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► To cite this version:

Gilles Grolleau, Naoufel Mzoughi, Angela Sutan. Does advertising the green benefits of products contribute to sustainable development goals? A quasi-experimental test of the dilution effect. *Business Strategy and the Environment*, 2019, 28 (5), pp.786-793. 10.1002/bse.2280 . hal-02074770

HAL Id: hal-02074770

<https://hal.science/hal-02074770>

Submitted on 12 Sep 2023

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Does advertising the green benefits of products contribute to sustainable development goals? A quasi-experimental test of the dilution effect

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Abstract: Using two studies, we examine the dilution effect for green products, by testing whether advertising green benefits decreases their perceived instrumentality and thus harms sustainable development. We use a between-subjects design and ask participants to evaluate the efficacy of a pen (study 1) and a dish detergent (study 2) with and without environmental attributes. Our results are inconsistent with the predictions of the dilution model, since the perceived instrumentality of both products does not decrease when environmental benefits are added. Our findings are relevant for eco-labeling given anecdotal evidence suggesting that adding green information can harm the perceived quality of products.

Key-words: environmental information; dilution model; green products; behavioral economics; eco-label; quality.

JEL codes: D03; Q55; Q57.

Does advertising the green benefits of products contribute to sustainable development goals? A quasi-experimental test of the dilution effect

“Things are what people think they are”

(Hayek, 1948)

1. Introduction

Promoting the green benefits of products can be considered as a simple and direct way to harness the power of green consumption in order to contribute to sustainable development goals (Grolleau et al., 2016). Nevertheless, how do consumers judge products usual functions or instrumentality when they are informed that the considered products also deliver green benefits? At first glance, the answer to this question may seem ‘awkward’ given the neo-classical assumptions considering human decision makers as rational and thus able to perfectly judge these two (*a priori*) independent dimensions. Nevertheless, anecdotal evidence supports that people can discount other product qualities when green benefits are at stake and even compensate this perceived inferiority by overdoses in order to reach the expected end result of the green product (Lin and Chang, 2012). For instance, Lieber (2005) reports that green cleaners are frequently perceived as underperforming compared to traditional cleaners and can automatically activate some stereotypes: ‘It costs twice as much to remove half the grime’ (see also Morris, 2010). The Economist (2015) reported that even if many manufacturers of detergents products would now qualify for the EPA’s seal of approval, and for various eco-labels from other certifiers, they do not apply for them, nor advertise how their products have been made greener. The main reason to explain this puzzle is that although a growing proportion of consumers seek out green products, most are mainly “interested in how much they cost and how well they work” (The Economist, 2015). In a

similar vein, Smith (2016) states that “although it seems like these products would be more appealing than their “non-green” counterparts to a more environmentally conscious population, most consumers automatically perceive these products as less effective, as if these eco-friendly products lack a sort of “super chemical” ingredient, imperative for it to work properly”. Lupberger (2017) even argued that millennials do not buy green brands because they think that green products, specifically green cleaners, “do not work as well”.

Thanks to two original studies, the objective of this paper is to examine whether providing green information on a product changes its perceived qualities on other valuable dimensions. We focus on individuals’ perceptions of products instrumentality when green benefits are highlighted. Even if today green products perform better than before, false expectations can persist. Individuals have the tendency to instinctively believe that an entity performing a single function or pursuing a single goal (e.g. cleaning) is better at that than another entity performing the same function or goal and additional ones (e.g., cleaning and greening), which is referred to as the dilution effect (Zhang et al., 2007). In other words, adding goals is likely to reduce or dilute the perceived effectiveness for meeting each goal, which reduces the likelihood that a person will use this entity when he/she is looking to achieve anyone of the considered goals.

The remainder of the paper is organized as follows. Section 2 is devoted to the conceptual framework. It exposes three mechanisms that can explain why advertising green benefits can decrease the perceived quality of other product dimensions and draws the main hypothesis. Sections 3 and 4 describe two experiments aiming at investigating the potential effect of the goal dilution bias on the perceptions of other conventional product qualities, respectively on

pens and detergents. Section 5 discusses the results and draws some implications. Section 6 concludes.

