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Can shaping a boost according to the codes of self-determination theory improve its effectiveness in health, compared to a simple boost and a nudge? Focus on buying endocrine disruptor-free products in supermarkets

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Research dissertation

**CAN SHAPING A BOOST ACCORDING TO THE CODES OF
SELF-DETERMINATION THEORY IMPROVE ITS
EFFECTIVENESS IN HEALTH, COMPARED TO A SIMPLE
BOOST AND A NUDGE?**

FOCUS ON BUYING ENDOCRINE DISRUPTOR-FREE PRODUCTS IN
SUPERMARKETS.

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Date: June 2023

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**Master M2 Le Quanti – Research and data
Intelligence in Marketing**

2022 - 2023

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**CAN SHAPING A BOOST ACCORDING TO THE CODES OF SELF-
DETERMINATION THEORY IMPROVE ITS EFFECTIVENESS IN HEALTH,
COMPARED TO A SIMPLE BOOST AND A NUDGE?**

Focus on buying endocrine disruptor-free products in supermarkets.

Research dissertation - 2022/2023

Master 2 Le Quanti - Research and Data Intelligence in Marketing

Under the supervision of Marie-Laure GAVARD-PERRET

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SUMMARY

Endocrine disruptors are present in our daily lives and the resulting cocktail effect can be harmful to humans. In the field of health, self-determination theory (SDT) is well known to be effective in changing behaviours such as fighting against smoking or encouraging physical activity. Many persuasion techniques and nudges aimed at helping individuals to have a healthier lifestyle, but they also have limitations. This is why boosts, which aim at giving individuals the necessary capacities to make the right decisions themselves, are proposed as a better alternative. This dissertation proposes, from a marketing perspective and by observing the impact on the consumers' purchasing behaviour of products in supermarkets, 3 studies with 2 quasi-experiments and a qualitative exploration in order to determine if a boost is more efficient than a nudge in this health context, and if designing the boost with respect to the 3 dimensions of the SDT makes it more efficient than a traditional boost. (156 words)

RÉSUMÉ

Les perturbateurs endocriniens sont présents dans notre vie quotidienne et l'effet cocktail qui en résulte peut être nocif pour l'homme. Dans le domaine de la santé, la théorie de l'auto-détermination (TAD) est connue pour être efficace dans le but de changer les comportements, comme lutter contre le tabagisme ou encore favoriser l'activité physique. Plusieurs techniques de persuasion et d'incitation douces (nudges) visent à aider les individus à avoir un mode de vie plus sain, mais elles ont aussi des limites. C'est pourquoi les boosts, qui visent à donner les capacités nécessaires aux individus pour prendre les bonnes décisions, sont proposés comme étant une meilleure alternative. Ce mémoire propose, sous un angle marketing et en observant l'impact sur le comportement d'achat des produits en supermarché par les consommateurs, 3 études dont 2 quasi-expérimentations et une exploration qualitative afin de déterminer si un boost est plus efficace qu'un nudge dans ce contexte de santé, et si façonner le boost en respectant les 3 dimensions de la TAD le rend plus efficace qu'un boost traditionnel. (172 mots)

KEYWORDS: endocrine disrupting chemicals, boosts, nudges, persuasion, self-determination theory (SDT), self-efficacy perceived, behaviour change, intervention, health, supermarkets.

Perturbateurs endocriniens, boosts, nudges, persuasion, théorie de l'auto-détermination (TAD), sentiment d'auto-efficacité, changements de comportements, intervention, santé, supermarchés.

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INTRODUCTION

According to the World Health Organization (WHO), endocrine disruptors are chemical substances which can be of natural or artificial origin- that are foreign to our body and can interfere with the functioning of our endocrine system. The endocrine system is a set of glands, such as the thyroid, ovaries or pancreas, which secrete hormones released in the body [See Appendix 1]. These hormones help to control behaviour, growth and the development of our body or the one of our offspring (Schug et al., 2016). The role of the endocrine system is thus to regulate the amount of hormones released. However, when the endocrine system is disrupted by a substance or mixture of substances, the functions of the endocrine system are altered and this has adverse effects on one's body, in one's offspring but also in (sub)populations (WHO, 2002). Indeed, endocrine-disrupting chemicals (EDC) can cause physiologic or metabolic changes by mimicking the activity of hormones in one's body (Gassner et al., 1958) and activating, blocking or even altering natural hormone synthesis. This can result through different mechanisms in "false" or abnormal signals that may "increase or inhibit normal endocrine functioning" (Schug et al., 2016).

Interest in the consequences of exposure to endocrine disruptors began as early as 1958, when Roy Hertz wrote about the potential harm to human health from growth hormones used to feed livestock (Gassner et al., 1958). Since then, many studies have highlighted the consequences of EDCs and all converge to show that they are responsible for the peak of many non-infectious chronic diseases such as neurological disorders, many cancers, adverse effects on reproduction, immune disorders (WHO, 2012), but also obesity, diabetes, precocious puberty, infertility, asthma or learning and behavioural disorders (WHO, 2012; Schug et al., 2016). In addition to the effects on humans, studies on animals have also shown adverse impacts on wildlife -such as sex changes in some fish populations- and on ecosystems, by participating in the erosion of biodiversity (Ministère de la Transition écologique et de la Cohésion des Territoires, 2021)¹.

The topic of endocrine disruptors is of major interest because of its impacts on global environmental and societal health, requiring urgent interventions. According to the WHO (2016)², 23% of global mortality in 2012 was related to the environment, including the presence of toxic chemicals such as endocrine disruptors, which cause 12.6 million deaths per year, including 1.4 million in Europe. The negative effects of endocrine disruptors have a cost to society that is difficult to estimate, but

¹ <https://www.ecologie.gouv.fr/strategie-nationale-sur-perturbateurs-endocriniens> consulted on 01/02/2023

² <https://www.who.int/news/item/15-03-2016-an-estimated-12-6-million-deaths-each-year-are-attributable-to-unhealthy-environments> consulted on 29/04/2023

some studies have estimated the costs to the European health system at €160 billion per year, not including environmental costs (Ministère de la Transition écologique et de la Cohésion des Territoires, 2021).

France is also affected by these negative externalities. Moreover, French people are concerned about the risks associated with endocrine disruptors, since according to the IRSN 2019³ barometer, half of the French people surveyed consider that the risks are high. At the European level, the European Union has defined a regulatory framework to reduce environmental contamination by endocrine disruptors and to better protect the population. This framework defines bans or limitations on the use of a substance when scientific data converge to demonstrate its endocrine disrupting effect. However, the demonstration of this effect is sometimes difficult and the scientific data insufficient. In France, the Ministry of Ecological Transition and Territorial Cohesion (2021) therefore recommends the precautionary principle to reduce our exposure to endocrine disruptors.

Nonetheless, from a precautionary perspective, it is still difficult to avoid endocrine disruptors in everyday life. As a matter of fact, there are three types of exposure routes to endocrine disruptors: ingestion, inhalation or dermal route (ANSES, 2013)⁴. In consequence, we can for example be in contact with endocrine disruptors through our food, by drinking water, by breathing the air in our home (Barret et al., 2015) but also outdoors –in a city or in the countryside- or by applying cosmetic care products on our skin. We are exposed every day to many harmful substances (Martin et al., 2022) which can be additives in food packaging, ingredients of cosmetics, constituents of cleaning products (Réseau Environnement Santé, 2012), or even constituents of children's toys (ATSDR, 2002).

Thus, in order to protect the population through the precautionary principle, one way would be to reduce the amount of products used by individuals containing endocrine disruptors. To do so, we could use persuasion, which is defined by Cacioppo et al. (2018) as the active attempt to change a person's beliefs, but also attitudes and behaviours by sharing 'information, feelings or reasoning' to the individual. Attitudes are defined by Petty and Cacioppo (1986) as general evaluations a person holds toward something else. They can be easily changed through information sharing and they may be an effective driver to change behaviours (Cacioppo et al., 2018). However, we will see later in the literature review that persuasion has some limitations to change behaviours, which is why some researchers proposed the use of tools such as nudges or boosts.

³<https://www.irsn.fr/actualites/barometre-irsn-2019-sur-perception-risques-securite-par-francais-principaux-constats> consulted on 20/05/2023

⁴<https://www.anses.fr/en/content/ansess-work-and-involvement-area-endocrine-disruptors> consulted on 29/04/2023

Nudging has been defined by Thaler and Sunstein (2008) as an alteration of people's choice architecture to predict their behaviour without constraining them. Many types of nudges exist and are used to benefit the society. However, even if they need to be used for the common welfare, nudges face many criticisms such as a lack of ethics or doubtful long-term effects. The boost concept has been brought in 2017 by Hertwig and Grüne-Yanoff as a policy approach based on simple heuristics that empowers individuals by providing them competencies. The purpose of this approach is to allow individuals to make informed decisions by themselves. If the use of boosts were effective in many cases, the long-term effects of the boost are still not proven. However, some may think that they may have longer-term effects on behaviour, which would make it a powerful tool to address the endocrine disrupting chemicals health issue.

Thus, in this dissertation I suggest based on literature that using a boost may be beneficial to change consumer's habits in terms of products purchase containing endocrine disruptors. However, we will see that the boost definition and its development is unclear. That is why I propose that defining a boost following the codes of the Self-Determination Theory (SDT) -theory that already has proven its efficiency in health contexts- may improve its efficacy and help the literature defining the boosting approach. Indeed, SDT is a motivation and personality development theory developed by Deci and Ryan in the 1980s that suggests the necessity of satisfying three basic and universal psychological needs to maintain psychological health and well-being (Williams et al., 2011). The three needs are related to the control of one's life and choices (need for autonomy), the feeling of being competent through the development of skills (need for competence), and the feeling of being connected to people and cared for (need for relatedness).

I explain in this dissertation that we can already consider that a boost has inherently 2 dimensions of the SDT in its definition: the need of competence and autonomy, by empowering people while being a transparent tool that requires one's participation to be effective. In consequence, I suppose that adding the third dimension of the SDT -relatedness- to the boost may be more effective.

My resulting problematic is as follows: "Can shaping a boost according to the codes of self-determination theory improve its effectiveness in health, compared to a simple boost and a nudge? - Focus on buying endocrine disruptor-free products in supermarkets."

Hence, after briefly reviewing the literature of the different concepts highlighted, I will present my hypotheses based on my research model and suggest a methodology based on 3 studies. I will end this dissertation by having a discussion on the research and managerial implications, and highlight the limitations of my work by proposing future research.

PART 1 – THEORETICAL BACKGROUND

CHAPTER 1 – CONTEXTUAL ANALYSIS ON ENDOCRINE DISRUPTORS LITERATURE

In this part we will first go deeper into the importance of developing interventions related to endocrine disruptors, and then we will talk about the existing interventions found in literature or carried out by local or national organisations.

I. IMPORTANCE OF DEVELOPING INTERVENTIONS AGAINST ENDOCRINE DISRUPTORS

As said in the introduction, endocrine disruptors can have major impact on health, as it is linked with many diseases (WHO, 2012). One big problem is that we are in contact with these substances every day, through different routes of expositions.

For example, it is common to find Phenols (Alkylphenols and p-Nonyl-phenol) in personal care products such as sunscreen, cleansing products for body and hair, fragrance but also in toothpaste. These chemicals can have effects on reproductive organs (e.g. Chen et al., 2016) and can for example lead to pregnancy loss and poor-quality embryos or cause breast cancer (Schug et al., 2016). It is also present in plastics used as packaging or other plastic items (e.g. Liao and Kannan, 2013).

Another well studied compound in recent years is the Bisphenol-A (BPA). It is found in plastics in order to ensure durability of the product or to solidify the plastic. Many studies provide evidence of multi-systemic effects at low doses of this EDC, such as breast and other cancers, problems of metabolism, puberty alteration, neurobehavioural diseases (Schug et al., 2016) or even skin irritation.

Other derivatives of bisphenols are found in high quantity in the environment and impact reproductive health (Martin et al., 2022), such as Triclosan (TCS), Triclocarban (TCC) and parabens (such as methylparaben or ethylparaben etc.). For example, Triclosan is used as an antibacterial preservative in cosmetics (soaps, deodorants, toothpastes etc.) but also in cleansing products (detergents) and is associated with lower fecundity when the level of TCS is high in the body (Martin et al., 2022). In the United States, TCS was banned by the FDA, but is still remaining in different rinseable care products such as toothpaste, mouthwash and hand sanitizers (Weatherly and Gosse, 2017). In Europe, Triclocarban and Triclosan are not forbidden but limited in terms of maximum concentration, which varies according to the type of product, its rinse-off quality and the age of the consumer. (Scientific Committee on Consumer Safety, 2022)

We also need to mention Phthalates that are essentially present in perfumes (fragrances), nail polish, some hair conditioner and some plastics to –such as the use of phenols- “increase the shape, flexibility and durability of plastics” (Martin et al., 2022). The diseases linked are related to the metabolism, reproductive problems (Chen et al., 2016), asthma or also neurobehavioral problems (Schug et al., 2016; Meeker et al., 2009). The only phthalate still authorised in the European Union to be in cosmetics composition is Diethyl phthalate, which is highly used to fix and prolong odors in fragrances. However, when looking at cosmetics ingredients, perfumes are indicated on the list under the name “Fragrance”, which does not allow consumers to know if the perfume contains phthalates or not.

By being familiar to our daily lives, endocrine disruptors are commonly present in the environment and the human body, such as the urine, the blood, the umbilical cord or even in breast milk (Réseau Environnement Santé, 2012). Many of these chemicals, if not forbidden, have an “acceptable daily intake” and/or a “tolerable daily intake”, as they have a limited life expectancy in the body. Martin et al. (2022) explained that EDCs have different ‘life expectancies’ in our bodies. For example, bisphenol A has a half-life of around six hours (Meeker et al., 2009) and is evacuated almost completely via the urine in 24 hours (Volkel et al. 2002). As for the phthalates, they have a half-life of around twelve hours (Hoppin et al., 2002) and are evacuated in the urine within two days (ATSDR, 1995). The derivatives of phenols such as Triclosan or Triclocarban, have much longer half-lives expectancies, with 21 hours for Triclosan (Smarr et al., 2017).

Nevertheless, researchers are greatly concerned about the cocktail effect caused by the cumulative exposure to various endocrine disruptors, which is a little understood aspect of our daily chronic exposure (Martin et al., 2022). Moreover, according to Ministère de la Transition écologique et de la Cohésion des Territoires (2021), the effects of EDC can be delayed in time and transmitted over several generations, which makes it a major issue. Thus, protecting the fetus or infant of future generations is an important stake, and for this no parent should be exposed to endocrine disruptors anymore (Réseau Environnement Santé, 2012). It is especially true during the pre-conception period, during pregnancy and during the first 1000 days of life which are the most critical stages of development (Réseau Environnement Santé, 2012).

To do so, researchers tried different interventions to reduce individuals’ exposition to EDCs.

II. ENDOCRINE DISRUPTING CHEMICALS (EDC) REDUCTION INTERVENTIONS

In the literature, most of the studies try to make a list of potential endocrine disruptors. They also try to determine how is an EDC level fluctuating in the participant's body after removal of a specific product in their daily use. The purpose of these studies is to improve both individual level and population-level interventions, as having a list of known EDC can help institutions to adopt policies against these chemicals. For example, Martin et al. (2022) explain that the EU removed in 2010 Triclosan from the food-plastic packaging. Another example is that after getting evidence on the harmful effects associated with BPA, the Food and Drug Administration (FDA) banned BPA from some products in the US such as in baby bottles (FDA, 2012)⁵.

Nonetheless, studies on potential endocrine disruptors are still evolving, as industrials replace substances of concern to the public and the authorities by alternatives. The problem is that BPA-free alternatives (BPF, BPS or PBP) have similar adverse effects on health (Liao and Kannan, 2013) and it could be similar for other alternatives. Accordingly, Martin et al. (2022) assert that even though there is persistent proof, assessments of risk and interventions by policies frequently arrive late.

