiliser tous des caractères proposés.

Vous ne devez utiliser les caractères présentés qu'une seule fois.

Séquence de caractères: A-C-L-M-R-I-E-L-U-C-R

Nom du poisson (*femelle*) : _____



Reportez ensuite le nom du poisson sur l'ardoise qui se trouve devant vous.

(*Merci d'indiquer à l'expérimentateur/trice lorsque vous avez terminé*)

Code participant (merci d'indiquer votre code) :

Date :

Heure :

Les participants à notre protocole sont amenés à observer le déplacement d'un poisson et à indiquer à chaque fois que le poisson passe dans un endroit précis de l'aquarium. Les poissons que nous utilisons pour cette étude sont des cyprins dorés. Le cyprin doré est une espèce sociale qui se déplace en banc et qui a une alimentation très variée.

Pour le suivi du protocole, veuillez attribuer un code de suivi à l'animal.

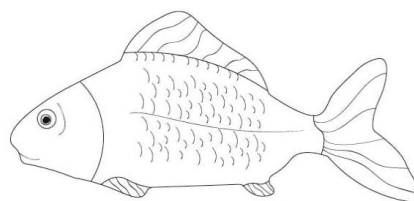
Pour vous aider à créer ce code, utilisez la séquence de caractères aléatoires ci-dessous et composez avec ceux-ci un code de chiffres et de lettres.

Vous n'êtes pas obligé-e d'utiliser tous des caractères proposés.

Vous ne devez utiliser les caractères présentés qu'une seule fois.

Séquence de caractères: C-L-8-R-M-R-5-3-L-9-C

Code du poisson (femelle) : _____

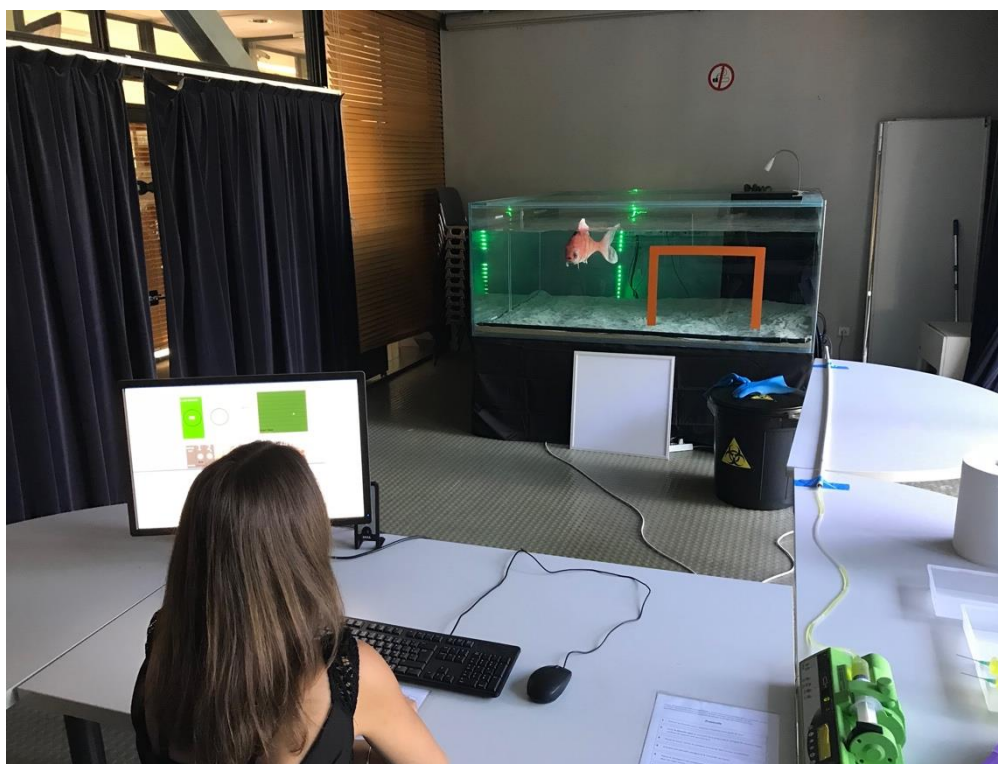
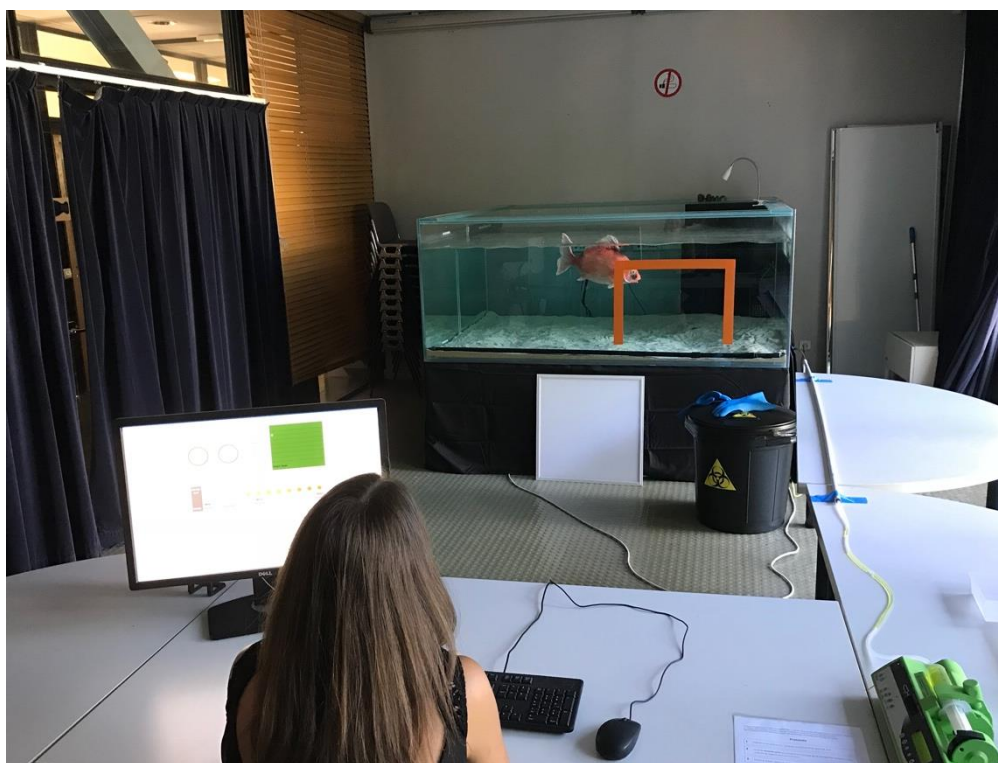


