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Nudge marketing: literature review and bibliometric analysis

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Abstract: Nudge theory has had a huge impact on behavior change literature, it has been used in numerous interventions in a wide range of fields. This had led to several variations including nudge marketing. However, there are still few studies on nudge marketing and what it actually represents. The following paper seeks to analyze, review and through this understand the nudge theory by presenting its principles and tools while positioning it in comparison to other methods of behavior change through a literature review combined with a bibliometric analysis. We aim to give a somewhat new definition of nudge marketing using the contributions of behavioral economics and social marketing.

Key words: Nudge, choice architecture; nudge marketing; bibliometric analysis; behavioral change.

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1. Introduction

The theory of nudge was first introduced in Richard Thaler and Cass Sunstein's book "*Nudge: Improving Decisions about Health, Wealth, and Happiness*". This theory involves changing the environment in which choices are made, or what we call choice architecture. Taking the definition given by Thaler & Sunstein (2008), this term refers to "*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*". In other words, the concept covers actions that are non-binding, easy to resist, that maintain freedom of choice and promote people's well-being. This intervention helps in shifting intentions to actions, it acts in the interest of the individual and doesn't seek to influence thoughts but to understand and change behavior, with its ultimate goal being to make people's lives simpler, safer and easier (Sunstein, 2014).

Human behavior studies have focused on our abilities to make decisions and position ourselves with regard to our environment. As it turns out, we are not as rational as we claim to be, nor do we possess perfect or complete information, nor superior cognitive abilities; thus, we have limited rationality, which undermines and therefore weakens the decision-making process (Simon, 1955). Our decisions are not always rational, as when making choices we adapt to the context and are more inclined to make quick decisions, settling on the most satisfying option without it necessarily being the most optimal. This is explained by the presence of two thinking mechanisms: a decision-making process with an automatic, unconscious and spontaneous dimension known as "system 1", and a more reflective and conscious one referred to as "system 2" (Kahneman, 2003). System 1 generates cognitive shortcuts or what we call heuristics, which by facilitating task accomplishment and simplifying problems, they, in turn create cognitive biases that can lead to flawed decisions. Nonetheless, we can use these same biases to shape behaviors, as insights from behavioral sciences helps us not only in understanding behavior and in what causes them to change, but above all to tailor effective interventions to promote and improve well-being (Mont, Lehner & Heiskanen, 2014). Given our bounded rationality, and how we are subjected to cognitive biases while relying on mental shortcuts, human fallibility calls for a better structure of decision making to help minimize undesirable repercussions. This is why we need to implement nudges into our daily lives: effectively in the face of erroneous and biased resolutions, facilitating choices and showing the right path seems to be a necessary prerequisite.

The reason for choosing this theme lies in its implications in our daily lives: why make a mediocre choice if we can make a better one? As a relatively recent theory, the attention on it is still growing; that being said, several literature reviews have already delved on the subject, but few have added a statistical approach, and therefore there are still gaps in comprehensibility and a lack of distinctness in comparison with other similar interventions. This paper seeks to fill the gaps by means of a bibliometric analysis of the existing literature, in order to better understand the state of the art and implications of nudge research. This method complements our conventional literature review by offering a quantitative counterpart emphasizing the potential of nudge research. We will attempt to clarify the ambiguity surrounding nudges by devoting the first part of the article to the definition of nudge, its principles and the tools on which it is based, followed by a bibliometric analysis of the nudge study, and ending with a proposal towards the definition of nudge marketing through the contributions of behavioral economics and social marketing.

2. Literature review

2.1 Problematic definition of nudge

Nudge can be viewed as the provision of a helping hand or a timely boost in a specific direction, i.e. by drawing attention to a specific point. It has been utilized in a number of fields, including physical chemistry and atmospheric science, prior to being applied to behavioral science. Within the context of behavioral sciences, this notion refers to actions that are non-binding, easy to resist and preserving freedom of choice while promoting personal well-being. Since it first appeared several revisions have been made to this definition (Mongin & Cozic, 2018; Hansen, 2016; Saghai, 2013; Hausman & Welch, 2010).

According to Hausman & Welch (2010) "*nudges are ways of influencing choice without limiting the choice set or making alternatives appreciably more costly in terms of time, trouble, social sanctions, and so forth. They are called for because of flaws in individual decision-making, and they work by making use of those flaws*". The starting point for this intervention is none other than human fallibility, and therefore the aim is to correct habits and guide decisions by introducing small interventions rather than imposing rigid, intolerable constraints. Another way of defining nudge is to think of it as "*a function of the choice architecture that alters people's behavior in a predictable way that is called for because of cognitive boundaries, biases, routines, and habits in individual and social decision-making and which works by making use of those boundaries, biases, routines and habits as integral parts of the choice architecture*" (Hansen, 2016). This definition focuses on the reasoning behind nudge and the limits that inhibit rationality. However, nudge is not a new field of research but rather an application of knowledge about decision-making and behavior change; it does not seek to change our behaviors via conscious processes as other forms of interventions do, but rather it dwells on our thinking flaws (Marchiori et al., 2017).

These revisions all led to the agreement that nudge combines behavior change methods that alter the decision-making context, by mobilizing cognitive biases and limitations without imposing constraints or infringing freedom. Thus, we can consider a nudge as encompassing a set of methods seeking to mobilize cognitive biases and limitations in order to modify and improve behavior, without creating obstacles or constraints. Having a clear conception of nudge is necessary in order to avoid confusing it with other methods of behavior change, and to better convey the window it offers into ascertaining the implications of behavioral science and choice architecture.

2.2 Nudge principles

2.2.1 Libertarian paternalism

This approach revisits the notion of paternalism, emphasizing its benevolent, non-intrusive aspect, while associating it with the maintenance of freedom: Paternalism's advice and guidance is fused with preserved freedom that libertarians advocate. We can define it as "*a set of interventions aimed at overcoming people's stable cognitive biases by exploiting them in such a way as to steer their decisions towards the choices they themselves would make if they were rational*" (Gigerenzer, 2015). This philosophy encourages and promotes certain behaviors and actions, without forcing or punishing individuals. However, a number of ethical questions arise, including the legitimacy of influencing and whether or not it actually preserves freedom. So where does this legitimacy stem from? We often make bad decisions that we would not have made if we had more information or paid more attention, and our actions can be greatly affected by a number of insignificant details. Influencing choices by shaping options helps to overcome the complexity of decisions without coercion or restriction. Other schools of thought, notably asymmetrical paternalism, share this perspective. This view applies rationality in behavior modification as "*asymmetrical paternalism aims to help boundedly rational people avoid making costly mistakes, while at the same time causing little or no harm to rational people*" (Camerer et al., 2003).

While nudges do not prevent people from choosing their own preferences or acting on their own desires, they still fall within the domain of behavior-change practices but remain less intrusive. From a governmental point of view, shaping choices is more effective and less restrictive than limiting choices or imposing sanctions (Hausman & Welch, 2010). But how can we be totally sure that individuals make good decisions? Theoretically, this depends on their previous experiences, their cognitive capacities and the amount of information they hold; but in reality, these factors are not nearly enough. In the absence of perfect choices, the fact that a policy can make them better by facilitating decision-making is acceptable and tolerable even (Sunstein & Thaler, 2003). With nudges, the emphasis is on freedom as people act more appropriately when they believe they are free, and will be more receptive to gentle incentives than to carrot-and-stick methods.