Other studies are about designing interventions to reduce exposure to EDCs, most of the time by replacing products in participants' daily life and once again with the idea of measuring the level of endocrine disruptors in their urine afterwards. In this perspective, Martin et al., (2022) made a review of interventions to determine the most effective ones. Nevertheless, their analysis was limited to 21 interventions, as they consider there is a lack of studies that aim at reducing exposure to EDCs. The 21 selected interventions were principally focusing on phenols and to a lesser extent, phthalates. Among these studies, the most promising strategies to reduce EDC concentrations in participants' bodies were accessible (web-based) education resources (Kim et al., 2021), targeted replacement of products with EDC (Huang et al., 2021), and personalization through meetings, feedbacks and support groups (Park and Chung, 2021). Hence, the most successful interventions targeted multiple routes of exposure, as we know they can be from ingestion, inhalation or from dermal contact. They also eased the behaviour change for the participant by providing a new EDC-free product, they were interactive (for example online games) and they were self-incentives with encouragements and meetings.

⁵[https://www.fda.gov/food/food-additives-petitions/bisphenol-bpa-use-food-contact-application#:~:text=FDA%20has%20amended%20its%20regulations,\(ACC\)%20%5B9%5D](https://www.fda.gov/food/food-additives-petitions/bisphenol-bpa-use-food-contact-application#:~:text=FDA%20has%20amended%20its%20regulations,(ACC)%20%5B9%5D). consulted on 29/04/2023

To cover different routes of exposure, they analysed dietary interventions by targeting water, food, packaging and canned food (e.g. El Ouazzani et al., 2021; Barrett et al., 2015). The second one was behavioural interventions with efforts towards personal care products or other products use that may expose to EDCs (e.g. Harley et al., 2016). And the last one was residential interventions (Rutkowska et al., 2020), that were aiming to reduce exposure in the household, by analysing dust samples. At the end, the most commonly studied route of exposure of EDCs, was ingestion through dietary intervention (Martin et al., 2022) with 11 dietary studies out of 21. The least studied route was the inhalation one, with residential interventions focusing on EDC accumulated in dust, perfumes, toxic cleansing products, air fresheners, candles, detergents etc. The residential interventions represented only one study out of 21, showing a lack of studies in this field of application.

The most common interventions were the dietary ones. They consisted of two elements: firstly, instructing the participants on methods to prevent dietary exposure, and secondly, offering substitute diets for the duration of the intervention. However, even when substitute diets were provided, investigators had difficulties to remove and/ or trace sources of exposure of EDC. The need for appropriate consumer labelling and prior testing of the provided items in replacement during intervention is underscored by this issue, as stated by Martin et al. (2022).

An interesting point to raise is that the majority of studies (12 out of 21) had a sample made exclusively with females (e.g. El Ouazzani et al., 2021; Park and Chung, 2021; Barrett et al., 2015). Only 9 included male and female participants, and these 9 interventions were either dietary or residential (the only residential study included men). Martin et al., (2022) acknowledge the gap in non-dietary interventions, as men also use hygiene products that are harmful for their health, which would also have a great importance in the procreation of their future children and their offspring's health. Also, a large majority (16 studies out of 21) had a sample made of females in their reproductive years. In my opinion, focusing only on female is interesting but reductive especially when we see with other studies that the concentration of EDCs in the body tend to be similar in the different members of a family.

Looking at the different studies' methodologies in literature, we can notice that many aim to do an intervention to reduce the level of EDC in participants' bodies. They measure the EDC concentration mainly through the collection of urine pre and post-intervention. Few studies also measured it through blood, colostrum, dust, drinking water or a combination of different samples. However, as many studies gave evidence on the harmful effects of EDCs in the body, we can suppose that it is good to use the precautionary principle proposed by different researchers. As a precaution, it would be relevant to avoid buying products that potentially contain endocrine disruptors. For example, some studies have attempted to substitute participants' harmful products with non-disruptive products,

which generally reduced their blood EDCs levels. For this to be effective in the long-term and to cover the different routes of exposure, I believe that people need to learn how to choose products with fewer EDCs on their own to be able to make autonomous purchasing decisions in the future. However, no intervention so far -which I am aware of- measured the intention to purchase, or the actual purchasing behaviour, of products with or without endocrine disruptors.

Many of these studies also made the choice to focus on one endocrine disruptor for their intervention. For example, some studies focused on reducing plastic packaging, others on inducing participants to eat organic or to reduce canned food. The advantage of targeting one specific EDC is that it becomes easier for the participant to change his/her behaviour towards the products he/she typically used containing this EDC, rather than changing his/her entire lifestyle. Nevertheless, even if the participant is aware of the adverse effects of a specific EDC and wants to be careful, it might still be difficult to change one's consumption. Indeed, it can be dependent on many factors such as the price, as organic food tends to be more expensive than traditional one. It can also be due to a lack of time to carefully select products or to a lack of alternatives or to doubtful alternatives (Harley et al., 2016), for example if the supermarket is selling only personal care products in plastic bottles. Thus, interventions focusing on different routes of exposure and different EDC could be relevant, as giving the keys to the participants to choose on their own may improve the general quality of their purchases depending on what is available in their supermarket.

This is the case with some studies, which have tried to educate participants about the risks of EDCs and how to avoid them. If the efficacy of these educational interventions was not always significant alone according to Martin et al. (2022), they at least managed to increase risk perception of EDC among the participants (e.g. El Ouazzani et al., 2021). As EDCs affect health over a long period of time, and since people are in chronic exposure, maybe interventions should last longer in order to increase efficacy of the educational purpose. Indeed, in the review of Martin et al., (2022), the most common intervention lasted three days, even though they mention that there were many different lengths proposed.

In addition, as Martin et al., (2022) noted, the most effective interventions have to be personalized, accessible and should integrate support groups with frequent meetings in order to give encouragements and frequent knowledge. Thus, the educational material provided to the participant should be enough developed for one's to go back on it and practice on the long-term. For example, in their study, Kim et al. (2021) employed a web-based intervention that incorporated an educational video, a game to identify sources, educational resources, and a question-and-answer section. The researchers encouraged the participants to regularly use the online platform during the four weeks of

the intervention, which resulted in a significant decrease of EDCs in the body. Another possibility is to provide long-term social support, through feedbacks or meetings either online (e.g. by using social media (Rutkowska et al., 2020)) or offline in addition to the educational material provided. For example, in the case of Park and Chung (2021)'s study, it reinforced the benefits of online educational materials, which highlights the potential of these techniques.

Moving away from individual-level interventions and looking at more systemic interventions, the WHO and the United Nations Environment Programme recognize endocrine disruptors as a global hazard requiring resolution. France has taken a significant stride in addressing this issue by implementing a National Endocrine Disruptor Strategy⁶ in April 2014 with the goal of decreasing the population's exposure to these chemicals. Moreover, at a more local level, the city of Grenoble is also taking action to minimize exposure to endocrine disruptors through a Municipal Health Plan⁷. Examples of such measures include environmental and health clauses in public procurement contracts, procuring 50% of the canteen's food from organic and/or local sources, raising awareness among early childhood professionals and agents, and prioritizing indoor air quality.

In order to achieve effective interventions, the Ministère de la Transition écologique et de la Cohésion des Territoires (2021) considers that the government, local authorities, economic actors, associations but also various experts (health, education, communication, scientists etc.) must mobilize and work together. Indeed, still according to the barometer 2019 of the IRSN, if half of the French consider endocrine disruptors as highly risky, only 10% have confidence in the authorities to protect them. This is why acting at the national level but also at the individual level is important, to train inhabitants so that they themselves can make informed decisions.

In April 2014, the French government adopted the first national strategy on endocrine disruptors (SNPE 1), making France the first country to take such an initiative at the global level. This first strategy focuses on "reducing the exposure of the population and the environment to endocrine disruptors." The national strategy on endocrine disruptors (SNPE 1) is organized around four main axes, namely research, development and monitoring, expertise on substances, regulation and substitution of endocrine disruptors, and training and information. (Ministère de la Transition écologique et de la Cohésion des Territoires, 2021).

⁶<https://www.ecologie.gouv.fr/strategie-nationale-sur-perturbateurs-endocriniens#:~:text=Cette%20strat%C3%A9gie%20fixe%20comme%20objectif,Expertise%20sur%20les%20substances> consulted on 01/02/2023

⁷ <https://www.grenoble.fr/1686-sante-environnementale.htm> consulted on 13/04/2023

The second national strategy on endocrine disruptors (SNPE 2) aims to structure national actions related to endocrine disruptors and to ensure their full compliance with the European framework. The SNPE 2 has three main objectives: to inform and train, to protect the environment and the population, and to improve knowledge on endocrine disruptors. It also aims to raise awareness and inform stakeholders and citizens on this issue. (Ministère de la Transition écologique et de la Cohésion des Territoires, 2021).

However, although French people expect to be informed about the exposure of their products to chemicals, this information is often technical and not easily understandable. This is why the information and awareness-raising measures proposed by the SNPE2 aim to provide citizens and prevention stakeholders with information based on scientific advances on the subject of endocrine disruptors. They aim to disseminate clear information, in particular through the introduction of labelling at European level. They also aim to identify good practices that allow everyone to reduce their exposure to endocrine disruptors and chemicals in general, to explain existing regulations and the actions of institutions in the field of safety and health. They also want to encourage awareness-raising actions in the territories, particularly in health establishments, establishments caring for young children, schools and small and medium-sized enterprises, in order to limit the presence of endocrine disruptors in indoor environments and thus reduce the population's exposure. (Ministère de la Transition écologique et de la Cohésion des Territoires, 2021).

The methodology I will present here in this work would be then situated in the training and information axis of SNPE1, and more specifically situated in sharing practices to participants to avoid exposure to these chemicals (SNPE2). To summarize this first part, endocrine disrupting chemicals are everywhere around us and need to be addressed, either by an individual-intervention level, or by a more systemic one with the collaboration of many stakeholders.

Consequently, in order to address this need, few studies already tried to reduce exposure to EDCs, and the most effective are the ones that bring educational resources, personalization through meetings, feedbacks and support groups, and replacement of products with EDCs. However, I believe that we need more studies that target individuals' behaviours in order to reduce this exposure. Thus, we will now see how the use of persuasion or behavioural science can help to change people's health-related behaviours.

CHAPTER 2 – LITERATURE ON PERSUASION

Persuasion has been largely used in health-related behavioural campaign, and it can sometimes be really powerful to change people's behaviours. However, it also has limits, reason why nudges and boosts have emerged, tools that we will discuss in the following chapter.

I. THE USE OF PERSUASION TO CHANGE BEHAVIOURS

In order to change behaviours, notably in health-related contexts or to induce sustainability in environmental contexts for example, researchers mainly focused on persuasion. Persuasion refers to "the active attempt by an individual, group, or social entity (e.g., government, political party, business) to change a person's beliefs, attitudes, or behaviours by conveying information, feelings, or reasoning" (Cacioppo et al., 2018).

Changing people's behaviours has been the study of many works based on the emergence of behavioural economics to understand the limits of human rationality (Thaler, 1987), the influence of cognitive and heuristic biases (Tversky and Kahneman, 1979; Thaler, 1987, Chen and Chaiken, 1999), the time and cognitive efforts needed to process persuasive messages (Chen and Chaiken, 1999; Petty and Cacioppo; 1986) or even how attitudes, perceived social norms and perceived controls on behaviour influence decision-making (Ajzen, 1991).

Persuasion is related to the study of attitudes and behaviours. Attitudes can be defined as "general evaluations people hold in regard to themselves, other people, objects, and issues" (Petty et Cacioppo, 1986). The authors also say that these evaluations can be the result of past behavioural, affective and cognitive experiences, and may be able to influence or guide present behavioural, affective and cognitive processes (Cacioppo et al., 2018). On the other side, behaviours are defined as observable actions made by a person (Cacioppo et al., 2018). However, the study of attitudes is not unanimous and some authors wonder about the predictive role of attitude in changing behaviours.

Indeed, attitudes can change easily by giving new information to individuals and by giving them goals or challenges (Cacioppo et al., 2018). The fact that attitudes can change easily and may be a driver to change behaviours makes persuasive appeals an important tool in our society. Nonetheless, the literature is not always consistent on the effectiveness of persuasion to change behaviours. If an independent variable can increase persuasion in some situations, it can have no impact in other situations. Moreover, Petty and Cacioppo (1986) note that the literature has little agreement whether

if, when and how the source, the message, the recipient and the channel variables affect attitude change.

Persuasion can have many forms, such as relying on logical arguments and appeal to reason, emotional persuasion, appeal to ethics, or even personal appeals to convince others. These different approaches can emphasize factors such as comprehension, learning and retention of message arguments or even emphasize positive or negative cues (Petty et Cacioppo, 1981).

For example, in order to raise knowledge or influence psychological variables, psychologists tried to focus on informational interventions. Yet, some authors showed that informational approaches can be less effective than other types of intervention (Abrahamse et Matthies, 2012), as they can raise awareness and concern but do not always change behaviours. Still, according to Whitmarsh et al. (2021), the informational approaches that are more effective in changing behaviour are: shaping messages according to the individuals' values and beliefs, communicating the co-benefits of the action, targeting times and locations of the decision-making, such as product labels while purchasing, using social norms, promoting self-efficacy and encouraging to follow realistic goals to motivate action.

Another example of a tool that can be efficient is the use of feedbacks. Feedbacks are described as 'the act of providing knowledge of the results of a behaviour or performance to an individual' (Benn et al., 2012). They can be either comparative, evaluative or descriptive feedbacks and can be effective by making individuals adjust their behaviours by comparing the gap from their actual behaviours to the standard or their goal. For some, negative feedback may be more effective than positive feedback because it shows to individuals a higher gap between their actual behaviour and their desired goal (Burgers et al., 2015). On the contrary, positive feedbacks may sometimes be more persuasive than negative ones, as it provides a sense of competences in individuals who may be more willing to autonomously set higher goals afterwards (Burger et al., 2015).

However, persuasion technics face some limits as the effect can be impacted by different variables. For example, to be effective, the message content has to be carefully designed, and Fishbein et Ajzen (1981) suggest that the general neglect of the information present in a message is a serious problem to make the persuasion effective. Moreover, according to Petty and Cacioppo (1984), other variables such as the source credibility, attractiveness of the action (Petty et Cacioppo, 1981), resistance or susceptibility to the message (Petty and Cacioppo, 1977), personal relevance or commitment of the person etc. can influence the effectiveness of persuasion.

Therefore, individuals are not rational agents, they can act and adopt bad behaviours for them and the society. Moreover, individuals are fallible and can adopt inconsistent habits, but also irrational behaviour linked to bias, that comes from imperfect processing of information. However, some

authors pointed out the ineffectiveness of direct persuasion in some cases, and the need to address some societal problems differently by diverting bias and heuristics in order to induce people to change for their good. Indeed, these biases are not random but systematic, and we can therefore understand their mechanisms, predict them and influence them in a good way, for example by the use of nudges.

II. NUDGES

As individuals are not rational and are impacted by cognitive and emotional biases, they can't make choices that are in their best interests (Thaler et Sunstein, 2003). This is why these authors introduced the concept of libertarian paternalism, that aims to encourage individuals to make choices respecting their best interests, while respecting their freedom to choose otherwise (Thaler et Sunstein, 2003). These authors defined the concept of nudge as "any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives" (Thaler et Sunstein, 2008, p.6). The idea of nudging became more widely recognized after the release of Daniel Kahneman's book "Thinking, Fast and Slow" in 2011. The book brought attention to cognitive biases and their effect on decision-making. Kahneman identified two thinking systems: system 1, which is quick and reflexive, and system 2, which is more elaborate and requires more effort. Nudges leverage the automatic nature of system 1 to promote desirable actions, and therefore work with cognitive biases rather than fighting it.

Cadario and Chandon (2018) categorized nudge interventions into three types: interventions that target cognitive processes and impact what individuals know, interventions that target affective processes and impact how individuals feel, and interventions that target behavioural processes and impact what consumers do, without necessarily altering their knowledge or emotions.

However, while nudges can be effective in promoting desirable behaviours, they also are facing critics, and more especially related to ethical considerations. For example, Ewert (2020), criticizes the nudge according to four dimensions. First of all, he criticizes the lack of clear and precise definition of the concept, as many authors give inconsistent meaning to the concept. He also considers that evidence supporting the effectiveness of nudge interventions is often limited and inconsistent, or subject to methodological limitations and potential bias. Other authors also discuss the poor long-term effect of the nudge, as to get sustainable behaviours for example, domain in which the concept of nudge is highly used, changes have to be made in the society as a whole rather than at the individual

level. Thus, in order to be effective in the long term, nudges may require additional interventions to maintain behaviour, such as education.

