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Nutritional Effects on Consumer Choice Behavior – Investigating the Influence of Caffeine on the Attraction Effect, Compromise Effect, and Choice Deferral

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List of Abbreviations

Abbreviation	Long form / Definition
AE	Attraction effect
CE	Compromise effect
CNS	Central nervous system
PNS	Peripheral nervous system
TBI	Traumatic brain injury
fMRI	Functional magnetic resonance imaging
EKB	Engel, Kollat, and Blackwell
RIM	Reflective-impulsive model
FMCG	Fast moving consumer good
EJM	European Journal of Marketing
IMR	International Marketing Review
JBR	Journal of Business Research
JCP	Journal of Consumer Psychology
JCR	Journal of Consumer Research
JMR	Journal of Marketing Research
JR	Journal of Retailing
ManSci	Management Science
ML	Marketing Letters
MarSci	Marketing Science
CRT-L	Cognitive reflection task extended
SAM	Self-assessment manikin
SOEP	German Socio-Economic Panel
RPM	Random payoff mechanism

Introduction and Structure of this thesis

"Tell me what you eat and I will tell you what you are" (Brillat-Savarin, 1825). It is no surprise that nutrition significantly impacts the human body. Most basically, an unhealthy diet, which is a key risk factor driving worldwide death and disability rates (Forouzanfar et al., 2015), leads to an unhealthy body. Accordingly, various methods have been implemented to assist humans in their nutritional choices, highlighting healthy over unhealthy foods (Lobstein & Davies, 2009). Regardless of the nutritional information provided, consumers oftentimes are unaware of the physiological and psychological impact of their diet or are even willing to accept the health risks involved with the consumption of unhealthy nutrition. This especially holds for psychostimulants, which have globally established themselves within the regular human diet. In the US alone, the psychostimulant nicotine is involved in more than 480,000 deaths annually in form of cigarette smoking, while additionally incurring smoking-related costs in excess of $300 billion per year (Centers for Disease Control and Prevention, 2022). An even more prominent psychostimulant, namely caffeine, has established itself as a relevant dietary aspect within western societies, with the US population's mean daily consumption at 2.2 mg/kg body weight/day (Mitchell, Knight, Hockenberry, Teplansky, & Hartman, 2014). As caffeine is the most consumed psychostimulant worldwide (Fredholm, Bättig, Holmén, Nehlig, & Zvartau, 1999; Varani et al., 2005), the interest regarding its physiological impact, including toxicity due to habitual use (Reyes & Cornelis, 2018), is increasing for both public and scientific stakeholders. Related problems that have been discussed regarding the risks of caffeine consumption include dangers of energy drink overuse (Rath, 2012; Reissig, Strain, & Griffiths, 2009), interaction of caffeine consumption with alcohol consumption (Ferreira, De Mello, Pompéia, & De Souza-Formigoni, 2006; Sweeney, Meredith, Evatt, & Griffiths, 2017), caffeine addiction (Budney & Emond, 2014; Jain, Srivastava, Verma, & Maggu, 2019; Olekalns & Bardsley, 1996) and caffeine intoxication (Kerrigan & Lindsey, 2005). The influence of caffeine has been researched in various fields, including but not limited to physical sports performance (Del Coso et al., 2014), health (Nawrot et al., 2003), pregnancy (Qian, Chen, Ward, Duan, & Zhang, 2020), subjective time perception (Arushanyan, Baida, Mastyagin, Popova, & Shikina, 2003), and driving safety among truck drivers (Heaton & Griffn, 2015). Caffeine consumption has especially shown to influence important aspects of human behavior strongly associated with the human central nervous system (CNS) and accordingly the decision-making process. Consuming the CNS stimulant has indicated significant

improvement in cognitive capabilities such as choice reaction time (Lieberman, Wurtman, Emde, Roberts, & Coviella, 1987), visuo-spatial reasoning (Jarvis, 1993), and attention (Heatherley, Hayward, Seers, & Rogers, 2005). Furthermore, caffeine has been revealed as a driver contributing towards the experience of feeling or emotion, namely affect. Studies have reported caffeine to increase arousal levels (Barry et al., 2005), improve arousal vigilance (Sanchis, Blasco, Luna, & Lupiáñez, 2020) and to benefit mood (Haskell, Kennedy, Wesnes, & Scholey, 2005).

The impact of the physiological and psychological state of human beings and its influence on consumer perception and behavior has been a topic of interest in recent literature (Dai & Hsee, 2013; Lichters, Brunnlieb, Nave, Sarstedt, & Vogt, 2016a; Madzharov, Block, & Morrin, 2015; Masicampo & Baumeister, 2008). An under-researched topic, however, is the influence of caffeine on consumer purchase behavior. Due to the importance of cognition's and affect's involvement in the decision-making process, inspecting the link between the CNS stimulant and human purchase decisions should be considered a step towards better comprehending the consumer's decision-making process and its underlying neurobiological origins. Improving to comprehend this process with an interdisciplinary approach may offer insight towards appreciating contextual settings (i.e. context effects) in which caffeine may manipulate the consumer's decision-making ability and to which degree caffeine consumption may influence choice deferral. To investigate caffeine's influence on consumer behavior, my thesis implements an array of placebo-controlled double-blind protocols with the intent to manipulate the participants' levels of cognitive and affective capabilities before conducting a series of realistic product purchase tasks. Specifically, I investigate the degree to which caffeine consumption impacts purchase decisions in context sensitive scenarios and choice deferral. In an attempt to better comprehend their underlying mechanisms of consumer decision making (e.g. Lichters et al., 2016a; Masicampo & Baumeister, 2008), my research aims at contributing to existing literature having investigated the physiological states influencing context effects and choice deferral. In line with previous research (Lichters et al., 2016a; Lichters, Müller, Sarstedt, & Vogt, 2016b), I evaluate the neuropsychological processes driving context effects and choice deferral by investigating caffeine's influence on decision-making in purchase scenarios entailing economic consequences (i.e., participants had to pay in exchange for products).

The initial chapter of my thesis will focus on the principles of the two most prominent context effects, namely the attraction effect (AE), also referred to as the asymmetric dominance effect, and the compromise effect (CE), which both feature prominently throughout various recent articles of high ranking marketing journals (e.g, Farmer, Warren, El-Deredy, & Howes, 2017; Hadar, Danziger, & Hertwig, 2018; Liao, Chen, Lin, & Mo, 2020). The phenomena describe consumer behavior that deviates from axioms we take for granted in rational choice theory (Huber, Payne, & Puto, 1982; Simonson, 1989; Simonson & Tversky, 1992) and have been replicated in various settings (Lichters et al., 2016a; Milberg, Silva, Celedon, & Sinn, 2014; Neumann, Böckenholt, & Sinha, 2016; Simonson & Nowlis, 2000). While the underlying mechanisms of the CE are consistently associated with cognitive processes (Chang & Liu, 2008; Dhar & Gorlin, 2013; Lichters et al., 2016a), previous research suggests the AE to result from an impulsive decision-making style (Hedgcock & Rao, 2009; Mao & Oppewal, 2012; Pocheptsova, Amir, Dhar, & Baumeister, 2009). However, recent literature is shifting the narrative towards the AE resulting from a deliberate thought process (Hadar et al., 2018; Lichters, Bengart, Sarstedt, & Vogt, 2017).

The second chapter of my doctoral thesis establishes the foundation for the hypotheses generated in chapter three. I first provide a general overview of caffeine before focusing on the physiological and psychological impact the psychostimulant has on the CNS and thus influences human behavior. Next, I combine the neuropsychological impact of caffeine on regions within the human CNS with the underlying mechanisms of context sensitive choice behavior to develop the hypotheses evaluated in the following studies. Prior to assessing the influence of caffeine on consumer choice behavior, chapter 4 will briefly address the limitations of context effect experiments (Frederick, Lee, & Baskin, 2014; Yang & Lynn 2014) while discussing guidelines suggested by Lichters, Sarstedt, and Vogt (2015) to improve the quality of experimental context effect research. I will review current literature evaluating the quality of recent experimental context effect research and to which degree the suggested guidelines made by Lichters et al. (2015) have since been implemented into experimental research published in high-ranking marketing journals.

In the following chapters I present the conducted experiments evaluating the stimulant's impact on decision-making within alternating experimental designs. Over three studies, caffeine will be administered orally by adding the substance to a decaffeinated coffee beverage or soft-drink, which was administered a caffeine dosage of 200 mg for the treatment

group. This amount equals the caffeine dosage of 2.5 cans (250ml) of an energy drink such as RedBull® or 1.25 of Starbucks® 'short' coffee servings (Mackus, van de Loo, Benson, Scholey, & Verster, 2016). Thus, the administration procedure enabled a clear distinction between caffeine administration and lack thereof in a realistic setting. Aligning with previous studies examining psychological and physiological states influencing consumer decision making (Lichters et al., 2016a; Lichters et al., 2016b), I inspect how caffeine's manipulation of cognition levels influences consumer decision-making. More precisely, I evaluated the stimulant's impact on decision-making phenomena in product choice (i.e., context effects and choice deferral (Lichters et al., 2015)). I was able to observe a reduction in choice deferral rates for consumers of the psychostimulant while the magnitude of both the AE and the CE in free-choice and forced-choice decision situations on a between-subjects and within-subjects basis was enhanced. Furthermore, my findings directly contest previous arguments of the AE resulting from an intuitive decision-making process (Hedgcock, Rao, & Chen, 2009; Pocheptsova et al., 2009).

The final chapter of my thesis closes by compiling all findings and providing a detailed overview of the implications which can be derived by my studies followed by an evaluation of their respective limitations. An insight on future research avenues completes my thesis.

Chapter 1

Principles of the Attraction Effect and the Compromise Effect

1. Chapter overview

The consumer decision-making process can be context sensitive. Factors such as scent (Madzharov et al., 2015; Mattila & Wirtz, 2001), music (Andersson, Kristensson, Wästlund, & Gustafsson, 2012; Yalch & Spangenberg, 1990), and product assortment composition (Lourenço & Gijsbrechts, 2013; Simonson, 1999) have shown to exert influence on product choice in the market place. Researchers have identified specific contextual settings in form of product choice set composition leading to seemingly irrational choice behavior. With Huber, Payne and Puto shedding light to the topic of context effects within their seminal paper in 1982, researchers have been investigating these choice inconsistencies in various different choice settings. Belonging to these context effects are the phantom decoy effect (Pettibone & Wedell, 2007; Trueblood & Pettibone, 2017), the zero-price effect (Niemand, Mai, & Kraus, 2019), the common-attribute effect (Evangelidis & Van Osselaer, 2018), and the more prominent AE and CE. The latter two effects have been heavily investigated in the field of marketing research, specifically focusing on the influence of choice set composition on choice behavior (Huber et al., 1982; Lichters et al., 2017; Lichters et al., 2016b; Simonson, 1989). The interests of researchers range from comprehending the underlying mechanisms of specific context effects (Sanjay Mishra, Umesh, & Stem Jr., 1993) to evaluating how these effects are influenced by certain physiological factors (Lichters et al., 2016a). As my thesis will investigate the physiological impact of caffeine on consumer decision making, specifically in the contextual setting presented by the AE and the CE, it is necessary to initially comprehend the principles underlying both context effects. By obtaining an understanding of what constitutes the respective context effect, I will be able to define how these phenomena violate basic assumptions of rational choice behavior.

This chapter will first substantiate the foundations of rational choice behavior and the underlying axioms before evaluating conditions under which decision making occurs. Next, I will explain and visualize the principles of both the AE and the CE and how their occurrence aligns with consumers not fully behaving rationally as expected within the boundaries established by basic axioms of rational choice behavior. Upon establishing a cornerstone of my thesis, I will conclude the chapter with a brief summary.