2.2.2 Choice architecture

The architecture of choice is based on the organization and rearrangement of the environment in order to enhance the decision-making process, this modification of the context seeks to direct behavior

towards the right choice. It is thus possible to modify behavior by altering the formulation, number, appearance and context of the choice. People's reactions and sometimes even preferences are influenced by the way the context is presented. In order to design this context, it is essential to identify the biases underlying a decision and provide the appropriate tools to counter them. Effectively, the framing bias shows the extent to which our decisions are shaped by the way information is presented. We can say that the mission of choice architects is to short-circuit the possible options and highlight one choice rather than another. Choice architecture therefore seeks to facilitate choice and guide towards better behaviors.

When confronted with a choice, the decision maker encounters a plethora of options that each offer different alternatives. This difficulty in choosing justifies the use of choice architecture, which reduces perplexity and makes it easier to select the right option. However, there is no "neutral" architecture: any choice presentation influences the decision-making in one way or another. Even if we refrain from choosing, in order to preserve the status quo, this will still be considered as a choice (Johnson et al., 2012). Additionally, it is important to examine the specifics of the environment in question and analyze the problem and the factors contributing to its occurrence in order to set up an architecture adapted to the context (Meder & Osman, 2018).

We suggest that choice architecture is the context in which we make a decision and that nudges are interventions on this architecture with the aim of guiding behavior, while libertarian paternalism can be seen as the philosophy behind these interventions (Barton & Grüne-Yanoff, 2015). The breakthrough element of these interventions is that they assume that cognitive deficiencies can be leveraged rather than seen as a barrier to the decision-making process (Hertwig, 2017).

2.3 Nudge tools

Decisions often depend on the context in which they are made, and the contextual background contributes to the saliency of an option, which is then preferred and taken. Nudge includes a variety of tools mobilizing visual, affective, social and informational components. It is all about convenience, salience and ease in altering the way decisions are usually made. They can be combined as well as applied independently.

2.3.1 Default option

The default option represents the path of least resistance to the pull of habits, as the person turns to the option that requires the least amount of effort. In the absence of explicit choice and active decision-making, the most optimal choice will be selected, which often turns out to be the default option. We tend to choose it because it is less costly in terms of effort and time. This option relies on various psychological levers, including individual inertia, which is the tendency to prefer an option provided by others rather than making the effort to generate it ourselves. Another contributory factor towards the choice of the default option is social utility, which is the assumption that the option has been conceived that way for a good reason and that it offers better outcomes (Muller, 2017).

This is where the status quo bias comes into play; in short, it is the willingness to stay in a situation rather than change it (Samuelson & Zeckhauser, 1988) and this aversion to change pushes us to prefer an already predefined option rather than take the risk and effort of choosing another. There is always a default, required or imposed choice, therefore it falls upon the choice architect to offer a predefined salient option that reduces the reluctance to act. This tool has been widely used in the healthcare sector in the instance of organ donation (Johnson & Goldstein, 2003), where it has been shown that the consent rate in countries favoring a donor default option is 60% higher than in countries where the option is not by default.

2.3.2 Anticipating error

Factoring errors and anticipating them is one of the methods used in choice architecture. This involves designing systems in such a way that every error is taken into account, so that it does not slow down the decision-making process (Thaler, Sunstein & Balz, 2014). If we did not make mistakes we would not need help to make decisions; we do not evaluate all the possible alternatives, and not all information is available. Therefore, when we feel overloaded in terms of deciphering information, whether complete

or incomplete, in order to choose the best option for ourselves, we may get overwhelmed and make more mistakes than usual. One of the most common types of errors is that of post-completion (Byrne & Bovair, 1997): after completing a task, we tend to forget the details relating to the previous steps, e.g. ATM's return the credit card before withdrawn money to ensure that clients do not forget about their cards once they get their money. Another way of anticipating errors is to set up checklists, which introduces habits that make memorization much easier and reduce errors, such as pre surgical control checklists (Haynes et al., 2009).

2.3.3 Reminders and feedback

Not only do we need to tell people when they are on the right track or when they are doing things right, but we must warn them when things are not going all that well. In the long term, this feedback on individual performance can improve behavior. There is a general tendency to not always complete certain behaviors thoroughly. Whether or not this is due to inertia, procrastination or forgetfulness, there will always be a risk that people will forget to make decisions they intended to make. Feedback targets these shortcomings by re-centering one's attention on the task at hand; it provides informational value by evoking already known information, or providing easy access to new information. In addition, notifications can serve as motivation to finish an incomplete action, and here we can rely on the Zeigarnik effect - the tendency to remember unfinished or interrupted tasks better than completed ones. This way, a task in progress creates a certain amount of tension that only subsides once it has been completed. We can also add goal-setting as a feedback form; once set, goals become salient reference points that should be attained in order to avoid the psychological or financial costs of non-achievement. Reminders have been used to encourage student performance (Clark et al., 2020), as well to push people to reduce their energy consumption levels (Fischer, 2008).

2.3.4 Structuring and simplifying complex choice

The complexity of choices hinders decision-making and leads to confusion and ambiguity. Therefore, barriers should be reduced through options being better structured, thus simplified and more convenient to evaluate. When faced with a challenging choice, a person may react negatively to a large number of alternatives, or may even refrain from choosing. This is why decision-making becomes easier when few options are present and when they are simple and straightforward. Elimination by aspect (Tversky, 1972) is a strategy that can be used to better structure choices. This decision-making model identifies an important attribute that forms a threshold, which is used to eliminate unsuitable options. Visual hierarchy is an example of choice structuring, e.g. the utilization of color wheels in paint stores (Thaler, Sunstein & Balz, 2014).

As for simplifying, it is the process of making information more direct so that the individual encounters no obstacles while choosing. The path from choice to outcome is called *mapping*, i.e. rendering choices through making information as comprehensible as possible by transforming complex, numerical data into accessible, easily intelligible units of knowledge (Thaler, Sunstein & Balz, 2014). This technique has been used in higher education by simplifying forms in order to encourage application to financial aid programs (Bettinger et al., 2009).

2.3.5 Incentives

Figuring out what truly motivates people to choose is a central element of nudge. There is an intrinsic motivation in which states that an action is pursued for the inherent satisfaction it provides, while extrinsic motivation is pursued because it leads to a distinctly compelling outcome (Ryan & Deci, 2000). Incentives therefore serve as extrinsic motivation; and finding out the right incentives corresponding to each person's particularity is a form of nudge. However sometimes the outcome of incentives is deemed to be guaranteed or even predictable, thereby altering one's motivation. In order to counter this tendency, gains should be made less certain so that the value of prizes increases and participation becomes more attractive (e.g. lottery), especially if participants think they only have one chance to win (Schmidt et al., 2014). Furthermore, each situation brings different costs to be taken into account, and therefore using saliency to draw attention to them or hiding their presence is a form of incentive. For instance, displaying the costs of a phone call has a greater impact than increasing its price (Thaler, Sunstein & Balz, 2014). Incentives do not all have the same format: they can be monetary, material or psychological. This

method has been used on several occasions to reduce smoking, encourage exercise and improve school performance (Gneezy et al., 2011).

2.3.6 Social nudges

We often tend to tailor our behaviors to those of others, or rather on our perception of what others do, leading us to compare ourselves and conforming to social norms to avoid getting rejected by the group. Norms outline the do's and don'ts and additionally they serve as a form of moral compass that we have to follow to know how to act in a given situation. There are two types of norms: descriptive and injunctive (Cialdini et al., 1990), the former reflects what must be done, and is often used in situations of uncertainty, while the latter entails the group's approval or rejection of a given behavior. Our actions carry social cues: they reflect our predisposition to follow norms and our degree of agreement or disagreement with the line of conduct advocated by society, to the extent that we choose an option depending on whether it is approved or even valued by the group.