2. Conceptual framework and main hypothesis

From a traditional viewpoint, successful eco-labeling schemes mainly solve an information asymmetry problem, notably by transforming a credence attribute into a search one (Nelson, 1970; Darby and Karni, 1973; Caswell and Grolleau, 2006) and reducing the uncertainty of consumers related to the validity of their environmentally purchases (Teisl and Roe, 1998; Pedersen and Neergaard, 2006; Caswell and Grolleau, 2006; Testa et al., 2015).¹

Consequently, it is intuitively convincing to inform consumers about an improvement that matters especially if the improved dimension is orthogonal and does not objectively affect other dimensions. This appealing basic marketing principle seems to apply well to modern green products, given that other dimensions remain unchanged.

Nevertheless, the reality is more complex if consumers *perceive* erroneously that due to greening efforts inferred from green claims other dimensions have been deteriorated. Schubert (2017) argues that although it is generally conceived that providing consumers with additional information necessarily improves their choices, things are different in the real world. Findings in behavioral sciences suggest that well-crafted eco-labels do much more, such as reducing

¹ The information environment for different attributes may be search, experience, or credence in nature (Nelson, 1970; Darby and Karni, 1973): the consumer can learn about the quality level prior to purchase (search), after purchase and use (experience), or not at all (credence). In the case of environmental qualities which are frequently unverifiable by the consumer, the credence attributes can be transformed into search attributes via credible labeling (Caswell and Mojduszka, 1996; Grolleau and Caswell, 2006).

individuals' cognitive dissonance, overcoming loss aversion issues and conveying social norms (Beretti et al., 2009; Grolleau et al., 2016; Schubert, 2017). In the same vein, we argue that eco-labels are sometimes perceived as harming the product rather than improving it. Consequently, many manufacturers prefer not advertising the green benefits of their products in order not to harm the consumers' perception of the product performances on traditional dimensions (The Economist, 2015).

Two robust findings in behavioral sciences can explain why the real-world frequently diverges from traditional predictions: (i) the 'construal' which captures the notion that decision makers need to construe a representation of the relevant situation in their mind, and, (ii) the 'power of the situation', implying that such construal is heavily impacted by the context of the decision. Consequently, behavioral sciences stress the need to design messages and contexts in ways that do not only convey the accurate information, but also generate the intended construal (Shafir, 2008; see also Schubert, 2017). Consistent with these insights, we argue that eco-labeling schemes generate specific construals and contexts that can influence people's perceptions of other quality dimensions. In the following, we develop three non-mutually exclusive mechanisms that can explain why advertising green benefits of a product could reduce the perceived effectiveness of the product regarding more traditional dimensions.

First, the goal dilution model (e.g. Zhang et al., 2007 and references therein; see also Meyvis and Janiszewski, 2002) suggests that when multiple goals are pursued with a single means, people perceive them as less effectively achieved than goals pursued individually, regardless of the objective reality. Indeed, individuals have the tendency to instinctively believe that an entity performing a single function is better at that than another entity performing the same

function and additional ones. Adding goals reduces or dilutes its perceived effectiveness for meeting each goal, thus reducing the likelihood that a person will use the means when they are looking to achieve any one of the goals. Zhang et al. (2007) performed six experiments in various domains that supported the prediction of “a dilution model of self-regulation, whereby increasing the number of goals (e.g., building muscles and losing weight) that a single means (e.g., exercising) can satisfy reduces the perception of its instrumentality with respect to each goal”. We contend that this dilution effect can be reinforced by previous (bad) experience of first generation of green products (or even collective experience of green products), pushing consumers to base their decisions on the basis of previous expectations rather than actual experience (Ottman et al., 2006; Lin and Chang, 2012).