Moreover, Ewert (2020) questions the paternalistic view of governance, that assumes the role of guiding individuals' choices toward desirable outcomes. And like many authors, he criticizes the ethical level of the nudge, as it raises questions related to autonomy, freedom of action, privacy, and manipulation of individuals (e.g., Goodwin, 2012). For other authors, the well-being of the whole society is more important than the individual's freedom of choice. For example, in a health-related context, Unnikrishnan et al., (2017) used a nudge to induce people to take iodized salt to prevent possible mental retardation of individuals due to iodine deficiency. They wonder if the individual's freedom is then more important than the public good in this context. The authors also take the example of nudging smokers in public spaces. They argue that 'the prevention of second-hand smoke exposure in a crowded airport is more important than any individual's right to smoke anywhere that he/she pleases' (Unnikrishnan et al., 2017).

Therefore, nudges have other limits that are highly discussed. Some researchers and critics have for example called for more transparency in the design and implementation of nudges. They stress the importance of individuals being aware that they are being influenced by a nudge and understanding how it works (Grüne-Yanoff et Hertwig, 2016). But also Thaler et Sunstein (2008) called for their limited scalability, as nudges may not be easily scaled up to larger populations or contexts. This is linked to the limited generalizability. Indeed, nudge is often developed in a specific cultural and social context, raising questions of external validity. And finally, nudges raised questions about equity. The issue of equity is an important limitation raised by some critics of nudge. Indeed, nudge can be considered unfair if certain population groups are disproportionately targeted or if nudges are designed to favour certain behaviours at the expense of others, without considering the broader social consequences. For example, nudges that encourage people to switch to healthier alternatives may be seen as unfair to those who do not have access to or the means to obtain those alternatives. This raises questions of social justice and equity in the design and implementation of nudges (Goodwin, 2012).

The nudge is committed to welfarism, and should encourage people to adopt the 'right' behaviour without coercing. To do so, when designing and implementing nudges, policymakers and organizations must carefully balance the potential benefits of nudges against the ethical and normative concerns they raise to ensure that nudges are implemented in a fair, effective and transparent manner that respects individual autonomy and democratic values (Thaler et Sunstein, 2008). Before implementing a nudge, policy-makers should follow generally accepted guidelines for the ethical and effective implementation of nudges. They should for example clearly define the problem that they are trying to address, and identify the behaviours that they want to encourage or discourage in order to select the

most appropriate nudge for the targeted group. They should also be careful that the nudge does not discriminate any group or reinforce existing social inequalities, that the nudge respects individual choice and ensures an alternative option. Finally, policy-makers should monitor and evaluate the effectiveness of the nudge over time to ensure that the desired outcomes are achieved and to identify any potential unintended consequences.

These discrepancies have fuelled debate and discussion in the scientific community and society at large about the use and effectiveness of nudge, this is why to counterbalance the negative implications of nudges, Ralph Hertwig and Till Grüne-Yanoff brought in 2017 the concept of 'Boost', that instead of changing the behaviour directly, rather increases individual competencies to bring change.

III. BOOSTS

Such as nudges, 'boosting' (Hertwig et Grüne-Yanoff, 2017) refers to a policy approach that is empowering individuals by giving them competencies to make good and informed decisions. Boosts are interventions based on simple heuristics and provide an adaptive fit between the individual and his/ her environment. In this kind of intervention, the boost is not trying to condition one's behaviour, but rather to foster one's existing competencies or to bring new ones that are better suited to make a decision (Hertwig et Grüne-Yanoff, 2017).

Before comparing the Nudge with the Boost, we first need to recall how a nudge can be implemented according to Hertwig et Grüne-Yanoff (2017). Being committed to welfarism, the nudge needs to answer three normative questions to be implemented. Because the goal of the intervention is to correct momentous mistakes in a specific context caused by imperfect decision making, the first question is "What constituted the mistake in particular situations?", followed by "Why a nudged behaviour is a welfare-improvement?" and finally "Why the nudge intervention itself is not welfare degrading?". If the nudge was implemented without answering these normative questions, the risk would be to change a behaviour that didn't need to be changed and that was not dangerous for the society's welfare (Grüne-Yanoff, 2018). However, in comparison with the nudge, the boost doesn't have to answer these three normative questions, because they only provide to the agents the competencies by bringing them skills, knowledge, and decision tools to empower them (Grüne-Yanoff, 2018). The goal of boosts is to train the functional processes or to adapt the external world (for example the way to present information), or both, to improve decision making and its outcomes. This way, people can make better choices on their own.

Boosts are not manipulative, as according to Grüne-Yanoff and Hertwig (2016;2017), the environment is just restructured to fit the competencies of the people, and boosts have to be explicit, visible, transparent, and they require individual participation to be effective. Because of this, boosts are easier to implement than nudges that have to prove that they are committed to welfarism. On the contrary, boosts just have to argue that some people make a mistake to implement a boost. Individuals are then equipped to change their behaviour in a good way and on the contrary of nudges that do not have long-term effects, when a successful boost is removed, the effect should remain, which would answer to the limits of nudges and make it a really interesting tool for interventions policies.

Classic examples of boosts are bringing the ability to understand statistical health information, or the ability to make financial decisions on the basis of simple accounting rules. Actually, empowering people by fostering their competencies is something that has been studied across different fields, such as educational science, psychology, management science or even economics. According to the Max Planck Institute for Human Development⁸ in Berlin, these different approaches can be considered under the umbrella concept of Boosting, even if originally the research was framed in a different manner.

Nonetheless, in the literature, it is unclear what precise rules have to be followed to build a boost intervention. What is clear, is that boosts differ from institutional education and feedbacks. In fact, boosts aim to foster or develop new competencies under specific conditions, such as limited time and resources. Also, it is less effortful for the individuals as they don't teach universal skills, which is the focus of traditional education, but rather simple decision strategies (Hertwig et Grüne-Yanoff, 2017). Regarding feedbacks, the difference between feedback and boosts is according to Lazaric and Toumi (2022), based on the difference between information and knowledge. If some feedbacks enable learning by providing additional information and may improve individual skills, boosts require some investment to increase individual learning and change individual heuristics. Lazaric and Toumi (2022) also consider that a boost provides more personalized and rich information compared to feedbacks.

Boosts studies may then have different approaches to change behaviours. Indeed, boosts can target people's skills directly, as they can also target the environment in which people behave and take decisions. It means that the environment can be better suited to ease the choice of an individual without acquiring new skill. It can be for example the use of a tool that communicates in a better format the benefits or harm of a treatment, such as a fact box (Schwartz et al., 2009). Another example, in a climate context, Lazaric and Toumi (2022) conducted a field experiment in Southern Europe which demonstrated that "boosting" citizens by enhancing their skills and knowledge through the setting of

⁸ <https://www.scienceofboosting.org/> consulted on 11/03/2023

specific goals and targeted advice, encouraged individuals to undertake home maintenance work with the aim of achieving specific energy reduction objectives. In the health domain, related to endocrine disruptors, Ouazzani et al. (2021) were for example the first to make an educational study through 2-h workshops in a perinatal environmental health context. They included the notion of 'know-how' by providing experience in a positive approach. We can also talk about Vos et al. (2022) study regarding parents' choices of healthy and sustainable food. The results include several interventions that may benefit to parents and that we could consider as boosts. We can for example cite interventions that provide information but that also provide inspiration and improve cooking skills with recipes to follow or via media sources. Some parents also showed interest in recipe booklets with healthy and sustainable ingredients (change of environment) and tasting sessions to learn and improve their skills (foster their existing skills). Thus, as we can see, 'educational' interventions may include different approaches to bring competencies to participants, according to the behaviour we want to target. The advantage is that improving skills can be done in a multitude of ways, and in all areas.

However, Fabian et Pyckett (2022) also highlighted the disadvantages of boosts for Well-being Public Policy, as they require a large scale participation to be effective at a national level, they are expensive to apply and it is a strict framework. The Max Planck Institute for Human Development in Berlin also considers that we need to know more about the long-term effect of boosting but also determine to which degree is the public acceptance of such an intervention to promote behaviour change. Finally, they consider that we should also know more about whether a widespread implementation of a boost intervention may increase inequity, as boosting reaches people who are already able and motivated to change their behaviours. Thus, such an intervention may not benefit to those who would need it the most.

As we have seen in the first part about endocrine disruptors, the most effective studies were the ones that bring competences to participants, which can be considered as boosts interventions. But also interventions that answer to people's needs of relatedness through social support. And in order to make these effects long-term, my point is that studies should promote autonomy in order to train participants to repeat the behaviour. The need of competence, relatedness and autonomy are in my opinion really important in order to change behaviour in a health context, and these three human needs are part of the Self-Determination Theory (Ryan et Deci 2000) that we will talk about in the next part.

CHAPTER 3 – SELF-DETERMINATION THEORY, MEDIATOR AND MODERATORS

In this chapter, we will discuss about the relevance of using the self-determination theory approach in building a health intervention and also as a moderator. We will also present the others moderators and the mediator that will be used in the different studies of my research.

I. SELF-DETERMINATION THEORY AND ITS APPLICATIONS TO HEALTH-RELATED BEHAVIOURS

Self-Determination Theory (SDT) is a theory of motivation and personality development that explains why some people are more motivated than others and how individuals' intrinsic motivation can be nurtured and enhanced. It was developed by Edward Deci and Richard Ryan in the 1980s and has since become one of the most widely researched and validated theories of motivation. According to SDT, there are three basic and universal psychological needs that individuals require to maintain psychological health and growth and well-being in their lifetime (Williams et al., 2011). These needs are:

- **Autonomy:** the need to be in control of one's own life and choices.
- **Competence:** the need to feel effective and capable by learning new skills.
- **Relatedness:** the need to feel “connected to people, nature and universe as a whole” (Schösler et al., 2014) and cared for by others.

When these three needs are satisfied, individuals are more likely to experience intrinsic and autonomous motivation. According to Deci and Ryan (2000), intrinsically motivated people have the highest level of self-determination, which is the driver to engage in an activity for its own sake, rather than for external rewards or pressure. Intrinsic motivation leads to more long-term behaviours (Moller et al., 2006) and persistence. In contrast, when these needs are not met, individuals are more likely to experience extrinsic motivation, which is the driver to engage in an activity for external rewards or pressure, such as money, grades, or social approval.

Deci and Ryan (2000), think there are four types of extrinsic motivation which range from least to most autonomous. These include external regulation (controlled by external factors), introjected regulation (motivated by a desire to avoid guilt or shame), identified regulation (personally endorsed), and integrated regulation (aligned with an individual's values, goals, and self-needs). External regulation and introjected regulation are then regrouped as controlled motivation. They are the least autonomous regulations that are motivating an individual to conform to ethical objectives and other's preferences (Fabian and Dold, 2022). However, identified regulation and integrated motivation are

regrouped as a more autonomous motivation, along with intrinsic motivation, as they all involve a high degree of internalisation. It is made of an individual's wish to become its ideal self (Fabian and Dold, 2022). If extrinsic motivation can lead to less sustained engagement, less enjoyment and satisfaction, and greater anxiety and stress, identified regulations can become integrated over time. Finally, the SDT also has a third category, called 'amotivation', which refers to the absence of motivation and the absence of behavioural regulation.

Regarding to the impacts of extrinsic motivation, it depends on the category we are in. When it is controlled motivation, such as introjected regulation, some studies in a health context linked it for example to negative outcomes like depression or anxiety (Ng et al., 2012). The potential positive effects are over the short term, and it can also backfire the initial purpose as extrinsic aspirations are more likely to engage adolescents in unhealthy behaviours like smoking or drinking alcohol (Williams et al., 2000). However, when the regulation is identified or integrated (autonomous), people are more likely to engage in the targeted behaviour, for example in pro-environmental behaviours (Pelletier et al., 2011). Finally, amotivation is also associated in the literature with a low engagement in the behaviour. Thus, such information shows the necessity to promote autonomous behaviours over controlled forms of regulation.

The SDT also recognizes that individuals have different degrees of intrinsic motivation, depending on their personality, past experiences, and environmental factors. However, SDT emphasizes that intrinsic motivation can be fostered and developed through social contexts that support the basic psychological needs: autonomy, competence, and relatedness.

A. The need of competences

As we said previously, the need of competence corresponds to the need of being skilful to promote one's flourishing (Deci et Ryan, 2017).

Self-determination theory has been used in many domains, such as health, education, environmental concerns or even physical activities or technology.

In the health-domain, SDT has been used a lot to study motivation to health-related behaviours. For example, Hartmann et al., (2015) showed that increasing people's competencies to regulate their weight increased their self-determination and the daily behaviours were more sustainable in the long term. They increased participants' competencies for example by increasing their knowledge about how to regulate their weight and how to overcome barriers in implementing these regulations. It could also be to increase cooking and tasking skills of participants to enjoy healthy foods. Indeed, when an

individual's level of competences improves and the individual begins to incorporate these behaviours into his daily life and routines, the behaviours become integrated (Fabian and Dold, 2022).

Increasing one's competencies is crucial, as it allows people to make actions. For example, related to the context of protection of the environment, Devine-Wright et al. (2022), said that people need at the same time motivation and competences to be able to choose low-carbon technologies, to encourage and protect the biodiversity, to change the way they eat, purchase, travel, vote, or even communicate about climate change. Related to the context of endocrine disruptors, bringing competencies to people may allow them to take action and make changes in their everyday lives. They may also develop new habits, such as purchasing safer products, reducing their exposure to plastics or chemicals. By making changes, individuals can feel a sense of control over their environment and their health, which can enhance their sense of competency.

Williams et al. (2011), listed different ways to support the need of competence in a health-related context, to facilitate tobacco abstinence. First of all, the practitioner may be positive that the individual can succeed. In the context of endocrine disruptors, we must show individuals that they can succeed reducing their exposure to EDCs. Second, they recommend to provide accurate and relevant feedback. This induces a social support. Third, they recommend to identify barriers to change. It allows us to provide alternative ways to reduce their EDCs' contaminated products if necessary. Fourth, they recommend to engage the patient in developing his/her skills and to solve problems on his/her own. This induces competencies and autonomy support. Fifth, they suggest to develop a plan of change adapted to the patient's abilities. And finally, they advocate for framing failures as short successes. This last point necessitates to keep in touch with the individual for a sufficient time to give him/her feedback on his actions.

B. The need of autonomy

If increasing competencies is important to get sustained behaviours in the health-domain, it is also essential to get autonomous self-regulation (Ryan et al., 2008) in order to be in control of one's choices and one's life (Deci et Ryan). For Ryan et al. (2008), the link from autonomous self-regulation to health outcomes is often indirect, as self-regulation is first associated with an increased in perceived competence, which is in turn associated with health outcomes.

Regarding autonomous self-regulation, the authors suggest that the success of interventions would be related to the importance for the self that participants feel toward the targeted behaviour. Indeed, if participants feel under pressure by others in a dietary intervention for example, the diet is linked to

bulimic and depression symptoms and lower self-esteem (Pelletier et al., 2004). Another example of the efficacy of autonomous motivation could be that self-motivation behaviour is according to Williams et al., (1996), “the most consistent outcome predictor for weight loss maintenance in obesity treatment”. On the contrary, when weight-loss is externally motivated by a spouse or significant other (Pelletier et al., 2004), Ryan et Deci (2000) suggest that it might result in a perceived loss of self-determination and autonomy and decrease the engagement to get a healthy body weight. The presence of others can then be controlling, or supportive (Ryan et Deci, 2011), whether it is an influence from family, friends or peers that interact regularly with the individual (proximal influences), or from mass media, role models or governments (distal influences) (Pelletier et al., 2011).

In order to induce an autonomous regulation, the message would then have to trigger the importance of the targeted behaviour for the participant (identified regulation), or be congruent with the participant’s values and aspirations, which corresponds to the integrated regulation (Williams et al., 2011). The message provided can then target intrinsic or extrinsic goals. Indeed, as we have seen previously, behaviours can become integrated (Fabian and Dold, 2022), and so can be extrinsic motivation through identified and integrated motivation (autonomous motivation). Hence, if intrinsic motivation will have more long-term effects on behaviour (Moller et al., 2006), it doesn’t mean that an external motivation won’t be effective. For example, a study on meat consumption by Schösler et al., (2014) showed that sustainable choices can still be made by individuals who are motivated by external factors. Actually, in their study, internalized motivation was the main factor that brought people to eat sustainable, due to values such as solidarity or animal and human health. Intrinsic motivation also played a role, for example with a feeling of enjoyment of cooking and eating.

