DESIGN ELEMENTS OF DIGITAL NUDGES AND EFFECTS ON CONSUMER BEHAVIOR: A LITERATURE REVIEW

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List of Abbreviations

AIS	Area of Information Systems
CCH	Consumer Choice
EDU	Education
FIN	Finance
GOV	Government
HEA	Health
MISC	Miscellaneous
PSB	Pro-social Behavior
SCP	Security and Privacy
SUS	Sustainability
TRA	Transportation
UI	User Interface
UT	University of Texas
UX	User Experience
VHB	Verband der Hochschullehrer für Betriebswirtschaft

Abstract

1 Introduction

It is a typical Sunday afternoon. John is sitting on the couch, watching the match of his favorite soccer club on TV. On his lap, he is holding his tablet while browsing the internet. John is looking for a good travel deal for his upcoming trip to Bali with his girlfriend. On a news site, a prominent and bright advertisement catches his attention: *Booking.com - From cozy country homes to funky city apartments*. That is precisely what John is looking for. He clicks the link and finds himself on a website full of amazing images of traveling people. Moreover, there is a search field, too. John enters his dream-destination, the travel time and clicks on ”search.” After some seconds a list of hotels shows up. The first one catches his eyes. A beautiful beach, a nice pool and cozy, big bedrooms. Perfect. He clicks on the details. However, John is starting to become nervous. A bright, red piece of information is saying to him that this room has been booked three times in the last twelve hours. Also, there are only seven rooms left! His heart beats faster. He needs to get that deal! John clicks on the reservation button. He just has been nudged[1].

Johnson et al. 2012 states that ”what is chosen often depends on the representation.” This representation describes as the term of choice architecture, which should ”alter people’s behavior in a predictable way” (Thaler and Sunstein 2009). In the age of digital transformation, digital environments are powerful tools where the choice architecture can be controlled in detail and therefore provide opportunities to influence user behavior in several ways with the help of user-interface design elements. This process is called ”digital nudging” (Weinmann et al. 2016).

Digital nudging and the design of online choice architecture have recently gained interest in different research areas. Because of the complexity behind this concept, it is significant to understand how such nudges influence the decision-making of the user and how the cognitive biases behind this process are working. Especially in consumer choices, there are good and bad patterns of nudging when it comes to an ethical point of view (Sunstein 2015). To get a better understanding of how digital nudges influence consumer choice this paper presents a systematic literature review from the last ten years in a scientific manner.

The goals of this paper are two-folded. The primary aim is to provide an overview of different research streams within the topic of digital nudges. The paper focuses here on digital nudges in the area of consumer choice and their specific design elements. Litera-

[1] A screenshot of the web page can be found in the appendix on figure 2

ture in this domain shall be gathered, reviewed and analyzed. Secondary, a recommendation for future research is derived from the analysis to advance research in this particular subject. Because of the multidisciplinary assortment of digital nudged, this paper contributes to several scientific domains. First of all, it is major implications for the area of information systems by showing areas with little research. Furthermore, the paper holds implications for the areas of marketing and consumer research as well as psychology and behavioral economics with regards to digital environments.

2 Conceptional Background

2.1 Birth of Nudges

With the release of the book ”Nudge” in 2009, Thaler and Sunstein have laid the foundation stone for the concept of nudging. This concept was primarily a subject of research in behavioral economics. Because of the multifaceted meaning of the word *nudging*, a consistent understanding is essential. Further on, this paper uses the central definition of nudges from Thaler and Sunstein 2009:

”A nudge [...] is any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives.”

One central aspect of this definition is the economic incentive of the consumer, which should not be changed. This fundamental thought is the basis of a concept called *libertarian paternalism*. In this concept, choices are influenced in a way to make them easy for people and aligning them with their interests. One example of that would be ”putting the fruit at eye level.” However, banning the food would not be a nudge. (Thaler and Sunstein 2009). This principle is the foundation of nudges for a good reason. Influencing people's behavior can simply be exploited. So, the ethical viewpoint on nudges should always be kept in mind when implementing and using them to guide customer choices (Sunstein 2015).