Second, the zero-sum heuristic (Chernev, 2007; Chernev and Carpenter, 2001) suggests that consumers use a lay theory about firm resource allocation. In other word, increasing quality on one product dimension is automatically compensated by decreasing quality on other dimensions (Chernev 2007; Chernev and Carpenter 2001). The zero-sum bias corresponds to the tendency to judge intuitively a situation to be zero-sum: resources invested in one dimension are automatically matched with an equivalent loss of resources invested in other dimensions, even if the objective situation is actually non-zero-sum. Regarding products that are advertised as green, this bias pushes consumers to infer that devoting resources to generate green benefits necessarily implies that the firm invested fewer resources in other quality dimensions (Newman et al., 2014). Consequently, consumers can perceive green products as involving a sacrifice of fundamental qualities that frequently justify the purchase of this product. Moreover, as mentioned above, the green benefits of products are frequently credence attributes and thus characterized by a strong informational asymmetry, which makes the situation even more complex. Indeed, because, they cannot be verified and even defined

by consumers, consumers frequently have to rely on credible third parties. Given the transaction costs implied just to obtain credible information and avoid being a “greenwashing victim”, it seems intuitively convincing that they are more likely to make consumers think the other dimensions have been negatively affected (Grolleau, 2002), because of resources invested in the certification process that are perceived as automatically unavailable for reaching other goals.

Third, the conventional wisdom suggests that adopting green alternatives is frequently associated with a kind of sacrifice. Even if the reality is different, this subconscious association may lead people to consider pro-environmental choices as requiring personal sacrifice, notably in terms of price, convenience and performance. Several studies support that this kind of subtle linguistic associations can cause perplexing biases in perception and decision-making in a variety of domains (Farrow et al., 2018). For instance, greener household cleaning products are frequently associated with the idea that they will underperform conventional products and potentially cost more (Lieber, 2005). This cost increase can both correspond to a classical price increase but also to necessary overdoses to reach the expected end result (Lin and Chang, 2012).

Based on the theoretical arguments developed above, we formulate the following main hypothesis that will be tested in two experiments:

H1: Advertising green benefits influences negatively consumers' perception of a product performance on traditional functions or characteristics.

3. Study 1

The first experiment was conducted in September and October 2012 among a perfectly gender balanced sample of 291 students at Burgundy School of Business (Dijon, France) and Lyon EM Management School (Lyon, France). Students were already present for their lectures and the experiment was presented as a classroom activity at the end of the lecture. We use the term experiment in the sense that our between-subjects design allows us to assign participants to the various treatments, that are the control (without any indication of green benefits) and the environmental treatment (with advertising on the green benefits) (Croson et al., 2007). While over-generalization from one-shot experiments on small samples can be misleading, several economists agree that experiments can be a relevant source of insights and data to reach a better understanding of human behavior (Levitt and List, 2007; Falk and Heckman, 2009). Participants were not informed previously that they would participate in an experiment to avoid any selection bias. In order to test the dilution effect, we selected an object commonly used by students, that is, a pen. Pens were selected because they are an object used every day by most students and inviting them to test it in the classroom seems natural. Moreover, students can be considered as common purchaser and expert users of pens. The experiment lasted about 20 minutes.

Method

Using a between-subjects design, participants had to evaluate a B2P pen. In the control treatment (137 individuals of the class), the product is provided with its conventional attributes only (retractability, flexibility, smooth writing, and size of the trace). In the environmental treatment (154 individuals of the same class), participants were also informed about the environmental attributes, namely the percentage of recycled materials, existence of an environmental label and writing life expectancy (see Appendix 1 for the instructions). We

consider that there is a dilution effect if the perceived quality of the primary attribute is lower when environmental attributes are advertised (Zhang et al., 2007). It is worthy to notice that (1) the product description is directly inspired from the commercial product description, and, (2) green attributes are not indicated on the pen itself but mainly on accompanying ads.

Participants were instructed to write down three lines with the pen in order to evaluate its writing quality. We call this task the writing test. Participants were then asked to evaluate the writing quality of the pen on a 1 (very low) to 7 (very high) Likert scale. In the environmental treatment, participants were also asked to evaluate on a 1 (very low) to 7 (very high) Likert scale the credibility of the environmental claims.

Results and discussion

Table 1 reports our main results. There are no significant differences between treatments ($p > 0.1$, Welch Two Sample t-tests) in terms of perceived quality.²

[Insert Table 1 around here]

Surprisingly, our main result does not support the goal dilution effect and implies that there is no significant difference of perceived instrumentality when environmental information is advertised. It is possible that users' ratings of the pen performance were found to be unaffected by the presence (or not) of green prompts because the experiment was based on actual use. It is also possible that 'green' pens are frequently high-end products and are less likely to be affected by the dilution effect compared to other types of products (Newman et al. 2014). Moreover, the strength of the dilution effect can also depend on the number of primary

² Complete data on distribution are available from the authors upon request.

goals that are already associated with a given product. Given that this first experiment involved a product that is maybe less prone to the goal dilution effect and constituted a conservative test, we extended our research to a more controversial product, namely a dish detergent.

