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## RIODD 2023: Change or Collapse?

*Multidisciplinary analyses, landmarks, and proposals in the face of the need for a rapid and profound change in our ways of producing, consuming, and exchanging*

### **A multidisciplinary methodology to study consumers' creativity according to their age to foster food system transformation.**

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### Summary:

Transforming our food systems to increase their sustainability requires involving all stakeholders, not to mention consumers, in the exploration of innovative solutions. As fixation effects are considered to be one of the main cognitive obstacles to creativity, this ongoing research aims to analyse how consumers' fixation effects on food transition evolve as a function of their age. By combining skills in cognitive psychology and design sciences, we have developed an ad hoc protocol to study fixation effects on food transition. Since 2022, we have been implementing it with more than 700 pupils from primary, middle and high school, as well as adults, in a rural area of western France. As analysis is ongoing, this paper mainly presents the research rationale, the methodology developed and applied as well as preliminary results. Knowledge of fixation effects according to consumers' age and profile will enable us to design tools and methods to stimulate consumers' creativity, and more broadly to increase their capacity to transform their food systems towards sustainability.

## Résumé (en français):

Transformer nos systèmes alimentaires pour accroître leur durabilité nécessite d'impliquer toutes les parties prenantes, notamment les consommateurs, dans l'exploration de solutions innovantes. Les effets de fixation étant considérés comme l'un des principaux obstacles cognitifs à la créativité, notre recherche, en cours, vise à analyser l'évolution des effets de fixation des consommateurs sur la transition alimentaire en fonction de leur âge. En combinant des compétences en psychologie cognitive et en sciences du design, nous avons développé un protocole ad hoc. Depuis 2022, nous l'avons déjà mis en œuvre auprès de plus de 700 élèves de primaire, collège et lycée, ainsi que des adultes, dans une zone rurale de l'ouest de la France. Etant donné que les analyses sont en cours, cet article présente essentiellement la problématique, la méthodologie de recherche, ainsi que des résultats préliminaires. La connaissance que nous aurons de ces effets de fixation nous permettra de concevoir des outils et des méthodes pour stimuler la créativité des consommateurs et, plus largement, augmenter leur capacité à transformer leurs systèmes alimentaires.

## Keywords:

Food system transformation; Consumers' transformative capacities; Fixation effect; Innovative design; Developmental psychology

## Introduction

### *Involving consumers in food system transformation, a need to bridge parallel literatures*

The current and future complex large-scale challenges related to biodiversity collapse, pandemic outbreaks and climate change threaten the sustainability of our societies. Our agricultural and food systems (hereafter food systems) both suffer from, and contribute to, these challenges. Indeed, agriculture is a major contributor to greenhouse gas emissions, while threats posed by climate change directly and indirectly disrupt the production, processing, transport and marketing of food (Ericksen et al., 2012). The COVID-19 pandemic and the current war in Ukraine particularly enlighten the fragility of our food systems (Béné, 2020). The challenges linking agriculture and food value chains to diets, health and planetary ecosystems can no longer be ignored; the need for fundamental transformation of food systems towards increased resilience is now irrefutable (O'Brien, 2012, Webb et al., 2020). Given the current and future complex large-scale challenges related to climate change and biodiversity collapse, incremental changes are now inadequate (Nalau and Handmer, 2015), and calls are made for societies to implement transformative approaches in order to manage complex problems in a more sustainable way (O'Brien, 2012, Olsson et al., 2017, Chapin et al., 2011). Yet, how to implement such a systemic transformation, and what are the capacities required for this, remain open questions.

This research draws on the notion of transformative capacities, defined in the literature on socio-ecosystem (SES) resilience as the ability of individuals or organizations to transform a socio-ecosystem, i.e. to fundamentally and definitively change certain elements or aspects of this system (Olsson et al., 2010, Westley et al., 2011). Yet the distinction between the capacities that allow for adaptation and the capacities that allow for transformation is still not well understood. Based on theoretical understandings of SES transformation, Moore et al. (2018) deemed two capacities critical for systemic transformation: (1) the ability to navigate emergence, i.e. to get prepared to uncertainty and surprises, and (2) enhanced system reflexivity, which they link to institutional reflexivity (Suddaby et al., 2016), that is, the capacity to see, interrogate, and reimagine the taken-for-granted structures that sustain current systems and people–planet relationships. Hence, developing people's transformative capacities involves combining different

types of abilities, such as those of innovation, anticipation, adaptation to change and reflexivity (Moore et al., 2018).