The underlying foundation for nudging the cognitive limitation of human brains. Because the human brain only has a limited capacity to store and process information, the consumer often feels subconsciously overloaded. This results in greater difficulty and complexity when it comes to decisions and cognitively demanding tasks (Broniarczyk and Griffin 2014). Therefore ”many decisions are based on beliefs concerning the likelihood of uncertain events (Tversky and Kahneman 1974). Based on this assumption Tversky and Kahneman 1974 formulated three heuristics and several biases that build the underlying foundation of human decision making. Those heuristics and biases can also be found acting as a guideline in the world of digital nudges.

Besides the cognitive foundation of decision making, also the principles of nudges play a major role in their application and implementation. Overall, there are five general principles of nudging (based on Thaler et al. 2010)

Incentive Those kinds of nudges aim to make incentives more salient to increase the effectiveness of the nudge. The focus lays on the motivation behind the decision. The nudge should always search for the right motivation for the right people. This motivation goes beyond monetary and material incentives.

Understanding mapping Making the consequence of a choice clear is an essential part of easing the decision-making. Mainly, this concerns complex information that is difficult to evaluate. For example, the number of megapixels of a camera. Frequently, customers cannot evaluate this information directly and only compare on a single number. A rational mapping would be to display the maximum printable size of a taken picture. This way, the product attribute can be compared efficiently.

Defaults The pre-selection of certain information has enormous power. By changing the default option, consumers are more likely to choose that near to the selected default or even is the default. One prominent example of such a nudge is the question if people want to consent to be an organ donor. Simply by changing the default option, in this case, can nearly double the percentage of organ donors (Johnson and Goldstein 2003).

Giving feedback By giving feedback during the decision-making, people can evaluate their performance and estimate the output or consequences of the decisions they face. Such an example can be found in an experiment for pre-ordering lunch in a school. Students arrange their lunch with different kind of foods. According to this arrangement they receive feedback about how balanced and healthy their food compilation is. Only based on this feedback, students selected significantly more fruits and vegetables in their meals (Miller et al. 2016).

Expecting error Precisely because of the underlying complexity of the decision-making process, it is necessary to expect errors to be made. Such errors should be taken into account when designing a decision, and the environment should be as forgiving as possible. In complex choice environments, such as the food of healthy and balanced food, many people make mistakes. By giving direct feedback on those errors and providing information on how to improve the performance, this decision can be made easier (Guthrie et al. 2015).

Structure complex choices Another difficult task in decision-making is to compare different product alternatives. By listing all attributes, people can evaluate trade-offs and make better decisions, based on their interests. In a field experiment, researches evaluated the effect of such a nudge in a bar, when it comes to craft beer choice. By listing product more product attributes that naturally describe the taste, people could decide easier what they want to order (Malone and Lusk 2017).

2.2 (Online) Choice Architectures

The concept of nudges builds on the assumption that decisions are made in choice architectures, which are designed by choice architects (Thaler and Sunstein 2009). In this case, the parallel to a ”real” architect of a building is not far-fetched. Johnson et al. 2012 describes the power of such choice architects and how choice architects guide people's choices like other architects guide behavior through the design of the ”placement of doors, hallways, staircases, and bathrooms. Just like in a hotel or building, ”there is no neutral architecture” (Johnson et al. 2012) for choices. Even small things like a default choice affect the decision which is made by the user. The mobile payment app Square, for example, nudges people into giving tips only by setting a default value. This way, customers actively must select a ”no tipping” option if they do not want to give a tip (Weinmann et al. 2016). ”Because advances in technology and the user of the Internet also provide new ways of finding, creating and exchanging information [...]” (Broniarczyk and Griffin 2014) people automatically shifted a majority of their decisions in the online or digital world. However, those digital environments are not less complex. Just like in offline environments, there is no neutral way to present choices. Therefore, any user interface can be viewed as a digital choice environment (Schneider et al. 2018). This ranges from the positioning of elements, the colors in the interface, the language, even the design elements themselves and beyond.

To get a better understanding of how such choice architectures can be built up and what elements are available, Münscher et al. 2016 created a taxonomy of choice architectures and their techniques. Overall, there are three major categories with several associated techniques.