Reportez ensuite le code du poisson sur l'ardoise qui se trouve devant vous.

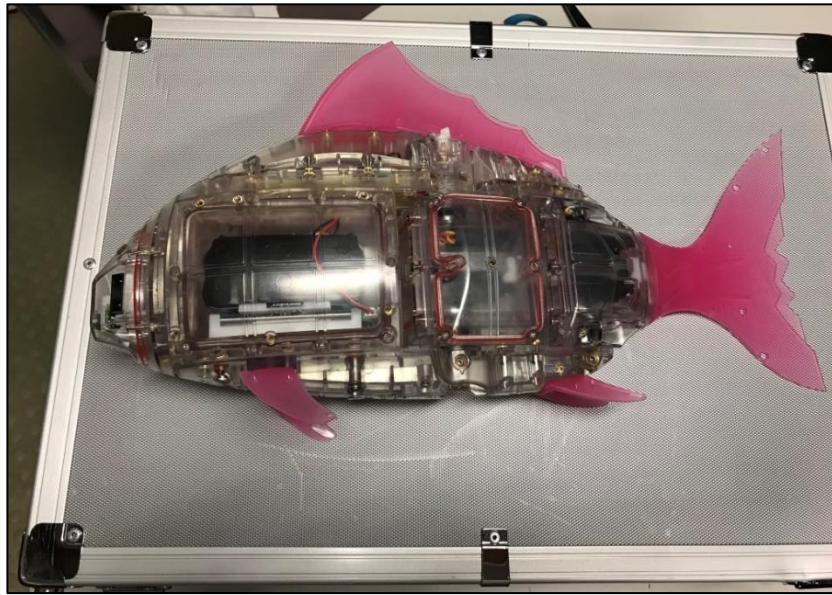
(Merci d'indiquer à l'expérimentateur/trice lorsque vous avez terminé)