2. Foundations of rational choice behavior

For the purpose of evaluating the influence of caffeine on consumer decision making, I will consider consumers to make decisions in a rational matter. Rational choice theory focuses on the optimal exchange between two agents, for example consumers and firms, both looking to fulfill their objectives. Consumers will strive to achieve the best result under given circumstances. In order to define alternatives, the rational choice paradigm implements utility functions. These measure the value of each available option, allowing consumers to draw comparisons between alternative choices. To draw these comparisons, rational choice theory introduces axioms defining consumer preference, as outlined below. In line with the maximum expected utility principle, rational consumers will always select the alternative which provides or is expected to provide the highest utility (Rabin, 2000). This section will briefly discuss the foundations on which the decision-making process builds upon.

2.1. Axioms of consumer preference

Rational decision making involves consumers to behave in a rational matter. Accordingly, rational consumers have rational preferences. Defining rational preferences is an important step, as this establishes the boundaries of rational choice behavior. Rational preferences in line with the well-established expected utility theory are constraint to a set of axioms developed by John von Neumann and Oskar Morgenstern in the 1940s, formally known as the *von Neumann-Morgenstern axioms* (Levin, 2006). The axiom set consists of completeness, transitivity, continuity and independence, which collectively assign boundaries for rational choice to occur within.

Complete preferences allow decision makers to define preferences. For example, in a choice set containing two options (A, B), a consumer can either prefer option A over B ($A^P B$), prefer option B over A ($B^P A$), or be indifferent between both options ($A^I B$) (Levin, 2006). By choosing *one* of the aforementioned preferences, the axiom of completeness is fulfilled. Next, I will briefly discuss the axiom of transitivity. Consider a set containing three options (A, B, C). Whenever option A is preferred over B ($A^P B$), and option B is preferred over C ($B^P C$), then, by transitivity, option A must be preferred over C ($A^p C$). Fulfilling the transitivity axiom allows decision makers to be consistent in their choices (Levin, 2006). The continuity axiom states that when option A is strictly preferred to option B, and option B is strictly preferred to option C, an appropriate combination of A and C will be strictly preferred

to B, and B will be strictly preferred to another appropriate combination of A and C (Davis, Hands, & Mäki, 1998). Continuity implies that when A is preferred to B, then a choice alternative close to A (e.g. A´) is still preferred to B (Davis et al., 1998). Complete, transitive and continuous preferences can be represented by a utility function. Key to expected utility theory, the independence axiom is defined as follows (Levin, 2006):

A preference relation ≥ on the space of lotteries P satisfies independence if for all b, b´, b´´ ∈ B and α ∈ [0,1], we have

$$b \geq b' \iff \alpha b + (1 - \alpha)b'' \geq \alpha b' + (1 - \alpha)b''$$

Independence states that if an option B is preferred to option B´, given that the alternative in both situations is the chance of receiving B´´, a decision maker will prefer the chance of receiving option B over the chance of receiving option B´ (Levin, 2006). As a result, rational decision makers preferring option B to option B´ should not also prefer option B´ to option B (Oppenheimer & Kelso, 2015). Taken together, complete, transitive, continuous, and independent preferences can be represented by expected utility functions, allowing decision makers to compare available alternatives in the process of choice.

Extending on the boundaries of rational choice behavior established by the *von Neumann-Morgenstern axioms*, Luce (1959) proposed the choice axiom (LCA), a probabilistic approach of modeling choice behavior. Luce defines axiom 1 as follows: Let T be a finite subset of U such that, for every S ⊆ T, P_S is defined.

(i) If P(x,y) ≠ 0, 1 for all x, y ∈ T, then for R ⊂ S ⊂ T $P_T(R) = P_S P_T(S)$

(ii) If P(x,y) = 0, for some x, y ∈ T, then for every S ⊂ T $P_T(S) = P_{T-|x|}(S - \{x\})$

Lemma 3 of the LCA is introduced to express the idea of independence from irrelevant alternatives (IIA).

If P(x,y) ≠ 0, 1 for all x, y ∈ T, then axiom 1 implies that for any S ⊂ T such that x, y ∈ S,

$$\frac{P(x,y)}{P(y,x)} = \frac{Ps(x)}{Ps(y)}$$

Axiom 1 is said to be a probabilistic version of the IIA, which states that when comparing two alternatives by means of preference, this comparison is to remain unaffected by the introduction of a new alternative (Luce, 1959). Accordingly, preference reversal by means of introducing a new option to an existing core set does not coincide with seemingly rational behavior. The LCA has found application in rational economic choice theory focusing on consumer behavior (Halldin, 1974) and establishes the basis for elaborating on the principles violated by both the AE and the CE, which will be addressed at a later stage.

Expected utility theory is a key instrument for assessing decision making in situations where outcomes are unknown to the consumer. Nonetheless, decision making can occur under various conditions, which will briefly be evaluated in the following section.

2.2. Decision making conditions

2.2.1. Certainty

In its simplest form, decision making is made under certainty. Given certainty, the decision maker has full information regarding the decision outcome and is thereby fully aware of the future state of nature. To clarify, consider an investor with the option to purchase 500 EUR of a risk-free government bond with an interest rate of 3% p.a. The investor evaluates if a 10-year investment is worthwhile. Since all necessary information is provided, the decision outcome is certain. Under certainty, decision makers are interested in either maximizing the benefit (e.g. profit) or minimizing the costs (Wang & Ruhe, 2007). Accordingly, rational decision makers will evaluate if this risk-free investment is the investment which will maximize the *guaranteed* return after the 10-year period and select accordingly.

2.2.2. Risk

The second strand of decision-making focuses on situations involving risk. In consumer behavior, the decision maker is generally unable to know the choice outcome for certain (Bauer, 1960). Accordingly, decisions made by the consumer at large involve risk (Taylor, 1974). Over the past decades, various attempts of defining risk have been made. Lowrance (1976) defines risk as “a measure of the probability and severity of adverse effects”. Priest (1990) defines risk as the “the potential to lose something of value”. In a more recent attempt, risk has been defined as “the potential of losing something of value, weighed against the potential to gain something of value (Kungwani, 2014, p. 83). As can be taken from the

definitions, risk generally has a negative connotation, even though the outcome oftentimes involves the ability to gain. The negative connotation coincides with the concept of risk aversion and loss aversion. Risk averse decision makers will prefer to receive the expected value of a lottery rather than taking part in it (Montesano, 1991). Loss aversion can be interpreted as instances where losses weigh heavier than equivalent gains (Kahneman & Tversky, 1979). Collectively taken, consumers generally tend to avoid risk, when possible.

In decision-making under risk, a decision maker assumes a fixed number of possible future outcomes with a known probability of the respective outcome. An example of decision making under risk is the toss of coin. In a fair coin toss, two outcomes are known to be feasible, heads or tails. The probability of each outcome, in this case approximately 50% each, is known beforehand. Knowing the possible outcomes and their respective probability, the expected value of each outcome can be assessed. By taking the sum of the products of every potential outcome multiplied by the respective probability of occurrence, the expected value for each outcome can be calculated. Rational decision makers will select the option yielding the highest expected value (Damghani, Taghavifard, & Moghaddam, 2009). In case of identical expected values, the decision maker will be indifferent between selecting the respective options.

2.2.3. Uncertainty

In its final condition, decisions are made under uncertainty. Uncertainty can be defined as "a situation in which something is not known, or something that is not known or certain"[1]. In uncertain situations, decision makers face problems where a multitude of outcomes exist but the respective probabilities of occurrence are unknown (Damghani et al., 2009). Decision makers are now forced to make decisions involving calculated risks (Hammond, Keeney & Raiffa, 1999, p. 109). Under uncertainty, it is critical to increase the odds of making a good decision by systematically understanding the uncertain situation and the involved outcomes, their likelihoods, and their impact (Hammond, Keeney & Raiffa, 1999, p. 109). Nonetheless, the respective decision approach will depend on the type of decision maker is involved in the decision. Literature addresses various types of decision makers, including optimistic and pessimistic. An optimistic decision maker intends to maximize the possible outcome and strives for the maximax solution (Damghani et al., 2009). As an example, consider a situation

[1] https://dictionary.cambridge.org/dictionary/english/uncertainty

where two alternative outcomes exist, A and B. Outcome A gives a maximal outcome of a 500 EUR gain and a minimum outcome of a 100 EUR loss. In the alternative outcome B, the maximum outcome is a gain of 300 EUR while the minimum outcome is 0 EUR. The optimistic decision maker will select the maximum outcome of all maximum outcomes, which in this case is 500 EUR. Alternatively, the optimistic decision maker might also strive for cost minimization, in which the strategy aims at the solution of the lowest costs of all low-cost alternatives. The pessimistic decision maker will aim at selecting the outcome which is "least bad" (Damghani et al., 2009), striving for the minimax solution. Accordingly, the minimum outcomes are evaluated and the maximum of these is selected. Following the previous example, the decision maker will select the outcome yielding 0 EUR. As a further decision strategy, pessimistic decision makers will follow the minimax cost strategy (Wang & Ruhe, 2007), which implies the decision maker to minimize the maximum cost scenario (Damghani et al., 2009).

Upon having established a basic understanding of the axioms of consumer preference and the three main conditions under which consumer decision-making takes place, the following section will discuss the underlying principles and axiomatic violation of the AE and the CE.

3. The Attraction Effect

Initially demonstrated by Huber et al. (1982), the AE is amongst the most prominent context effects violating rationality axioms of consumer choice. To explain the AE, rational decision makers are expected to *generally prefer* (1) high quality (vs. lower quality), and (2) low prices (vs. high prices), while achieving higher quality entails paying a higher price. Consider a binary core set of two conflict-generating options, where products are described by quality and price, made up of a competitor, low-tier option (L) and a mid-tier, target option (M). Consumers will initially more likely prefer to choose the low-tier option. Next, the binary core set is extended by one further option (D), which is identical to the mid-tier option in quality, however is inferior to this option in price. Accordingly, the newly introduced option (D) is dominated by the existing mid-tier option (M), as can be seen in figure 1. The AE, also known as the "decoy effect" or "asymmetric dominance effect", refers to the introduction of a dominated, or relatively inferior option which increases the choice probability of the dominating option (de Clippel & Eliaz, 2012; Huber et al., 1982). By introducing an

irrelevant “decoy” option, the dominating “target” becomes more attractive for consumers (Hadar, Danziger, & Hertwig, 2018; Hedgcock & Rao, 2009; Lichters et al., 2017). As an example, picture two portable USB chargers (power banks). One option (L) is priced at 20€ and has a battery capacity of 10,000 mAh. The second option (M) is priced 30€ and has 15,000 mAh. All other attributes are identical. While in this binary setting consumers may tend to prefer the lower cost option A over the higher-priced option B, consider the introduction of a third option (D), which is priced at 40€ and has a capacity of 15,000 mAh. All other attributes are identical to those of the two alternatives. With option D having an identical battery capacity to option M, the decoy is dominated by the target option, establishing asymmetric dominance within the choice set. According to the AE, asymmetric dominance will increase the relative market share of option B. In certain situations, the introduction of a decoy option may taint the choice set, making the target option (M) less attractive than the competitor option (L). Based on the tainting hypothesis (Simonson, 2014), this so-called repulsion effect has been observed to impact context sensitive decision making (Frederick, Lee, & Baskin, 2014; Liao et al., 2020; Spektor, Kellen, & Hotaling, 2018).