Decision information The first level of choice architectures targets the ”presentation of decision-relevant information” (Münscher et al. 2016). One important aspect is that

this category only includes the presentation and no altering of the options itself. Techniques for that choice architecture category are the translation of information, visibility of information and the providence of social reference points

Decision structure Secondly, choice architects directly modify the available options of choice itself. This includes techniques like choice defaults, the related effort and consequences of an option and also the range of composition and options.

Decision assistance Lastly, choices can be designed in a way that consumers follow their intentions. Techniques for such assistance can be the fostering of a commitment or by providing reminders of the preferred behavior.

2.3 Nudging became digital

Because various choices we take today ”involve some form of information technology” (Johnson et al. 2012), the concept of nudging recently gains interest in research of different disciplines. Thereby, the underlying concepts of ”offline” nudges are transferred and adapted in digital environments. The result is digital nudges. According to Weinmann et al. 2016 digital nudges are defined as follows:

Digital nudging is the use of user-interface design elements to guide people's behaviors in digital choice environments.

Just like in the offline and analog environments, digital environments face multiple sources of decision difficulty such as task complexity, information load, information uncertainty, conflicts, emotional difficulty and preference uncertainty (Broniarczyk and Griffin 2014). To face those challenges in digital environments, the use of cognitive heuristics and biases can act as a baseline to design digital nudges. Different user-interface design elements facilitate different nudges. Table 1 gives an overview of the different biases, in which way they influence decision-making and how those are translated to specific design elements.

Even though nudges aim to influence behavior in digital environments, they should not be mistaken with persuasion. A persuasion is instead a form of human communication, that is also used in technology. The goal of this technique is also to influence user behavior, but more persistently, so that underlying attitudes are influenced (Oinas-Kukkonen and Harjumaa 2009). Although both concepts share similarities, this paper solely focuses

Heuristic / Bias	**Example Design elements and mechanisms**
Status quo bias	- Radio buttons - Checkboxes - Dropdown menus - Sliders with default position - Pre-filled inputs
Decoy effect	Presentation of options in: - Radio buttons - Checkboxes - Dropdown menus
Primacy and recency effect	Positioning of elements (earlier or later)
Middle-option bias	- Addition of higher- and lower-price alternatives around the preferred option. - Ordering of alternatives. - Modification of the option scale.
Anchoring and adjustments	- Variation of slider endpoints. - Use of default slider position. - Predefined values in text boxes for quantities.
Norms (moral / social)	- Display of popularity (social norms). - Display of honesty codes (moral norms)
Scarcity effect	- Use of default slider position. - Language and displaying additional information about quantity and availability

Table 1: Heuristics and Design elements of digital nudges (based on Schneider et al. 2018)

on digital nudges and the decision-making process. An ongoing influence on underlying behavior is still possible, but not directly part of a nudge and therefore not further evaluated.

3 Methodology

This literature review follows a systematic approach, that is well-tried in the discipline of information systems (Webster and Watson 2002). Because of a limited time frame, this review was done in limited scope which means that it does not cover all papers and studies of the subject. Rather, this literature review targets a qualitative subset of literature and thereby tries to be as representative as possible. The focus lies on publications of academic journals. To get a qualitative representation of the current research a journal-wise analysis is preferable to a database-based analysis. The overall approach follows a known pattern in information systems literature reviews (Alavi and Carlson 1992).

1. Identifying, reviewing and analyzing existing literature in the field of digital nudges. This includes empirical, as well as non-empirical studies

2. Identifying theoretical and methodological approaches used to understand the use of nudges in consumer choice. This also includes the type of choices and the designed choice architecture.

3. Identifying a research gap within existing literature to guide future research.

To facilitate this strategy, several variables are necessary to consider. Because the underlying multidisciplinary of digital nudges it is was not feasible to analyze all articles. Digital nudging is a concept that spans across several fields of research. Those variables are set journal- and paper-wise. A graphic of the screening process is available in the appendix (3).

3.1 Journal selection

Journal-wise variables are the journal domain and its rating. As suggested in existing literature, it is reasonable to not only look within the field of information systems research but also outside (Webster and Watson 2002). It is reasonable to examine academic journals with the most influence in the research domain. As already mentioned, nudging is a subject of several research streams. This includes research from the area of information systems, management, marketing, behavioral economics, and psychology. Regarding research about information systems the *AIS Basket of 8* provides a good source (Alavi and Carlson 1992). This basket consists out of eight well-respected journals in the domain.