The theory of social identity (Tajfel, 1971) designates the part of the self that comes from our awareness of belonging to a social group and the emotional value we attach to this belonging (Licata, 2007), whereby we seek to maintain a positive identity by following the actions of group members; developing this identity relies on following norms. Informing people of what others are doing has been used in several interventions, whether by comparing electricity consumption levels with those of neighbors (Allcott, 2011) or by adding a social norm and compliance messages to tax payment letters (Hallsworth et al, 2017). However, even if social norms are used as a push to improve behavior, they can also lead to the opposite action and create what we call a boomerang effect, so it is up to the choice architect to choose wisely and balance the used norms.

2.3.7 Saliency

When facing difficult choices, we tend to favor the easiest option, we rely on *cognitive ease* which refers to the fluidity with which our mind processes information. This can lead to emphasizing salient elements, which subsequently lead to biased decisions. *Salience bias* describes our tendency to focus on salient components and neglect those that do not draw our attention. To prevent these effects, we should accentuate important aspects, by for example using illusions, playful elements and tools that amplify visibility. This involves making a "good" option more visible or a "bad" option less visible; for instance, one experiment made the act of saving for retirement more salient by showing people an older representation of themselves (Hershfield et al., 2011). Another element that can be included in this category is that of game-based adherence, namely prompting change via game like elements. This principle is based on the *Gamification* concept, which refers to the use of game elements to achieve real objectives beyond the confines of the game (Deterding et al., 2011), such as rankings, scores and levels. The motivational power of games is leveraged to stimulate engagement and promote desired behaviors. Gamification has been used to promote user engagement in mental health and wellness applications, and also in education to improve student engagement (Auf et al., 2021; Huang & Soman, 2013).

2.3.8 Framing

The way we present information alters decisions. Framing can be described as "*presenting logically equivalent options in semantically different ways*" (Krishnamurthy et al. 2001). On the other hand, the *framing effect* is a bias referring to how the patterning of information influences our decisions (Berthet & Autissier, 2021). Framing interventions involve small and deliberate changes in the choice environment that influence the saliency and characterization of different aspects of available information. We can include risk and guilt communication as well as cognitive dissonance in this category, since they reframe information to bring about change, as has been the case in the healthcare field to test patients' treatment preferences (O'connor, 1988). Information can be presented in different ways: we can use positive framing to emphasize gains, or we can use negative framing to highlight losses. Here we can cite the case of an experiment conducted by Tversky & Kahneman (1981), who presented two formulations of the same problem to patients. Although the same outcome was presented each time, the difference in formulation made people choose differently. Positive framing reduces risk aversion, while negative framing emphasizes losses and risk-taking (Tversky & Kahneman, 1981). Offering reference points also falls into this category of nudge, as providing an initial piece of

information that people can rely on will help them make a good decision. The anchoring bias leads us to rely on this initial information before making a decision (Kahneman & Tversky, 1974).

Social nudges, reminders and framing are amongst the most widely used nudge tools across a variety of fields (Aldrovani et al., 2015; Möllenkamp et al., 2019; Barker et al., 2021), and we will address this in more detail in the following bibliometric analysis section. Following this exploration of nudge tools, we will now look at their application. Appendix 1 contains a list of experiments carried out in various countries, covering the fields of health, food, finance, education and energy efficiency. We have tried to show which fields often exploit nudges and those which are not sufficiently explored in the literature, such as mental health and the digital sphere (Auf et al., 2021). The effectiveness of interventions depends on both the context and the techniques applied.

3. Bibliometric analysis

Having established the concept of nudge, its issues and mechanisms. The next section will focus on a visualization of nudge theory. For this, we turned to bibliometrics, which refers to the application of statistical methods to bibliographic references (Rostaing, 1996). This method helps us describe and trace the evolution of research based on bibliographic elements, and furthermore helps us fill the gaps left by conventional documentary reviews. A number of studies have used bibliometric analysis in their research (Jia & Mustafa, 2022; Nguyen & Llosa, 2020). For our part, we used VOSviewer, a bibliometric treatment software characterized by its numerous network and density visualization graphs. We also chose to conduct our bibliographic research in the Web of Science database (WOS), due to its citation indexing and the large number of influential journals it contains, as well as the various analysis features offered by this platform. To extract bibliographic data, we first chose appropriate keywords, followed by a delimitation of the temporal perimeter and search categories in the WOS database. The chosen keywords were "*nudge*" and "*nudge marketing*". This initial search, conducted in January 2023, generated 7895 publications; we limited ourselves to the period between 2008 and 2022, resulting in 7230 publications. We then excluded non-nudge-related fields such as chemistry, which left us with a total of 1914 references. We transferred these publications to VOSviewer in the form of a text file containing information on journal names, country of origin, keywords, etc. This data will serve as the basis for our bibliometric analysis.

3.1 A chronological approach to nudge publications

Figure 1 depicts the evolution of nudge research publications from 2008 to 2022, allowing us to follow the chronological evolution of the overall number of publications, with an increasing number of articles published each year. We end up with two main phases: the first is an initiation phase covering the period from 2008 to 2013, during which the number of publications was more or less low, and did not reach 100 publications per year. While the second phase had growth reflected by both an increase in the number of articles between 2014 and 2021, and rapidly growing from 65 publications in 2014 to 121 in 2016. We noted a decline in 2022, with publications dropping from 338 in the year before to 313 the following year.

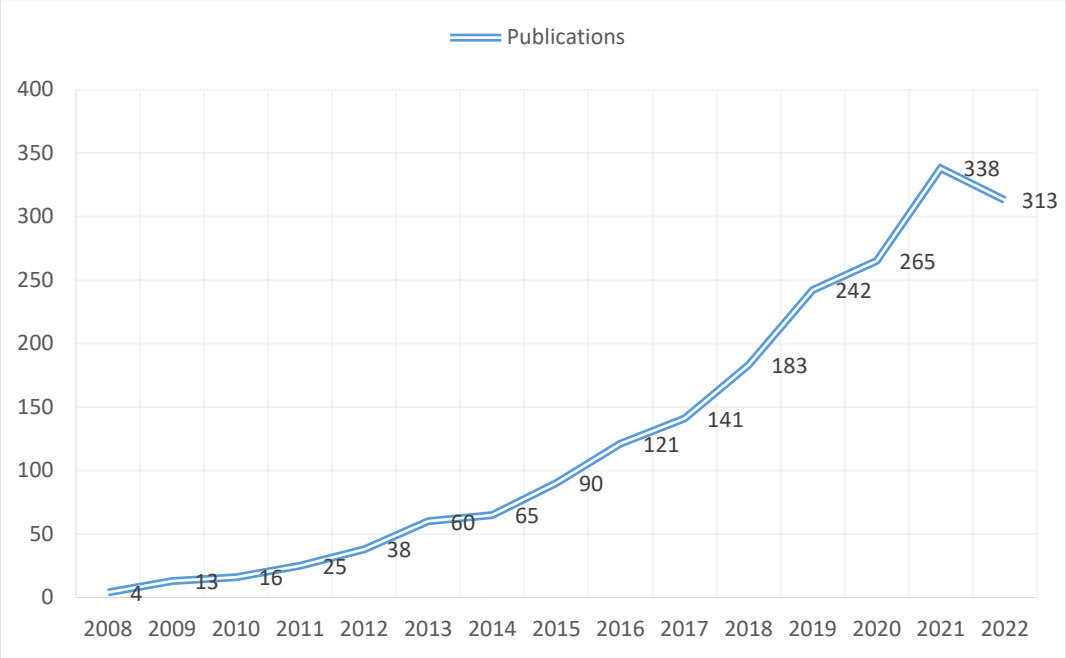

Figure 1: Chronological evolution of nudge literature.