Before further evaluating its relevance in marketing practice and further fields of research, it is crucial to understand what constitutes the occurrence of the AE in the first place. The AE violates two fundamental choice principles, namely proportionality and substitutability. Both principles are foundations of the quantitative hypothesis LCA. Consistent with the proportionality principle, adding an option to an existing set will *proportionally* extract market share from previous alternatives within choice set (Huber et al., 1982). Substitutability refers to an extended option to *disproportionally* withdraw market share from the most similar option (Huber & Puto, 1983). By violating both proportionality and substitutability, the AE violates the principle of regularity (Luce, 1977), and thereby indicates decision makers to behave not fully rational. The regularity principle, which can be interpreted as a weakened form of the independence axiom (Nobandegani, Castanheira, Otto, Shultz, 2019) is a basic axiom of rational choice theory and is required as a minimum condition in well-established decision-making models (Luce 1977, Tversky 1972). For all x $\in$ A $\subset$ B, regularity can be formally defined as follows:

$$Pr(x;A) \geq Pr(x;B)$$

In other words, considering A as a subset of B, an item belonging to the set A must be chosen with a probability no smaller than the probability of choosing this item from B. As described in the example above, it is easy to identify the AE to clearly violate this axiom.

Commonly implemented in marketing research (Dhar & Simonson, 2003; Lichters et al., 2017; Lichters et al., 2016b), the AE has been evaluated in various settings and found to be robust over various research domains, including medical, where Hedgcock and Rao (2009) employed fMRI to evaluate the AE's impact on cerebral activation, and zoology, where the AE has been observed amongst hummingbirds' selection of artificial flower types (Bateson, Healy, & Hurly, 2002). Researchers have tried to give reason to the AE by investigating its underlying mechanisms. Explanations for the preference reversal reach from reason-based choice justification (Simonson, 1989) to loss aversion (Pettibone & Wedell, 2000), and has found to be embedded in lower-level perceptual processes (Dhar & Simonson, 2003). This is primarily due to the idea of the "target" option standing out with the introduction of the "decoy", which is easily observable by the decision maker and seemingly can effortlessly be processed.

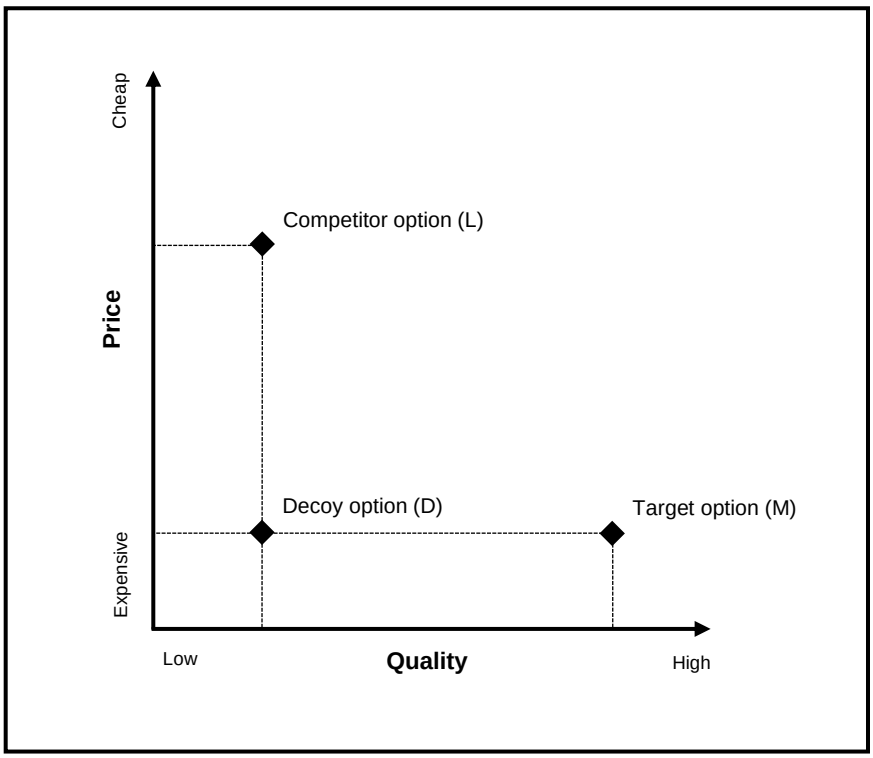


Figure 1 Illustration of the Attraction Effect

However, this gives reason for AE to be more prominent in choice situations where decisions have no consequences, as this setting motivates consumers to decide without giving it much thought. Yet, the opposite has been proven by Lichters et al. (2017), who observed the AE to occur with the introduction of economic consequences and could not find the choice phenomenon to hold when decisions were hypothetical. Accordingly, although various, sometimes contradicting drivers of the AE have been identified, its true nature remains to be uncovered and therefore gives researchers reason to further evaluate the choice irregularity to better grasp the underlying mechanism.

4. The Compromise Effect

In the words of the 44th president of the United States of America, "a good compromise, a good piece of legislation, is like a good sentence; or a good piece of music. Everybody can recognize it. They say, 'Huh. It works. It makes sense'." (Finnegan, 2004). The concept of compromise is highly relevant in numerous societies, as it encompasses the ideology of establishing a common ground for the included parties. In the field of consumer research, the compromise effect (CE), initially observed by Simonson (1989), has gained massive interest by researchers evaluating the context effect in various settings. In a choice setting of multiple alternatives, the CE describes consumers' preference towards the option with attributes positioned in the middle of more extreme alternatives (Lichters et al., 2016a; Simonson, 1989; Simonson & Tversky, 1992). Figure 2 depicts the CE. In a set of options where products are described by quality and price, consumers generally tend to prefer (1) high quality (vs. lower quality), and (2) low prices (vs. high prices), achieving higher quality entails paying a higher price. Evaluating a binary setting with a low-tier option (L) and a mid-tier option (M), consumers *generally* tend to prefer to select the low-tier option (Lichters et al., 2016a). Evaluating a choice situation as described in figure 2 (three option choice set), consumers will relatively more frequently select an option positioned as a compromise option (M – previously mid-tier option) in comparison to a low-tier option (L), once a high-tier option (H) is introduced to extend the binary core set (Simonson, 1989). As an example, picture two portable USB chargers (power bank), both identical in weight. One option (L) is priced at 20€ and has a battery capacity of 10,000 mAh. The second option (M) is priced 30€ and has 15,000 mAh. While in this binary setting consumers tend to prefer option L over option M, the introduction of a third option (H), which is priced at 40€ and has a capacity of

20,000 mAh, will increase the relative market share of option M. This behavior of preference reversal, which is embedded in the relative superiority relationship (Simonson, 1989), clearly violates the regularity condition (Luce, 1977), according to which the introduction of a new option results in the decline of market share for all previous options (Pleskac, 2015). Challenging the Value Maximization Strategy (Luce 1959), which highlights consumer choice to be independent of context, the CE has robustly proven that choice can be dependent on context (Lichters et al., 2016a; Pocheptsova, Amir, Dhar, & Baumeister, 2009; Simonson, 1989; Simonson & Nowlis, 2000).

The underlying mechanisms of the CE and why consumers reverse their preference has been a topic accompanying the choice phenomenon since its initial observation. Consumers make decisions in part based on others' perception of their choice (Dhar & Gorlin, 2013). Selecting a compromise option is less difficult to justify to others (Simonson, 1989), especially when considering that an extreme option will find resonance when consumers have matching preferences, however will lead to dissonance when consumers prefer opposite extremes. This dissonance can make it difficult for consumers to justify their choice. Accordingly, the CE is often explained as a result of extremeness aversion (Simonson & Tversky, 1992), a feat strengthened by Mourali, Böckenholt and Laroche's (2007) findings of the effect increasing with prevention focus goods. Congruent to the concept of extremeness aversion, loss aversion has also been identified as an underlying mechanism of the choice phenomenon (Simonson, 1989). Losses weigh more upon consumers than identical gains (Kahneman & Tversky, 1979). Respectively, by selecting a compromise option positioned between the two extreme alternatives, a consumer can minimize the expected loss (Chuang, Cheng, Chang, & Chiang, 2013). Furthermore, (low) self-confidence (Chuang et al., 2013) and quality consciousness (Müller, Kroll, & Vogt, 2012) have been identified as underlying drivers influencing the CE.

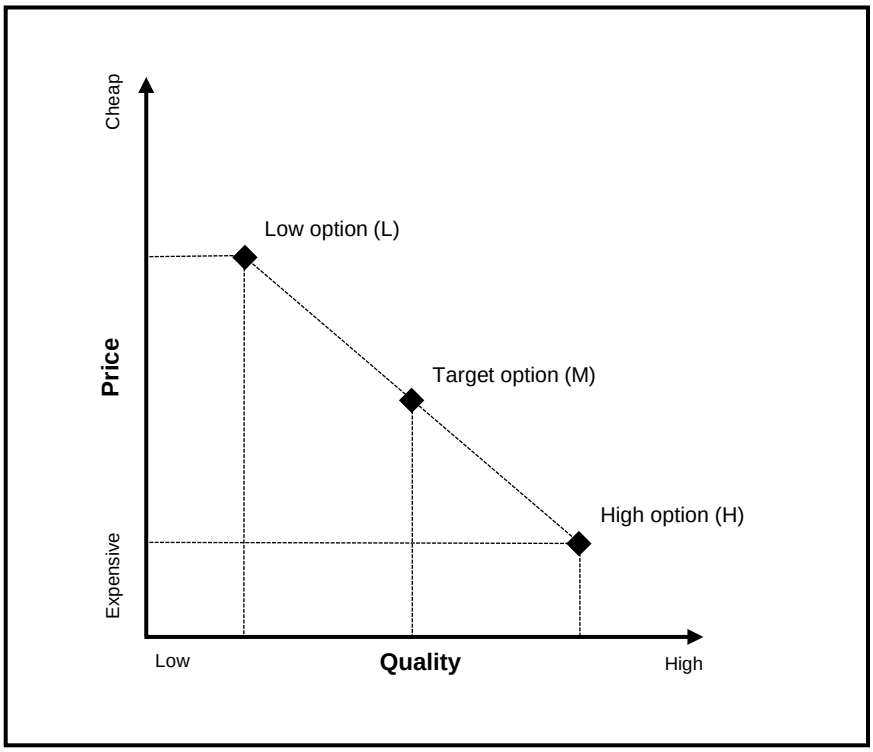


Figure 2 Illustration of the Compromise Effect

5. Chapter summary and implications

Since their first observation, the evaluated context effects have been extensively investigated. One of the main intentions was to better understand their underlying mechanisms, the psychological process behind this seemingly irrational decision-making behavior. With the goal of later evaluating the influence of caffeine on both the AE and the CE, this chapter establishes the necessary foundation by discussing fundamental principles of both anomalies and which specific axioms are violated in the process of this irregular choice behavior. In the process, I was able to define fundamental axioms of rational choice behavior and the three conditions under which decision-making arises. Understanding the theoretical underpinnings of decision making and specifically the two context effects of interest allows me to thoroughly investigate caffeine's influence at a neuropsychological level upon evaluating the psychostimulant's properties in the upcoming chapter.

Chapter 2

The Caffeine Effect – Towards Understanding Caffeine's Influence on Human Behavior

1. Chapter overview

Humans are confronted with various types of challenges on a daily basis. Preparing for regular activities and going through these challenges have motivated us to fall back on supportive measures that empower us to cope with these cognitive and affective demanding tasks. As such, various methods in support of this process are routinely applied, including the consumption of psychostimulants. A psychostimulant can be defined as a "psychotropic substance with the capacity to stimulate the CNS. It causes excitation and elevated mood, as well as increased alertness and arousal. Its global effect is to speed up signals into the brain." (Favrod-Coune & Broers, 2010). Belonging to the group of psychostimulants, or "mood booster", are nicotine, caffeine, methylenedioxymethamphetamine, and cocaine. Although the two latter substances are illegal in Germany (DHS, 2022), both nicotine and caffeine are legal and regularly consumed by a large part of the population. Widely accepted by consumers, caffeine has established itself as the most consumed psychoactive drug worldwide (Ferré, 2008; McCusker, Goldberger, & Cone, 2003). As a result, caffeine is offered to consumers in various forms and shapes, including energy drinks, energy shots, chewing gum, soft drinks, and coffee drinks, which are consumed at various times throughout the day. As caffeine has become an instrumental part of the worldwide dietary schedule, it is crucial to not only comprehend the stimulant's mechanisms of action and corresponding positive effects, but also the negative effects and risks involved with its consumption. In this process, I will differentiate between caffeine's influence on behavioral dimensions amongst various levels of consumption, including light, moderate, high, and very high.