Appendix 9

Pictures of the laboratory setting



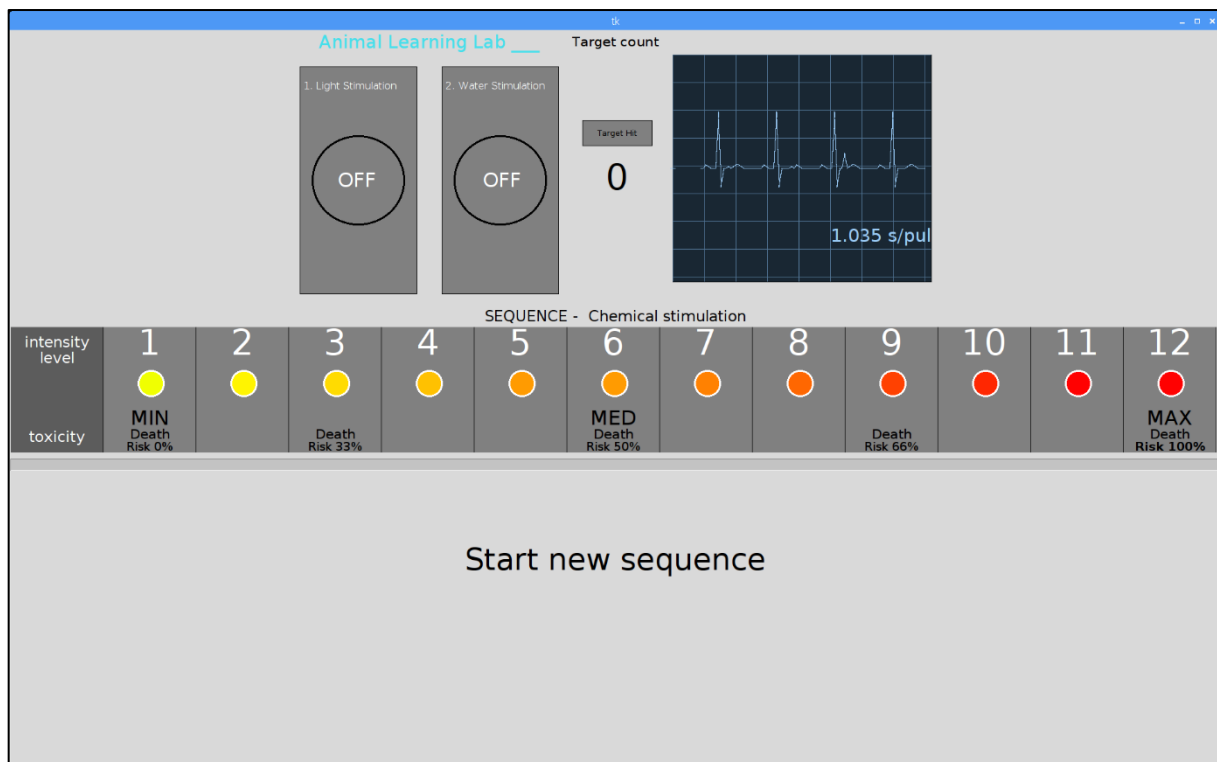
Pictures of the laboratory-fish



Picture of the mechanical syringe




Picture of the computer interface controlling the drug administration



Graphical representation of the laboratory setting



Pictures of the flyers used for the data collection

Aidez la recherche + recevez 15 euros 


Participez à une *expérience scientifique* : **[Observation Animale]**

Tâche Remplir un questionnaire (en ligne), puis observer et décrire le comportement d'un animal qui réalise une tâche.
Période de 9h à 19h, du lundi au vendredi
Durée 1h ou moins
Qui Tout le monde sauf personne ayant déjà participé à une expérience similaire
Où MSH, Campus universitaire de St Martin d'Hères (à 1 mn du tram « bibliothèques universitaires »)
Rémunération: **15 euros**

Pour participer : Rentrez directement cette adresse URL dans votre navigateur : <http://bit.ly/Observation-Animale>
Ou envoyer un « Observation + votre email » au **06 88 20 87 57**

Maison des sciences de l'Homme Alpes / Université Grenoble Alpes / CNRS

Aidez la recherche + recevez 15 euros

Participez à une *expérience scientifique* : **[Observation Animale]** 

Tâche Remplir un questionnaire (en ligne), puis observer et décrire le comportement d'un animal qui réalise une tâche.
Période de Mars 2019 à Janvier 2020 de 8h à 20h, du lundi au vendredi
Durée 50 minutes ou moins
Qui Tout le monde sauf personne ayant déjà participé à une expérience similaire
Où MSH, Campus universitaire de St Martin d'Hères (à 1 mn du tram « bibliothèques universitaires »)
Rémunération **15 euros**

Pour participer : envoyer un SMS « Apprentissage » avec votre email au **06 88 20 87 57** ou flashez ce code
ou rentrez directement cette adresse URL dans votre navigateur :
<http://bit.ly/ObservationAnimale>

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