After the AIS scholarly basket, academic journals about management and marketing were recorded in the research process. Thereby, the journal list of the *UT Dallas* was taken as a reference point. Duplicate journals from the lists of the AIS scholarly basket and the UT Dallas were eliminated and only analyzed ones. Overall the journal list of the UT Dallas contributes with twelve journals to the research pool. To gain further insights into the concept of nudges, academic journals from the domains of behavioral economics, decision making and psychology (with regards to human decision making) are included in the research process. The relevant publications are identified by the *VHB* journal rating *JOURQUAL3*[2]. Journals with a rating of *B* or better are taken into account for the research. To finalize the list of sources for the upcoming analysis, conference publication from the AIS pool with a VHB rating of *B* or better were included, too. In total 36 journals were examined. A complete list of these journals can be found in the appendix.

3.2 Paper selection

Paper-wise, only articles with more than two pages and a publication date older than 2010 are concerned. This date is set because nudging is a rather new concept that was first introduced under this definition in 2009 (Thaler and Sunstein 2009). To obtain relevant articles, a keyword-based search is conducted. The major keywords in this search are *nudg* AND digital*. A full-text search searches all journals. Because the term nudging is not always directly mentioned in the articles, additional keywords are added to the search query if the examined journal does not provide any necessary results with regards to their keyword *nudg**. Those additional keywords are *decision, choice, consumer*. Overall 87 journal articles were found that mentioned the term nudge or matched the described keywords. To extract the most relevant sources, articles were excluded to based on several criteria. This concerns journal papers that only embody offline nudges. Such articles were excluded from the final article list, as well as articles that focus on the topic of persuasion and long-term behavior change. In the end, 37 articles are evaluated in the final concept matrix. The complete list of articles is available in the appendix.

[2]more information under `https://vhbonline.org/vhb4you/jourqual/vhb-jourqual-3/gesamtliste/`

3.3 Analysis approach

To guide the analysis, the research takes several questions into account. The structure of those questions is based on prior literature research (Alavi and Carlson 1992).

- What is the type of choice?
- What is the research approach?
- What major theories, concepts, heuristics, and biases are used to study the effect of the evaluated nudge and how is the choice guided?
- What part of the choice architecture is influenced?

Concerning the in-depth analysis, the extracted articles are coded in a concept matrix. To answer the underlying research questions, different categories of the relevant articles are inspected. Those categories are

- General research information and metadata
- Influence on choice architecture
- Underlying concepts and theories

A complete version of the coding and concept matrix is available in the appendix.

4 Results

4.1 Overall research output

Since the release of the ”Nudge” by Thaler and Sunstein in 2009, the concept of nudges gained more and more interest in several research streams and domains...

For reasons of overview, the domain names are coded. The complete coding of the domain names is available in the appendix on table 8 as well as in the abbreviation section.

Publishing year	CCH	EDU	FIN	HEA	PSB	SUS	TRA	SCP	GOV	MISC
2011 (1)	1	0	0	0	0	0	0	0	0	0
2012 (1)	0	0	0	0	0	0	0	0	0	1
2013 (0)	0	0	0	0	0	0	0	0	0	0
2014 (5)	4	0	0	0	0	0	1	0	0	0
2015 (3)	0	0	1	2	0	0	0	0	0	0
2016 (7)	3	0	0	1	1	1	0	1	0	0
2017 (10)	6	0	0	0	2	1	0	1	0	0
2018 (9)	5	0	0	1	0	1	0	1	0	1
2019 (1)	1	0	0	0	0	0	0	0	0	0
Total (37)	20	0	1	4	3	3	1	3	0	2

Table 2: Overall research output across domains

4.2 Research type and methods

Identified articles categorized based on the Alavi and Carlson’s research classification scheme (Alavi and Carlson 1992).