Research on food system transformation has traditionally targeted producers, be they farmers, extension services, policy actors and supply chain intermediaries such as agri-food industries, as they are leading contributors to the food system's significant ecological footprint. Nevertheless, the role of consumers has also begun to receive increasing attention from policy makers, practitioners, and academics (O'Rourke and Ringer, 2016, Hatanaka, 2020, Tukker and Jansen, 2006, Renting et al., 2012, Lamine et al., 2012). Indeed, as underlined by the FAO (2018), "consumers around the world can be a powerful force for change towards more sustainable and equitable food systems". Various concepts have been developed to underline the role of consumers in shaping sustainable production and food systems, such as ethical consumerism, reflexive consumption, prosumption and political consumerism. These concepts advance the idea of "citizen-consumers" who exercise citizenship in the marketplace (Hatanaka, 2020, Renting et al., 2012). The underlying assumption is that if consumers make conscientious food choices in the marketplace, this will result in market demands for more sustainable production practices, and ultimately generate change at both producers and potentially all supply-chain levels.

This literature essentially considers consumers as individuals able to choose between existing alternatives proposed by food system producers. Focusing on consumer sovereignty, which can be enhanced by information, choice and alternative retailers, is a dominant perspective in consumer sciences as well as for government, industry and most consumers' organizations (Shaw et al., 2006, McGregor, 2005). This perspective has led to a growth in labels and accompanying communication initiatives such as public service announcements and education campaigns (O'Rourke and Ringer, 2016, Grunert et al., 2014). Yet, various scholars underline that such information is not sufficient to change food practices: first, concerns include consumer reliance on other actors to guide their decision-making as well as the individualized character of their agency (Vermeir and Verbeke, 2006). Second, there remains a gap between this type of information provided to the consumers and their understanding of sustainability issues (Grunert et al., 2014). Third, surveys have shown that although 30% to 70% of consumers say they want to buy greener, healthier and more socially responsible products, only 1% to 5% actually do (Eckhardt et al., 2010). The contributing factors that intervene between sustainability preferences and purchasing decision, beyond potential economic constraints, include scepticism about corporate claims regarding product and supply-chain sustainability as well as doubt about the impact that an individual consumer can make (O'Rourke and Ringer, 2016).

Scholars are increasingly calling for forms of engagement by consumers that go beyond "voting with dollars" (Hatanaka, 2020). To that end, there is a need to develop a critically and analytically aware attitude to consumption and to one's action as a consumer in society, also named critical consumer empowerment (McGregor, 2005). Giving someone information is helping create the ability to do something, but this is not empowerment. To be empowered entails holding the perception that one has the authority to take action, which make people value their potential and their capacity for self-growth, learning, and taking action (McGregor, 2005, Ziervogel et al., 2016). Further, critical food literacy reflects the dynamic interplay between people and their environment, suggesting that effective engagement with food issues may empower individuals not only to improve their own diets, but also contribute to broader changes in the food system. Empowerment may increase citizens' participation, exploration of solution and decision-making towards transformative action, thus contributing to a more democratic and sustainable food system (Bornemann and Weiland, 2019). The literature in critical empowerment thus underlines the specificity of the knowledge and skills that consumers need to acquire if they wish to transform their food system. Yet, what such knowledge and skills encompass is still unclear.

## Fostering innovative design capacities, a neglected stake of food system transformation

To date, while the literatures on transformation capacities and on critical consumer empowerment tackle similar issues, and both underline that the knowledge and skills required to commit stakeholders (e.g., consumers) and enable them to transform their food system remain to be characterized and developed, they remain separated. According to (Ziervogel et al., 2016) transformative capacity “includes the capacity to imagine, enact, and sustain a transformed world and a way of life that is in balance with the carrying capacity of our Earth”. Yet, consumers are rarely considered as food system innovation designers, but rather as innovation end-users. In this line, both literatures put emphasis on the stakes of innovation adoption and dissemination, and mostly neglect the capacities required to generate innovative solutions.

However, whether it is a matter of transforming one's food practices or renewing the organisations, institutions and governance of a food system, solutions to develop are not straightforward. Creativity and innovation capacities are needed. There is a need to understand how individuals and collectives may increase their creativity to tackle food and ecological transitions. Innovation processes require both cognitive and organisational specific skills for innovative design, which are studied by both design sciences and cognitive psychology (Le Masson et al., 2010).