4. Study 2

The second study has been conducted in November 2017 among a convenience (students, friends, colleagues) and gender-balanced sample (52% males) of 164 individuals, with a majority of students (114) attending different classes at the University of Avignon, south France. The study is quasi-experimental and non-incentivized concurring with several authors arguing that such surveys can provide reliable and accurate empirical evidence (Camerer and Hogarth 1999; Rubinstein, 2001; Read, 2005). The product considered here is a dish detergent. After reading several articles in various trade and consumer media, detergents and other cleaning products appear as an ideal candidate because they were quasi-systematically considered as an example of products where advertising the green dimension is perceived as harming the traditional functions (Lieber, 2005; *The Economist*, 2015; Smith, 2016; Lupberger, 2017).³

³ Even if we also considered wine as a potential candidate, we discarded it notably because it introduces the additional dimension of being drunk or ingested by the individuals. Moreover, wine was also inappropriate for a proportion of our sample notably because of religious concerns and a preference of many people for other kinds of spirits (e.g., beers) and/or for specific wines (e.g., Burgundy versus Bordeaux ones). Nevertheless, thanks to a well-crafted design, we contend that this product constitutes a natural candidate for future extensions.

Method

As in the first study, we used a between-subjects design to test the dilution effect.

Respondents to our survey were divided into two groups. In the control treatment (N=97), a real-based description of a dish detergent has been presented as a piece of paper to surveyed individuals without environmental information. In the environmental treatment (N=67), the same product has been presented by adding environmental claims (see Appendix 2 for the survey instrument). Individuals were then asked to indicate on 7-points Likert scale their perception regarding two dimensions, namely the efficacy of the detergent in washing dishes and its efficacy regarding users' well-being. For instance, dish detergents can irritate hands and cause other complications. As in the pen's experiment, individuals were randomly assigned to either the control treatment or the environmental treatment and were also asked in the latter case to indicate their perception of the detergent efficacy to protect the environment. The environmental efficacy question allows making salient the added environmental information and evaluating to what degree participants trust it.

Results

Individuals' responses regarding both the detergent's instrumentality and efficacy regarding users' well-being across treatments are reported in Table 2.

[Insert Table 2 around here]

Similarly to the first study, adding green information is found to not dilute other goals, since respondents perceive similarly the considered dimensions regardless of the treatment ($p = 0.66$ for washing dishes and $p = 0.15$ for well-being, Welch two sample t-test).⁴

5. Discussion

These consistent results indicate that advertising positive green information does not deteriorate the conventional qualities of the considered products, which constitutes preliminary good news for promoters of eco-labeling schemes. Indeed, it seems that they can signal the greenness of their products without worrying about potential adverse effect on other quality dimensions. Nevertheless, these results are preliminary and must not be over-interpreted. They require robustness checks across various contexts (e.g., other products, other samples, other countries) before leading to clear-cut recommendations. Notwithstanding, let us now discuss some speculative explanations behind these findings.

First, Chernev (2007) found that when all-in-one products are priced more expensively, they are less likely to suffer from the zero-sum heuristic. The products used in our experiments might have been perceived as high-end products with expensive prices that reduce the likelihood of the perception that their other characteristics are negatively impacted by green benefits. Indeed, the pen is a high-end product and the dish detergent, even if the price was not communicated to participants, may have been perceived as a high price product. We speculate whether green brands may have a vested interest in raising even artificially the price of their products to counterbalance the possible negative effect of green information on the perception of other dimensions.

⁴ Noteworthy, using ordered probit regressions, these findings are not sensitive to individuals' socio-demographic characteristics.