In order to promote autonomy, Williams et al. (2011) also made a list of essential steps to follow. First, they recommend to acknowledge the patient’s perspectives and feelings, but also explore the individual’s values and determine how they are related to the behaviour we want to address. For example, in the endocrine disrupting chemicals context, if one’s essential value is to take care of one’s family, it would be easier to bring change in one’s behaviour by targeting the harmful impact of EDCs on one’s family’s health. They also recommend to provide clear reasons to change one’s behaviour, and to provide effective and alternative options to change this behaviour. However, in order to respect autonomy, it is important to acknowledge the option of not changing and to minimize pressure and control over one’s behaviour, as the decision to change has to come from the individual.

The autonomy dimension is thus really important, as long-term health-related behaviours may come from the autonomy support of an intervention, the self-regulation, the perceived competence and intrinsic motivation. For a policy-maker, this point is really interesting as it can reduce the cost of the intervention. Indeed, according to Ng et al. (2012), a tobacco abstinence intervention made by

Pesis-Katz et al. (2011) under the scope of the Self-Determination Theory by enhancing perceived autonomy and competence actually increased abstinence with “a cost-effectiveness of just over \$400 per life year saved (or \$1,200 per quality adjusted life year saved)”. This is way lower than other tobacco interventions which are around \$3,500 per life year saved (Ng et al.,2012).

C. The need of relatedness

Relatedness is defined by Deci et Ryan (2017) as the need of being loved and cared for by others, and the need of belonging to a group. The general level of self-determination can be promoted by improving some factors linked to the relatedness need. For example, Deci et al. (1989) made a synthesis of studies to know how to promote this self-determined feeling. They concluded that first of all we need to take the person’s frame of reference, by understanding and acknowledging his/ her needs, feelings and attitudes related to the context of the situation in order to increase trust and his/her feeling of control perceived. They also added that giving non-controlling positive feedback could foster the self-determined behaviour, showing the important role of social support and relatedness in shaping people’s motivation. Similarly, Williams et al. (2011) recommended to support the need of relatedness by developing an empathic and warm relationship with individuals while being non-judgmental toward them.

Also, the need of relatedness can be linked to some external motivations. For example, some people could consume in a specific way in order to feel connected to a group of people, or a community. Community may indeed be an important tool to strengthen group capacities and bring more commitment to a behaviour. Vos et al. (2022) for example highlighted the importance of including lower socioeconomic status in a food community to increase their exposure to healthy foods.

Similarly, Bagnall et al. (2018) consider that individual well-being is closely linked to the well-being of one’s groups of belonging. The need of relatedness played for example a role in reducing meat consumption in Schösler et al., (2014) study. Indeed, when people reduce their meat consumption to protect the environment and their own health, they tend to be adherent of “organic, natural or locally sourced products” (Schösler et al., 2014) which fosters a kind of solidarity.

In the case of endocrine disruptors, people may for example want to avoid them in order to protect their health or the one of their loved ones, as according to Stern et al. (1993), people’s own well-being and the one of their family is the most important to them. It could also be to connect with people that share similar values and concerns about environmental and health issues, by looking out for support or information from other who share the same concerns. Furthermore, reducing consumption of

products with endocrine disruptors may also be motivated by a desire to contribute to a large social cause or movement, by reducing pollution to protect the environment and future generations.

In consequence, policy-makers that try to answer to environment and health challenges should, according to Schösler et al., (2014), understand the stakes of using the self-determination theory in their intervention implementation. In fact, SDT can help to understand why consumers make specific choices, due to different motivations, a lack of identification to people, nature, or for example a lack of motivation and behavioural regulation (amotivation).

Because of these reasons, Schösler et al., (2014) consider that the groups who have to change the most (in terms of consumption for example), are also the ones that are the least able to do so in their own initiative. Hence the need to use tools to change their behaviours by addressing their need for competence, relatedness and autonomy. One strategy of such a tool to address the endocrine disrupting chemicals problem could consist of using a boost which integrates these three dimensions of the self-determination theory, that increases the level of self-efficacy perceived by the individuals.

II. SELF-EFFICACY, REACTANCE TRAIT, PERSONAL INVOLVEMENT, PERCEIVED CONTROL AND PERCEIVED RISK

In the literature, I identified one relevant mediator –self-efficacy- and six moderators -including the psychological satisfaction level of the SDT in the previous part- that can impact the effectiveness of a health study and more particularly of a boost.

A. *Self-efficacy*

Self-efficacy refers to an individual's belief in their own ability to achieve success in a particular area (Bandura, 1977).

In literature, we can distinguish two types of self-efficacy: General self-efficacy and Specific self-efficacy. The General self-efficacy refers to a feeling of success in general related to one's abilities to deal with stressful or challenging demands in life, across different domains. It may correspond to a particular trait tendency of an individual throughout his/ her life.

On the other hand, the Specific self-efficacy is a subjective belief of having competences to attain success in a particular domain and under certain circumstances (Bandura, 2012). For example, an individual can feel like being highly competent in one domain, such as cooking, but less competent in repair tasks. However, Bandura (1997) suggests that those self-efficacy beliefs are likely to change over

time and can be modified or acquired through different processes. In fact, he considers that an individual's self-efficacy beliefs are influenced and shaped by various learning experiences, such as personal accomplishments, observing and learning from others, receiving verbal encouragement or persuasion, and experiencing physiological arousal related to emotions (Bandura, 1997). Similarly, Hoy and Spero (2005) state that receiving social support might favour perceived self-efficacy.

Related to the Self-Determination Theory, Bandura (1977) argues that an increase in the level of self-efficacy perception may enhance the three related basic psychological needs. Indeed, as an individual with a high level of self-efficacy tends to set more specific and realistic goals and is more likely to achieve them, the individual will be also more likely to satisfy his/her basic needs, and in particular the need of autonomy and competence (Bandura, 2012). After successfully achieving specific goals, the individual could then feel more confident toward his/her abilities to handle similar tasks in the future.

Thus, self-efficacy has a direct influence on behaviour. The individual, by getting more confidence will exert more control on his/ her own motivation. In the case of a tool to change behaviours, perceived self-efficacy might be a powerful mediator of the actual purchasing behaviour, as if the individual doesn't feel capable of choosing his endocrine disruptors free-products when doing groceries, he/she might feel overwhelmed and take the product that necessitates the least cognitive effort. Hence, an individual who's for example acquiring new skills and verbal encouragement from peers thanks to a boost might get a higher specific self-efficacy, whereas the use of a nudge might not change the specific self-efficacy compared to no intervention at all.

Moreover, it would be interesting to analyse the impact on the purchasing behaviour of an individual who has an increased specific self-efficacy level (for example after a boost intervention), but a low general level of self-efficacy. Indeed, the individual could for example feel stressed or anxious as he/she would not feel competent dealing with challenges, and could lose one's means when having to purchase a product.

However, the purchasing behaviour could also be moderated by many variables, such as one's the level of involvement, the perceived risk of the health-issue, the perceived control of the participant or even his/ her reactance trait.

B. Reactance trait

The theory of psychological reactance, often cited in explaining unexpected failures of persuasive communication, posits that individuals perceive persuasive messages as threats to their freedom, triggering a motivational state known as psychological reactance. It is defined by Brehm and Brehm (1981) as a motivational state supposed to occur when a freedom is removed or threatened of elimination. This reactance is characterized by an aversive response aimed at restoring one's sense of autonomy and freedom (Shen et Dillard, 2005). Consequently, the persuasive message fails to be effective. While initially studied as a temporary state, it has become evident that people differ in their inherent tendency to experience reactance, suggesting a trait component (Brehm et Brehm, 1981).

In the context of developing a boost under the SDT scope to fight against endocrine disruptors, it can be relevant to verify at first if the participants indeed find the boost more respective of autonomy than do nudges, or if they feel like their autonomy is threatened.

C. Personal involvement

While there are various definitions of involvement in social and consumer psychology, it is generally agreed upon that high involvement messages hold greater personal relevance and consequences, evoking stronger personal connections compared to low involvement messages. In social psychology for example, Sherif and Hovland (1961) argue that high involvement is linked with intrinsic importance. In Marketing, personal relevance is considered to be linked with personal values, needs or goals in life (Strazzieri et Hajdukowicz-Brisson, 1995). Similarly, Zaichkowsky (1985) defines involvement as an individual's perception of the communication's relevance based on their needs, values, and interests.

Involvement plays a crucial role in influencing the extent and manner in which persuasive communication is processed (Petty and Cacioppo, 1981). When individuals are highly involved, they are more motivated to exert cognitive effort in evaluating the product, as opposed to low involvement where less effort is dedicated (Petty et al., 1983).

According to the Elaboration Likelihood Model (Petty et Cacioppo, 1986), personal relevance increases an individual's motivation to thoughtfully consider the issue or product-relevant information presented, aiming to form an accurate opinion. Still based on this model, attitude change is more likely

when individuals engage extensively with a persuasive message (central processing) compared to when their engagement is low (peripheral processing).

In a health-related domain such as endocrine disruptors, personal relevance may be a strong moderator in one's involvement to reduce his/her exposition to contaminated products. It means that if the context is relevant to an individual, the latest may be more likely to change his / her purchasing habits in terms of products. However, individual difference variables such as perceived risk or perceived control may also play significant roles in shaping the path to persuasion.

D. Perceived control

Perceived behavioural control refers to an individual's perception of the ease or difficulty involved in carrying out a specific behaviour, as defined by Fishbein and Ajzen (2010). It is part of the Reasoned Action Approach (RAA), previously known as the Theory of Planned Behaviour (TPB), that has been extensively utilized to predict behavioural intentions across various consumption behaviours, such as food choices, sustainable and ethical consumption, organic food purchasing etc.

Low levels of perceived behavioural control are often associated with barriers such as price, availability, trust, and labelling, leading to lower intentions to purchase organic food products (Aikten et al., 2020). According to Aikten et al. (2020), there appears to be a discrepancy between consumer attitudes and their behavioural intentions to purchase organic food products, despite positive attitudes toward such items. By increasing individuals' sense of control over their actions, they are more likely to align their purchasing behaviour with their favorable attitudes towards sustainability (Aikten et al., 2020).

If we translate it in the context of endocrine disruptors-free products, people may be involved in this specific health-issue, but may be limited in terms of action because of a lack of information, high prices of healthy products or also availability of healthy products. I think it is relevant to determine how much people feel like having control on their purchasing behaviour after a boost intervention and compared to a control group.

E. Perceived-risk

Risk perceptions is sometimes considered as stable beliefs that are retrieved from memory when needed. With this point of view, providing new information is not likely to alter one's perceived risk of a context-specific issue. However, if there is a change in perceived risk, it can be assumed that the individual consciously integrated the new information (Rothman et Schwarz, 1998). Similarly, in a context of consumption, Campbell and Goostein (2001) suggest that the level of perceived threat plays a crucial role in how individuals evaluate products. When consumers perceive a high level of threat, they tend to adopt a more cautious and conservative approach. Conversely, when the perceived threat is low, individuals tend to evaluate products more positively.

In the context of endocrine disruptors, even if the information about the potential harm of pesticides or general pollution is highly accessible, we do not often hear the term "endocrine disrupting chemicals", and we hear about the specific consequences on health even less. I think that the risk perceived before a boost intervention may be lower than after, as the information was currently not accessible much. If the risk-perceived increases, individuals may be more careful at evaluating products containing EDCs, following Campbell and Goostein's (2001) reasoning. Consequently, they may purchase less contaminated products.

PART 2 – PRESENT RESEARCH

CHAPTER 4 – RESEARCH HYPOTHESES

In this chapter, we will first see the research gap identified from the literature, then establish the hypotheses and define the general method of the studies.

I. RESEARCH GAP

Concerning endocrine disrupting chemicals, the gaps in literature related to this topic are many. First, in toxicology and endocrinology, most of the studies tried to determine potential endocrine disruptors, or to determine the fluctuation of a specific EDC in the body after removal of a specific product in people's daily use. However, industrials are also using many alternatives because of regulations that are not safe either. Other studies try to design interventions to reduce people's exposure to EDCs by replacing contaminated products in participants' daily life. They mostly measure the level of EDCs in participants' urine afterwards. Nonetheless, replacing products can be effective for a while but if the individual doesn't learn the vital necessity of reducing their exposure to EDCs and how to do so, the individual may go back to his/her habits after the intervention.

Thus, bringing competences to participants has also been tested, for example in studies present in Martin et al.'s (2022) review to determine the most effective ones. The authors however point out the lack of studies with this purpose, as their analysis was limited to 21 studies. Moreover, these studies mostly focused on one route of exposure, which was most of the time dietary (11 studies out of 21). Yet, research has shown that EDCs are part of our daily lives, and the cocktail effect coming from the exposure to different EDCs, and from different routes may be dangerous. This shows a lack of studies trying to bring competences to participants toward different categories of products that they can use in their daily life, whether it is to eat, clean their house or to put on their skin.

Also, the majority of studies (12 out of 21), had a sample made exclusively with females (Martin et al., 2022), and more especially on pregnant women or girls. Few were based on a mixed sample with male and / or boys, and very few based on community (parents with children, or groups). However, a household is generally not composed of one person only, and studies have shown that the concentration of EDCs in the body tend to be similar in the different members of a family (Park et al., 2022), whether it is a mother, a father, a girl or a boy.

Last but not least, studies in literature measure the EDC concentration in the body by collecting urine (or in some cases, blood, dust etc.) pre and post-intervention. In this health-related context which is also a societal problem, no interventions I am aware of tried to induce individuals to avoid doubtful products and measured their purchasing behaviour after an intervention, and especially while grocery shopping in supermarkets. Indeed, if people who shop in organic grocery stores are probably more aware of the risks of EDCs, according to a study made by OpinionWay⁹ for Bonial in 2022 in France, 87% of the respondents are shopping in supermarkets. According to Schösler et al. (2014), the food environment (such as a supermarket) is more likely to induce consumers to choose the easy way and discourage reflection by relieving them from a sense of responsibility. And because purchases can be dependent on many factors, such as the price, a lack of alternatives (Harley et al., 2016), a lack of time, the influence of marketing etc. I think it is interesting to make an intervention on people that may not be fully aware of the risks of EDCs while purchasing in supermarkets. It would also be interesting because individuals purchasing in supermarkets may have different socioeconomic backgrounds and different abilities to change their behaviours.

Concerning the self-determination theory applied to the creation of a boost, no studies yet that I am aware of studied its effectiveness related to this tool. Indeed, boosts aim at increasing competences of people while supporting one's autonomy. Related to this assumption, we can see that boosts already have two aspects of the SDT inherent to its elaboration. Thus, it is relevant to wonder what would be the impact of the boost if we try to answer the three fundamental needs of the SDT by adding the 'relatedness' dimension in the elaboration of a boost. Yet, most of the studies that I have talked about so far used one or two dimensions of the SDT, such as competences and relatedness, or competences and autonomy, but I think that no studies on the endocrine disruptors context tried to satisfy simultaneously the three needs of the self-determination theory to improve the effectiveness of the intervention.

Thus, in the present research, I want to test the effect of a Boost, tool that is still not much discussed in the literature, that answers simultaneously to the three dimensions of the SDT to determine if it increases its efficacy. It means that this boost, in this specific context, should decrease the participants' purchasing behaviour of products contaminated with endocrine disrupting chemicals, more than a nudge would do.

⁹[https://www.ecommercemag.fr/Thematique/retail-1220/barometre-etude-2168/Breves/Les-Fran-ais-et-leurs-achats-alimentaires-face-a-l-375846.htm#:~:text=Plus%20de%20huit%20consommateurs%20sur,%25\)%20et%20Intermarch%C3%A9%20\(43%20%25\)](https://www.ecommercemag.fr/Thematique/retail-1220/barometre-etude-2168/Breves/Les-Fran-ais-et-leurs-achats-alimentaires-face-a-l-375846.htm#:~:text=Plus%20de%20huit%20consommateurs%20sur,%25)%20et%20Intermarch%C3%A9%20(43%20%25).). Consulted on 14/05/2023

The objectives are as follow: first, I want to determine if a traditional boost would indeed be more efficient than a nudge in changing a specific behaviour related to endocrine disruptors products purchases. This aim will correspond to the first study I will present. Second, I want to determine if a boost with three dimensions of the SDT is more efficient than a traditional boost that would answer the competences and / or autonomy need. I want to determine if such a tool would be efficient at decreasing the purchasing behaviour of products with endocrine disruptors. This purpose corresponds to the second study I will present. Third, I would like to understand the possible impact of the perceived level of self-efficacy on the effectiveness of the boost on the behaviour (study 1 and 2). Fourth, I would like to understand the possible impacts of the different moderators identified, such as the stable needs of the individual related to the SDT, the risk perceived, the personal involvement, the perceived behavioural control, and the reactance trait.