In this research, we aim to study the capacity of consumers to design and implement innovative solutions, either individually or collectively, to change their food practices in the aim of contributing to transform their food system. To that end, we seek to identify the obstacles to consumers' innovative design capacities. Drawing on developmental psychology and design sciences, we focus on cognitive bias called fixation effect (Smith et al., 1995). Fixation effects result from our automaticity in using easily accessible knowledge leads to, which constrain the exploration of solutions to a small number of category of solutions. According to the triadic model of creativity, individuals tend to follow the "path of least resistance" when they have to solve a problem creatively, which strongly constrains the exploration of paths leading to more original solutions (Cassotti et al., 2016). Thus, the first ideas that spontaneously come to mind would lead individuals to focus on a limited number of alternatives, while other, more creative solutions would be accessible by mobilizing other, more generative types of reasoning. Recent studies (Agogu e et al., 2014, Cassotti et al., 2016, Camarda et al., 2018) argue that the ability to resist the spontaneous activation of design heuristics and privilege other types of reasoning, is critical to support creativity. These studies suggest that the ability to think of something truly new and original requires inhibiting (i.e., block the activation of) spontaneous solutions that come to mind quickly and unconsciously (Cassotti et al., 2016) as well as a capacity to explore new paths of solutions. Studies in developmental psychology also highlight that the nature of fixation effects during the generation of creative ideas changes with age, education, and expertise (Cassotti et al., 2016, Agogu e et al., 2014). Children, adolescents and adults can have strong differences in their learning abilities, and more specifically in terms of fixation effects, due to different cognitive specificities and developmental trajectories (Casey et al., 2005, Kleibeuker et al., 2016). For example, inhibition control function develops until late adolescence, and this explains an important part of the difficulty adolescents encounter in generating creative ideas when compared to adults (Kleibeuker et al., 2016).

To identify individuals' fixation effect, scholars combined tools and methods from cognitive psychology and design sciences: they applied the CK (Concept-Knowledge) design theory (Hatchuel and Weil, 2003, Hatchuel and Weil, 2009) formalism to map ideas. The C-K formalism allows to distinguish exploration paths that are based on the spontaneous activation of knowledge (i.e., fixation effects) from exploration paths that rely on the activation of less accessible knowledge (outside fixation effects) (Agogu e et al., 2014).

Once fixation effects are identified, further research has demonstrated that it was possible to develop levers to overcome them and stimulate creativity according to one's personal fixation (Agogué et al., 2014, Ezzat et al., 2017). In fact, these studies have demonstrated that a well-chosen example of solution (i.e., example outside of the path of fixation) can stimulate participants' creativity regardless their age (Cassotti et al., 2016). They have also shown that different strategies used by experts can enhance the exploration of creative path of solutions. Thus, using the example as information that "must not be followed" can be a source of stimulation for expansive ideas (Agogué et al., 2014). Furthermore, the minimal feedback from an expert that would allow individuals to become aware of their fixation effects would push them to explore new ways of solutions (Ezzat et al., 2017). This literature suggests that there exist levers to enhance individuals' creative capacities, hereby enhancing their innovative design capacities and potentially their transformative capacities.

Fixation effects are considered to be one of the main cognitive obstacles to creativity, as they constrain the exploration of ideas to a limited field depending on one's knowledge. The idea we're defending is that if we want to increase consumers' capacity to propose innovative solutions to change their own food consumption practices, and more broadly to upscale food transition, it is useful to identify their fixation effects in this area. The fixation effects on issues related to ecological transition, and more specifically food transition, are to date unknown. To identify them, we mobilize the formalism of C-K theory (Hatchuel and Weil, 2009), which categorizes ideas in the form of a tree structure and represents the links between knowledge and ideas. In contrast with most consumer studies that target adult consumers, our research is focused on consumers from children to adults, encompassing teenagers, even if they do not necessarily buy their own food. The (non-exclusive) focus on young consumers has several motivations: younger generations are now particularly concerned with eco-anxiety; children and young people have decision power, both directly as consumers and citizens themselves, as future buyers, and indirectly as they influence parents' choices and consumption (Benn, 2004). Our research questions are as follows: How do consumers' fixation effects, on the issue of food transition toward sustainability, evolve as a function of their age? Subsequently, how does the ability to propose creative solutions to an ecological problem develops with age? This research offers an opportunity of examining creativity development from the angle of a concrete situation linked to ecology. We hypothesize that the ability to explore in ecological tasks depends on three elements: 1) the ability to explore ideas and to be generative; 2) access to knowledge bases and 3) a critical mind linked to knowledge about food and ecology. The research protocol presented below addresses these three hypotheses.

As the research is on-going, this paper is mainly methodological. We detail in the following part the protocol elaborated to answer this research question and the way we applied it in our study area since 2022. We then give some preliminary results and present some research perspectives.