This chapter will focus on preparing a thorough understanding of caffeine and the psychostimulant's impact on the human nervous system and thus human behavior, thereby preparing the hypotheses development addressed in chapter 3. I will begin with a definition of caffeine and the corresponding pharmacokinetics. Next, I will analyze the impact caffeine has on specific brain regions involved with affective and cognitive processes before evaluating dose dependent beneficial and adverse effects on human behavior upon caffeine consumption. Finally, the chapter will close with a brief summary and provide implications for future research in the field of caffeine with a special focus on marketing practices, which will be implemented in the experimental research discussed at a later stage of my dissertation.

2. Caffeine consumption

Caffeine is the most consumed psychostimulant worldwide (Ferré, 2008; McCusker et al., 2003; Mitchell et al., 2014). In the United States alone, approximately 85% of the population consume a caffeinated beverage daily as part of their regular diet (Mitchell et al., 2014). As caffeine is most known for being a key substance contained in coffee and tea, it may seem shocking to consider such a large fraction of the entire population to consume the psychostimulant daily. However, besides naturally most commonly being found in coffee beans, tea leaves, and guarana (Suzuki & Waller, 1988), caffeine is also found in various other plants including cocoa beans, a main ingredient of chocolate. Caffeine is often also added to beverages, as in the case of soft-drinks and energy drinks (Barone & Roberts, 1996; Mitchell et al., 2014; Reyes & Cornelis, 2018). An extensive review by Reyes and Cornelis (2018) on the worldwide consumption of caffeine containing beverages indicated annual total volume sales of 348 L per capita in North America and 200 L per capita in Europe. For both continents, fresh brewed coffee made up the majority of sales.

On average, caffeine is consumed daily in wide ranges, largely depending on the level of consumer. Research has categorized end-users from below 100 mg to above 300 mg, distinguishing between light, moderate, high and very high (Smith, 2002). Table 4 gives an overview of the consumption level of the specific user categories.

Table 1 Levels of caffeine Dosages

Dosage	light	moderate	high	very high
mg (Caffeine)	≤100	101-200	201-300	>300

Adapted from "Effects of caffeine on human behavior" by Andrew Smith, 2002, Food and Chemical Toxicology: September 2002, Vol. 40, Iss. 9.

In Germany, the average level of caffeine consumption varies with age and body weight. Figure 3 gives an overview of the average consumption level for the respective age category by gender. As can be seen, the level of caffeine consumption rises with age until it peaks at about 35-50 years. The most consumed caffeinated beverages in Germany include soft-drinks, tea, coffee and energy drinks, with the population consuming an average of 2.1 mg/kg of caffeine per day (Lachenmeier et al., 2013).

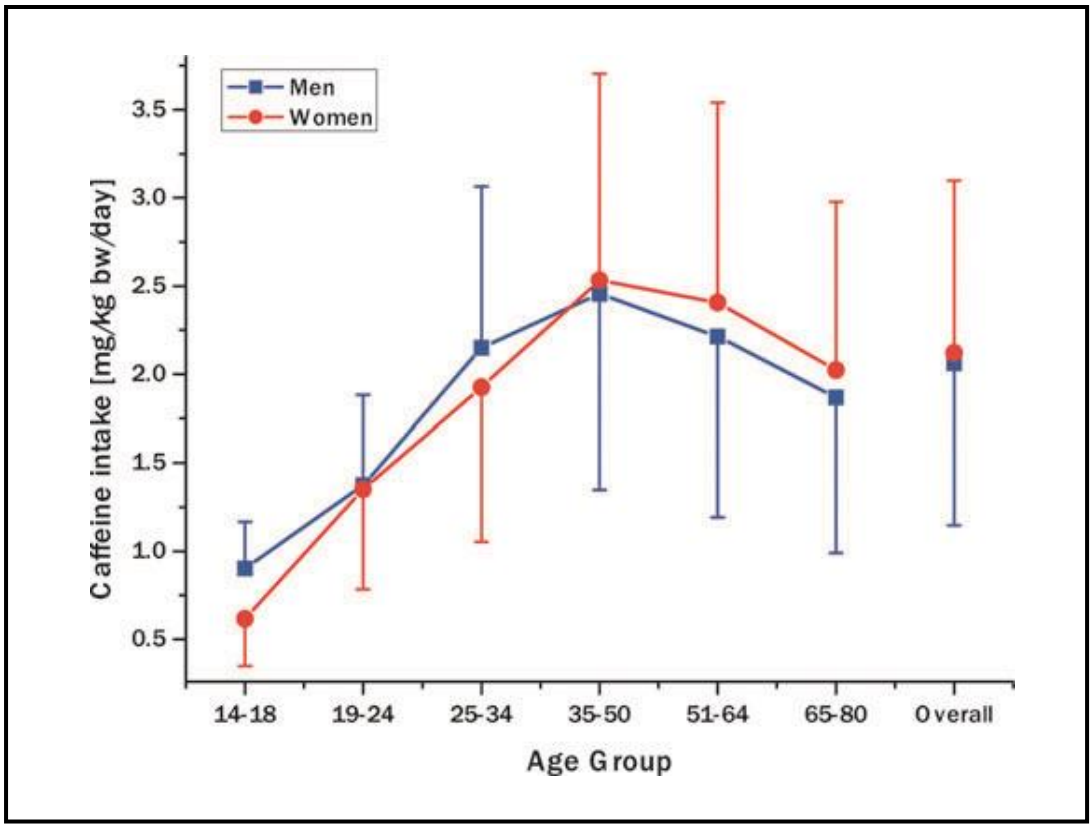


Figure 3 Estimated average caffeine intake of German population (adapted from Lachenmeier et al., 2013)

Previous literature has well documented various studies focusing on the effect caffeine has towards human behavior (Smith, 2002). The effects of caffeine consumption can generally be categorized into two domains: affective and cognitive impact. Studies have identified caffeine to improve individuals' alertness while simultaneously reducing the level of fatigue (Hewlett & Smith, 2007; Lorist, Snel, & Kok, 1994; Lorist & Tops, 2003; Zwyghuizen-Doorenbos, Roehrs, Lipschutz, Timms, & Roth, 1990). Furthermore, various studies have indicated caffeine consumption as an alertness increaser. As plenty research focused on settings where unusually high amounts of caffeine have been used as a treatment, studies using a moderate caffeine dosage have shown significant increases in alertness levels (Warburton, 1995). The cognitive impact of caffeine has also been observed in higher order tasks, including the reception and processing of information (Kerr, Sherwood, & Hindmarch, 1991). An in-depth assessment of caffeine's impact on affective and cognitive processes will be thoroughly evaluated at a later stage of this current chapter.

Regarding physical performance, a study conducted by Hogervorst et al. (2008) has shown that caffeine significantly improved endurance in a study including exercise activities. Additionally, complex cognitive capabilities significantly improved during and after the exercises conducted in the study. Caffeine is generally considered to positively influence in-training and athletic performance. In the fitness industry, pre-workout nutrition has become an instrumental aspect of the athlete's nutrition schedule. A study conducted on the effects of a pre-workout supplement on upper and lower body muscular endurance, aerobic and anaerobic capacity, and choice reaction time indicated significant main effects for perceived energy, alertness and focus (Spradley et al., 2012).

Besides the psychostimulant providing positive effects, there are downsides of chronic consumption. Initially, I will focus on withdrawal effects experienced by regular caffeine consumers, beginning at daily doses of 100 mg/day. A multitude of symptoms arising from caffeine withdrawal have been reported over the past two centuries, including headaches (Scher, Stewart, & Lipton, 2004; Shapiro, 2007), impairment of cognitive performance (Rogers et al., 2005), and fatigue (Juliano & Griffiths, 2004; Sigmon, Herning, Better, Cadet, & Griffiths, 2009). Caffeine withdrawal has shown to increase fatigue and reduce the level of alertness (Schuh & Griffiths, 1997). Furthermore, withdrawal has shown to increase depression and anxiety in a study conducted by Silverman et al. (Silverman, Evans, Strain, & Griffiths, 1992), whereas caffeine consumption has been observed to reduce the risk of depression (Lucas et al., 2011). Symptoms occur upon 12-24 of abstinence and last for a duration of 2-9 days (Juliano & Griffiths, 2004). Conclusively, with its positive and negative effects, it is easy to acknowledge caffeine's relevance in everyday situations. To further understand the magnitude of caffeine's impact, I will observe the psychostimulant's influence at a neurobiological level to better comprehend the underlying mechanisms caffeine has on human behavior upon reviewing the substance's properties and pharmacokinetics.

3. Caffeine properties and pharmacokinetics

In the early 19th century, caffeine was first isolated as a pure compound from a coffee bean by German analytical chemist Friedlieb Ferdinand Runge (Waldvogel, 2003). Since then, caffeine has been found in various other plant species regularly consumed by humans (Barone & Roberts, 1984). Upon oral ingestion, e.g. by means of a beverage, caffeine reaches

peak levels in the bloodstream within 30 – 60 minutes, with approximately 99% being absorbed within 45 minutes post consumption (Bonati et al., 1982; Liguori, Hughes, & Grass, 1997). The absorbed caffeine is spread throughout the body water and quickly crosses the blood-brain barrier, where the stimulant produces the majority of psychological effects observed by researchers evaluating caffeine's impact on cognitive and affective processes. For adults, caffeine is mainly metabolized in the liver and about 3% is excreted unchanged in urine (Thorn, Aklillu, McDonagh, Klein, & Altman, 2012). Caffeine's half-life ranges between 3 and 7 hours, based on various influencing variables such as pregnancy, weight, smoking, and age (Nawrot et al., 2003).