II. CONCEPTUAL MODEL AND HYPOTHESES

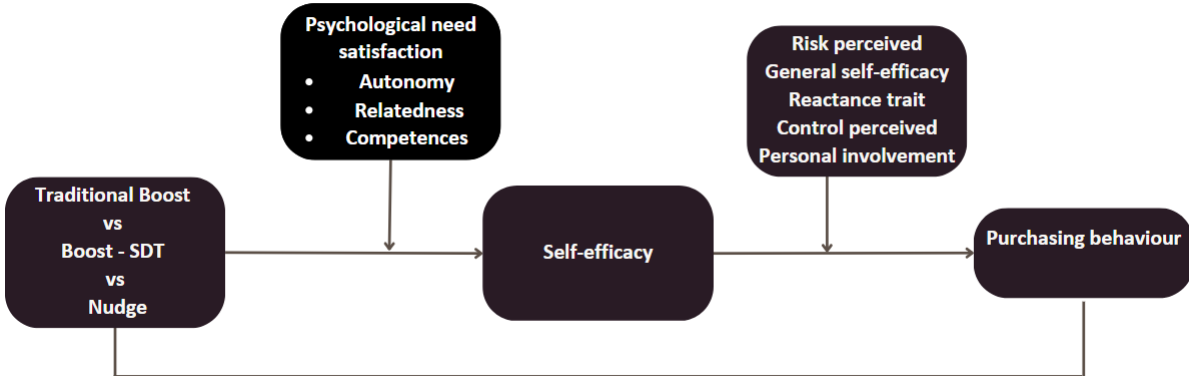


Figure 1 : Conceptual model

After identifying existing gaps in the literature, I developed this research general model. However, for reasons of comprehension, I will develop the hypotheses study by study with the appropriate sub-model.

A. Hypotheses study 1

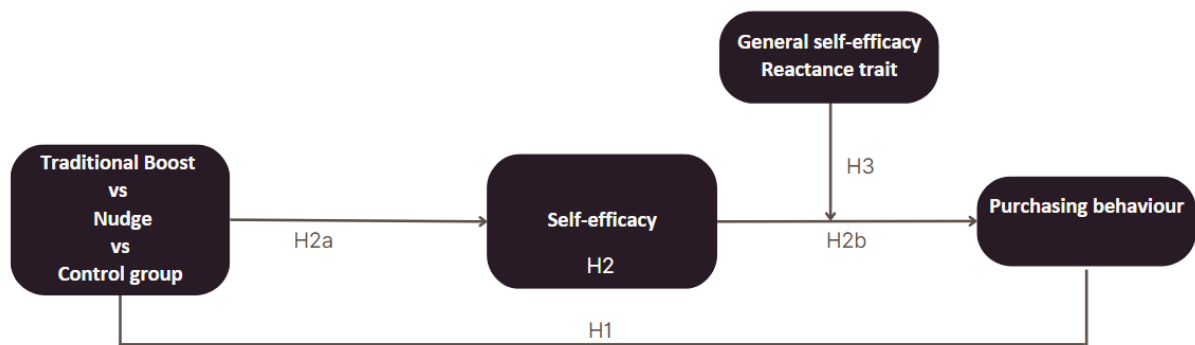


Figure 2 : Study 1 model

The aim of the first study is to determine if a traditional boost (a boost that answers the competence and autonomy needs) would be more efficient than a nudge in changing a specific behaviour related to endocrine disruptors products purchases, compared to a control group.

First, I suppose that using a traditional boost to decrease people's purchasing behaviours of products contaminated with EDC will be more effective than using a nudge, especially because it is autonomy supportive, transparent, brings competences and a boost is supposed to have long-term effects compared to a nudge. Indeed, if we take for example a comparative study of a boost and a nudge made in hospitals to improve hand hygiene (Roekel et al., 2021), the results suggested that the effects of the boosts remained briefly after removal of the intervention, whereas the effect of the nudge faded. However, I suppose that a nudge is still more effective than no intervention at all, as Harley et al. (2016) showed that labelling for example can indeed reduce significantly personal exposure to potentially endocrine disrupting chemicals.

H1: The use of a boost or a nudge is more effective than no intervention at reducing people's purchasing of products with EDCs. And the use of a boost is more effective than a nudge (and the control condition) at reducing people's purchasing of products with EDCs.

Then, I suppose that a boost will increase one's level of self-efficacy. Indeed, a boost aims to improve individuals' competences. Moreover, the specific self-efficacy is a subjective belief that can change over time through different learning experiences on having the right competences to attain success in a particular domain and under certain circumstances (Bandura, 1997). Thus, I assume that the positive effect of a boost on one's purchasing behaviour of products without EDCs is mediated by the level of one's self-efficacy. Indeed, if an individual has a low self-efficacy in this context, one's may

feel overwhelmed while grocery shopping and opt for the product that requires the least cognitive effort, that costs the least or that is the most easily available.

H2: The effect of a boost on the purchase behaviour concerning products without endocrine disruptors is mediated by the level of self-efficacy.

H2a: The use of a boost will increase one’s level of self-efficacy compared to the use of a nudge or the control condition.

H2b: As the level of one’s self-efficacy increases, the purchasing behaviour of products with EDCs decreases.

I also think that the effect of specific self-efficacy on purchasing behaviour is moderated by the reactance trait and general self-efficacy. In this case, the effect of the boost (vs. nudge vs control group) would be more effective in terms of purchasing behaviour as it should increase the perceived level of specific self-efficacy more than the other tools. Moreover, nudges are seen as controversial and manipulative (vs. transparent, not coercive and supportive of autonomy for a boost), which could increase the reactance trait and reduce the positive effect of the specific self-efficacy on the purchasing behaviour. Also, the general feeling of self-efficacy could moderate the impact, as it refers to a general feeling of success related to one’s abilities to deal with stressful demands in life. A boost could be more effective than a nudge when associated with a high level of general self-efficacy, because I suppose that this tool increases more than the nudge and the control group the perceived specific self-efficacy.

H3: The positive effect of specific self-efficacy on purchasing behaviour will be higher for individuals who present a high level of general self-efficacy (vs. low level) and low level of reactance trait (vs. high level).

B. Hypotheses study 2

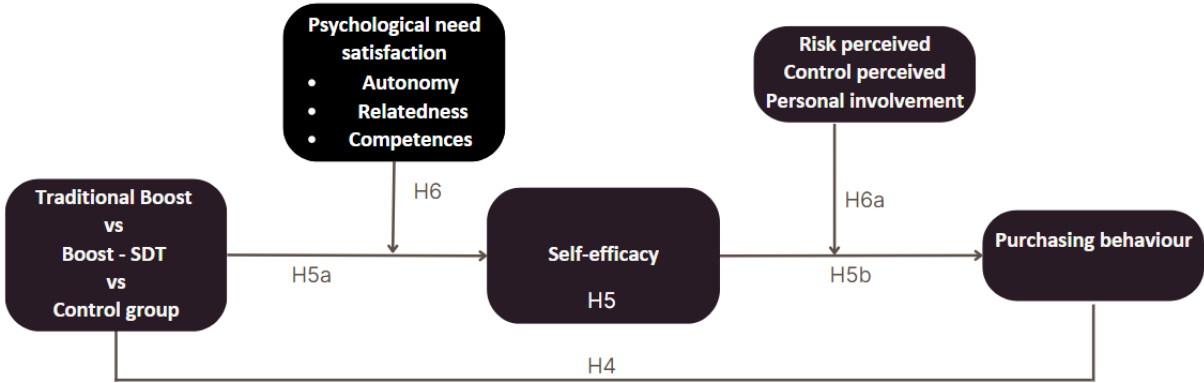


Figure 3: Study 2 model

The aim of the second study is to determine if a SDT-aligned boost (which respects the 3 needs of the SDT) would be more efficient than a traditional boost at changing the purchasing behaviour.

I hypothesize that a boost made under the scope of the SDT, thought to respect the need of competence, autonomy and relatedness, will be more effective than a traditional boost -only aiming at increasing people's competencies and respecting autonomy- at reducing people's purchasing of products with EDCs.

H4: The use of a boost created to respect the 3 dimensions of the Self-Determination Theory, - such as the need of competence, autonomy and relatedness- compared to a traditional boost that respects two dimensions of the theory (the need of competence and autonomy), can increase its efficacy by lowering the consumers' purchase intentions of products with endocrine disruptors.

I also hypothesize that a boost which respects the three fundamental needs of the Self-Determination Theory will increase one's level of self-efficacy more than a traditional boost. In fact, Bandura (1977) argued that an increase in the level of self-efficacy perception may enhance the three related basic psychological needs. I assume that if a boost is made to answer these needs, it may also further increase the level of self-efficacy. For example, by receiving verbal encouragement, sharing knowledge with others etc. such as Hoy and Spero (2005) stated that social support, that we can link with relatedness in the SDT, might favour perceived self-efficacy.

H5: The effect of a boost, whatever are its characteristics, on the purchase behaviour concerning products without endocrine disruptors is mediated by the level of self-efficacy.

H5a: The use of a boost created to respect the three dimensions of the Self-Determination Theory, (vs. a boost that respects two dimensions of the theory and the control group), will further increase one's level of self-efficacy.

I also hypothesize that as the level of one's self-efficacy increases, the purchasing behaviour of contaminated products with EDCs will decrease. And as the level of one's self-efficacy following the boost under the three dimensions of the SDT should increase, the purchasing behaviour of products containing EDCs should further decrease than a traditional boost.

H5b: As the level of one's self-efficacy increases, the purchasing behaviour of products with EDCs decreases.

Finally, I also suggest that the effect of a boost on the purchasing behaviour is moderated by the satisfaction of the three fundamental human needs of the SDT, competence, autonomy and relatedness. Yet, I think that the positive effect of the specific self-efficacy perceived on the purchasing

behaviour is also moderated by the risk perception, the perceived behavioural control and the personal involvement. Indeed, an individual is more likely to make cognitive efforts when highly involved (Petty et al., 1983), as it has a strong personal relevance. One is also more likely to purchase healthy products when feeling like having control over one's choices (Aikten et al., 2020). At last, the individual is also more likely to reduce his / her purchases of harmful products for one's health if the perception of risk is high, as when the risk perceived is high, individuals tend to adopt a more conservative approach when evaluating products (Campbell and Goostein 2001).

H6: The boost will be more effective for the people who present a high level of Psychological need satisfaction -Autonomy, Relatedness, Competences- (vs a low level).

H6a: The positive effect of specific self-efficacy on purchasing behaviour will be higher for individuals who present a high level of risk perceived, personal involvement in this health-issue and perceived behavioural control over one's choices (vs. low level).

III. GENERAL METHODS' DEFINITION

The studies I will propose share a general method of setting and recruitment that I will explain.

A. Setting and participants

The experiment would take place during a limited period of time, for example from the month of July 2023 to August 2023 in France, on a supermarket's Drive application. As said earlier, the choice of focusing on supermarkets is related to the fact that the majority of people shop in supermarkets, and they cover with their products the three routes of exposure I want to target: inhalation, dermal and ingestion. However, for convenience reasons and to avoid dealing with external factors that could bias too much the studies, such as stress of being observed or desirability bias, I decided to deliver my treatment on a Drive application that allows consumers to do online groceries. For these studies, I would have to get a partnership with a supermarket. In the following illustration (Figure 4), I took the example of the Intermarché's Drive application. This partnership would be important, as it would allow us to deliver the messages or the material directly to the supermarket's consumers who have an account and a fidelity card with this grocery shop. Furthermore, for confidentiality reasons, the supermarket could be in charge of the enrolment of the participants - via a recruiting notification on the main page of the app- so that they would not have to share with us personal data of their customers.

The participants would then be pre-selected by the fact of having a fidelity card. This way, it would increase the likelihood that the participant would commonly do grocery shopping in this specific supermarket. This point would be useful in order to get sufficient data for the longitudinal study. Because of this pre-selection, these studies would be with quasi-experimentations as it won't be a fully randomized design. More particularly, the fact of having a fidelity card would allow us to link the products purchased by a participant with an account, and see the evolution afterwards during the follow-up study (the list of products purchased after the boost delivery and per account participating would be transmitted to us by the supermarket after anonymization).

In each of the following quasi-experimentations I will propose, I would like to get 50 participants per group with the purpose of having sufficient and valuable data, in a between-subjects design. In order to be recruited, participants would have to be more than 18 years old, speak French (as the material would be in French), would have to possess a fidelity card and would have to purchase in a recurring way via the Drive application (online purchase). Both genders would be needed and appreciated in the studies, as I consider that there is a lack on studies related to EDCs with men, whereas they are part of a household too and take part in the procreation of their offspring.

B. Design and procedure

The quasi-experimental designs include three groups each, including one control group. Every groups would be enrolled through the app, via a notification on their main page. Every group would also receive the same incentives to participate to the study. In this case, I would propose 10% off their shopping cart if they participate to the study. In order to design the different groups' materials, I chose similar cognitive tasks for every group, including the control group that would receive a general information. As a matter of fact, the observation would be done as a post-intervention measure, via the shopping cart on the application that keeps purchase history and receipts.

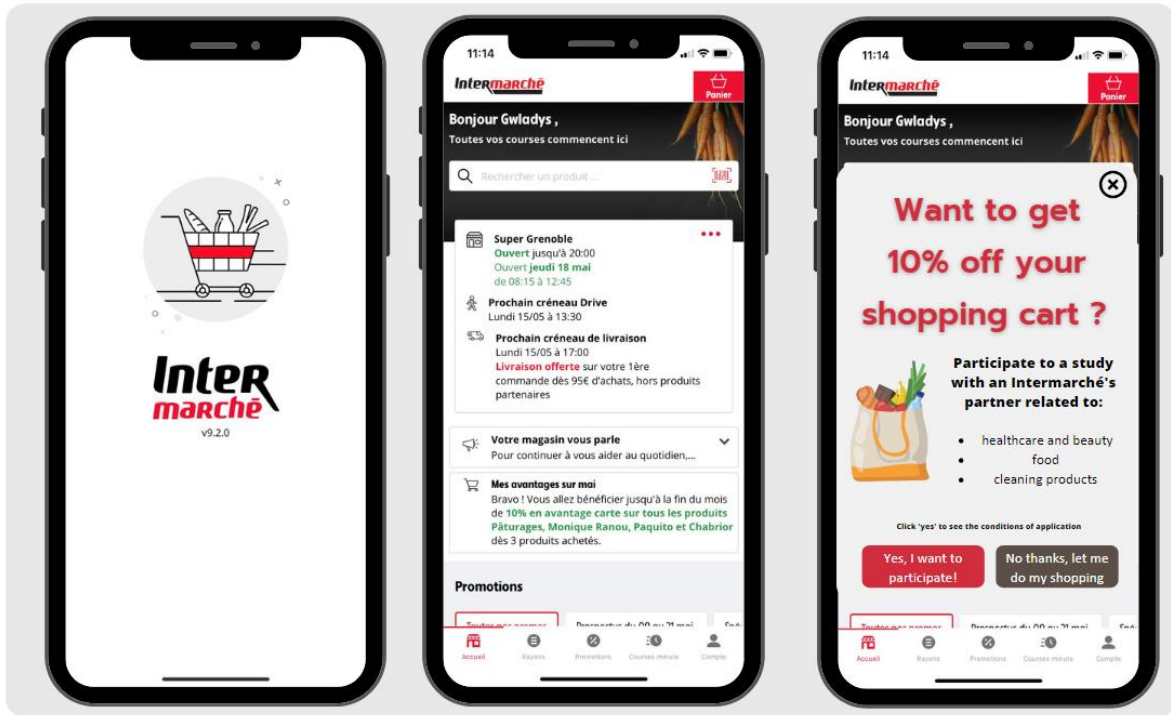


Figure 4 : Recruitment of participants – notification and incentive

CHAPTER 5 – STUDIES DEFINITION

To test the different hypotheses, I will propose three studies, including two quasi-experimentations and one qualitative study.