## Presentation of the study area

Our research is conducted in the south of Deux-Sèvres department, Nouvelle-Aquitaine Region, western France. In this rural area, agriculture is a dynamic sector employing 3.9% of the working population and agri-food industry accounts for one in four employees, working in animal husbandry (sheep, cattle and poultry), ready meals, butter and cheese production. Population density is 62 hab./km<sup>2</sup> (France average population density is 100 hab/km<sup>2</sup>). This cereal plain has known over the past decades a strong agricultural intensification and specialization, leading to an increasing use of pesticides and a simplification of the landscape due to the removal of hedges, the enlargement of crop fields, the simplification of crop

rotations, and the reduction of mixed farming for the benefit of cereal farming. Agricultural intensification poses considerable environmental problems with regard to water quality, health or biodiversity. The food system of this territory has become more and more globalized, as agriculture relies on imported resources (fertilizers, pesticides, seeds, etc.) and about 60% of its production is exported abroad. Conflicts related to water resources are increasing due to chronic water shortage compounded by climate change and to developing projects of water reserves for agricultural use.

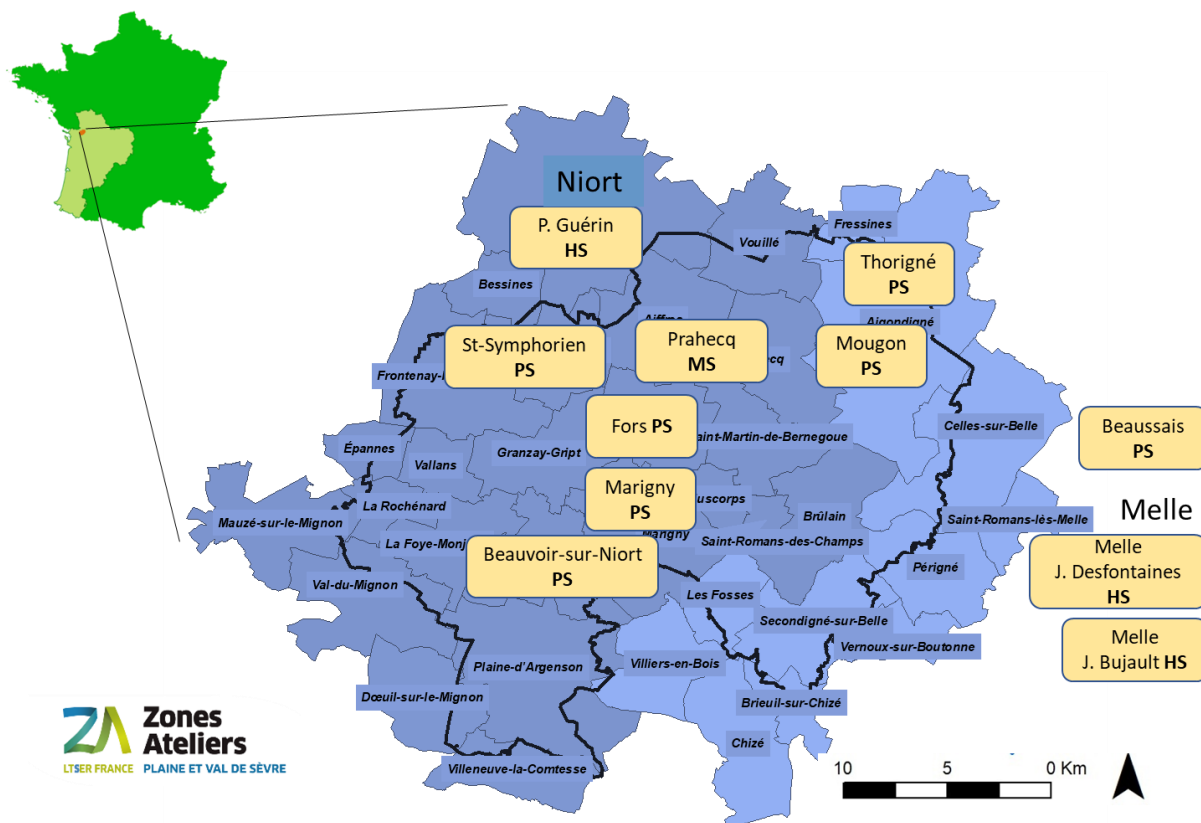
Our research is more particularly conducted in a Long-Term Social-Ecological Research (LTSER) site, the “Zone Atelier Plaine & Val de Sèvre” (ZAPVS), managed by the CEBC (Bretagnolle et al., 2018, Berthet et al., 2022). This research infrastructure is a large (ca. 435 km<sup>2</sup>) rural territory, covering 40 villages (c.24 municipalities) totalling 34,000 inhabitants (Fig. 1), and encompassing about 400 farms. It is surrounded by Niort (121,200 inhabitants), which is the main employment area, and Melle (3,607 inhabitants). Since 1994, the ZAPVS is an observatory dedicated to understand the SES dynamics in response to changes in agricultural management; it includes the monitoring of land cover, biodiversity, farming practices (Bretagnolle et al., 2018) and, since more recently, food consumption practices (Berthet et al., 2023). Transdisciplinary research programs have been carried out for more than ten years with farmers, cooperatives, NGOs, municipal councils and schools (Berthet et al., 2016, Bretagnolle et al., 2018, Gaba and Bretagnolle, 2020, Houte et al., 2020).