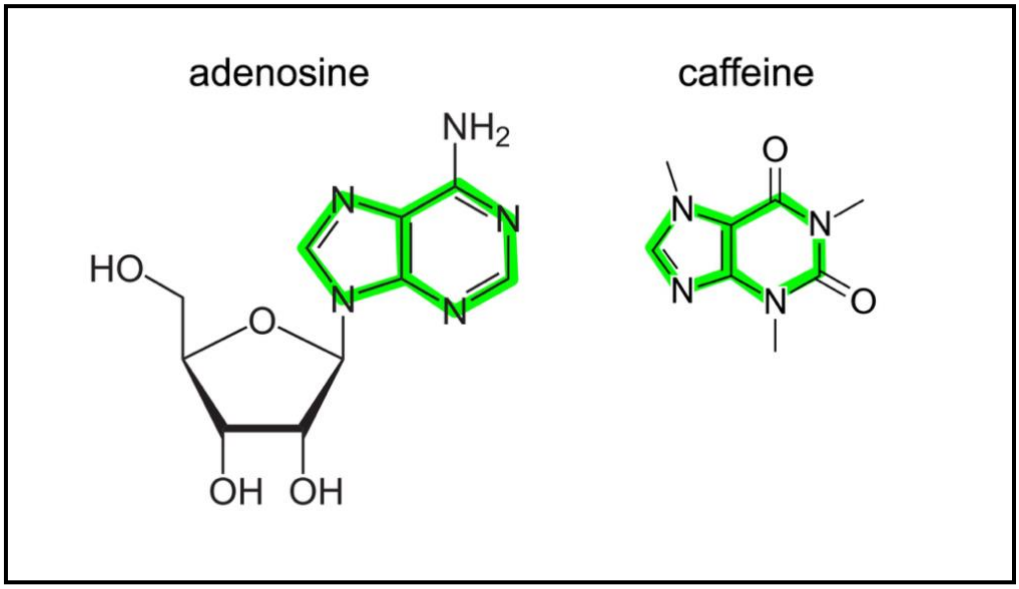


Figure 4 Illustration of caffeine and adenosine molecule (adapted from Hemkin, 2018)

Caffeine is best known for its ability to make consumers feel more awake and alert (Smith, 2002). This phenomenon is based on the stimulant's similarity in molecular structure to adenosine, as shown in figure 4. The human body's cells are constantly breaking down the molecule adenosine triphosphate to generate energy. During this process, the breakdown product adenosine is created (Costenla, Cunha, & De Mendonça, 2010; Silva-Vilches, Ring, & Mahnke, 2018). As more energy is generated, the level of adenosine increases within the cells throughout the day. This establishes an adenosine overflow, which leads to adenosine exiting the neuron. Upon exit, adenosine binds with and activates adenosine receptors, including A1 and A2A receptors (Huang et al., 2005). The four adenosine receptors (A1, A2A, A2B, and A3) are expressed on the entire body, with A1 receptors especially found in the brain, heart and automatic nerve terminals. A2A receptors are mainly found in the brain,

heart, and lungs (Ralevic & Burnstock, 1998). Adenosine binding with an A1 receptor reduces the level of activity and promotes sleep-inducing effects by inhibition of wake-promoting cells in the basal forebrain (Basheer, Strecker, Thakkar, & McCarley, 2004), while the A2a receptors are crucially involved in sleep promotion (Satoh, Matsumura, & Hayaishi, 1998). The combination of both bindings motivates the human body to rest.

As caffeine's molecular structure is very similar to adenosine (see figure 4), it has the ability to non-selectively bind with adenosine receptors, taking up adenosine's place and acting as an antagonist to the modulator (Biaggioni, Paul, Puckett, & Arzubiaga, 1991). However, while caffeine blocks adenosine from binding, it cannot activate the adenosine receptors and therefore hinders the receptors to signal activity reduction throughout the body. Instead, an increase in neuron activity occurs, enabling adrenaline production by the adrenal glands (Sawyer, Julia, & Turin, 1982). This causes the human body to continually feel alert and postpones the feeling of sleepiness until adenosine is finally, upon caffeine decomposition, able to bind with and activate the receptors. Accordingly, caffeine has the main effect to act as an antagonist to adenosine receptors. However, researchers have considered investigating second order effects caffeine may have in other brain regions, including the dopaminergic system. Although caffeine does not produce direct effects to the dopaminergic system as other psychostimulants do (e.g. cocaine or amphetamine), Ferré and his research team were able to establish strong relationships in the interplay between adenosine receptors (mainly A2A) and dopamine receptors (Ferré, 2010; Ferré, Díaz-Ríos, Salamone, & Prediger, 2018; Quarta et al., 2004), indicating caffeine to enhance dopamine signaling in the brain and significantly increasing the availability of dopamine receptors D2 and D3 in the brain regions putamen and ventral striatum (Volkow et al., 2015). The corresponding effects caffeine has on the central nervous system will be addressed in the next section of this chapter.

4. Caffeine and the central nervous system

The nervous system is responsible for the majority of controlling, monitoring, and communication within the human body. It is made up of the CNS, which mainly consists of the spinal cord and brain, and the peripheral nervous system (PNS), which consists of all nerves located outside of the CNS (see figure 5). Collectively, the two systems are responsible for controlling all functions of the body, e.g. the lifting of a hand accidently

placed on a hot stove top. I will briefly describe the interplay of both systems and how external stimuli inputs (e.g. scents, temperature, sounds) received by humans are converted into behavioral output.

Primarily, the PNS focuses on connecting the CNS to organs and limbs by means of nerves that extend from the spinal cord throughout the entire body, allowing the CNS to send and receive information collected by experienced external stimuli. Without the PNS, the body would not be able to function, as information sent from the CNS would not lead to an execution of specific communicated tasks. The CNS is mainly responsible for the reception of sensory information and controlling the body's responses by the interplay of neurons, spinal cord, and the brain. Highlighting the incredible depths in which the CNS operates, it is estimated that the human brain consists of one hundred billion (10^{11}) neurons (Committee on Research Opportunities in Biology, 1989). The nervous system consists of different types of neurons with varying responsibilities. For example, motor neurons signaling movement are responsible for transferring information from the brain to muscles. Responsible for sensory information exchange, sensory neurons evaluate external stimuli received by the senses and transfer this information to the brain.

The neurons, or nerve cells, which consist of a cell body, dendrite, and axon, communicate with each other to assist the brain and spinal cord in information exchange and production of responses to registered stimuli. This process occurs by the corresponding receptors responding to stimuli by means of action potentials, which can be described as nerves signaling in order for neurons to transit to the targeted tissue. The action potential causes the corresponding neurons to send an electrical signal throughout the axon, which is then converted into a chemical signal. This chemical signal is then transferred via transmitters (e.g. neurotransmitters) into the synapse of another neuron, creating a so-called excitatory postsynaptic potential. The received chemical signal is re-converted into an electric signal and processed by the receiving neuron. The process is repeated until the registered information initially sent from one neuron reaches its destination within the nervous system, e.g. the surface membrane of a muscle cell which in turn forces the targeted muscle to contract. To complete the physical process, neurons in the spinal cord are activated and transport information to higher levels within the nervous system, which consciously communicate the conducted action throughout the nervous system and motivate reflex adjustments within the nervous system to assure necessary adjustments simultaneous to

executing the task at hand (e.g. establishing balance when reaching for a falling glass) (Committee on Research Opportunities in Biology, 1989).

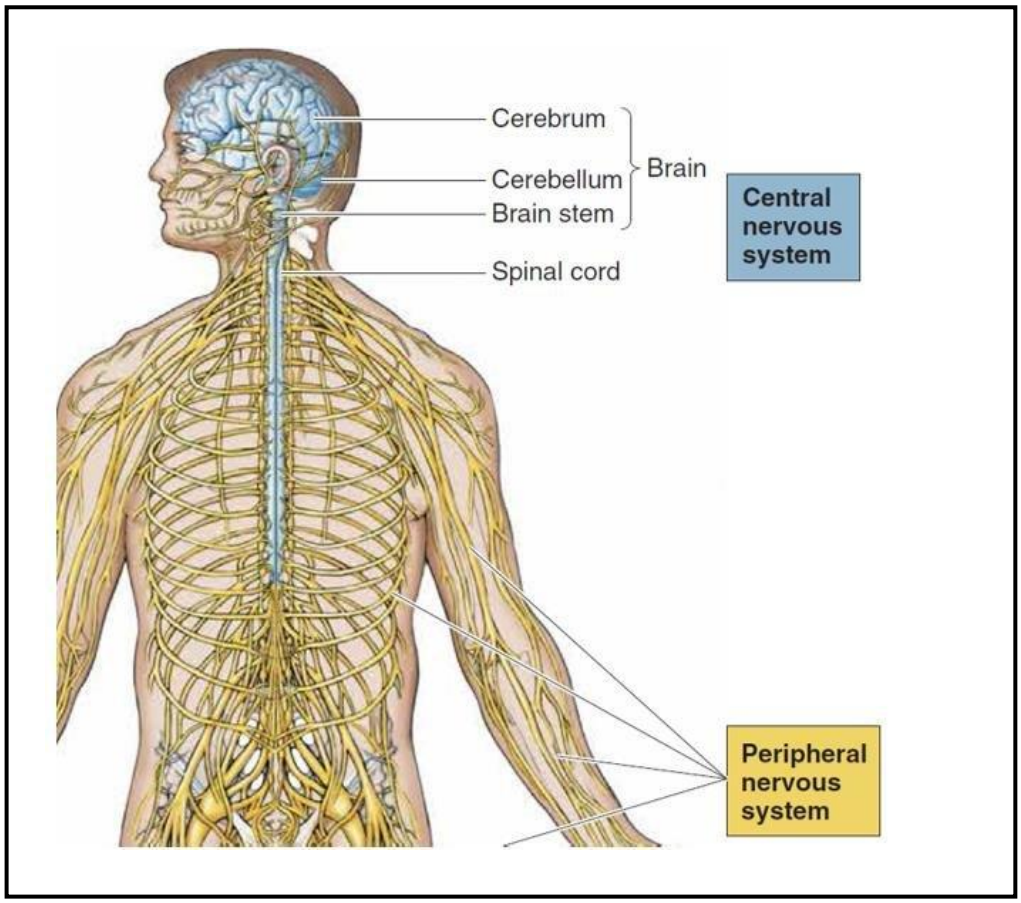


Figure 5 Main divisions of the nervous system (adapted from Bear, Connor & Paradiso, 1996)

In addition to the neurons, the spinal cord and brain complete the divisions of the CNS. The spinal cord connects the CNS and PNS and acts as an information distributor between the brain and body. The CNS has various protective measures to safeguard itself from damage. Both the brain (skull) and spinal cord (vertebrae) are enclosed in bone. Additionally, the bone structures are protected by fluid-filled membranes and a protective tissue known as the meninges (Jacobson & Marcus, 2008). Nonetheless, damage to the CNS still can occur and often inhibits the brain or spinal cord to properly function. The inhibition of brain injuries can be categorized into four subcategories including behavioral, cognitive, emotional/psychiatric, and interpersonal (Moore & Stambrook, 1995). Traumatic brain injury (TBI) has shown to inhibit various behavioral dimensions, including attention (Stierwalt & Murray, 2002; Vanderploeg, Curtiss, & Belanger, 2005), aggression (Rao et al., 2009; Tateno, Jorge, & Robinson, 2003), and depression (Fleminger, Oliver, Williams, & Evans, 2003; Jorge et al.,

2004). A recent literature review on empirical evidence of TBI during childhood identified approximately 50% of children having sustained a brain injury to present behavioral impairments, including depression, aggression, and attention deficits, over the following years (Li & Liu, 2013). Furthermore, common results of TBI in physical applications include impairment in speech and language with children (Michaud, Duhaime, & Batshaw, 1993) and adults (Bobba, Munivenkatappa, & Agrawal, 2019), and impaired auditory function (Gallun, Papesh, & Lewis, 2017).

Next, I will address the process of caffeine consumption and its mechanisms of action on the human's nervous system, especially focusing on the CNS. Upon being absorbed by body water, caffeine crosses the blood-brain barrier and thereby enters the brain. Various mechanisms of action taken by caffeine after penetrating the brain have been hypothesized, including the mobilization of intracellular calcium, inhibition of phosphodiesterases, antagonism at the level of adenosine receptors, and interactions with benzodiazepine binding sites (Nehlig, Daval, & Debry, 1992). Cortical regions of the brain are strongly involved with cognitive processes. Inside the brain, caffeine has shown to significantly impact the cortical regions thalamus, putamen, insula, and posterior medial cortex (Park et al., 2014), which are mainly responsible for cognitive processes involving attention and memory (Bzdok et al., 2015). In an attempt to evaluate caffeine's effect on a 2-back verbal working memory task by means of a functional MRI (fMRI) signal, caffeine consumption has shown to have an increased activation in the bilateral medial frontopolar cortex, suggesting the CNS stimulant to modulate neuronal activity in the prefrontal cortex (Koppelstaetter et al., 2008).