I. STUDY 1

The first study aims to determine if indeed a traditional boost that increases competences and respects autonomy is more effective than a nudge or no intervention at changing participants' purchasing behaviour.

A. Intervention development

In this quasi-experiment, the intervention targets the search environment of the participants, as the message is present on the app in the section of products that individuals would have chosen. The illustration (Appendix 2 : Components of the three cells of study 1 shows the messages presented related to products in the healthcare and beauty section (dermal route of exposure). However, please note that the messages would also be adapted and presented in sections related to food (ingestion), and cleaning products (inhalation).

The nudge message is made on a social norm, as according to Whitmarsh et al. (2021), even if informational methods are generally less effective than other kind of interventions, social influence through norms appealing is one of the most effective informational approaches to change behaviour. For convenience reasons as the study is via an application, an informational approach was more suited and it allowed to keep a short message. This nudge tries to increase the risk perception of endocrine disruptors by giving a percentage of French people worried about EDCs. It also tries to include a norm such as half of the people take care of choosing carefully their products. The tagline is the following:

“50% of the French consider that the risks linked to endocrine disruptors are high.

And 50% review the list of ingredients in their cosmetics before buying care products.

What about you?”

The boost message is made really simple in order to get a text of a similar length as the nudge. It explains the consequences of the endocrine disrupting chemicals on the human’s health, and it provides simple recommendations to avoid these harmful ingredients, still by respecting one’s autonomy of action and choices. The purpose of the boost is to increase the understanding of the risks of purchasing products with EDCs. The message is the following:

“Personal care products are the primary route of exposure to endocrine disrupting chemicals.

They can cause cancer, allergies, obesity and other diseases.

To stay safe:

- *try avoiding plastic packaging*
- *try avoiding phthalates, parabens, phenols if possible,*
- *try buying natural, organic or make your own products”*

The control group also gets a general message in order to respect a similar cognitive task between the three groups. However, the message of the control group cannot be persuasive, and should not bring any competencies to the participant. Thus, still with the example of the healthcare and beauty section, I chose to show a fun fact message on this general topic to the participants of this group. The information is the following:

“Fun fact: Cleopatra was the founder of the skin-care and cosmetic industry!

She did develop her own manufacturing plant to produce perfumes, cosmetics, skincare potions and many more!”

B. Treatment delivery

The experiment takes place on the Drive application. Participants that agreed to participate to the study –via a notification on the main page of the app- would be randomized into the three different groups. They would afterwards be shopping as usual, but would have a different intervention poster in the different sections they would go on the app (healthcare, food, cleaning products). The poster would be present on participants' app until their first purchase. In order to avoid a loss of respondents if they do not complete their purchase, we would stop the recruiting process from the moment we reach 50 participants per group who completed a purchase and answered the measurement questionnaire afterwards.

C. Measurement

The effect on the purchasing behaviour of products would be measured through observations of the online shopping carts that the supermarket would share in an anonymous way with us. The first step would thus be to collect the list of products purchased by participants directly after the intervention was implemented and the purchase completed. The research team would then analyse the products per category (healthcare and beauty, food and cleaning products). Thanks to the application, we can directly see which products was purchased and click on the product to see the ingredients. This would allow us to detect any harmful substances that we would have had previously categorized as 'potentially harmful' following the literature and/or studies realised in the EDCs domain. In order to conduct these categorizations correctly, the research team would first attend a training by experts in the domain (such as endocrinologists).

Just before completing the online purchase, the participants would be asked to answer the questionnaire in order to get their 10% off their invoice. The questionnaire would be shared through the app and assess gender, age, profession, as well as their specific self-efficacy level, their general self-efficacy trait beliefs and their reactance trait.

Concerning the specific self-efficacy, the scale needs to be adapted to the specific context (Bandura, 2005). As there is no self-efficacy scale that can cover every purpose, there is a need to construct our own scale. I created a scale with 8 items that reflect the construct, see Appendix 4 : Specific self-efficacy scale. Following Bandura (2005)'s recommendation, the items are phrased in order for one's to rate *how certain* one's thinks that one's *can do* the task. Respondents then normally have to rate their degree of capability from 0 "Cannot do" to 10 "Highly certain can do" (Bandura,

2005). However, for homogeneity reasons, I would put all my scales on a 7-point scale. The scale would obviously need to be pre-tested (test-retest) in order to see if in the same conditions the scale yields the same results twice. The pre-test would allow us to remove or rewrite some items in order to increase internal consistency, with the Cronbach's alpha check. If the Cronbach's alpha is above 0,7 it would be good, 0,5 being the minimum. Then, the homogeneity of the items would have to be tested by a factor analysis (KMO and Bartlett's test).

For the general self-efficacy trait, the scale of Schwarzer and Jerusalem (1995) would be used, see Appendix 5 : General self-efficacy scale. It is based on 10 items related to one's belief in one's abilities to deal with different situations in life. It is linked to positive coefficients (optimism, emotion) and negative ones (depression, stress, anxiety etc.) (Schwarzer et Jerusalem, 1995). Respondents have to rate their degree of agreement from 1 "Not at all true" to 7 "Exactly true". Then the total score is calculated by adding the sum of all the items. The higher the score is, the higher is the general trait of self-efficacy. Concerning the internal reliability of the scale, the Cronbach's alphas are between 0,76 and 0,90 (Schwarzer and Jerusalem, 1995).

Finally, the reactance trait would be measured with Hong and Faedda (1996)'s psychological scale, see Appendix 6 : Psychological reactance trait scale. The scale wants to measure the person's propensity to experience psychological reactance (Shen et Dillard, 2010). The scale has 11 items (after the 1996's refinement of the scale) and 4 factors. The internal reliability for the 11 items scale is 0,77 and the correlation between the items is $r=0,98$. Respondents have to rate their degree of agreement on a 7-point Likert scales ranging from 1 (not at all) to 7 (very much).

D. Analysis

A quantitative analysis would be conducted on the different observational data and on the measures collected through the questionnaire.

In order to do statistical analysis, we would first process to a cleaning of the data. We would have to verify that participants indeed saw the treatment (the nudge or the boost), by checking the control question. We would also check that participants are well more than 18 years old, and speak French (as the other control variables such as the possession of a fidelity card and the recurrent purchase on the Drive application would be automatically processed by the app).

Then, in order to perform any test, we would code the data to get only numerical values. We would then perform the analyses on SPSS. The independent variable (traditional boost / nudge / control

group), the profession and the gender are qualitative value (string). For these values, we would calculate the mode, frequencies and percentages to see how each group is distributed.

However, the purchasing behaviour, the age, the specific self-efficacy, the general self-efficacy and the reactance trait are quantitative value (continuous). We could consider the three last variables as ordinal but to facilitate the statistical tests we would consider them as continuous. We would then calculate the mean and the standard deviation.

To start this analysis, we would for example do a Student test in order to compare the means between men and women regarding their purchasing behaviour. Then, we would also, by computing new variables, compare the means of the traditional boost cell and the nudge cell regarding their age and their purchasing behaviour. This would help us determine if there is a difference of the tool's effectiveness among participants regarding their age and their gender.

Following the hypotheses of the sub-model, we first want to determine the direct effect of the quasi-experimental cells on the purchase behaviour. We want to know if there are differences (H1: there are differences) in purchasing behaviour between a traditional boost, a nudge and the control group, or not (H0: there are no differences). We would perform an ANOVA, which is a one-way analysis of variance, in order to determine if there are any significant statistical differences between the means of the three groups (traditional boost, nudge or control group), regarding the purchasing behaviour. However, before applying the ANOVA, we would first have to check the homogeneity of variances (Leven test), and the normality test (Kolmogorov-Smirnov and Shapiro-Wilk). We would interpret all the statistical results with a 5% risk of error.

We would also perform an ANOVA to determine if the independent variable (traditional boost / nudge / control group) has an effect on self-efficacy. Then, we would do an independence test (Pearson correlation) between the specific self-efficacy and the purchasing behaviour to determine the relation and its intensity (sign and value).

Then, we would perform a multivariate analysis to distinguish the types of relationship between the variables. The purpose is to determine if the effect of the tool (Independent variable) on the purchasing behaviour is mediated by the specific self-efficacy. To do so, I would use the MACRO Process to determine the simple mediation.

Finally, I would also use the MACRO Process to determine if the effect of the tool on the purchasing behaviour is moderated by the general self-efficacy and the reactance trait. More particularly to determine if the boost or the nudge would be more effective when associated with a high vs low level of reactance trait or general self-efficacy.

II. STUDY 2

The purpose of this study is to determine whether a boost that includes the relatedness component of the self-determination theory improves the effectiveness compared to a traditional boost that would respect the need of autonomy and competences.

A. Intervention development

In order to test the hypotheses related to this sub-model, I chose to establish this study in two phases.

In the first phase, participants would be exposed to the same boost and control group's messages than in study 1, in order to verify that the boost was effective at changing participants' purchasing behaviour. Having the same boost and the same control condition message would also allow me to prepare the participants to the phase 2, as it would raise their awareness and probably their interest in going further into the study. Indeed, as we defined boosts earlier, the boost need to be transparent and the individuals need to be voluntary involved and interested in changing their behaviours. Thus, the phase 1 acknowledges the risks of EDCs, and explains that there are some ways to avoid them.

In phase 2, participants would be randomly assigned to one of the three following groups: the SDT aligned boost, the traditional boost or the control group. In this phase, the material would take the form of an e-book, in order to facilitate the transmission to participants and to be more convenient to implement.

The e-book of the traditional boost would then respect the need for competence and autonomy, which means that the e-book would be designed to tell about the impact on health of EDCs, bring competences to participants on how to find these chemicals, how to avoid them but also how their purchasing habits can be linked to negative health effects. Of course, the e-book would be targeting the three routes of exposure: inhalation, dermal and ingestion. The e-book would also provide recipes in order to provide participants from different socio-economic backgrounds alternatives following their budgets. Indeed, if we take the example of cleaning products, some participants could prefer to purchase branded products that can be organic, whereas for some others it may be too expensive and may prefer to make their own instant products for a cheap price but with the same efficacy, such as vinegar, baking soda or for example sodium percarbonate etc.

Moreover, it would also respect the need for autonomy, as it would explain to participants how to choose products when they are facing the different products of a grocery shop, without a research team that is selecting products for them (from what we can see in previous EDCs related health studies in literature). If the e-book provides alternatives products, it also provides alternatives in terms of behaviour if the change is not possible. For example, if they can't change one habit because they like the product too much, or if the alternative is too expensive, it requires too much cognitive effort or whatever. The e-book also wants to tell participants that it is normal and it is 'okay' not to change everything. They need to go step by step, without pressure, and they can try to reduce the EDCs present in really high quantity in other products rather than changing everything at once.

On the other side, the boost aligned with the Self-determination theory would also have these two competence and autonomy dimensions described above, but the relatedness dimension would be also added. To answer this need, the e-book would be provided in addition of feedback on their purchases as it can be a learning tool to help participants understanding their actual consumption behaviour (Darby, 2006). Participants would also be motivated to join a social media conversation, on WhatsApp (it they want it). The purpose of this conversation is to let participants ask and answer questions together, as well as sharing knowledge or tips together. This can be linked with social feedback that comes from approval or disapproval, encouragement and advice from one's peers. As participants would be on this conversation voluntarily, and according to their interests (as a boost needs to be self-involved to be effective), I suppose that this conversation can bring the feeling of a community to participants, where they can freely talk and be an in-group member. Participants would be encouraged in this group to share articles, blogs, documentaries or even podcasts to learn more about the topic. If the conversation is not active enough, one member of the research team would be asked to share on the group or ask for advice in order to push the conversation. Finally, participants would be proposed one workshop session or a webinar following their preferences in order to increase relatedness and social enhancing through interactive modules for example.

The control condition would be provided with materials that can't be linked with the need for competence, autonomy or relatedness. However, the control condition still needs to receive an e-book in order for participants to receive the same kind of material as the other groups. Because the message in study 1 is related to a fun-fact on the general domain of healthcare and beauty, the e-book that participants would receive in study 2 would be a list of fun facts on general domains linked to food, beauty or cleaning. The information would be carefully selected in order to not be in relation with health or the EDCs domain.

Concerning the similarity of material provided, the traditional boost and the control group would nevertheless not receive feedback or be added in any social media conversation, in order to avoid an overlap on the boost aligned with SDT.

The sum-up of what material is inside every group is available in Appendix 3: Components of the boosts in study 2 following the SDT approach.

B. Treatment delivery

As said above, the treatment delivery would be done in two phases.

The first phase would be the delivery of the Study 1 material of the boost and the control group after participants' agreement to participate to the study on the Drive application of the supermarket. At this point, participants would be randomized into two different groups: the traditional boost and the control group. The material would be provided such as in study 1, such as a poster intervention in different sections on the app (healthcare, food, cleaning products). Once again, in order to avoid a loss of respondents if they do not complete their purchase, we would stop the recruiting process from the moment we reach 50 participants per group who completed a purchase, agreed on participating to phase 2 and answered the measurement questionnaire afterwards. Participants would get 10% off their invoice if they participate to the study.

After this first purchase, participants would be told that they have the possibility to get more competences on this topic, and would be asked if they want to participate to the second phase, with an additional incentive of 5% off their invoice for their next grocery shopping.

Participants who received the boost in phase 1 would then be randomly assigned to two groups: one receiving the boost aligned with SDT, the second receiving the traditional boost. Participants who were assigned to the control group in phase 1 would still be serving as a control group in phase 2. Moreover, participants would have time to get acquainted with the material and would be asked if they indeed read it with a simple control question in the questionnaire of the phase 2.

The exception here is for the SDT boost cell, who would have to receive some aspects of the relatedness dimension directly after assignment to their group. Indeed, because of the limited time of the study and also the possible limited measurement on participant's' purchases, we would need to give participants feedbacks on their first purchase to be sure they would have time to process the information and to be able to measure the impact of the relatedness dimension on the purchase 2.

C. Measurement

The measurement process would be the same as in study 1. The effect on the purchasing behaviour of products would be measured through observations of the online shopping carts that the supermarket would share in an anonymous way with us. We would track and document the frequency and type of products purchased by the participants in both the interventions and control groups in order to measure participants' short-term outcomes.

Just before completing the second online purchase, the participants would be asked to answer the questionnaire in order to get their additional 5% off their invoice. The questionnaire would be shared through the app and assess gender, age, profession, as well as their specific self-efficacy level, basic psychological needs satisfaction level, risk perceived, personal involvement and behavioural control. However, the control group would not receive any questionnaire as the information provided to them is not supposed to influence their self-efficacy level or other moderators.

The specific self-efficacy level would be measured with the same scale as in study 1 (Appendix 4 : Specific self-efficacy scale).

The basic psychological needs satisfaction would be measured with Sheldon et al. (2001)'s scale, see Appendix 7 : Psychological need satisfaction level scale (SDT) It is a 9-item scale that looks for the satisfaction of autonomy, competence and relatedness. The items would be rated on a 7-point Likert scales ranging from 1 (Completely disagree) to 7 (very much). The Cronbach's alpha was for example measured in Chen et al. (2014)'s study, and was 0,69 for autonomy, 0,77 for relatedness and 0,81 for the competence dimension in a Belgian sample.

Then, the level of risk perceived would be measured via an adaptation of Campbell & Goostein (2001)'s scale, see Appendix 8 : Risk perceived scale. In order to match the topic, I adapted the items and therefore would have to pretest it to check for the validity of the scale and/or rewrite some items. Then, the homogeneity of the items would have to be tested by a factor analysis, and the reliability should be checked with the Cronbach's alpha. Moreover, it is a semantic differential scale, so the respondents would have to choose between how they feel about endocrine disruptors through opposite adjectives. There would be seven intervals between adjectives in order to remain coherent with the other scales of this study.

Furthermore, the personal involvement scale would be measured with Strazzieri and Hajdukowicz-Brisson (1995)'s scale (see Appendix 9 : Personal involvement scale measuring the stable trait of involvement of a respondent for a product or an activity. The scale is made of 6 items in total, related to personal relevance, interest and attraction (2 items each). For this study I would adapt the scale by

modifying the word “product” by “topic” and make it a 7-likert scale. Concerning the validity of the scale, the authors stated that all the item-total score correlations were high, from 0,71 to 0,87, and that all intercorrelations between items were also good (between 0,41 to 0,74). Finally, they stated that the Cronbach’s alpha was 0,892, which is good.