The ZAPVS and its adjacent cities Niort and Melle count 36 primary schools (6-10 year-old pupils), 13 middle schools (11-15 year-old pupils), 9 high schools (16-18 year-old pupils), among which 5 general high schools and 4 technical or professional high schools.

## Research strategy

In this research project, we are conducting a diagnosis to understand the potential barriers to consumers' transformative capacities, in particular their fixation effects and knowledge gaps regarding food and ecological transition. As we assume that fixation effects and knowledge gaps are not going to be the same for different types of consumers - especially according to their age, we target different types of consumers: children, teenagers and adults.

Since 2022, we have visited 2 general high schools, 1 agricultural high school, 1 middle school and 7 primary schools (see Figure 1). In total, we have met more than 700 pupils and adults (see Table 1).



**Figure 1:** Location of the educational establishments in which the interventions were conducted in 2022-2023. (PS: Primary school; MS: Middle school; HS: High school).

City/village	Educational establishment	Classes	Number of pupils met
Niort	P. Guérin general high school	6 classes 2nd	173
Prahecq	E. Zola middle school	2 classes 5e + 2 classes 4e	86
Fors	Primary school	1 class CM1-CM2	21
Thorigné	Primary school	1 class CM1 + 1 class CM2	45
St-Symphorien	Primary school	1 class CM2	23
Beauvoir-sur-Niort	Primary school	1 class CM1 + 1 class CM1	43
Melle	J. Desfontaines general high school	4 classes 1e + 2 classes 2nd	171
Marigny	Primary school	1 class CM1-CM2	24
Mougou	Primary school	1 class CM1 + 1 class CM2	48
Beaussais	Primary school	1 class CM1-CM2	23
Melle	J. Bujault agricultural high school	1 class 2nd et 1 class T	35
<b>TOTAL</b>		<b>High school</b>	<b>379</b>
		<b>Middle school</b>	<b>86</b>
		<b>Primary school</b>	<b>227</b>

**Table 1:** Number and levels of pupils involved in this research.



## An ad-hoc protocol to assess fixation effects according to age

By combining skills in cognitive psychology and design sciences, our research team has developed an ad hoc protocol to study fixation effects on food transition. The methodology for such a diagnosis has been applied over the past ten years in various contexts (Agogu  et al., 2014, Cassotti et al., 2016). It consists in four successive steps:

- (i) Formulating the creativity briefs. A creativity brief should have minimal properties, such as being intelligible by a large audience, and being open enough to allow for idea exploration and narrow enough to guide the respondents' exploration.
- (ii) Building one "idea referential" per brief, i.e., an arborescence of ideas using the CK theory formalism. The CK formalism allows the researchers to pre-explore a wide range of ideas and organize these ideas that could be proposed by the respondents on an idea referential.
- (iii) Conducting the creativity tasks. A creativity task consists in asking individuals to give the highest number of ideas to solve a problem formulated as a creativity brief. After the researchers enounce the creativity brief, the respondents have 10 minutes to write down their responses on a paper sheet.
- (iv) Using the "idea referential" to position the various responses proposed by the participants. For each creativity brief, we position the ideas proposed by the respondents on the various branches of the idea (CK) referential, and count the number of ideas per branch. The high number of respondents targeted in this study allows for statistical analysis and a robust assessment of the fixation effects.