Second, it is also likely that green products have been significantly improved and are nowadays better than what they were years ago. For instance, most state-sponsored eco-labeling schemes require as a prerequisite that green products perform on usual qualities, at least as conventional products in a similar category. Consequently, another natural explanation of our results can be due to the fact that our two samples are relatively young, making them less sensitive to the reputation of the first generation of green products, even if this argument is at odds with Lupberger (2017) who argues that “Millennials think green products don’t work as well”. Morris (2010) suggests a similar issue by stating that “those early products have little in common with today's, but their legacy, which is not entirely positive, lives on and quotes the chief executive of a major company of green cleaning products in Britain: ‘The myth about green products not performing well persists (...) That was the case in the beginning but not now. Then, the company wanted to create a green product more than a washing product.’”

In retrospect, we contend that the goal dilution is an important part of the story but not the whole story. Indeed, signaling the green dimension can correspond to very different realities. In some cases, signaling the green dimension can even be considered as a way to reinforce other desirable and more conventional functions. On one hand, if a product is desired primarily for its healthiness or naturalness, credible green information can be considered as perfectly consistent with these dimensions. On the other hand, if a product is desired primarily for functions that seem at odds with the green dimension, such as car engine power or speed, the dilution effect seems more likely. Another interesting dimension is related to whether the green dimension advertised relates to the product itself (e.g., ingredients, used materials), the production process (e.g., energy and water savings) or both.

Given that some anecdotal examples come from the wine realm, it makes sense to test experimentally whether our findings are also verified for wine products. Indeed, it is well-known in the wine industry that some producers meet organic requirements, become certified but prefer not displaying an organic label on their bottles (Rauber, 2006). E-The Environmental Magazine (2006) quotes such a winemaker who stated that “in all honesty, wine consumers have not embraced quality and organic in the same line yet. They still have the attitude that organic wine is a lower quality than what you can get in a conventional wine. It’s a stigma”. Several French winemakers also use organic grapes but do not label it on their bottles because organic wines suffer from bad reputation (Le Loët, 2013). By their very nature, eco-labeled food products frequently mention several simultaneous issues such as health, nutrition, price and sustainability issues to quote a few. We contend that wine offers an interesting candidate by using an appropriate sample of wine consumers to examine how other dimensions of food items are perceived when they mention environmentally friendly attributes. Indeed, given the weight of health in food-related decisions and its interactions with the environmental dimension, the figure is more complex and deserves further analysis. Wine also offers the opportunity to compare whether and how a potential dilution effect occurs similarly for low-end and high-end products and before and after tasting the product.

6. Conclusion

Thanks to two studies, we did not find empirical support to the predictions of the dilution effect for green products. In other words, adding environmental claims does not seem to deteriorate products’ perceived instrumentality. To some extent, and, without negating the relevance of some findings in behavioral sciences, our results suggest that managers and policymakers should carefully consider and test the relevance of some biases under various

circumstances, e.g., by varying the products and the samples. It can be useful to better categorize products by identifying the number of conventional goals they fulfill before introducing the environmental information and to examine whether some categories are more or less amenable to the dilution bias. This recommendation echoes Schubert (2017) about nudges who states that their impact may “be highly context-dependent”. A natural extension of our study will be to examine whether our results remain robust with other kinds of products and non-student samples, especially samples that were more exposed to the first generation of green products.

Our findings suggest that the common insight that green products are less performant than similar conventional products on non-environmental qualities may be ill-founded nowadays. As such, our findings are preliminary good news for eco-labels promoters. From a conceptual viewpoint, we recommend to not take for granted popular intuitions but to systematically test them in order to evaluate *whether* and *how* they really affect human behaviors under various circumstances, especially by using incentive-compatible experiments. Such investigations can inform decision-makers at reasonable cost and allow them to avoid big and costly mistakes.

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Table 1. Mean responses for the perceived quality, WTP and anticipated price⁵

| | Control treatment | Environmental treatment |
|--------------------------|--------------------------|--------------------------------|
| Perceived quality | 4.43 (1.27) | 4.56 (1.17) |

* The values between brackets correspond to standard deviations.

Table 2: Mean responses for the perceived instrumentality and users' well-being*

| | Control treatment | Environmental treatment |
|---------------------------------------|--------------------------|--------------------------------|
| Efficacy in washing dishes | 5.01 (1.13) | 5.08 (1.17) |
| Efficacy in terms of users well-being | 5.56 (1.27) | 5.82 (1.01) |

* The values between brackets correspond to standard deviations.