Finally, the perceived behavioural control would be measured with an adaptation of Ajzen (2002)’s scale from the Reasoned Action Approach theory, see Appendix 10 : Perceived behavioural control scale. The scale was initially applied in the context of organic food purchasing (Aikten et al., 2020) and had a Cronbach’s alpha of 0,627, which is quite low but still acceptable as the scale has only 3 items.

In order to determine the possible long-term effects of these two types of boost, I propose to do a follow-up study one month after to assess the durability of the intervention effects. I would then re-administer the measures from the post-intervention assessment.

D. Analysis

Such as Study 1, a quantitative analysis would be conducted on the different observational data and on the measures collected through the questionnaire. The same way, we would first clean the data, verify the control question, and code the data. First, the analyses on gender and age would be done the same way as in study 1.

Concerning the hypotheses of the sub-model 2, we also want to determine the direct effect of the quasi-experimental cells on the purchase behaviour. We want to know if there are differences in purchasing behaviour between a traditional boost, a SDT-aligned boost and the control group, or not. We would also perform an ANOVA in order to determine if there are any significant statistical differences between the means of the three groups (traditional boost, SDT-aligned group or control group), regarding the purchasing behaviour. We would also first check the homogeneity of variances (Leven test), and the normality test (Kolmogorov-Smirnov and Shapiro-Wilk). We would interpret all the statistical results with a 5% risk of error.

An ANOVA would also be performed here to determine if the independent variable (traditional boost / SDT-aligned boost / control group) has an effect on self-efficacy. Then, we would such as in study 1 do an independence test (Pearson correlation) between the specific self-efficacy and the purchasing behaviour to determine the relation and its intensity (sign and value). We would also do this test between the basic psychological needs satisfaction and the purchasing behaviour, as well as with the other variables I put in moderators.

Also, with the MACRO Process with simple mediation we would determine which type of relationship is between the variables, and see if the effect of the boost on the purchasing behaviour is mediated by the specific self-efficacy.

Finally, the MACRO Process would also allow us to determine if the effect of the boost on the purchasing behaviour is moderated by the risk perceived, the perceived behavioural control, the personal involvement and more importantly by the satisfaction of the basic psychological needs. This moderation analysis would allow us to determine if first, there is a moderating effect from these variables, but also if the boost is more effective when associated with a high vs low level of satisfaction, risk perceived, control perceived, or personal involvement.

III. STUDY 3

Finally, in order to gain in-depth insights, I propose to conduct off-line focus groups with participants from the SDT-aligned boost group and the traditional boost group. These focus groups would also allow us to determine the value of the intervention, and know if it is worth or not.

A. Focus groups

First of all, I chose focus groups instead of in-depth interviews in order to be less time-consuming for the participants that already spent time to answer the questionnaire of study 2, but also for the researchers. Moreover, the discussion in groups may be a driver to collective intelligence. Indeed, as the topic is not too sensible, participants may feel at ease to talk freely. The advantage of this discussion compared to in-depth interviews is that participants can interact and offer divergent opinions.

The different themes covered would be about the participants' experiences, motivations, breaks and perceptions (such as negative perceptions toward organic products, the price of the alternatives, the cognitive effort etc.) of the intervention. More particularly, the boost may be more relevant in some products categories, following the personal relevance of the participants. This qualitative exploration would allow us to identify the contexts in which participants are more likely to make efforts to avoid EDCs. For example, some people might mistakenly feel that the dermal route is more at risk than the ingestion or inhalation one, or reversely, and make least efforts in these products categories.

This qualitative exploration could provide insights to adapt the material for improving its effectiveness on the routes of exposure that are less taken seriously.

Diverse methods would be used: open and non-directive questions but also projective scenarios to determine what they would change in this intervention.

B. Treatment delivery

The qualitative study would be proposed to participants through the app, such as the participation's agreement. Once it is agreed, the research team would be in contact with the participants and provide them a consent form for legal and ethical reasons. The number of focus groups needed would be determined and adjusted according to the results observed and the need for in-depth exploration. Per focus group, there would be around 8 participants. However, in order to avoid a loss of participants during the recruiting phase, we would recruit 10 participants per focus groups, in case anyone cannot honour the meeting. The participants would be selected from the list of study 2's participants in the traditional boost cell and the SDT-aligned boost cell. In order to get more relevant information, we would try to recruit participants from different age, men and women.

The focus group would take place in a calm place, such as a meeting room that we would rent for approximately 2 hours, the length of the focus group. In order to favour interaction, participants would be sitting in a circle or U-shape. After an ice-breaker from the host to build group cohesion, the animator would start asking open and non-directive questions that would be prepared in advance. During the talk time, someone who doesn't take part in the oral would take notes and would record the session.

C. Analysis

The analysis would begin as soon as the data collection begins. After the focus group, we would proceed to an immediate transcript in order to avoid any omission. We would also code the transcript in order to get any hesitation, sigh, laughter etc. After the transcription is finished, we would debrief on the big themes that emerged, and proceed to a vertical analysis, per question / topic. We would also analyse the qualitative data to identify themes related to competence, autonomy, relatedness, and their impact on learning and behaviour change. Finally, we would use these rich data to proceed to interpretation of the different information collected.

CHAPITRE 6 – DISCUSSION

The present research sought to identify whether adding the ‘relatedness’ dimension of the self-determination theory to a traditional boost that commonly respect the ‘competence’ and the ‘autonomy’ dimensions, improves its effectiveness. To test it, I proposed 3 studies to compare the three dimensions’ boost intervention with a traditional boost intervention in a highly relevant field setting: purchases of products with(out) endocrine disrupting chemicals in a supermarket, and more particularly on the supermarket’s drive application. Based on the literature, I wanted to answer the following question: *Can shaping a boost according to the codes of self-determination theory improve its effectiveness in health? - Focus on buying endocrine disruptor-free products in supermarkets.*

I targeted EDCs context because we are in constant contact with these substances, and the cocktail effect we get every day can cause many diseases, which makes it a major societal problem. I wanted to work particularly on the purchasing behaviour in supermarkets in order to reach a high proportion of the population, as the vast majority is doing grocery in large distribution shops. Also, as the routes of exposure to endocrine disrupting chemicals are either dermal, from inhalation or ingestion, products related to these three routes would be all present in supermarkets. While endocrine disruptors are everywhere, even where we don’t expect them (e.g. in the dust, on cash receipt, on babies’ clothes...), even people who are aware of the risks may be mistaken and buy contaminated products. And especially with the high risk of greenwashing in shops. That’s why targeting supermarkets was for me essential, as high, medium and low income households may all be purchasing in these stores and therefore may all be concerned with the health’ related risks.

I. IMPLICATIONS FOR RESEARCH AND PRACTICE

This work provides various implications, rather academic or managerial.

A. Research implications

This dissertation aims at answering many gaps in literature related to the EDC domain, boosts and the self-determination theory. First, the topic of EDCs is not a common research subject in marketing. Studying the purchasing behaviour of products with or without EDCs was not done in literature at my knowledge. This can however provide insights to fight the devil directly to the roots of the problem.

Moreover, in EDCs literature, researchers aimed at bringing competences to participants by raising knowledge to them and providing educational material. However, in most of the studies I read the researchers provided the alternatives products directly to the participants without teaching them how to be autonomous in their decision making. Thus, the addition of the three dimensions of the SDT approach is also an implication for research.

Furthermore, this research aims to target the three routes of exposure, when most of the studies focused only one route despite the cocktail effect we have in our everyday life. Also, this dissertation targets men and women, while in EDCs literature women were primarily focused, which would provide new data on how to convince men to take care of their own health and the one of their family.

Also, this is to my knowledge the first time that we try to determine whether a boost aligned with the SDT is more effective than a more traditional boost, which could help to more clearly define the concept of boost, that is still unclear in literature. Indeed, the boost in general is still a tool not much discussed in literature, or often discussed in a comparison to nudges.

Another implication is that conducting focus groups can provide rich insights into consumers' experiences, motivations, and perceptions of the SDT-aligned boost. Exploring participants' perspectives can shed light on the specific elements of the boost that are most impactful and the barriers they face in making purchasing decisions aligned with endocrine disruptor-free products.

B. Managerial implications

This dissertation also has different managerial implications.

First of all, in a supermarket point of view, this research can help food companies to get a good image toward their consumers and a positive word-of-mouth. Indeed, if a supermarket is doing a partnership in order to improve consumers' risk perception, provide them alternatives and competences to choose carefully, the supermarket might get a better image than the one that drives consumers to over-consume, especially unhealthy products. It can also provide companies market differentiation, as supermarkets who proactively address the issue of endocrine disrupting chemicals can communicate about their commitment to their consumers' health, which can be favoured by consumers who value transparency and search for safe products.

Moreover, if consumers are more aware of the risks and try to reduce their consumption of products with EDCs, they might indeed buy less products, but they may buy more organic products, which are generally more expensive. Following this, the supermarket could propose more local,

organic and natural products to fulfil their consumers' needs and desires and enter a virtuous circle for the supermarket's image, the local economy and the consumers' health.

On the side of public services (such as cities town hall etc.), this research could be beneficial as if a SDT- aligned tool is effective, it could increase the population's risk perception, change its purchasing behaviour and thus reduce the healthcare system's costs by reducing diseases linked to EDCs such as obesity or cancers.

Furthermore, as it is an easy tool to implement, it could be reproduced to a large scale and at a rather low cost. If developed enough, the boost could then stimulate product innovation as consumers would search for healthier products and manufacturers would feel obliged to develop safer alternatives.

Last but not least, if to bring change interventions at multiple levels –systemic or individual- are needed, one is not going without the other. Indeed, individuals can have the potential to push systemic change, but they also need to be supported by policies (Nielsen et al., 2020). This dissertation wants to provide individuals core competencies to bring change for the environment protection but also for the society welfare.

II. LIMITATIONS AND FUTURE RESEARCH

If my work can have different implications, it is not without limitations.

First of all, as the present research is being proposed on the social marketing scope only, there is a risk that proposing participant some guidelines to choose products without EDCs, would increase another EDC concentration in the body due to alternative chemicals that are not discussed much yet about in the scientific field. Future research could be made in collaboration with a scientific lab to determine and test different products to recommend that do not contain EDCs.

Moreover, by pre-selecting participants via a fidelity card, we have a risk of selection bias. Future research could try this study on site in supermarkets in order to respect a full randomization. This would also allow to reach more customers, that don't necessarily have a fidelity card or that don't buy through a Drive application.

Also, the quantity of products containing EDCs may vary according to the type of shopping. For example, there may be more EDCs in shopping carts that are made to welcome people to eat (e.g.

more chips, sweets or salty things), thus it may be relevant to put as a control variable the type of shopping done to be analysed, for example a minimum quantity of articles purchased in one time.

The use of monetary incentive can also be considered as a limitation, especially when the boost is supposed to be effective particularly on involved individuals. Thus, the desire to have a discount (even if it is a small monetary incentive), may mitigate the results.

Another limitation is the use of focus groups. If they are time-consuming and cheaper to apply than individual interviews, they however have disadvantages. First of all, there could be biases coming from the lack of neutrality of the moderator / the animator of the session. Moreover, some participants may be more 'leader like' and monopolize the talk time, reducing other participants' voices. Every participant may also have a speaking time as they are many in each session. Most importantly, there is a risk of desirability bias for participants, for example if they don't want to purchase healthier products due to different reasons (high price, unavailability etc.). Indeed, if they can't change and are facing people that have a positive opinion toward the behaviour change, they might feel ashamed of the statu quo or feel like they put their family in danger. Finally, external validity of focus groups is generally low as they are often not generalizable. Thus, results must be treated with caution.

Furthermore, nudges and boosts are often compared, and sometimes used at the same time. For example, by first implementing the nudge to induce the behaviour change, and once the behaviour is changed, implementing the boost to explain why this behaviour change is important, e.g. Roekel et al. (2022). Thus, it could be relevant for future research to test a SDT-aligned boost in combination with a nudge in order to get quick effects and test the long-term effects of the mix.

Also, a boost on endocrine disrupting chemicals may be more effective on individuals who have children, as individuals' own well-being and their family's one is the most important factor to them (Stern et al., 1993). Hence, future research could try to determine if the effectiveness of a boost in this context is dependent on the products categories (e.g. baby drinks brands, family breakfast brands, children clothes etc.).

Last but not least, future research could as well focus on trying different kinds of SDT-aligned boosts in this EDCs context, for example such as 'La Fresque du Climat' concept that is educating people through workshops on climate change based on the GIEC report. The concept has already attracted more than 1 million participants in 132 countries in the world¹⁰. Thus, a concept similar to educate precisely on EDCs could be relevant and easily adapted to respect the three dimensions of the SDT.

¹⁰ <https://fresqueduclimat.org/> consulted on 29/05/2023

CONCLUSION

In this dissertation, I wanted to show that nudges and boosts are both effective in changing consumers' purchases behaviours of products in supermarkets. However, I hypothesized that a traditional boost was more effective than a nudge at reducing consumers' purchases of EDC contaminated products, and that a three dimensions' boost was more effective than a traditional boost. I compared the three dimensions' boost with the traditional one in many ways following the studies. Furthermore, the studies I propose provide an indication that the positive effects of the boosts are mediated by the level of self-efficacy thanks to an increase in competences, autonomy and relatedness. Yet, if the three dimensions' boost is indeed more effective than a traditional one, I admit that an additional follow-up study would be needed to determine the long-term effects or discrepancies. The biggest implications of this research are that if effective, it could reduce consumers' diseases on the long term and reduce the healthcare system's costs to a large extent. This tool is also applicable on a large scale to a rather low cost, which makes boosting a vital intervention in such a health context.

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ABBREVIATIONS AND ACRONYMS USED

WHO: World Health Organization

EDC: Endocrine disrupting chemicals

IRSN: Institut de radioprotection et de sûreté nucléaire

ANSES: Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail

ATSDR: Agency for toxic substances and disease registry

RES: Réseau Environnement Santé

EU: European Union

FDA: Food and Drug Administration

BPF: Bisphenol-F

BPS: Bisphenol-S

PBP: Polybenzoxazine precursor

DINCH: Diisononyl 1,2-cyclohexanedicarboxylic acid

SNPE: Stratégie nationale sur les perturbateurs endocriniens

BPA: Bisphenol-A

TCS: Triclosan

TCC: Triclocarban

SDT: Self-determination theory

RAA: Reasoned action approach

TPB: Theory of planned behaviour

GLOSSARY

Endocrine disrupting chemicals: According to the World Health Organization (WHO), endocrine disruptors are chemical substances -which can be of natural or artificial origin- that are foreign to our body and can interfere with the functioning of our endocrine system.

Persuasion: Persuasion refers to “the active attempt by an individual, group, or social entity (e.g., government, political party, business) to change a person’s beliefs, attitudes, or behaviours by conveying information, feelings, or reasoning” (Cacioppo et al., 2018).

Attitudes: Attitudes can be defined as “general evaluations people hold in regard to themselves, other people, objects, and issues” (Petty et Cacioppo, 1986).

Behaviours: Behaviours are defined as observable actions made by a person (Cacioppo et al., 2018).

Nudges: Nudges can be defined as “any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives” (Thaler et Sunstein, 2008, p.6).

Boost: The term ‘boosting’ (Hertwig et Grüne-Yanoff, 2017) refers to a policy approach that is empowering individuals by giving them competencies, skills, knowledge and decision tools (Grüne-Yanoff, 2018) to make good and informed decisions. They have to be explicit, visible, transparent and respectful of one’s autonomy. They need individual participation in order to be effective.

Self-determination theory: Self-Determination Theory (SDT) is a theory of motivation and personality development that explains why some people are more motivated than others and how individuals' intrinsic motivation can be nurtured and enhanced. It was developed by Edward Deci and Richard Ryan in the 1980s. It is based on the idea that individuals require to maintain satisfaction of three psychological needs to get psychological health and well-being (Williams et al., 2011). These needs are autonomy, competence and relatedness.

Self-efficacy: Self-efficacy refers to an individual's belief in their own ability to achieve success in a particular area (Bandura, 1977).