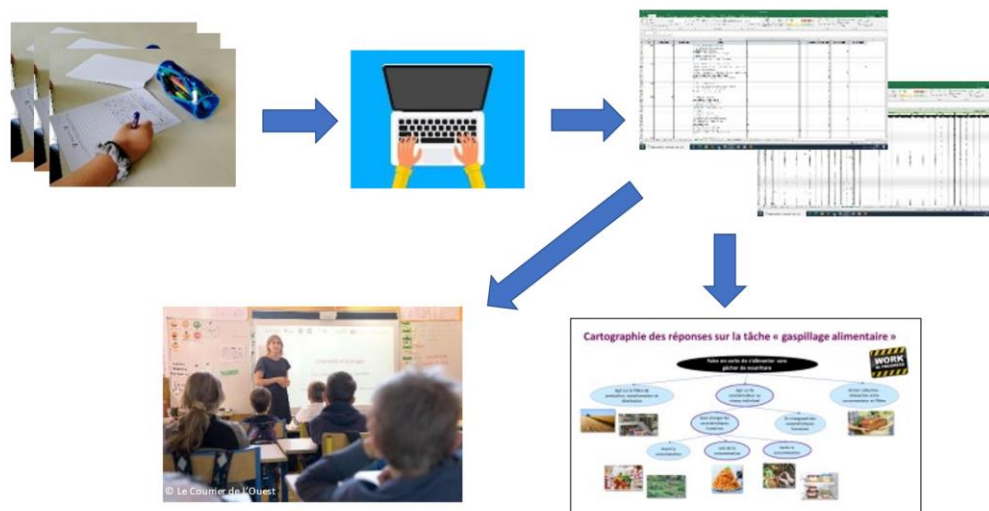
We have elaborated three creativity briefs to cover contrasted aspects of food system sustainability issues: "How to feed oneself without wasting food?" to tackle food disposal; "How can I ensure that everything I eat comes from my village?" to tackle food supply chains; and "How do I make sure I never run out of water at home?" to broaden the issue of ecological transition. A preliminary step consists in calibrating the creativity briefs in lab conditions to see if respondents are able to generate a minimal number of contrasted responses. For each participant groups, we conducted one creativity task related to food and ecological transition (out of the three mentioned above) and one control creativity task, called the egg task, whose brief is "How to ensure that a hen egg dropped from 10 meters high does not break". C-K modelling of this idea generation task has made it possible to better characterize fixation effects by identifying systematic deviations from a reference model of possible exploration in children and adults (Agogu  et al., 2014), but also engineers and designers (Agogu  et al., 2015, Ezzat et al., 2017). The egg task was submitted many times to participants of various ages, and all the solutions proposed by the participants could be grouped into 10 meta-categories (Agogu  et al., 2014). In the studies conducted, it appeared that 80% of the solutions were grouped into just three meta-categories ("slow the fall", "absorb the shock" and "protect the egg"). Since these three meta-categories are very frequent, they are considered to be the result of the fixation bias and are therefore called fixed ideas (Agogu  et al., 2014). The other ideas, which are rarer but more creative, are called expanding ideas.

We added to this creativity assessment protocol questions related to knowledge on food and ecological issues (2 questionnaires), as well as to lifestyle and ecological behaviour (2 questionnaires). The first knowledge questionnaire aims to assess the capacity of participants to discriminate true and false responses (preconceived ideas); the second is a general QCM. The first lifestyle questionnaire aims to assess daily behaviour with regard to food and nature and the second one deals with eco-friendly practices. Our aim is to identify, on the one hand, knowledge gaps regarding issues related to food and the environment, and, on the other hand, the relationships that the respondents have with food and nature. The combination of creativity tasks and questionnaires about knowledge and lifestyle is aimed at a better understanding of the relationships between consumers' creativity, knowledge and lifestyle.

The experiment takes place within the classrooms with paper and pencils. Each participant answers the various questions individually, without communicating with others and without looking for information on the Internet. As the interventions are experimental, it is important to ensure good conditions of experimentation. Each intervention is conducted by two experimenters, so that each class can be divided into two groups in order to maintain as much concentration as possible. The first author of the paper has participated to all the interventions led in 2022 and 2023, accompanied by various colleagues. Each experimenter is briefed prior to the intervention and provided with a manual detailing the behaviour required (e.g. do not judge any response; do not help any participant; do not give any example, etc.).

Data is collected anonymously and confidentially. At the end of the experiment, a participant number is given to each child to ensure anonymity. Participation is voluntary. For each minor participant, we send an information letter to the parents prior to the intervention and ask them to sign a parental authorization form for their child's participation. We also collect signed consents from adult participants and adolescents. We do not process data without authorization. The research protocol has been checked and approved by the research ethic board of Paris University (CER U-Paris) and is conducted in compliance with RGPD.

For each class, the researchers go back to the pupils after conducting some preliminary data analysis, in order to present them with the results. The objectives are to explain our research motivation and project, discuss the results with the respondents, make them exchange with each other about their responses and about the issues at stake, and let them know better about research activities and careers. See Figure 2 for a scheme of data collection, process, analysis and restitution.



**Figure 2:** Data processing after the interventions in the classrooms.

## Data analysis

Following the data collection, the research team transcribes all responses in Excel sheets. In parallel, the mapping of ideas is built for each brief with the CK methodology. This mapping allows identifying categories and sub-categories of ideas. In parallel, each response given by the respondents is coded and affected to a sub-category and category. Both top-down and bottom-up categorizations of ideas are

harmonized. Then the coding is conducted by two researchers independently.