⁵ The credibility evaluation (that was measured only in the environmental condition) score at 4.98.

Appendix 1: Study 1 instrument translated from French (*the green attributes added in the environmental treatment are highlighted in Italics, between brackets*)

Anonymous survey # _ _ _
(There are no right or wrong answers, just say your opinion)

A. The pen you just received is a gift.

[A photo of the product as a piece of paper]

Main benefits of this pen:

- ✓ Retractable
- ✓ 0,7 mm writing
- ✓ Flexible and comfortable
- ✓ Smooth writing

[Environmental claims:

- ✓ *Made from 89% post-consumer recycled plastic bottles*
- ✓ *Writes 2 kilometers*
- ✓ *Eco-labeled]*

A1. In order to test this pen, please write down with it 3 lines about an event you recently experienced.

A2. Based on this writing experience, can you evaluate the writing quality of this pen from 1 (very low quality) to 7 (very high quality)?

| | | | | | | |
|------------------|---|---|---|---|---|-------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Very low quality | | | | | | Very high quality |

[A3. Please indicate the credibility the environmental claims of this pen:

| | | | | | | |
|---------------------|---|---|---|---|---|----------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Not credible at all | | | | | | Very credible] |

1. What would be your willingness to pay for this pen? _ _ . _ _ EUROS
2. What do you think is the real price of this pen? _ _ . _ _ EUROS. If your estimation is the closest of the real price, you can win 10 euros.

D. Please indicate the following:

| | |
|--|---------------------|
| Age : _____ years | Comments (if any) : |
| Gender : Man <input type="checkbox"/> Woman <input type="checkbox"/> | |

Thank you for your participation

Appendix 2: Study 2 instrument translated from French (*the green attributes added in the environmental treatment are highlighted in Italics, between brackets*)

(There is no right or wrong answer. Only your opinion matters.)

1. Please look at the following dish detergent technical sheet:

| | |
|---|---|
| <p>[Ecological] Lime Dish Detergent 1000 ml</p> <p style="text-align: center;"><i>[A photo of the product as a piece of paper]</i></p> | <p>Gentle with excellent detergent and wetting power. This product allows to eliminate the impurities that are usually encountered when washing dishes: proteins, starch, sugar, fats ...</p> <p>Characteristics: Aspect: Clear liquid Color: Colorless Flavor: Lime (pure) pH at 20°C: 5.0 ± 0.5 Composition: Anionic surfactants 10% Nonionic, flavor < 5%</p> <p>Use: <i>[Ecological]</i> detergent that perfectly defats dishes, it is composed of surfactants derived from wheat and coconut. <i>[It does not contain phosphates, ammonia, petrochemical solvents.]</i> Its formulation is enriched with a gentle hypoallergenic vegetal component for a hydration and a maximal preservation of users' safety. Gentle for hands, it does not attack the skin physiological equilibrium and preserves kitchen utensils.</p> |
|---|---|

[2. Based on the provided description, would you please evaluate the efficacy of this dish detergent regarding environmental protection on a scale from 1 (very ineffective) to 7 (very effective) by picking the corresponding number?

Very ineffective Very effective]

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|

3. Based on the provided description, would you please evaluate the efficacy of this dish detergent in washing dishes on a scale from 1 (very ineffective) to 7 (very effective) by picking the corresponding number?

Very ineffective Very effective

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|

4. Based on the provided description, would you please evaluate the efficacy of this dish detergent regarding user's well-being on a scale from 1 (very ineffective) to 7 (very effective) by picking the corresponding number?

Very ineffective Very effective

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|

Please indicate the following information:

| | |
|--|---|
| 1. Age : _____ years | 2. Gender : M. <input type="checkbox"/> F. <input type="checkbox"/> |
| 3. Education level : French Baccaulaureate + __ years | 4. You are : Student <input type="checkbox"/> Other <input type="checkbox"/> Indicate : _____ |
| 5. Income/month : < 500€ <input type="checkbox"/> Between 500€ and 1000€ <input type="checkbox"/> Between 1001€ and 1500€ <input type="checkbox"/> >1500€ <input type="checkbox"/> | |