4.2.1 Non-empirical

Non-empirical research	CCH	SCP	MISC
Literature review (1)	1	0	0
Conceptual (2)	1	1	0
Literature review and conceptual (4)	3	0	1
Total (7)	5	1	1

Table 3: Non-empirical research across domains

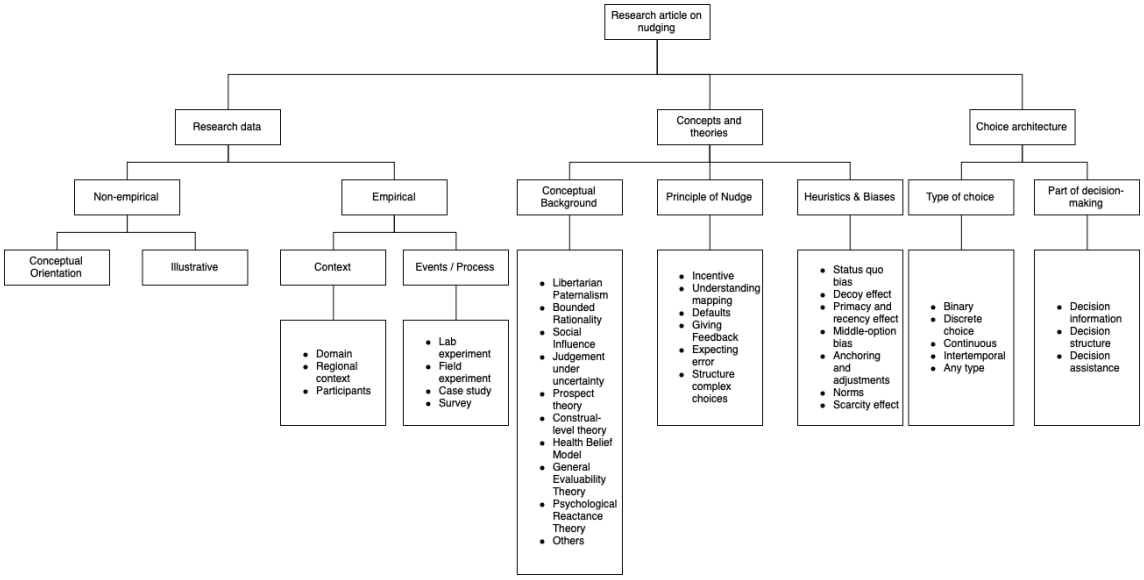

Figure 1: Classification of findings

Sources: Cao et al. 2018

Yoo and Sarin 2018

Gamliel and Peer 2017

Münscher et al. 2016

Broniarczyk and Griffin 2014

Lades 2014

Dolan et al. 2012

Literature review

Conceptual

4.2.2 Empirical

Case Study

Survey

Lab Experiment

Field Experiment

Empirical research	CCH	EDU	FIN	HEA	PSB	SUS	TRA	SCP	GOV	MISC
Lab experiment (15)	10	0	0	2	1	1	0	0	0	1
Field experiment (5)	2	0	0	1	1	1	0	0	0	0
Lab experiment and field experiment (1)	0	0	0	0	1	0	0	0	0	0
Lab experiment and survey (3)	2	0	0	0	0	0	0	1	0	0
Survey (5)	2	0	1	0	0	0	1	1	0	0
Case Study (1)	0	0	0	1	0	0	0	0	0	0
Case Study, survey and lab experiment (1)	0	0	0	0	1	0	0	0	0	0
Total (31)	16	0	1	4	4	2	1	2	0	1

Table 4: Empirical research across domains

Empirical research	Decision Information	Decision structure	Decision assistance	Combination
Lab experiment (15)	9	5	1	0
Field experiment (5)	0	1	1	3
Lab experiment and field experiment (1)	0	1	0	0
Lab experiment and survey (3)	1	2	0	0
Survey (5)	2	0	0	3
Case Study (1)	1	0	0	0
Case Study, survey and lab experiment (1)	1	0	0	0
Total (31)	12	9	2	6

Table 5: Empirical research across parts of the choice architecture

4.2.3 Context of Use

Participants

Location

Domain

4.3 Theories and concepts used to study nudges

4.3.1 Principle of Nudge

Incentive

Understanding mapping

Defaults

Giving Feedback

Expecting Error

Structure complex choices

4.3.2 Conceptual Background

Libertarian Paternalism

Bounded Rationality

Social Influence

Judgment under uncertainty

Prospect theory

Construal-level theory

Health Belief Model

General Evaluability Theory

Psychological Reactance Theory

Others

4.3.3 Heuristics and biases

Heuristic / Bias	Decision information	Decision structure	Decisions assistance	Combination
Status quo bias (5)	0	5	0	0
Decoy effect (1)	0	1	0	0
Primacy and recency effect (1)	0	1	0	0
Middle-option bias (0)	0	0	0	0
Anchoring and adjustments (1)	1	0	0	0
Norms (12)	8	1	2	1
Status quo bias and norms (1)	0	1	0	0
Scarcity effect (0)	0	0	0	0
Total (21)	9	9	2	1