For each creativity task, we analyse several variables as a function of the age of the respondents:

- Fluency, which is the number of ideas generated in ten minutes on a given creativity task
- Flexibility, which is the number of categories of ideas explored
- Fixation, which is the number of ideas generated in the “fixation” categories (i.e., the ones that are the most explored by the respondents)
- Expansion, which is the number of ideas generated in the “expansion” categories (i.e., the ones that are the less explored by the respondents)

These are theoretical representations of system 1, i.e., access to relatively close, easily accessible knowledge bases, and system 2, which requires access to more distant knowledge. We assess if these variables are more similar within a group of age and between groups of ages.

We also compare the fluency and flexibility of the respondents’ exploration of ideas on creativity briefs regarding food and ecology on the one hand, and on the control task (egg task) on the other hand. We analyse the potential impact of creativity task order, as well as the correlation between the tasks.

Lastly, we assess the scores obtained for each knowledge and lifestyle questionnaires. We look for relationships between questionnaires on knowledge, on lifestyle, and creativity according to the various categories of ages of the respondents.

## Preliminary results

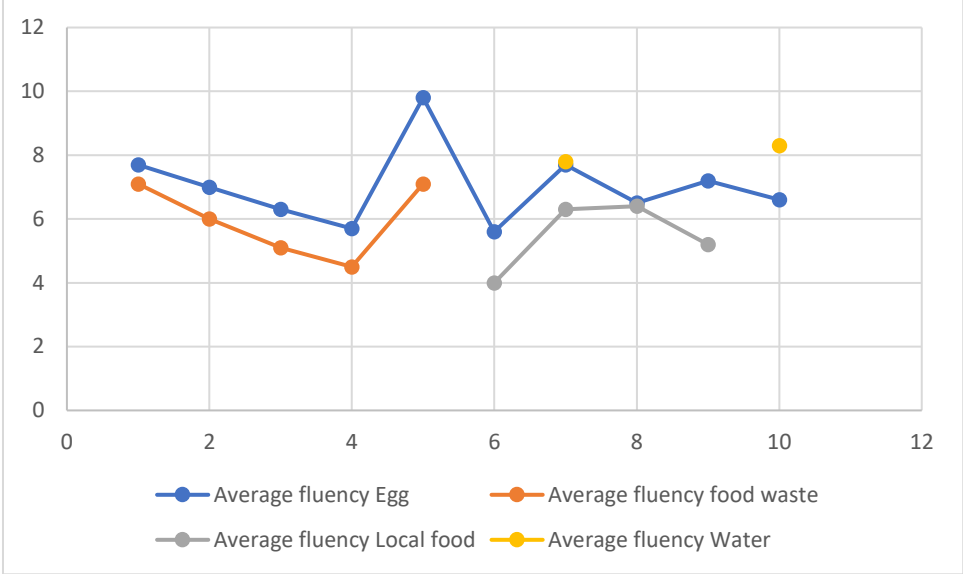
All the data collected has not been processed yet and further data is to be collected over the coming year. This is why the results presented here are preliminary and partial.

As far as the egg task is concerned, the primary school pupils’ fixations are mainly at the level of "cushioning the shock" and "using a living device (whether animals or humans) to stop the fall". Middle school pupils have the same fixations as primary school pupils. The fixation effect for high school pupils encompasses in addition to these two meta-categories of ideas the one "slowing down the fall". The fixation effect of adults is even broader as it also encompasses the meta-category "protecting the egg". Our calculation also concludes that flexibility significantly increases with age, which confirms the development of the ability to explore different solutions with age. We do not see significant effect of development on fluency. Yet, interestingly, many ideas proposed by primary school pupils are not feasible; these solutions that are not feasible disappear the older the respondents get. Overall, there are always fewer responses in expansion than in fixation whatever the age. All these results are congruent with those of previous studies on the egg task.

CK mapping on the food and ecology creativity tasks are being built. We obtain more meta-categories and sub-categories of responses than with the egg task, which is not surprising as the food thematic questions asked are broader and more complex than the egg task question. Yet it is important to limit the number of both meta- and sub-categories, and we need to refine the categories iteratively.

With regards to the task of “eating without wasting food”, our CK preliminary tree distinguishes first “food waste reduction at the supply-chain level”, then “individual consumption behaviour”, then “collective action that may influence consumption behaviour”. Further, for the branch “individual consumption behaviour”, it distinguishes “before eating”, “while eating” and “after eating”. The fixation

of primary school pupils seems to be focused on the branch “individual consumption behaviour” and “while eating” (e.g., asking for less food in the plate), as well as “after eating” (e.g., giving the remaining food to others). For middle and high school pupils, the fixation is quite similar to the one of primary school pupils, but broadened to the idea of “recycling and reusing what they don't eat”, for example composting. For adults, the focus is broadened to what happens before consumption: e.g., reducing the quantities of what one buy, favouring food that does not produce waste, etc. in all cases, solutions to be conducted at the individual level are far more taken into consideration than collective solutions or solutions to be explored at the supply-chain level.