3.2 Nudge publications by country and relevance level

Our results showed that North America is the most productive region in terms of nudge publications, with 682 publications for the USA, followed by Europe (mainly England and Germany, with 17.39% and 10.60% of publications respectively), while Asian and African countries account for a small proportion of scientific production in this field.

Table 1: Publications by country.

Country	Number of publication	Percentage of publication
USA	682	35,63%
England	333	17,39%
Germany	203	10,60%
Netherlands	159	8,3%
Australia	112	5,85%
France	87	4,54%
Chine	79	4,12%
Denmark	76	3,97%
Italy	76	3,97%
Canada	70	3,65%

Figure 2 shows the most influential countries in nudge research through bibliographic coupling. This option indicates that the more articles have common bibliographic references, the more similar they will be in terms of content, demonstrating the collaboration between the countries to which the publications belong. The largest of the clusters is the yellow one, with the United States as its center, and that is because it is not only where nudge first appeared, but also where nudge practices are widely adopted by private and public institutions. The blue cluster includes England, which was among the first countries to adopt nudge techniques. The rest of the clusters show the enthusiasm shared by Asian and European countries.

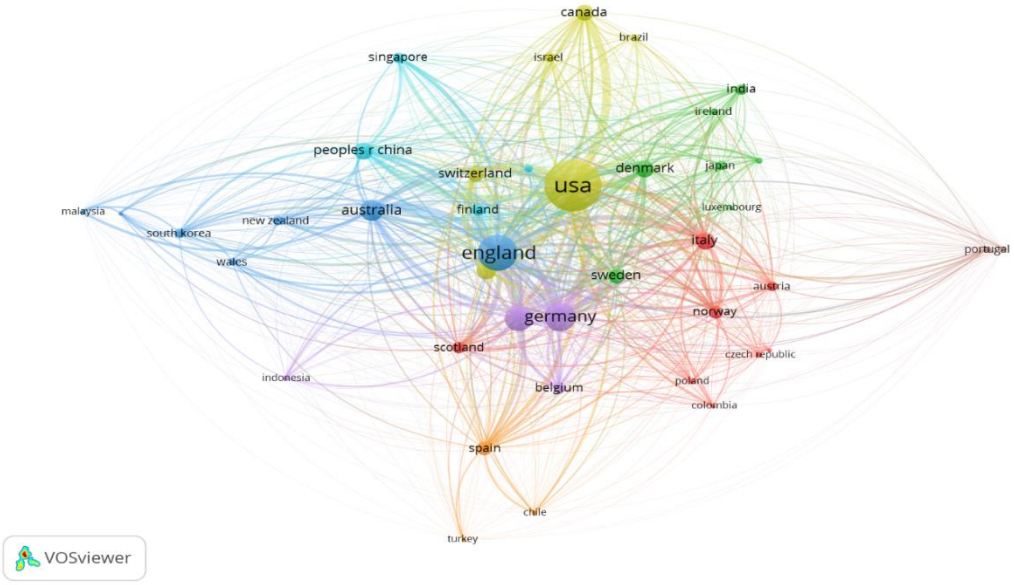

Figure 2: The bibliographic coupling network visualization of countries.

Figure 3 shows which countries have just embarked in nudge research and those which are considered pioneers. The year 2018 was the average year of active nudge research, indicating that since the rise of nudge there had been little work on it, with only the USA and England having recognized its potential, and it took some time later before other nations later began to apply nudges. Furthermore, it was not until 2020 that more developing countries started investing in nudge research, including Indonesia, Brazil and Malaysia.

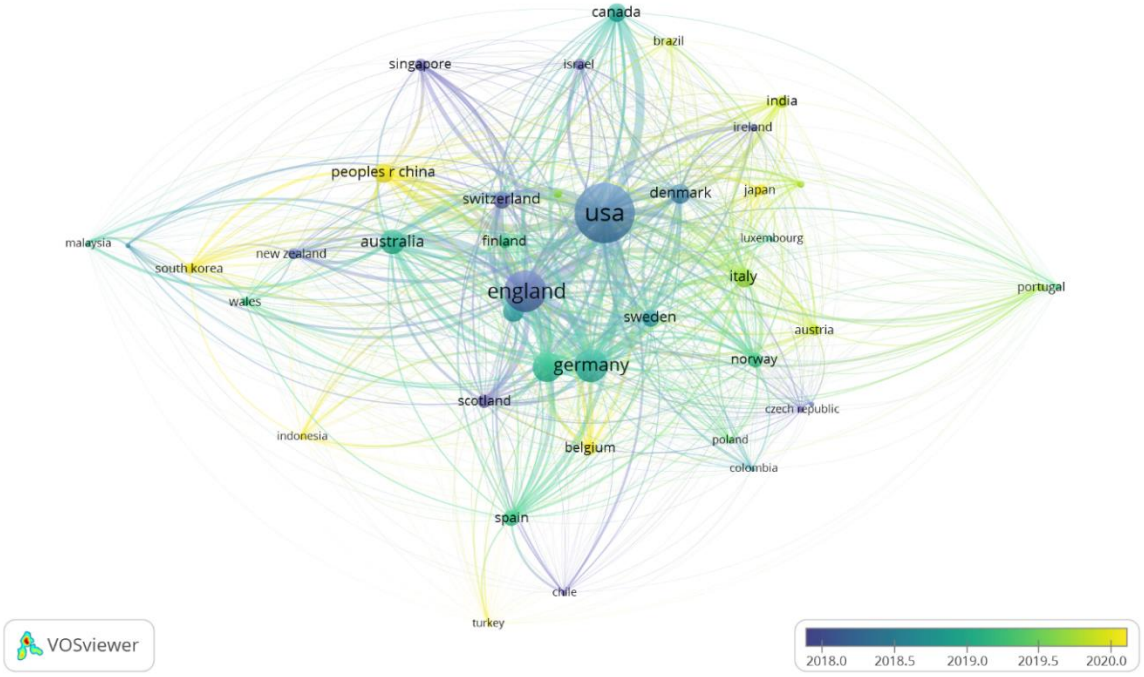

Figure 3: Overlay visualization of the country analysis.

3.3 Research categories and sources of nudge publications

We followed the classification generated by the WOS database to examine research fields and we selected the ten most recurrent areas. Economics unsurprisingly takes up a large share of the number of publications, with 30.46%, given that nudge stems from behavioral economics. We also note however that this practice is not limited to this category, and that it extends to other fields, such as environmental studies (11.44%) and nutrition (11.39%). Other disciplines such as education and social welfare are also taking an interest in nudge. This reflects the keen interest which this intervention in itself is generating and encourages its adoption in fields that are not yet, or not sufficiently, explored, such as information technology systems, which would enable the personalization of nudges and could further contribute to the resolution of problems extending into various fields.

Table 2: Research categories of nudge publications.