As caffeine has also shown to impact affective processes, it is crucial to explore the related areas within the CNS associated with emotional and mood states. Located just above the brainstem, the limbic system, which is made up of a set of brain structures, is partially responsible for the production of emotions. The amygdala, an almond shaped brain region involved in the processing of affective information, is a large structure of the limbic system (Smith, Lawrence, Diukova, Wise, & Rogers, 2012). The amygdala has various responsibilities, including the determination of where specific memories are stored within the brain (Kilpatrick & Cahill, 2003; McGaugh et al., 1993; Phelps & LeDoux, 2005). By impacting the dopaminergic system as a secondary mechanism of action, caffeine is suggested to increase arousal levels by upregulating D2 receptors (Volkow et al., 2015), which are located in the amygdala and play a crucial role in impulsive behavior (B. Kim et

al., 2018). The interplay between the amygdala and cortical regions (and vice-versa) has been evaluated and indicates the amygdala to also be involved in cognitive processes as attention and explicit memory, where the amygdala releases hormones which impact cognitive processes in cortical regions (LeDoux, 2007). Conversely, fully executed cognitive processes are transferred to the amygdala where the information is applied to produce emotions (LeDoux, 1995). Collectively, by impacting specific regions within the CNS, caffeine impacts the underlying mechanisms of human behavior. In the following section, I will evaluate specific behavioral dimensions directly impacted by the consumption of caffeine.

4.1. Caffeine's influence on behavior

Merriam-Webster defines behavior as "the way in which someone conducts oneself or behaves"[2]. At a psychological level, behavior refers to "an action, activity, or process which can be observed and measured. Often, these actions, activities, and processes are initiated in response to stimuli which are either internal or external"[3]. Considering the nervous system's role in executing specific actions to external stimuli, Paul-Popescu Neveanu conceptualizes behavior as "adaptive responses assembly that a body equipped with the nervous system performs as a response to the stimuli of environment which are also objectively observable" (see Popescu, 2014). As can be seen, human behavior is based on the interplay of stimuli (input) and reactions (output), in which both systems of the human's nervous system play an instrumental role. The National Research Council (Committee on Research Opportunities in Biology, 1989) summarizes the nervous system's role in behavior into seven main processes: (1) most behavior results from a response to an external sensory stimulus; (2) sensory signals are converted into nerve signals; (3) nerve impulses travel throughout the CNS before arriving at their respective destination; (4) in the process of reaching their destination, nerve cells communicate with each other by means of synapses; (5) based on the respective transmitter, synaptic transmission is either excitatory or inhibitory; (6) most behavior reflects overt motor actions; and (7) various sensory stimuli may be perceived as a result of information processed to higher brain centers, leading to behavioral consequences. Conscious arousal and attention focus on these stimuli may result from the aforementioned perception.

[2] https://www.merriam-webster.com/dictionary/behavior

[3] https://psychologydictionary.org/behavior/

As previously described, caffeine has shown to impact various dimensions of behavior. In the past decades, the impact of caffeine on human behavior has been extensively reviewed by Sawyer, Julia and Turin (1982), Smith (2002), and by Einöther and Giesbrecht (2013), who specifically focused on the stimulant's impact on attention. Going into depths of the underlying mechanisms of human behavior would far surpass the motivation of my thesis. However, key behavioral functions impacted by the CNS stimulant will receive special attention as they provide valuable insight in the process of building my hypotheses which are tested in the upcoming studies. Embedded in the development of behavioral responses, affect and cognition will be considered as key drivers in the decision-making process (LeDoux, 1989; Schwarz, 2000). In the following sections, I will initially attempt to define the constructs of affect and cognition before revisiting previous research findings of caffeine's influence on both concepts. Furthermore, specific dimensions of each process and the corresponding influence of caffeine at specific consumption levels will be evaluated.

4.2. Caffeine and affective processes

Properly defining certain states of emotions and feelings is a challenge in itself. This is surely related to the fact that both concepts are very difficult to measure. Thus, comprehending the construct of affect is not a simple task, resulting in various approaches and definitions. Russel and Carroll (1999) understand affect as "genuine subjective feelings and moods (as when someone says, 'I'm feeling sad'), rather than thoughts about specific objects or events", with mood and emotion representing instances affect may reach (Erevelles, 1998). Emotions can be interpreted as "mental states of readiness that arises from cognitive appraisals of events or thoughts; is accompanied by the physiological processes; is often expressed physically (e.g., in gestures, posture, facial features); and may result in specific actions to affirm or cope with the emotion, depending on its nature and meaning for the person having it" (Bagozzi, Gopinath, & Nyer, 1999). Mood, which is often seen as unidimensional and bipolar in nature (Hill & Ward, 1989), can be seen as positive to negative affective states, which have the ability to impact cognitive processes involved in the decision making process (Gardner, 1985). Whereas attitudes are oftentimes suggested as affective processes, they differ from mood and emotion on the basis of being evaluative in nature (Bagozzi et al., 1999). Affect plays an important role in marketing practice. With regards to retail, Donovan and Rossiter (1982) identified affect, specifically the emotional states pleasure and arousal, as a relevant factor of consumer behavior. Accordingly, in line with the upcoming hypothesis

development, I will pay special attention to caffeine's influence on affective processes at various levels of consumption.

As previously discussed, it is effortless to establish a connection between caffeine consumption and alterations in mood and emotion. Studies have observed the psychostimulant caffeine to impact mood levels at dosages beginning as low as 10 mg – 12.5 mg for average and habitual caffeine consumers (Silverman & Griffiths, 1992; Smit & Rogers, 2000). Smith, Sturgess and Gallagher (1999) observed caffeine consumers of 40 mg to report greater levels of anxiety compared to placebo subjects within 60 minutes of consumption. A caffeine dose of 50 mg, comparable to the amount contained in a regular sized soft-drink (Benowitz, 1990), has shown to significantly increase feelings of stimulation (Childs & De Wit, 2006). Light to moderate dosages of caffeine (75 – 150 mg) have shown to significantly increase friendliness, contentedness, and happiness in healthy individuals (Warburton, 1995), while caffeine consumption at moderate levels has shown to significantly increase anxiety levels (Peeling & Dawson, 2007).

High levels of caffeine (250 mg) have shown to significantly increase resting-state arousal levels in university students (Barry, Clarke, Johnstone, & Rushby, 2008; Barry et al., 2005). Researchers have observed the arousal effect of caffeine to depend on A2a receptors within the nucleus accumbens, a brain region involved with sexual, reward, and stress-related behavior (Salgado & Kaplitt, 2015). Further investigating neural correlates of caffeine consumption, identical levels of caffeine (250 mg) have induced threat-related midbrain-periaqueductal gray activation while abolishing threat-related activation in medial prefrontal cortex wall (Smith et al., 2012). In an attempt to overcome shortcomings of single dose administration and thereby presenting more realistic insight on the effects of caffeine consumption, Brice and Smith (2002) implemented repeated dosages of 65 mg over a 5-h period (260 mg in total) between 10:00 AM and 1:00PM. The results indicated caffeine to significantly increase anxiety levels for consumers of multiple small doses (4x65 mg) and consumers of one large single dose (200 mg).

High levels of caffeine dosage seem to be associated with negative experiences on affective processes, as administrations of 400 mg increased levels of tenseness and nervousness (Loke, 1988) and also lead to an increase in anxiety in combination with a stressful task (Shanahan & Hughes, 1986). Caffeine consumption at 500 mg has shown to significantly increase

unpleasant feelings including anxiety, nervousness, and irritability (Kaplan et al., 1997). An increase in anxiety was also observed at a caffeine intake of 600 mg (Sicard et al., 1996). The collected findings over varying levels of caffeine strongly indicated the psychostimulant's significance towards affective processes.

4.3. Caffeine and cognitive processes

The nature of cognition can be seen from two different perspectives: in terms of information processing (cognitive psychology) or in terms of behavior (functional psychology) (de Houwer, Barnes-Holmes, & Barnes-Holmes, 2016). Neisser (2014) defines cognition as "all the processes by which the sensory input is transformed, reduced, elaborated, stored, recovered, and used". Cognition involves multiple processes which are relevant in comprehending human behavior, including information intake, learning, memory, and thought, which is instrumental in the process of solving problems (Greeno, Collins, & Resnick, 1996). As cognition plays a basic role in consumer behavior (Bayton, 1958), I will pay special attention to the impact caffeine has on cognitive processes. The influence of caffeine on the aforementioned processes is very extensive and well documented. As structured in the observation of caffeine's impact on affective processes, I will consider dose dependent influences caffeine has on cognitive processes.

At a light dosage level, caffeine consumption of 60 mg has been observed to significantly impact the response speed of non-smoking males (Durlach, 1998). In an attempt to measure various dosage levels of caffeine, Smit and Rogers (2000) identified light doses of 12.5, 25, 50 and 100 mg to significantly impact cognitive performance. Furthermore, 100 mg caffeine has also shown to improve cognitive performance in middle-aged women (Waer et al., 2021), while also improving cognitive performance of trained cyclists during exhaustive exercise (Hogervorst et al., 2008).

At moderate dosage levels, 200 mg of caffeine has shown to significantly facilitate the encoding of new information (Smith, Clark, & Gallagher, 1999) and information processing at the encoding stage (Lorist et al., 1994), whereas caffeine consumption has shown to positively impact information processing for habitual and non-habitual users consuming at least 200 mg of caffeine (Giles, Mahoney, Brunyé, Taylor, & Kanarek, 2013). Furthermore, a caffeine dose of 200 mg increased subjects ability to benefit from alerting cues, improved their attention (Brunyé, Mahoney, Lieberman, & Taylor, 2010) and improved choice reaction

time for Navy Sea-Air-Land trainees (Lieberman, Tharion, Shukitt-Hale, Speckman, & Tulley, 2002).

High to very high levels of caffeine (>200 mg) have shown to significantly improve the ability to solve both simple and complex tasks (Kerr et al., 1991; Streufert et al., 1997), facilitate information processing (Frewer & Lader, 1991), and decreased error rates and reaction times as measured by means of a numerical Stroop task (Kenemans, Wieleman, Zeegers, & Verbaten, 1999). Nonetheless, a high caffeine dose of 250 mg did show to inhibit reaction time in a numerical Stroop task as compared to a moderate dose of 125 mg (Foreman, Barraclough, Moore, Mehta, & Madon, 1989). Supportive findings were made by Kaplan, Greenblatt et al. (1997), who identified a caffeine dose of 250 mg to enhance cognitive performance compared to placebo subjects, while a 500 mg dose produced less performance enhancement than the low dose. Accordingly, the facilitation of cognitive performance has been identified to be non-linear in caffeine consumption. As such, I will focus on implementing moderate levels of caffeine while investigating the psychostimulant's influence on consumer choice behavior.

5. Chapter summary and implications

Caffeine is a relevant substance included in the regular diet of a large fraction of the world's population. As such, it is significant to comprehend the positive and negative effects involved in the consumption of the psychoactive drug. This chapter included a brief overview of caffeine consumption and effected areas of the human body upon previously evaluating its molecular structure and main mechanisms of action. The nervous system, made up of the CNS and PNS, was identified to play a significant role in caffeine consumption. Scholars have pinpointed caffeine to impact the human brain in various regions. The affected regions are strongly involved in affective and cognitive processes, which underlie and drive human behavior. Understanding how caffeine effects the aforementioned processes enables researchers to better comprehend mechanisms underlying the process of decision-making and how caffeine can alter consumer behavior, which will be addressed in the upcoming chapters.

While evaluating the impact caffeine has on behavior is helpful to better understand consumer behavior, it is important to acknowledge that understanding human behavior is a

topic still in the developmental phase and currently rapidly evolving through methods such as artificial intelligence (Beam, Potts, Poldrack, & Etkin, 2021; Eisenberg et al., 2019). Accordingly, evaluating caffeine's influence on behavior can provide researchers with insight in a research field which still has much room for growth.