**Figure 3:** Average fluency according to creativity task for primary, middle and high school.

When calculating average fluency for each creativity task (see Figure 3), we first notice that there are significant differences between classes and tasks. We can also see that there is a correlation between the fluency of the Egg task and the Food waste task, but not between the Egg task and the other ones (Local food and water). The average fluency is always higher for the Egg task than for the Food waste task and it is the same to a lesser extent regarding the Local food task; but it is not the case regarding the Water task for which the respondents gave many ideas (yet we need to collect more answers on this task).

Regarding knowledge questionnaires, primary school pupils have more difficulties to discriminate true and false responses than teenagers (questionnaire 1). General knowledge (questionnaire 2) increases with age but all the scores are quite good as they are above 30 out of 40 for all classes. Finally, our preliminary analysis shows that most respondents declare that they have an eco-friendly behaviour in their daily practices.

### Discussion and perspectives

The aim of this communication paper is mainly to present the rationale and methodology of an innovative on-going research project that focuses on how to help consumers develop their creative capacities to enhance their transformative capacities to make food systems more sustainable. To date, fixation effects have mostly been studied on generic tasks (such as the Egg task) in laboratory conditions. In this research, we test them on new creativity briefs related to ecological transitions, and empirically, in a range of educational establishments, villages and towns.

The unsustainable trajectory of our agrifood system requires the implementation of transformative

approaches (Olsson et al., 2017, O'Brien, 2018). However, although the idea of transformation has become prominent within the scientific community, there is no clear consensus as to what the concept means in practice. To date, most proposals addressing these issues have remained conceptual, with little work on how to move from the theory to the practice of transformation at the scale of SES. This research project seeks to tackle the complex, multi-actor and dynamic aspects of social-ecological systems, as (i) it is interdisciplinary, combining management and design sciences, psychology and ecology, as well as transdisciplinary as it involves non-academic facilitators and relies on collaborations with local stakeholders. It is embedded in a place-based, long-term and large-scale research infrastructure (ZAPVS), thus allows to follow up the research on the long term.

In the field of sustainability sciences, this research project contributes to better understand practical aspects of SES transformation, what the notion of transformative capacity encompasses, and how this notion may be applied to consumers to contribute to the transformation of their food system. In the field of design sciences, this project provides both operational and conceptual knowledge on how to support collective design processes with actors (i) who are not necessarily initially part of pre-existing organisations, but might generate new forms of collective action through their design process, (ii) who are generally not considered as designers (and do not consider themselves as such either), and (iii) who, for at least part of them, do not necessarily have an interest in contributing to transform the system they are part of.

It is planned to pursue this diagnosis of fixation effects by completing data collection so that the age groups per creativity tasks are balanced as well as data analysis. In particular, we plan to identify fixation effects related to food waste, food supply chains and water management, as a function of age; and subsequently, how the ability to propose creative solutions to such ecological problems develops with age? We will also try to better understand to what extent idea generation on these issues is related to knowledge, ability to discriminate true from false statements a access to knowledge bases and lifestyle.

This diagnostic phase will be followed by the implementation of innovative design workshops in various classes, which will be conducted iteratively over several weeks. The aim of these workshops will be to develop both design capacities and reflexivity of the participants, be they children, teenagers or adults, so that they propose and implement collective projects aiming to transform their food consumption and, further, their food system. It is not the purpose of this paper to develop the methodology and underlying theoretical aspects. Yet, in a nutshell, the workshops are thought to take place over 7 two-hour sessions. An introductory session will consist in a presentation of the project, the principles and objectives of the method, and the planned schedule; in addition, a pre-test will be carried out in the form of a questionnaire to assess the initial state of the participants' knowledge and ideas. Three sessions will then be devoted to providing knowledge + generating ideas. The aim of these workshops will be to train the participants to 1) identify potential fixation effects by identifying easily accessible knowledge and ideas, 2) inhibit these fixation effects, 3) explore alternative paths by specifying concepts (or ideas) and seeking out new knowledge. At the end of these three sessions, the idea is to move towards the selection of a limited number of ideas to be developed. The two last sessions will be dedicated to reflexivity enhancing and project collective implementation. A post-test will be implemented several months later to assess the impact of this collective design approach.

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