Reactance trait: It is defined by Brehm and Brehm (1981) as “the motivational state that is hypothesized to occur when a freedom is eliminated or threatened with elimination”. The theory of psychological reactance posits that the reactance trait is the reason why individuals perceive persuasive messages as threats to their freedom, which induces the message to be ineffective.

Personal involvement: Zaichkowsky (1985) defines involvement as an individual's perception of the communication's relevance based on their needs, values, and interests. Involvement plays a crucial role in influencing the extent and manner in which persuasive communication is processed (Petty and Cacioppo, 1981, 1983). When individuals are highly involved, they are more motivated to exert cognitive effort in evaluating the product, as opposed to low involvement where less effort is dedicated (Petty, Cacioppo, and Schumann, 1983).

Perceived control: Perceived behavioural control refers to an individual's perception of the ease or difficulty involved in carrying out a specific behaviour, as defined by Fishbein and Ajzen (2010). It is part of the Reasoned Action Approach (RAA), previously known as the Theory of Planned Behaviour (TPB).

Perceived-risk: Risk perceptions is sometimes considered as stable beliefs that are retrieved from memory when needed. In a context of consumption Campbell and Goostein (2001) suggest that the level of perceived threat plays a crucial role in how individuals evaluate products. When consumers perceive a high level of threat, they tend to adopt a more cautious and conservative approach. Conversely, when the perceived threat is low, individuals tend to evaluate products more positively.

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APPENDICE 1: THE ENDOCRINE SYSTEM, A SET OF GLANDS THAT SECRETE HORMONES TO BE RELEASED IN THE BODY

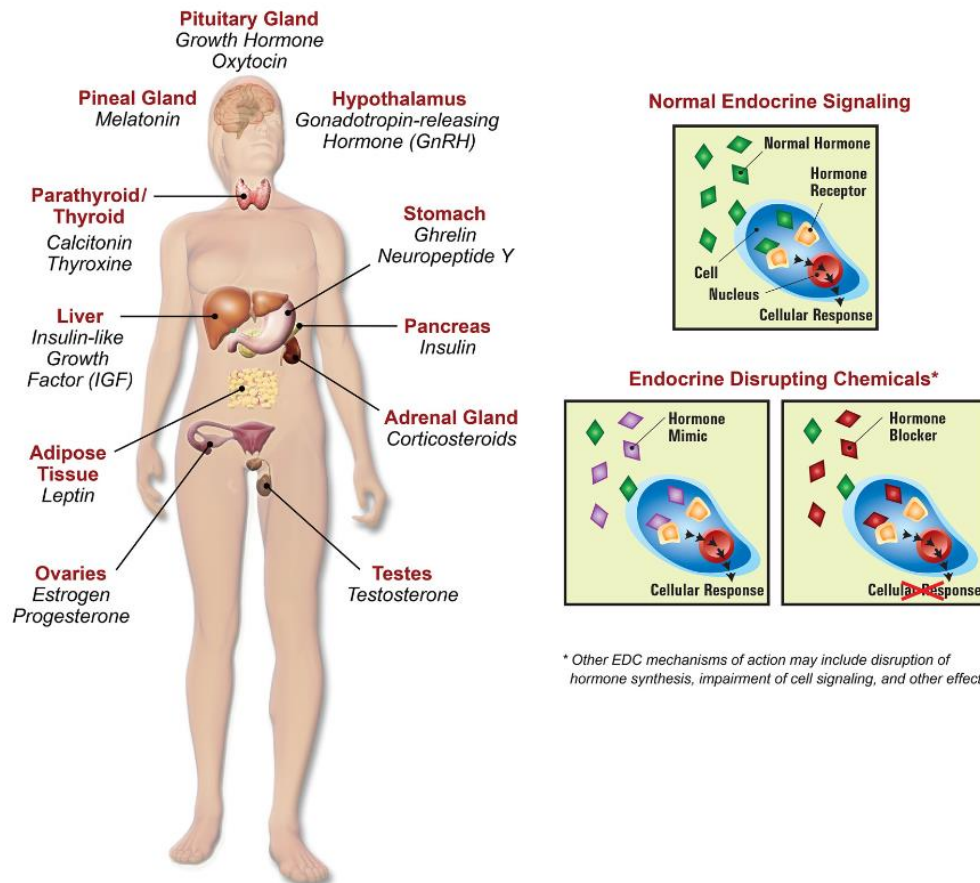
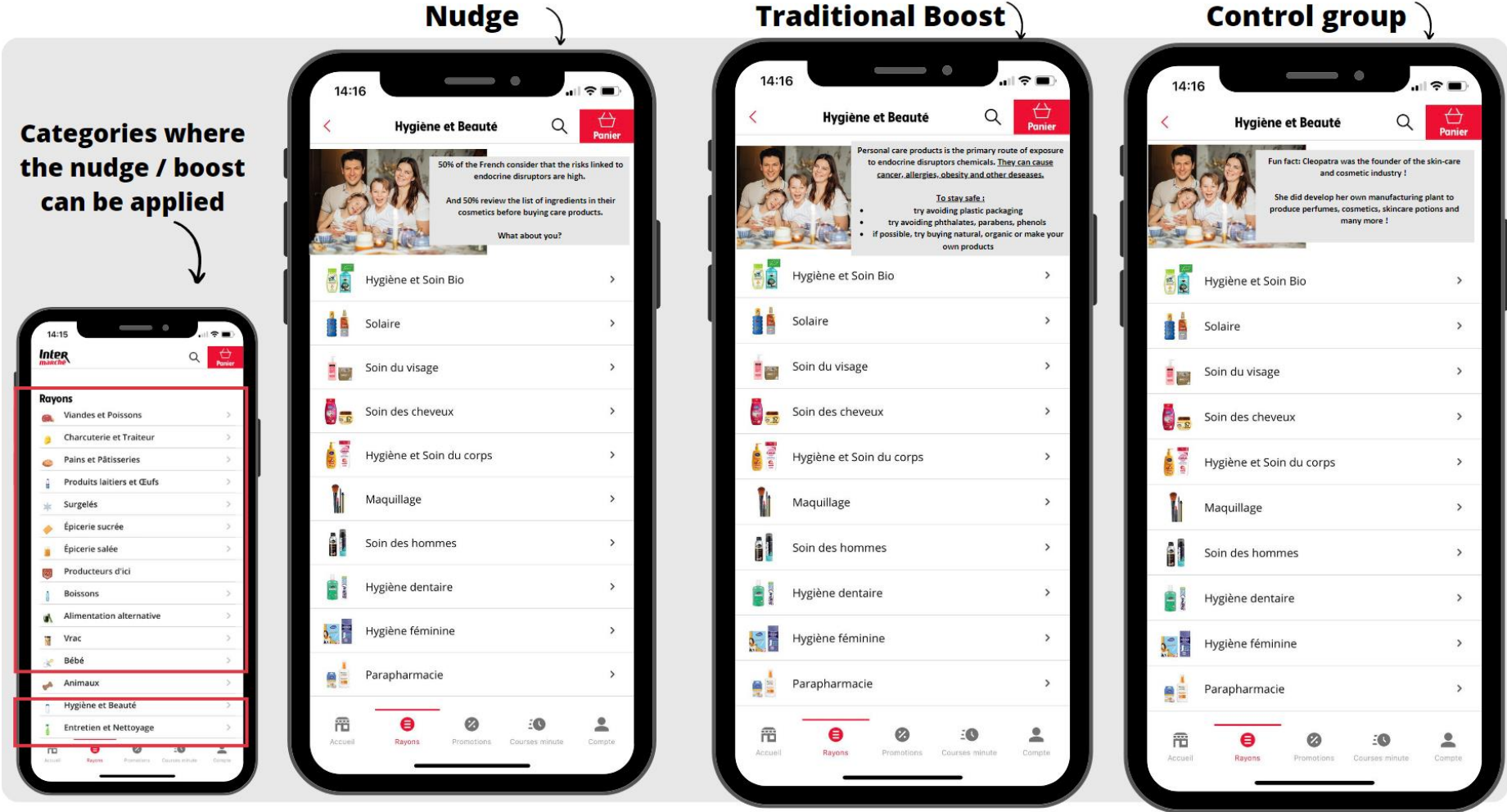


Figure 1. * Other EDC mechanisms of action may include disruption of hormone synthesis, impairment of cell signaling, and other effects.

Appendix 1 : Illustration from Birnbaum et al. (2016).

APPENDICE 2: STUDY 1 MATERIAL



Appendix 2 : Components of the three cells of study 1

APPENDICE 3: STUDY 2 MATERIAL

	Boost SDT	Traditional boost	Control group
Need for competence	<p>E-book that teaches, for each route of exposure:</p> <ul style="list-style-type: none"> • The harmful effects of EDC on health • The role of purchasing unsafe products related to the harmful effects • Where to find EDC, how to distinguish them, how to read labels • Receptions, • Recommendations to avoid them, propose alternatives products 		X
Need for autonomy	<ul style="list-style-type: none"> • Explain step by step how to choose when facing a multitude of products in one aisle of a grocery shop • Checklist to find safe products on their own • Propose alternatives if behaviour change is not possible (try to reduce, detect the most dangerous products and avoid these ones rather than changing every product...) 		X
Need for relatedness	<p>Recurrent feedback as a learning tool to help participants understand their purchasing behaviour.</p> <ul style="list-style-type: none"> • Provide encouragement and advices to motivate the participant (Darby, 2006) • Increasing the level of participant engagement and interest by proposing resources such as blogs, documentaries, podcasts to learn more about the topic. <p>Propose one workshop session or webinar to make their own cleaning and care products to increase relatedness and social enhancing.</p> <p>Make them join a social media conversation (WhatsApp) to let participants ask and answer questions and share together.</p> <ul style="list-style-type: none"> • Social feedback: approval or disapproval from peers, encouragement and advices have more influence "when the perceiver is considered by the perceived to be relevant to their self-concept, such as an in-group member" (Alicke et al., 2012) 	X	X

Appendix 3: Components of the boosts in study 2 following the SDT approach.

APPENDICE 4: MEDIATION – SPECIFIC SELF-EFFICACY

Please rate how certain you are that you can do each of the things described below. Rate your degree of confidence by recording a number from 0 to 7.

Your answers will be kept strictly confidential and will not be identified by name.

Identify products that are free from endocrine disruptor chemicals.

Read product labels and identify if they contain endocrine disruptor chemicals.

Find trustworthy sources of information to determine if a product is free from endocrine disruptor chemicals.

Compare different brands and choose products that are less likely to contain endocrine disruptor chemicals.

Navigate through product ingredients and identify those that may be endocrine disruptors.

Make informed decisions and select products that are free from endocrine disruptor chemicals.

Get the self-discipline to consistently choose products that do not contain endocrine disruptor chemicals.

Influence others around me to also choose products that are free from endocrine disruptor chemicals.

Appendix 4 : Specific self-efficacy scale

APPENDICE 5: MODERATOR – GENERAL SELF-EFFICACY

Please read each of the following items carefully, thinking about how it relates to your life, and then indicate how true it is for you.

Use the following scale to respond: 7-point Likert scales ranging from 1 (not at all true) to 7 (exactly true).

General Self-Efficacy Scale (GSE)

	Not at all true	Hardly true	Moderately true	Exactly true
1. I can always manage to solve difficult problems if I try hard enough	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. If someone opposes me, I can find the means and ways to get what I want.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. It is easy for me to stick to my aims and accomplish my goals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I am confident that I could deal efficiently with unexpected events.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I can solve most problems if I invest the necessary effort.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I can remain calm when facing difficulties because I can rely on my coping abilities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. When I am confronted with a problem, I can usually find several solutions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. If I am in trouble, I can usually think of a solution	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. I can usually handle whatever comes my way.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

GSE- Schwarzer and Jerusalem (1995)

Appendix 5 : General self-efficacy scale

APPENDICE 6: MODERATOR – PSYCHOLOGICAL REACTANCE TRAIT

Please read each of the following items carefully, thinking about how it relates to your life, and then indicate how true it is for you.

Use the following scale to respond: 7-point Likert scales ranging from 1 (not at all) to 7 (very much).

Hong Psychological Reactance Scale Items and Factor Structure

<i>Factor</i>	<i>Item Descriptors</i>
Emotional response toward restricted choice	4. The thought of being dependent on others aggravates me. ^a 6. I become frustrated when I am unable to make free and independent decisions. 7. It irritates me when someone points out things which are obvious to me. 8. I become angry when my freedom of choice is restricted.
Reactance to compliance	1. Regulations trigger a sense of resistance in me. 2. I find contradicting others stimulating. 3. When something is prohibited, I usually think, "That's exactly what I am going to do." 14. It disappoints me to see others submitting to society's standards and rules. ^a
Resisting influence from others	10. I am contented only when I am acting of my own free will. ^a 11. I resist the attempts of others to influence me. 12. It makes me angry when another person is held up as a role model for me to follow. 13. When someone forces me to do something, I feel like doing the opposite.
Reactance to advice and recommendations	5. I consider advice from others to be an intrusion. 9. Advice and recommendations usually induce me to do just the opposite.

Note. From "Refinement of the Hong Psychological Reactance Scale," by S. M. Hong and S. Faedda, 1996, *Educational & Psychological Measurement*, 56, p. 177, Copyright© by Sage Publications. Reprinted by Permission of Sage.

^aItems excluded from the 11-item model.

Source: Shen et Dillard (2005)

11-item HPRS - Hong et Faedda (1996)

APPENDICE 7: MODERATOR – PSYCHOLOGICAL NEED SATISFACTION (SDT)

Please read each of the following items carefully, thinking about how it relates to your feeling during your last purchase and then indicate how true it is for you.

Use the following scale to respond: 7-point Likert scales ranging from 1 (not at all) to 7 (very much).

“Following the e-book I received and thinking about my last purchase I felt...”

1. Autonomy

That my choices were based on my true interests and values.

Free to do things my own way.

That my choices expressed my “true self.”

2. Competence

That I was successfully completing difficult tasks.

That I was taking on and mastering hard challenges.

Very capable in what I did.

3. Relatedness

A sense of contact with people who care for me, and whom I care for.

Close and connected with other people who are important to me.

A strong sense of intimacy with the people I spent time with.

BPNSS – Adapted from Sheldon et al., (2001)

Appendix 7 : Psychological need satisfaction level scale (SDT)

APPENDICE 8: MODERATOR – RISK PERCEIVED

Please read each of the following items carefully, thinking about how it relates to your life, and then indicate how true it is for you.

Use the following scale to respond: 7-point Likert scales ranging from 1 to 7.

Concerning the potential presence of endocrine disrupting chemicals in my products, I think it is- **Not at all risky/Extremely risky**

Concerning endocrine disrupting chemicals, I feel – **Not at all concerned/Highly concerned**

I think choosing endocrine disruptors-free products is– **Very unimportant/Very important**

Concerning the presence of endocrine disruptors in my everyday life products, I feel– **Not at all worried/Very worried**

Adapted from:

Campbell & Goodstein (2001)

Semantic differential scale

APPENDICE 9: MODERATOR – PERSONAL INVOLVEMENT

Please read each of the following items carefully, thinking about how it relates to your life, and then indicate how true it is for you.

Use the following scale to respond: 7-point Likert scales ranging from 1 (Do not agree at all) to 7 (Agree entirely).

It is a topic that matters really much for me. (Relevance 1)

One can say that it is a topic I am interested in. (Interest 1)

It is a topic to which I attribute a special importance. (Relevance 2)

I feel specially attracted to this topic. (Attraction 1)

I specially like talking about this topic. (Interest 2)

Just making inquiries on this topic is a pleasure for me (Attraction 2)

PIA – From Strazzeri et Hajdukowicz-Brisson (1995)

APPENDICE 10: MODERATOR – PERCEIVED BEHAVIOURAL CONTROL

Please read each of the following items carefully, thinking about how it relates to your life, and then indicate how true it is for you.

Use the following scale to respond: 7-point Likert scales ranging from 1 (not at all) to 7 (very much).

- If I wanted to, I could buy endocrine disruptors-free products.
- I think it is easy for me to buy products without endocrine disruptors.
- It is mostly up to me whether or not to buy endocrine disruptors-free products.

Adapted from:

Perceived behavioural control (Ajzen, 2002; Arvola et al., 2008)

- If I wanted to, I could buy organic food instead of non-organic food
- I think it is easy for me to buy organic food.
- It is mostly up to me whether or not to buy organic food

Appendix 10 : Perceived behavioural control scale

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