Chapter 3

Hypotheses development

1. Chapter overview

The process of decision making usually involves the identification of problems, needs or opportunities and correspondingly the evaluation and choice of solutions or options to successfully solve the task at hand. Decisions are made on a daily basis and effect all humans as a decision maker at some kind of level (Stankevich, 2017). Accordingly, the decision-making process is considered an integral aspect of human nature. Decisions can be made in various settings and a multitude of conditions.

Comprehension of the decision-making process has found relevance over various fields of research, including psychology, economics, and biology (Mishra, 2014). Researching and understanding the decision-making process has especially found importance with profit driven businesses, who seek to capitalize off opportunities found in this process. Accordingly, companies implement various marketing strategies to execute their business strategies, as knowledge of what variables influencing the consumer's purchase behavior is of high value. This task involves thorough assessment of the psychological underpinnings of the decision-making process, which focuses on how consumers think, feel, how they argue their selected option amongst alternatives, and how their environment influences the formed decisions (Stankevich, 2017). Affect and cognition have been identified as key drivers of the consumer decision making process, encouraging further research of dual-process theory and development of dual-process models. While initially introducing the foundations of rational choice behavior, this chapter will discuss the decision-making process, specifically focusing on a dual-process approach. The underlying mechanisms of various decision-making phenomena, including the AE, the CE, and choice deferral, will be discussed before evaluating caffeine's impact on the aforementioned anomalies. To gain insight of this process at a neurobiological level, I will evaluate the impact of a central nervous system stimulant, specifically caffeine, on affect and cognition and how caffeine facilitates these processes within the reflective-impulsive model (RIM) of consumer decision making. The chapter will conclude by developing the hypotheses which will be evaluated in chapters 5 – 8.

2. Consumer decision making process

Comprehending the underlying mechanisms of the decision-making process is fundamental towards developing a better understanding of what drives consumer behavior. The term process is defined as "a series of actions that you take in order to achieve a result"[4]. A key aspect of the decision-making process, namely information-processing, in the past has been considered to be the greatest challenge to contemporary and future neuroscience (Committee on Research Opportunities in Biology, 1989), which is confirmed by recent neuroscience on information processing with the objective of understanding the human brain's functionality (Güçlü & van Gerven, 2017; Horikawa & Kamitani, 2017; Testolin, De Filippo De Grazia, & Zorzi, 2017). Differing approaches of information processing (i.e. dual process theory) in the context of decision making will be discussed at a later stage.

Scholars have been researching decision making for the past centuries, dating back to as early as the classical period, with methods of problem-solving rooted in the works of Socrates (Peterson, 2009). Over the past decades, modern economists have established various models to define the consumer decision making process. One of the earliest models focusing on the consumer purchasing process was presented by Francesco Nicosia in 1966. Nicosia's model evaluates the process from the perspective of firms communicating with their consumers and separates the entire purchase process into four fields (see Friedman, 1988). The model, which indicates attitude, motivation and experience as critical attributes of consumer behavior, divides the decision-making process into four interrelated fields, as can be seen in figure 5. The initial field (Field 1) focuses on communication, where the customer is exposed to the message and information transferred by the company, for example by means of advertisement. The communicated information intends to influence the customer's attitude, which in turn transitions to the second field involving the search and evaluation of products. Motivated by the findings, field 3 focuses on the decision amongst the available alternatives. The fourth step of the iterative model involves the feedback process (Field 4), which focuses on the on the actual purchase, consumption and experience obtained by the selection of this option.

[4] https://dictionary.cambridge.org/dictionary/english/process

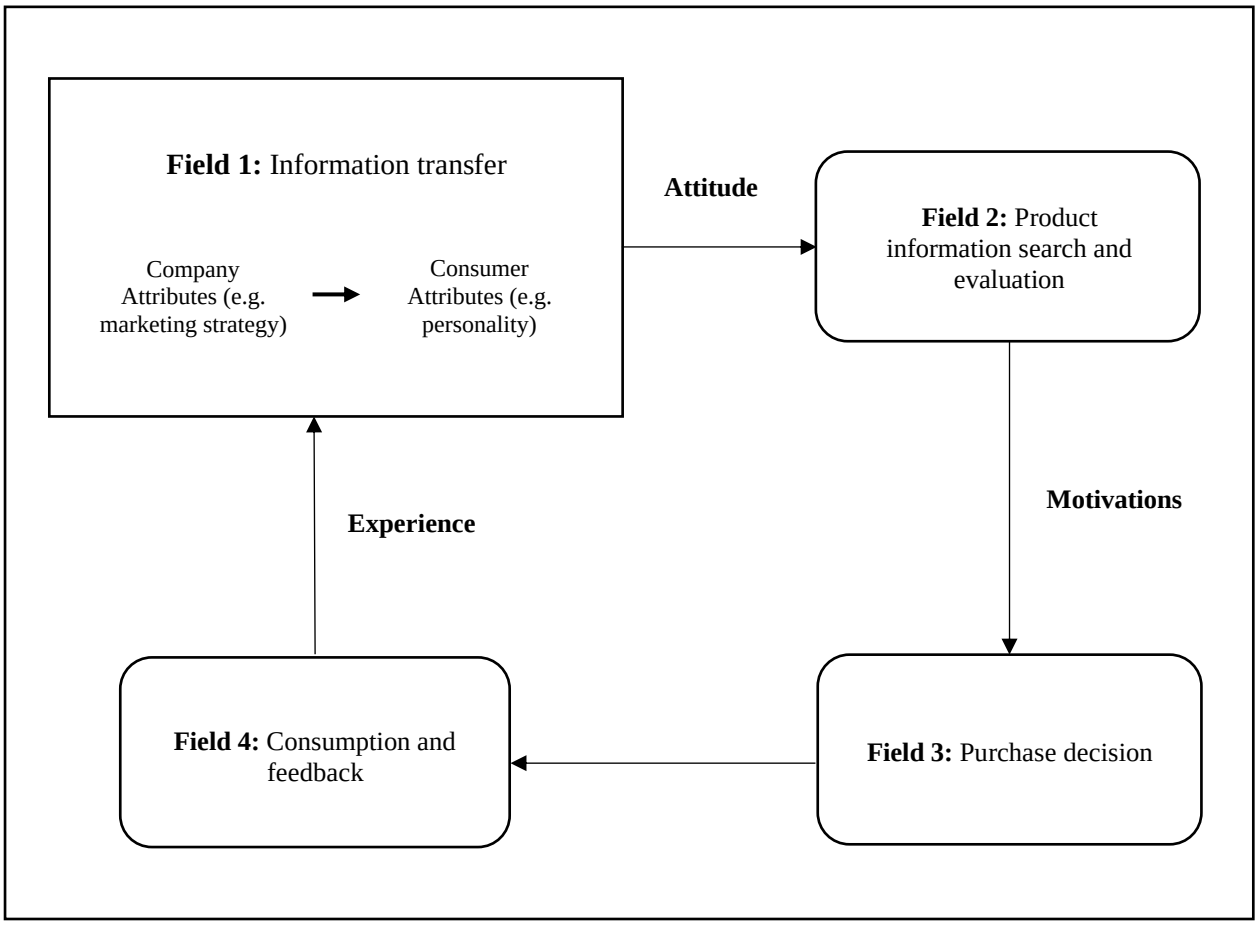


Figure 6 Illustration of the Nicosia model of consumer behavior (adapted from Nicosia, 1966)

A further model to evaluate and comprehend the consumer decision making process was first developed by Engel, Kollat, and Blackwell Model (EKB model) in 1968 and further revised over the upcoming decades (see Friedman, 1988). The EKB model, which has been implemented in various fields of consumer research, including automobile insurance (Bonnice, 1985), tourism (Osei & Abenyin, 2016), and e-commerce (Chen, Lee, Wu, Sung, & Chen, 2017), focuses on the consumer's perspective and defines decision-making as a five-step process: (1) Problem recognition, (2) search, (3) alternative evaluation, (4) choice, and (5) outcomes. Respectively, the EKB model considers decision making as a linear process. The full model (see figure 6), which is widely considered as the traditional model of consumer decision making (Erasmus, Boshoff, & Rousseau, 2001), takes into consideration how the factors of input, information processing, decision process variables, and external influences impact the decision-making process. Building on the Nicosia model, the EKB model especially improves in the search stage, as it also considers situations where no alternative is evaluated following the search phase, which in turn may lead towards choice deferral. Researchers have criticized the lack of consideration concerning interrelations of the

model's variables (Prakash, Sahney, Kodati, & Shrivastava, 2017). Specifically, the model considers memory a key link between the processing of information and problem recognition. However, it does not consider the underlying mechanisms and accessibility of memory. As a further limitation relevant towards establishing my hypotheses, the EKB model does not acknowledge affective processes as potential driver of the decision-making process.

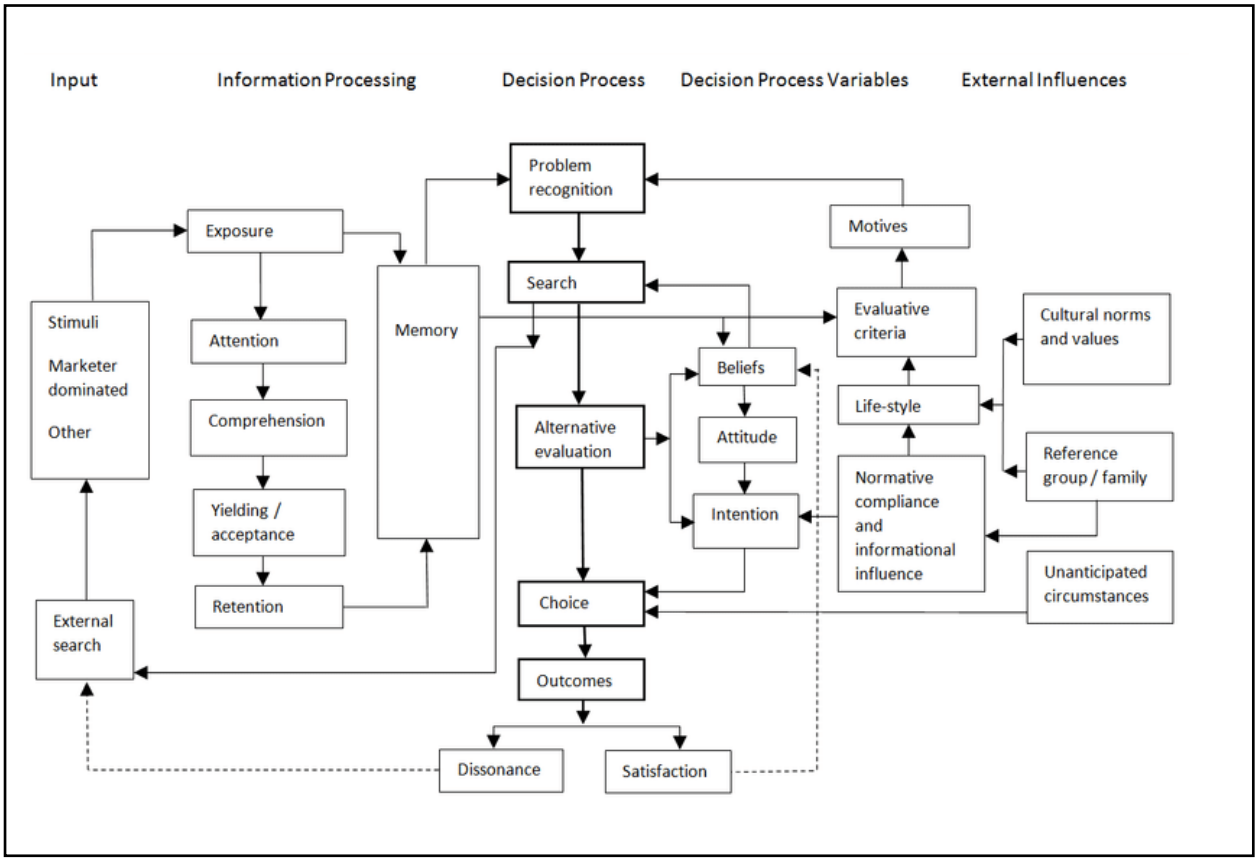


Figure 7 Illustration of the complete EKB model of consumer decision-making (adapted from Friedman, 1988)

As the aforementioned models are limited in their application, I attempt to comprehend the decision-making process in a broader sense. Considering both cognitive and affective processes, I will shift towards a dual process approach of decision-making to evaluate my hypotheses.