Field (Web of science categories)	Number of publications	Percentage of total publication
Economics	583	30,46%
Environmental studies	219	11,44%
Dietetic Nutrition	218	11,39%
Business	216	11,28%
Multidisciplinary psychology	211	11,02%
Management	159	8,30%
Ethics	137	7,15%
Social issues	134	7,0%
Education, Educational research	126	6,58%
Behavioral science	106	5,53%

Given the wide range of areas in which nudges are now used, it is quite appropriate to increasingly find it in several journals, which in turn shows the growth of nudge studies. In Figure 4, each circle represents a journal and its size reflects the number of citations the journal has received (Van Eck and Waltman, 2014). Nudge-related articles are published in an array of journals: the 1914 publications (referred to above) were published in 620 journals, with several economic journals present in this visualization (*Journal of consumer research, Journal of marketing*). The presence of marketing journals shows the use of nudge applications in this field. Their presence in psychology and behavior journals (*Journal of applied psychology, Frontiers in psychology*) and also in health, medical and environmental journals (*Appetite, Science, BMC public health, Ecological economics*) is a reflection of how their utilization seeks to modify behaviors for the well-being of individuals.

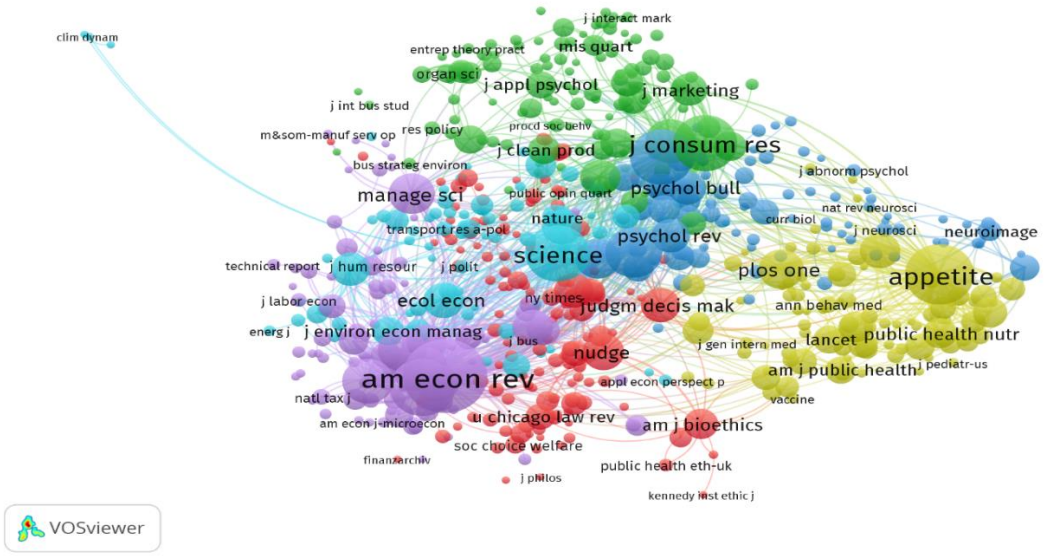

Figure 4: Co-citation network of journals.

3.4 Leading nudge authors and bibliographic references

In order to identify the most influential and productive authors, we had to carry out a bibliographic coupling analysis: in Figure 5, each circle represents a researcher, and the larger the circle, the more publications the researcher has. Sunstein is one of the most influential authors in nudge research, with over 17 publications. Given his major contributions to behavioral economics and his best-seller book (*Nudge: Improving Decisions about Health, Wealth, and Happiness*), there is a reason why he occupies such an important place in the literature. Brunstrom and Smeets are also authors who have left their mark on nudge research with their contributions in the nutrition field. Furthermore, with regard to Castleman, he has made several contributions in the field of education, mainly in improving school engagement and performance.

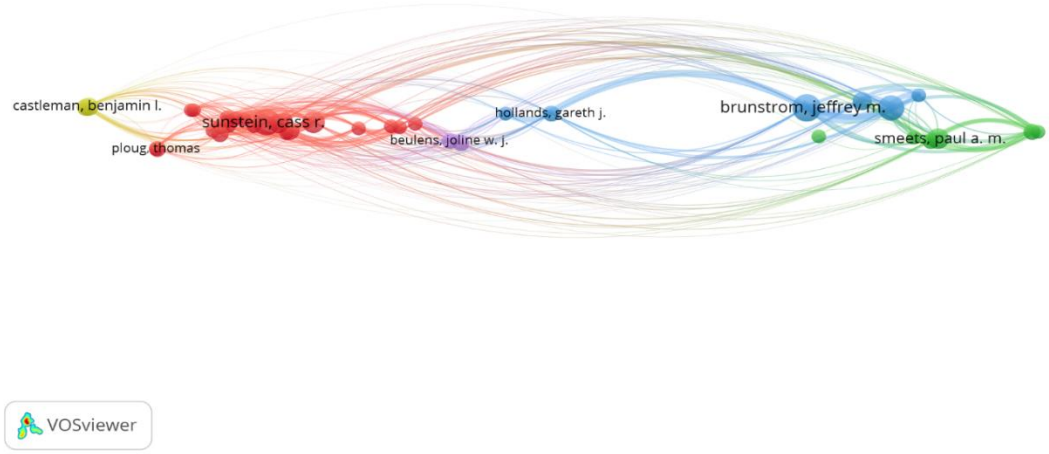

Figure 5: Bibliographic coupling network visualization of authors.

Figure 6 is a visualization of a co-citation analysis, allowing us to identify the most cited references. We decided on a minimum of 10 citations for the articles extracted, and this gave us a total of 567 references. The most cited reference is Thaler and Sunstein's book with over 402 citations and another reference that was cited around 368 times is a book review of Leonard published the same year. Hausman and Welch's article (*Debate: To nudge or not to nudge*) was cited 128 times and Allcott's (*Social norms and energy conservation*) over 159 times in the nudge literature.

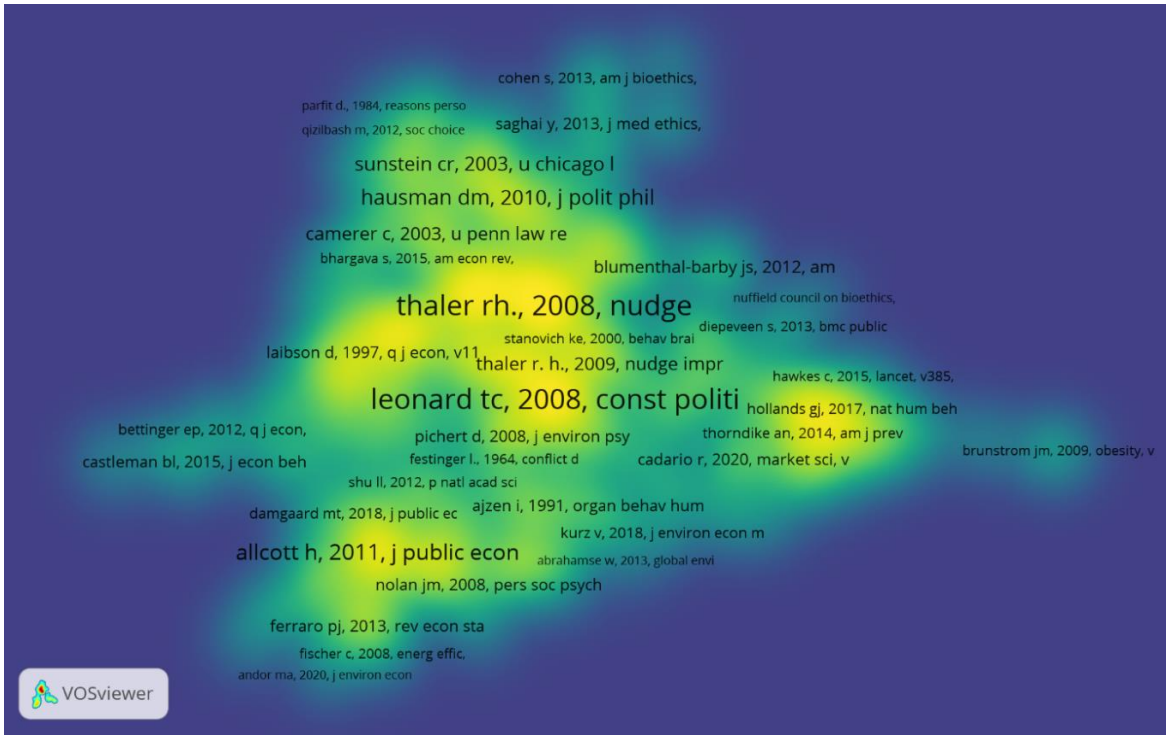

Figure 6: Co-citation visualization of references.