Table 6: Heuristics used across parts of choice architectures

Status Quo Bias

Decoy Effect

Primacy and Recency Effect

Middle-option bias

Anchoring and adjustments

Norms

Scarcity effect

4.4 Influence on the choice architecture and decision making

4.4.1 Type of choice

Binary

Discrete choice

Continuous

Any type of choice & inter temporal

4.4.2 Choice architecture

Choice Architecture	CCH	EDU	FIN	HEA	PSB	SUS	TRA	SCP	GOV	MISC
Decision information (15)	10	0	1	2	1	0	0	0	0	1
Decision structure (10)	4	0	0	0	2	2	0	2	0	0
Decision assistance (3)	2	0	0	1	0	0	0	0	0	0
Combination (6)	2	0	0	1	0	1	1	1	0	0
Total (34)	18	0	1	4	3	3	1	3	0	1

Table 7: Choice architecture parts used across the domains

Decision information

Translate Information

Make information visible

Reference point

Decision structure

Change defaults

Change effort

Change range or composition of options

Change consequences

Decision assistance

Provide reminders

Facilitate commitment

5 Conclusion

In the end of the thesis all results will be summarized and critically discussed. The goal is to identify a research gap and to give recommendations for future research that would advance the topic.

5.1 Summary of Findings

5.2 Limitations

5.3 Recommendations for future research

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Appendix

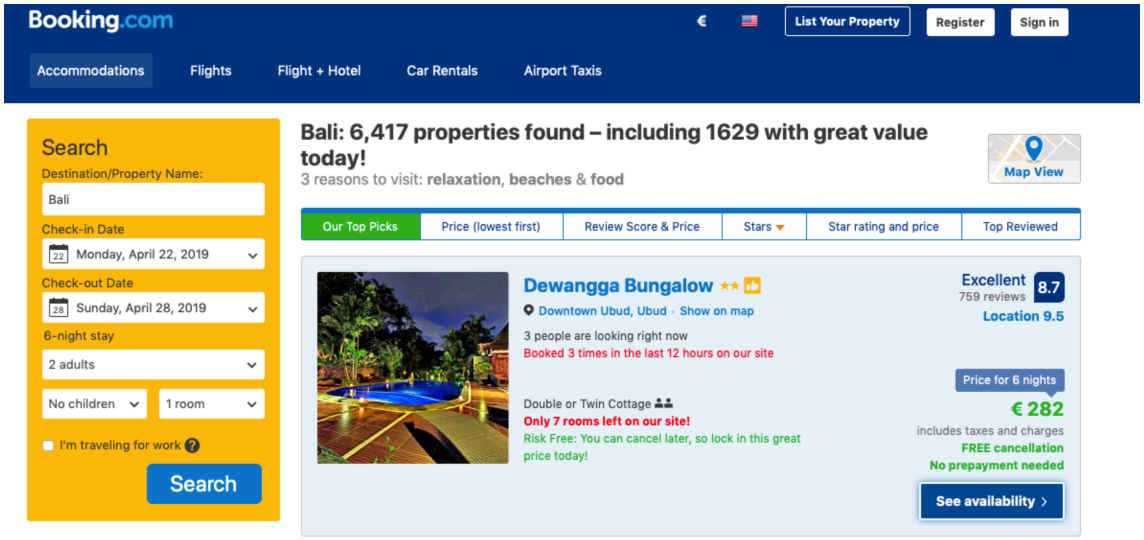

Figure 2: Digital nudging example - booking.com

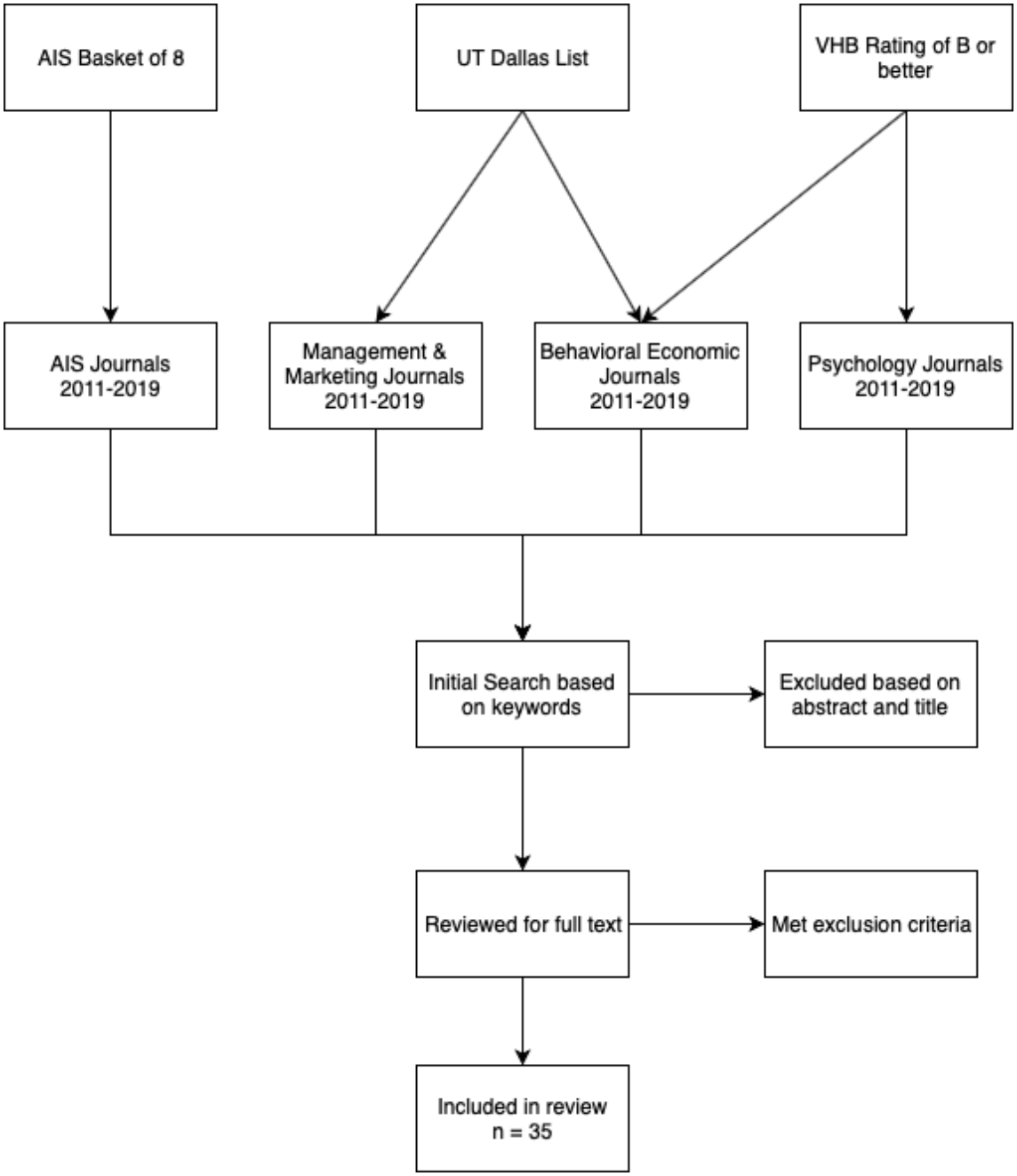

Figure 3: Information flow of the screening process

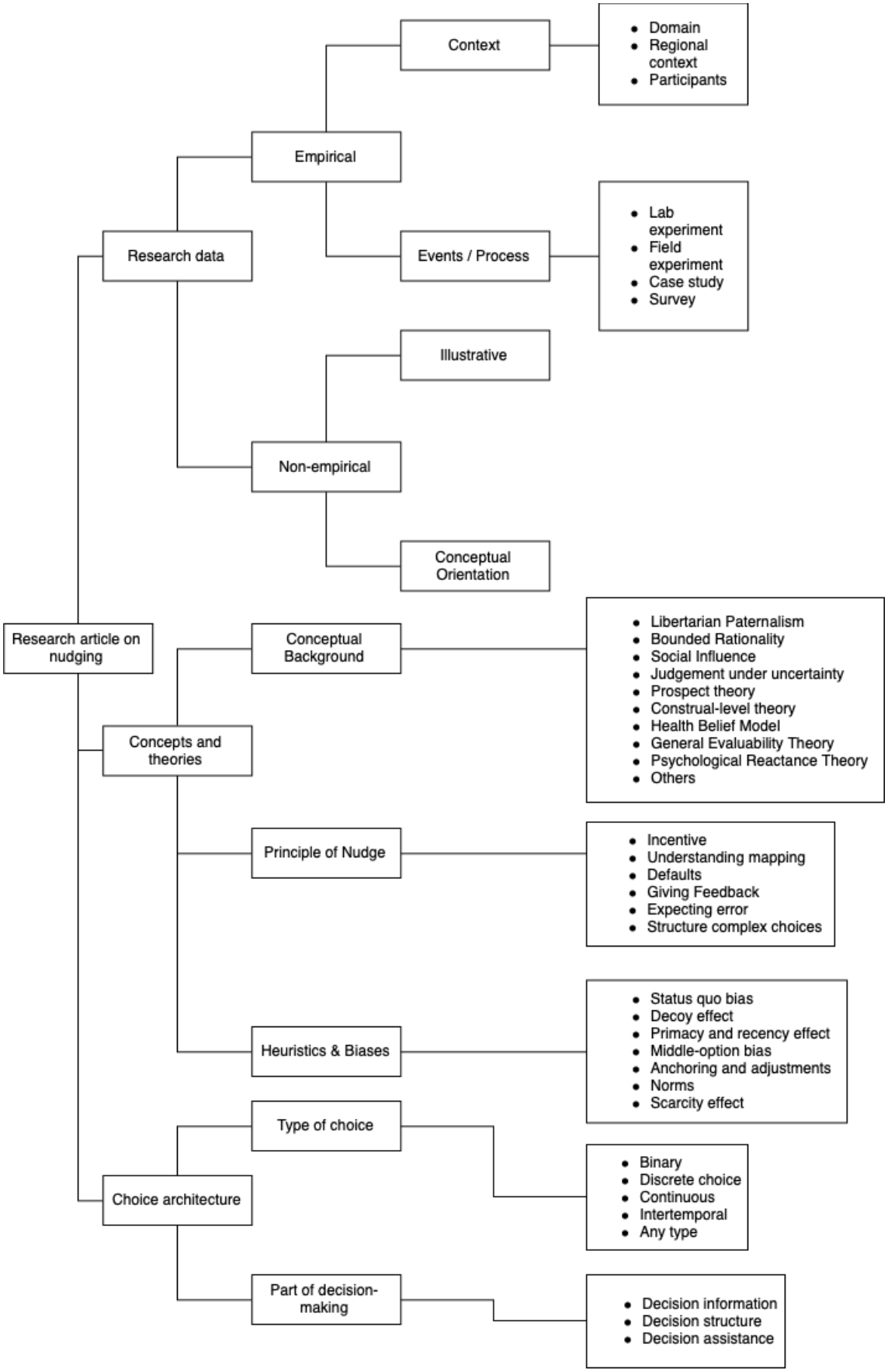

Figure 4: Classification of findings-detailed

Domain	Coding
Consumer Choice	CCH
Education	EDU
Finance	FIN
Health	HEA
Prosocial Behavior	PSB
Sustainability	SUS
Transportation	TRA
Security & Privacy	SCP
Government	GOV
Other	MISC

Table 8: List of domain codings

Affidavit

I hereby declare that I have developed and written the enclosed seminar thesis entirely on my own and have not used outside sources without declaration in the text. Any concepts or quotations applicable to these sources are clearly attributed to them.

This seminar thesis has not been submitted in the same or substantially similar version, not even in part, to any other authority for grading and has not been published elsewhere. I am aware of the fact that a misstatement may have serious legal consequences.

Mannheim, 30. March 2019

Marvin Messenzehl