We then compared the research already mentioned throughout the article with the best-cited publications. Table 4 shows the ten most-cited articles in the WOS database. We manually excluded non-nudge-related articles by examining titles and abstracts (e.g. *How opportunities develop in social entrepreneurship, Evolutionary economics of mental time travel*). The final articles focus on health, agricultural, financial and ecological behaviors, with one article dealing with an under-exploited theme which is Big Data. Reminders, incentives and social nudges are among the most cited nudge tools in these articles. We also noted that the majority of these articles come from American and European journals by authors we have already mentioned. However, if we apply the same criteria to another database, we will get different results in terms of the number of citations.

Table 3: The 10 most cited nudge articles nudges on Web of Science.

Rank	Globale citation	Title	Authors	Journal
1	555	Fighting COVID-19 Misinformation on Social Media: Experimental Evidence for a Scalable Accuracy-Nudge Intervention	Pennycook et al, 2020	Psychological Science
2	446	Nudging Farmers to Use Fertilizer: Theory and Experimental Evidence from Kenya	Duflo et al, 2011	American Economic Review
3	351	Beyond nudges : Tools of a choice architecture	Johnson et al, 2012	Marketing Letters
4	325	The Age of Reason: Financial Decisions over the Life Cycle and Implications for Regulation	Agarwal et al, 2009	Brookings Papers On Economic Activity

5	301	Should Governments Invest More in Nudging?	Benartzi et al, 2017	Psychological Science
6	294	Energy conservation « nudges » and environmentalist ideology : evidence from a randomized residential electricity field experiment	Costa et al, 2013	Journal Of The European Economic Association
7	250	‘ Hypernudge’: Big Data as a mode of regulation by design	Yeung, 2017	Information Communication and Society
8	244	Behavioural factors affecting the adoption of sustainable farming practices: a policy-oriented review	Dessart et al, 2019	European Review of Agricultural Economics
9	241	Adverse Selection and Inertia in Health Insurance Markets: When Nudging Hurts	Handel, 2013	American Economic Review
10	238	Nudging: A Very Short Guide	Sunstein, 2014	Journal Of Consumer Policy

3.5 Main themes covered in nudge literature

The VOSviewer software allows us to map the terms used in the titles and abstracts of articles, giving us a general idea of the main themes and the existing links between them. Co-occurrence analysis help us visualize the content of publications using keywords. In Figure7, each circle represents a term: the larger the circle, the greater the number of publications using it. This shows how prominent a term is in the literature. We chose to create a map based on bibliographic data, where we selected a minimum of occurrence of five keywords, giving a result of 573 recurring terms. The green cluster contains terms linked to the origins of nudge (*choice, libertarian paternalism, behavior, heuristics, prospect theory, loss aversion*); several researchers have therefore focused on the rationality and decision-making aspect of nudges. The blue cluster includes nudge application areas (*health, food intake, nutrition, energy consumption*), dealing with issues such as obesity and food waste among many others. The purple cluster is linked to ethical issues of nudge, with words pertaining to the legitimacy of the method (*fairness, deception, dishonesty, personal conscience*), as many articles have raised concerns about the undesirable consequences and impacts of nudge. The yellow, red and orange clusters contain terms associated with nudge variables (*feedback, social norm, reminder, energy efficiency, sustainability, artificial intelligence*), indicating the tools often used, including social norms, as well as possible future variations, including the digital domain.

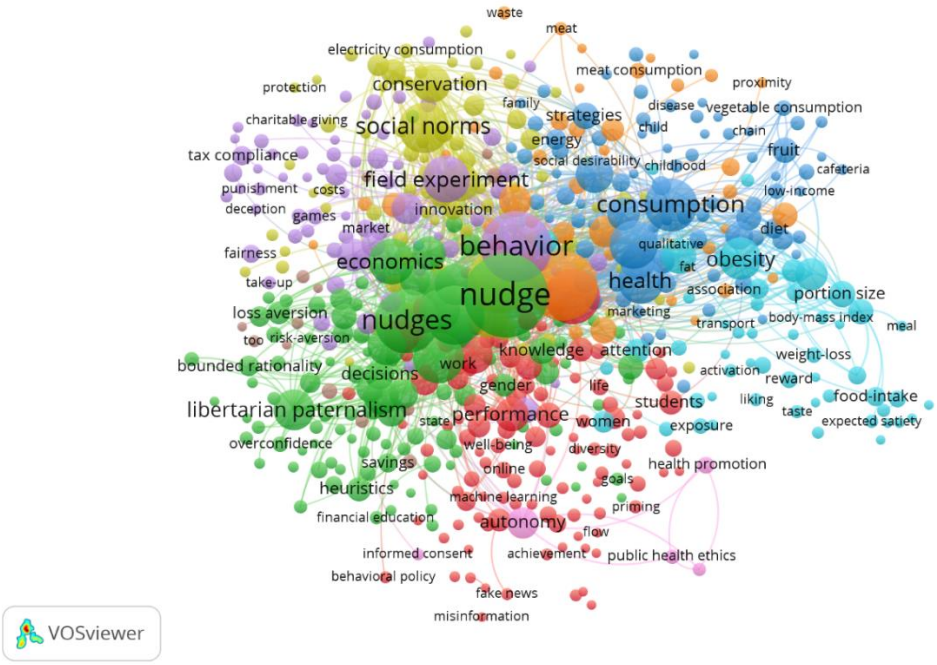

Figure 7: Co-occurrence visualization in nudge literature (via bibliographic data).

We also ran the co-occurrence analysis via text data, as shown in Figure 8, to see if we could obtain different results than with the previous method. We decided on a minimum occurrence of 10 keywords, which gave a result of 494 recurring terms. Density visualization helps us get an overview of the main themes, with the terms that stand out the most being associated with the topics most discussed in nudge research. We found that the nudge intervention is shifting towards food choices, health decisions, energy consumption, finance and consumer issues, with little interest in new technologies (*learning analytics*, *gamification*, *social media*).

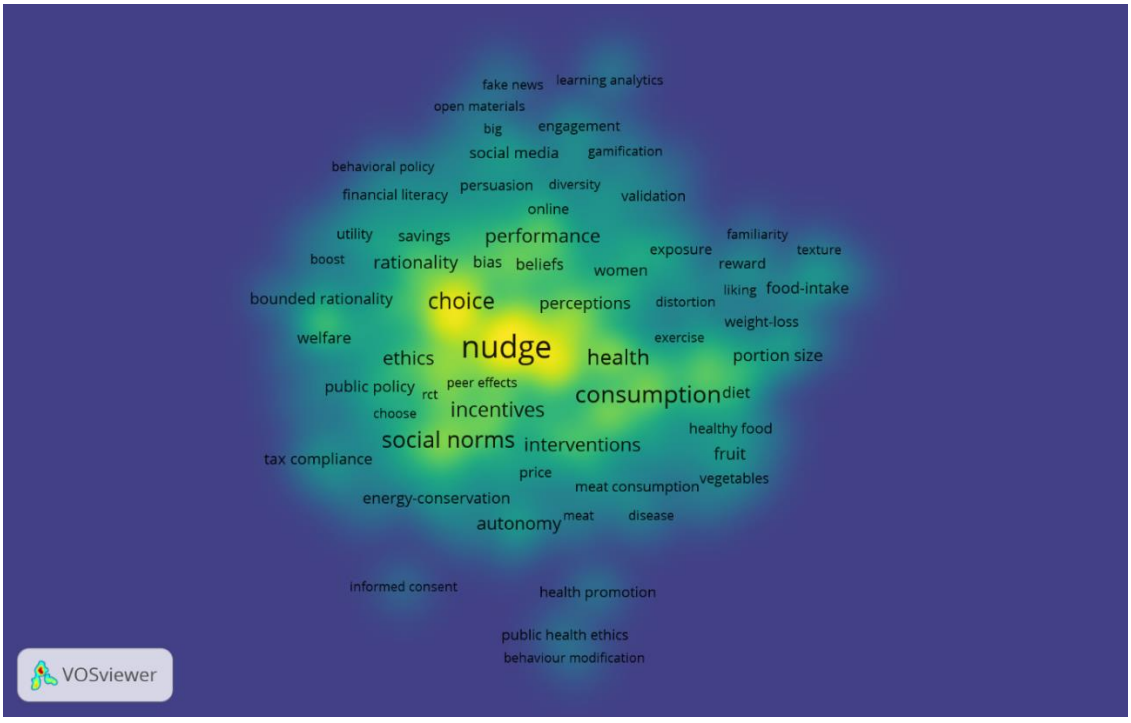

Figure 8: Co-occurrence visualization in nudge literature (via text data).

4. From nudge theory to nudge marketing

Nudge literature might seem as a relatively recent branch, but it is not exactly a new discipline. It builds on contributions from both behavioral economics and social marketing to provide behavior-change tools. However, there is no real consensus on the definition of nudge marketing. The following section will focus on the theories underlying the nudge technique, in order to provide a new definition of nudge marketing.

4.1 Behavioral economics contributions

In the past decade, executives and policymakers in many countries have been using behavioral insights to improve health, financial and environmental policies, by steering people towards certain choices without incurring significant costs (Sunstein, Reisch & Rauber, 2018). Companies, for their part, have long exploited consumer behavior studies and psychological and social levers in their marketing strategies. They have been using the guidelines of behavioral economics even before the surge of nudges, which gave rise to new practices such as social marketing. The use of behavioral economics cues is adopted in an effort to understand behaviors, so as to ultimately change the external environment and bring about positive behavioral change (Lee & Kotler, 2015).

The complexity of behavioral components calls for an entire discipline being dedicated to them, in order to find effective ways to improve behavior. Behavioral economics looks closely at decisions, and they are often deemed non-rational because of the heuristics and cognitive biases that come into play during the decision-making process, but also because of the emotions and norms that distort a person's judgment (Simon, 1955; Kahneman, 2003; Ariely & Jones, 2008). This discipline takes these elements into account and employs them to influence decisions. By combining cognitive and social psychology, behavioral economics is able to decipher human behavior and what lies behind economic choices. It focuses on mental processes, the links between action and intention, as well as the individual's relationship with their social group and the impact of norms and conformity. Nudge has taken form through these contributions. Effectively, by closely studying behavior and analyzing the factors influencing a decision, new fields of action have emerged, including nudge marketing, which seeks to support consumers in their decisions thanks to the teachings of behavioral economics.

4.2 Social marketing contributions

Social marketing involves the use of marketing techniques and behavioral theories to induce behavior change in response to social issues (Dann, 2010). According to Kotler (1971), it is "*the design, implementation and control of programs calculated to influence the acceptability of social ideas and involving considerations of product planning, pricing, communication, distribution and marketing research*". Social marketing applies both behavior change theories and commercial marketing techniques to attain a social objective. Several theories have inspired social marketing, including the transtheoretical model of behavior change, which suggests that the individual goes through a series of cognitive stages (Prochaska, 1979), whereas the diffusion of innovation theory shows how ideas spread and how people adopt them and change their behavior (Rogers, 2010). The theory of planned behavior states that attitudes and social norms influence behavioral intentions, which in turn shape actions (Azjen, 1991).

Some social marketing strategies can be considered a form of nudge since they aim to modify behaviors without prohibiting undesirable behaviors (Velema et al., 2017); social nudges for example use social norms and comparison as a tool for behavior change. They benefit society by steering people away from bad choices, for instance through energy conservation or tax compliance (Allcott & Rogers, 2014; Kettle et al., 2016). Nudges are increasingly used to address important social issues thanks to their potential and how they provide simple, unobtrusive and low-cost solutions. We therefore perceive nudge and social marketing as two complementary approaches, with the one distinction we could add being that nudge focuses on changing behavior, while social marketing seeks to change attitudes and perceptions.

4.3 Towards a nudge marketing definition

As soon as nudge was introduced, nudge marketing became a real tool for influencing consumers. It is an extension of nudge, which seeks to modify the choice environment presented to consumers in order

to influence their behavior and steer them towards options deemed to be good for them. So what is the difference between nudge and other marketing techniques designed to influence consumer choice? The answer lies in the very definition of libertarian paternalism: nudge focuses on the well-being of nudged individuals, whereas marketing tools, even if they preserve freedom of choice and mobilize cognitive biases, seek to increase profit regardless of people's well-being (Congui & Moscati, 2022).

Sale boosting techniques do not count as a nudge even if they rely on psychological levers. Moreover, a nudge is more of a push than a marketing strategy, and is adopted when the appeal to cognition is insufficient (Gallopel Morvan & Crie, 2022). The use of descriptive labels, such as calorie and nutrition labels or color-coded labels (Vandenbroele, 2020) is one example of the use of nudges in supermarkets. Online, digital nudges are applied with user interface modification via notifications and customer reviews (Schneider et al., 2018). This form of marketing does not seek to lure people, but to lead them towards beneficial choices which also favor the wider society. Nudges are not used throughout the customer journey, but at specific points, such as formulating preferences or right before a purchase, i.e. at the exact moment of decision making, or when a customer makes an unexpected mistake, uses a new feature or fail to progress from one stage to the next (Korhonen, 2020). Choosing is a difficult task, especially when it comes to making the right choice (Schwartz, 2004). Faced with a multitude of options, the paradox of choice comes into play, stating that having several options does not facilitate decision-making; on the contrary, this abundance disempowers the decision-maker. Nudge marketing can resolve this difficulty by altering the way choices are presented. The key is to find the right balance between too many and fewer options, and to guide the decision-maker towards the most optimal choice.

The results of our bibliometric analysis show that nudge marketing is part of a behavior-change intervention that seeks to improve civic, health and environmental behaviors, both internally and externally, online and offline. According to Table 2, more than half of nudge publications come from the field of economics (583 in economics and 216 in business), these have been published in 620 economic journals, as shown in Figure 4. This shows the application of nudge tools in a marketing context and for consumer’s wellbeing. Furthermore, the terms consumption, market, communication, economy, social networks and e-commerce are strongly present in nudge studies, as seen in Figure 7, which confirms the status of nudge marketing in the literature. Accordingly, we consider nudge marketing as the use of nudge mechanisms derived from behavioral sciences and marketing techniques to influence people's behavior in a consumer, social or environmental context for their well-being, whilst always seeking to maintain their freedom.

5. Conclusion

The behavioral approach has disrupted economic theory, through overcoming the limits of rationality by focusing on the individual's flawed thinking. This orientation has shaped many behavior-change interventions, and has given rise to a new approach promoting well-being and respecting freedom. Nudge improves decision-making, identifies and modifies the biases affecting choices, and changes choice architecture to encourage positive decisions. Nudges work well because they inform people, simplify and facilitate choices, solidify intentions as well as counteract and employ people's thinking loopholes; these same flaws are both obstacles and pathways to pursue in order to improve decisions. It is reasonable to question the morality of nudges as to whether they really are ethical interventions, and whether or not they actually promote or compromise well-being and autonomy. Providing and facilitating information does not threaten freedom, whereas manipulation does; maintaining freedom means maintaining autonomy. These interventions do not undermine people; on the contrary, they serve as guidelines in their search for righteous behaviors. Nudges are part of decision-changing models, focusing on a person’s unconsciousness and they are based on behavioral and social components, unlike other forms of influence that focus on a cognitive and rational logic.

This paper highlights the importance of using nudge tools in response to societal issues, in order to improve choices and address thinking shortcomings by creating a choice architecture leading to behavioral change. Our work builds upon nudge theory knowledge by providing a holistic overview of nudge literature, which has seen a rapid growth in studies seeking to understand this practice and search for new fields of application. The bibliometric analysis has shown us the extent of nudge-related research, its contributions, the evolution of research and its possible future directions. The number of

publications has risen considerably since 2014, and will probably continue to do so due to the interest shown in nudge experiments in various fields such as nutrition, environment, health and education. We also expect the adoption of nudge tools into the digital field, with artificial intelligence and other various analytical levers that promote the adoption of nudge being utilized to regulate behavior both On-line and Off-line. The growth potential of nudge research has yet to be explored, as while there are many behaviors that nudge can tackle, at the same time there are many more ethical and cultural considerations to take into account before implementing a nudge architecture.

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Appendix: Nudge theory interventions

Nudge tools	References	Study purpose	Methodology	Findings
Default option	Hansen, Schilling & Malthesen (2021)	Promoting healthy and sustainable food choices during conferences via a default vegetarian lunch option.	Participants registering online for a conference were divided into two groups: group 1 received a standard lunch package offering a non-vegetarian buffet by default but allowing active choice of a vegetarian option, while group 2 received a package featuring a vegetarian buffet by default with active choice of a non-vegetarian option.	In the first group 6% opted for the vegetarian option, whereas in the second 87% did so. Men had a significantly higher tendency than women to deviate from the vegetarian option (group 1: 7% of men chose the vegetarian option and in group 2, 63% chose it compared to 10% and 95% respectively for women in both groups).
Anticipating errors	Haynes, Weiser, Berry et al. (2009)	Reduce surgical complications and deaths with a surgical safety checklist.	A surgical safety checklist program was set up in hospitals in eight cities from different countries. These checklists describe the essential care processes that operating facilities usually implement from memory.	The death rate for patients undergoing surgery fell from 1.5% to 0.8% after the implementation of the checklists. Complications related to hospitalization went from 11% to 7%.
Reminders	Castleman & Page (2015)	Increase university enrolment among low-income students by using personalized nudges.	A text messaging campaign in which young high school graduates and their parents were sent a series of 8 to 10 SMS reminders of key summer tasks. These reminders were personalized to inform recipients about the tasks to complete at the school where each student intended to enroll, and offered the option of requesting help from a counselor by replying to the message.	The experiment had a positive impact on the registration rate, which was 4 to 7 percentage points higher than for counterparts who received no message at all.

Nudge tools	References	Study purpose	Methodology	Findings
Feedback	Choudhary, Shunko, Netessine & Koo (2022)	Improve driving quality by reducing accidents and traffic through performance nudges.	Sending three types of performance-related nudges to drivers in India: indicating their performance on the current itinerary in relation to their personal best, their personal average and their last driving performance via the DrivePower app.	The personal best and personal average nudges improved driving by 18.17% and 18.71% respectively, resulting in an increase in inter-accident duration of almost 1.8 years.
Simplifying/ Structuring	Linos, Quan & Kirkman, (2020)	Improve residents' compliance with municipal housing regulations using targeted behavioral interventions.	Three experiments were carried out in New Orleans (salient, simplified and personalized letter), Louisville (simplified notice of violation), and Chattanooga (proactive and personalized communication).	Contacting owners beforehand, redesigning notices, and proactively communicating with past violators improved compliance by 14.7%, 3.3% and 9.2% respectively with savings ranging from 6% to 15% of the city's annual reinforcement budget.
	De Neve, Imbert, Spinnewijn, Tsankova & Luts (2021)	Examining the impact of deterrence, tax morality and information simplification on tax compliance.	Simplified letters highlighting deadline and the due amount, shortening informations and adding tax morale and deterrence messages to clarify the consequences of non-compliance were sent to late taxpayers.	Reminders had a positive effect on payment before the inspection period (+25%), deterrent messages had an additional effect (+3.8%), while moral messages had a negative effect (-2.7%). Simplification has made the need to pay and the deadline more salient for taxpayers.
Incentives	Cadena & Schoar (2011)	Testing the efficiency of bank loan repayment incentives	Borrowers receive either a cash payment at the end of the loan (equivalent to a 25% interest rate reduction), a 25% interest rate reduction on the next loan they take out with the bank, or a monthly SMS reminder before the loan payment due date.	Borrowers experienced a 7-9% increase in the likelihood of paying on time, and the number of days in delay fell by 2 days per month. The impact of incentives was stronger for customers with small loans and less banking experience, and the reduction in future interest was more effective for customers with larger loans, while SMS was more effective for young people.

Nudge tools	References	Study purpose	Methodology	Findings
Social nudges	Chabé-Ferret, Le Coent, Reynaud, Subervie & Lepercq (2021)	Reduce farmer's water consumption using social nudges	Provide farmers with information on their own water consumption compared to the average consumption of their neighbors by sending weekly phone messages that aim to provide percentage information based on smart meter readings from the week preceding the message delivery.	The nudge reduced the highest consumption (by 1.8 points), but also increased the lowest, so the overall effect was neutral.
Saliency	Auf, Dagman, Renström & Chaplin (2021)	Exploring the most effective gamification and nudge design techniques for improving engagement in mental health applications	Assessment of the most installed mental health apps on the Google play store linking them to engagement data along with interviews with gamification and design professionals.	An average of 4 gamification mechanisms and 7 nudges per application were found (progress levels, rewards, badges and avatars). However, an increase in the number of mechanisms was not associated with an increase in engagement. One technique that proved potentially useful for both long- and short-term engagement was the creation of a narrative involving characters in a mental health context.
Framing	Choe, Jung, Lee & Fisher (2013)	Helping people avoid privacy-invasive apps when searching and comparing what apps to install via a framing tool.	Setting up a visual representation of the mobile application's privacy index and level of protection (similar to movie scores) framed in a positive or negative way to see how users perceive the application.	The results show a strong effect of the privacy index, indicating that visual disclosure influences people's decision. Installing an application with a low privacy index was 3.36 times higher if the index was framed negatively than positively.