2.1. Dual process theory

While some decisions are elementary in their nature (e.g. crossing the road at a green light), others certainly occur at an increased level of complexity (e.g. solving complex mathematical equations, or coping with uncertainty). Contrary to the traditional decision-making models, researchers have considered decision making from a dual-processing perspective (Chaiken &

Trope, 1999; Evans & Stanovich, 2013; Kahneman & Frederick, 2005). The origin of dual-process models dates back to the late 19th century, where American philosopher William James proclaimed reasoning to be a binary task, one aspect embedded in association while the other was more rational (James, 1890). The concept of dual process has since significantly developed and has found application in various research areas, including social behavior (Strack & Deutsch, 2004), consumer behavior (Deutsch, Strack, & Werth, 2006) management (David, Kline, & Dai, 2005), psychology (Beevers, 2005) and neuroscience (Rugg & Yonelinas, 2003). Dual-process theory distinguishes between two distinct types of thinking, which literature has defined in numerous ways, including Type 1 vs. Type 2 thinking (Allen & Thomas, 2011; Evans & Stanovich, 2013; Stanovich & Toplak, 2012) and System 1 vs. System 2 thinking (De Neys & Pennycook, 2019; Evans, 2008). Principally, dual-process systems include a fast and intuitive type of thinking, which is embedded in affective processes, and a slow, more deliberate type, which is embedded in cognitive processes (Frankish, 2010). The validity and applicability of dual process theories has been heavily criticized. In a recent critical review, Grayot (2020) identifies and elaborates on six criticisms of dual process theories. One of his criticisms includes that researchers have observed the systems to not truly operate discrete from each other and instead their processes "crosscut" (Evans & Stanovich, 2013; Mugg, 2016). Furthermore, evidence of dual systems is so far limited to artificial situations taking place in laboratory settings only. Nonetheless, dual process theories still find relevance in recent marketing research (Acar, Dahl, Fuchs, & Schreier, 2021; Shehu, Papies, & Neslin, 2020).

Neurobiologically, a multitude of brain regions are activated in the process of decision making (De Martino, Kumaran, Seymour, & Dolan, 2006; Heekeren, Marrett, Bandettini, & Ungerleider, 2004; Zhang & Gläscher, 2020). This is also in part related to the various conditions under which decision making takes place. While the orbitofrontal cortex is active in decision making under certainty, various regions are activated in decision making under risk, including the prefrontal cortex, temporal pole, and inferior temporal gyrus (Guo et al., 2013).

It remains unclear if the two thinking types derive from distinct regions within the brain, as research has presented evidence supporting discrete and integrational approaches. Considering affective processes within the human brain, researchers distinguish between the locationist approach, which suggests discrete emotion categories to derive from specific brain

regions, from the constructionist approach, which suggests discrete emotion categories to derive from interacting brain networks (Lindquist, Wager, Kober, Bliss-Moreau, & Feldman Barrett, 2012). Whereas specific brain regions have been associated with affective processes, a meta-analysis conducted by Lindquist et al. (2012) found evidence in line with the psychologist constructionist approach. As such, Lindquist et al. (2012) accredit affect in human behavior to be embedded in specific hubs of the brain, with core affect deriving from the amygdala, insula, medial orbitofrontal cortex, lateral orbitofrontal cortex, anterior cingulate cortex, thalamus, hypothalamus, bed nucleus of the stria terminalis, basal forebrain, and the central gray. Belonging to these defined hubs is the amygdala, which is strongly associated with fear (Fendt & Fanselow, 1999; LeDoux, 2007) and relevant in the consideration of uncertain stimuli (Herry et al., 2007). Brain imaging has identified cognitive processes to derive from the right prefrontal cortex and left hippocampus (Koechlin, Ody, & Kouneiher, 2003; McIntosh, 1999). As cognition occurs in a controlled manner, LeDoux (1989, 1993) has identified the execution of these processes to be slower than affective processes. Although these processes have been regarded distinct in their nature (Ekman and Davidson, 1994; Martin and Clore, 2001), it has been suggested that affective and cognitive processes should not be considered as such, but more as a functionally integrated system (Kinnison, Padmala, Choi, & Pessoa, 2012; Pessoa, 2018). This approach finds support from Gray, Braver and Raichle (2002), who present neurobiological findings of an integration of emotion and higher cognition equally contributing towards thought and behavior. As a result, I will consider distinct and integrative approaches towards establishing dual process models in consumer behavior, as discussed in the upcoming section.

Samson and Voyer (2012) categorize dual-process models into three strands, namely persuasion and attitude change, judgement and decision making, and buying and consumption behavior. The judgment and decision-making strand focus on information processing from an intuitive based, fast and effortless method often defined as System 1 (Kahneman & Frederick, 2005; Kahneman et al., 2002), which operates on heuristics and follows the decision makers initial decision approach (Chaiken & Trope 1999). The more deliberate and slow System 2 aims at solving more complex tasks (Kahneman et al., 2002). This method of thinking is more effortful (Stanovich, 2011) and depends on the accessibility of available cognitive resources (Masicampo & Baumeister, 2008). The buying and consumption behavior strand distinguishes between impulsive, unplanned choice and reflective choice, which occurs as a result from a previous consideration set and a thorough

thought process (Samson & Voyer, 2012). The implementation of a dual process model from the latter strand will later be discussed upon developing the hypotheses.

Understanding the concept of two systems of information processing, I set out to seek for a common driver holding the potential to influence both affective and cognitive components. My search concludes with caffeine, universally recognized to influence both affective and cognitive aspects of consumer behavior. It is easy to link prominent dual-process models to the central nervous system stimulant's effects, as outlined below.

2.2. Dual process models

Dual process models are generally classified into two divergent categories, namely parallel-competitive and default-interventionist, differentiating the order of cognitive processes and to which degree these impact the process (Evans, 2008). The parallel-competitive type defines dual process to occur in parallel, with both processes striving for the results' responsibility. This approach leads to competing and conflicted systems (Samson & Voyer, 2012). Contrary to the parallel-competitive type, the default-interventionist approach characterizes dual process in a distinguished fashion. After identifying the problem, the intuitive system proposes a solution which is evaluated by the reflective system, which will either support this solution or reject it, upon implementing the deliberate solution (Samson & Voyer, 2012). The type of approach is independent of which strand the dual process models is incumbent of. For example, when considering models in the attitude change and persuasion strand, the elaboration likelihood model follows a default-interventionist approach, while the Heuristic-Systematic model follows the parallel-competitive approach. In line with my research objective, I will focus on dual process models of the buying and consumption behavior strand, specifically the reflective-impulsive model (RIM) of consumer behavior as proposed by Deutsch, Strack and Werth (2006).

2.2.1. Reflective-impulsive model

Originally intended to explain social behavior by means of a dual process approach, Strack and Deutsch (2004) developed the RIM, which extends on foundations of previous dual process models (see figure 8). Strack and Deutsch (2004) consider behavioral outcomes as the result of an impulsive system, which is described "as a network in which information is processed automatically through a fast and parallel spread of activation along the associative links between contents" (Deutsch et al., 2006, p. 208), and a reflective system, which slowly

carries out processes of rule-based reasoning and symbol manipulation, which are jointly involved in the process, determining "social behavior as the result of several determinants that may operate in accord or conflict with each other" (Deutsch et al., 2006, p. 222). Accordingly, the RIM falls into the category of parallel-competitive models, as described by Evans (2008). Extending on previous dual-process models, the RIM integrates behavioral schemata into cognitive and affective structures, centralized in a "final common pathway to overt behavior" (Deutsch et al., 2006, p. 208). The behavior leading schemata, which can be imposed impulsively or reflectively, will be dependent on the relevant magnitude in which these processes are activated.

Strack and Deutsch (2004) outline the RIM by means of 10 theses, which will briefly be described before implementing the model into a consumer behavior framework. Mainly, as described above, the RIM holds the basic assumption that social behavior results from the operation of two distinct processes, namely reflective and impulsive (Thesis 1), which operate analogous (Thesis 2). Notably, the impulsive system is engaged throughout the entire process. The reflective system on the other hand engages only when activated and depends on the availability of high cognitive resources (Thesis 3). Thesis 4 focuses on the relations between elements, which are differently connected in each system. While the reflective system connects elements via semantic relations and assigns them a corresponding truth value, the impulsive system associates links between elements. Upon close presentation or activation of stimuli, association links are established. These links are mere correlations between environmental cues and cognitive and affective processes. This leads to the emergence of structures within affective processes, which can quickly be accessed upon activation of the aforementioned processes.

The execution of behavior is conducted via a final common pathway to overt behavior, which is located within the impulsive system and can be activated by either process when the necessary threshold is reached (Thesis 5). Furthermore, the RIM distinguishes behavior to result from the evaluation of a future outcome as defined by its value and outcome probability for the reflective system, while behavior in the impulsive system results from behavioral blueprints which are already registered in long-term memory (Thesis 6). The connection of behavior outlines and the actual decision is established by the mechanism of intending, which can be described as the commitment, decision or plan to execute a specific task, in the reflective system while it monitors information coming from the impulsive

system to execute the according behavior, terminating upon completion for both systems respectively (Thesis 7). Contrary to the reflective system, the impulsive system is considered to be firm in its behavior. This application does not hold for all situations, as certain conditions may motivate the impulsive system to act flexible, mediated by two motivational orientations: approach and avoidance (Thesis 8). Approach can be conceptualized as how prepared the decision maker is to decrease any distance between herself and the environment, whereas avoidance addresses the opposite. Strack and Deutsch (2004) define two possibilities in engaging in avoidance, "by either moving away from a target (flight) or by causing the target to be removed (fight)" (p. 231). Thesis 9 addresses the combability of behavior and its precursors. Specifically, information processing, experiencing feeling and emotion and the corresponding behavior are aided when consistent with the decision maker's motivational orientation. Finally, the fulfillment of essential, basic needs will be undertaken by the behavioral process which has successfully been applied in previous attempts (Thesis 10). Collectively, the 10 theses conceptually constitute the RIM.

Feelings and emotions are deeply rooted in the consumer decision-making process (Erevelles, 1998). Phenomena such as impulse buying are recognized within purchase behavior and have been explored by various researchers (Beatty & Ferrell, 1998; Jones, Reynolds, Weun, & Beatty, 2003; Zheng, Men, Yang, & Gong, 2019). Additionally, situations where consumers relate positive affect towards specific products, as in the case of advertisements or endorsements, may activate affective processes, which initiate the purchase process. This can be seen in celebrity endorsements in the sporting industry and the rapidly evolving field of influencer marketing (Ki, Cuevas, Chong, & Lim, 2020; Lee & Koo, 2015) . Nonetheless, consumers often face purchase decisions where a very complex evaluation is necessary**,** for example when considering the purchase of real estate or transportation vehicles. Accordingly, consumers are dependent on both impulsive and reflective systems. Strack, Werth and Deutsch (2006) suggest that the RIM may aid in comprehending the consumer's decision-making process. They address that buying behavior may be processed by either system, depending on the consumer's motivation and feeling involved in the decision process.

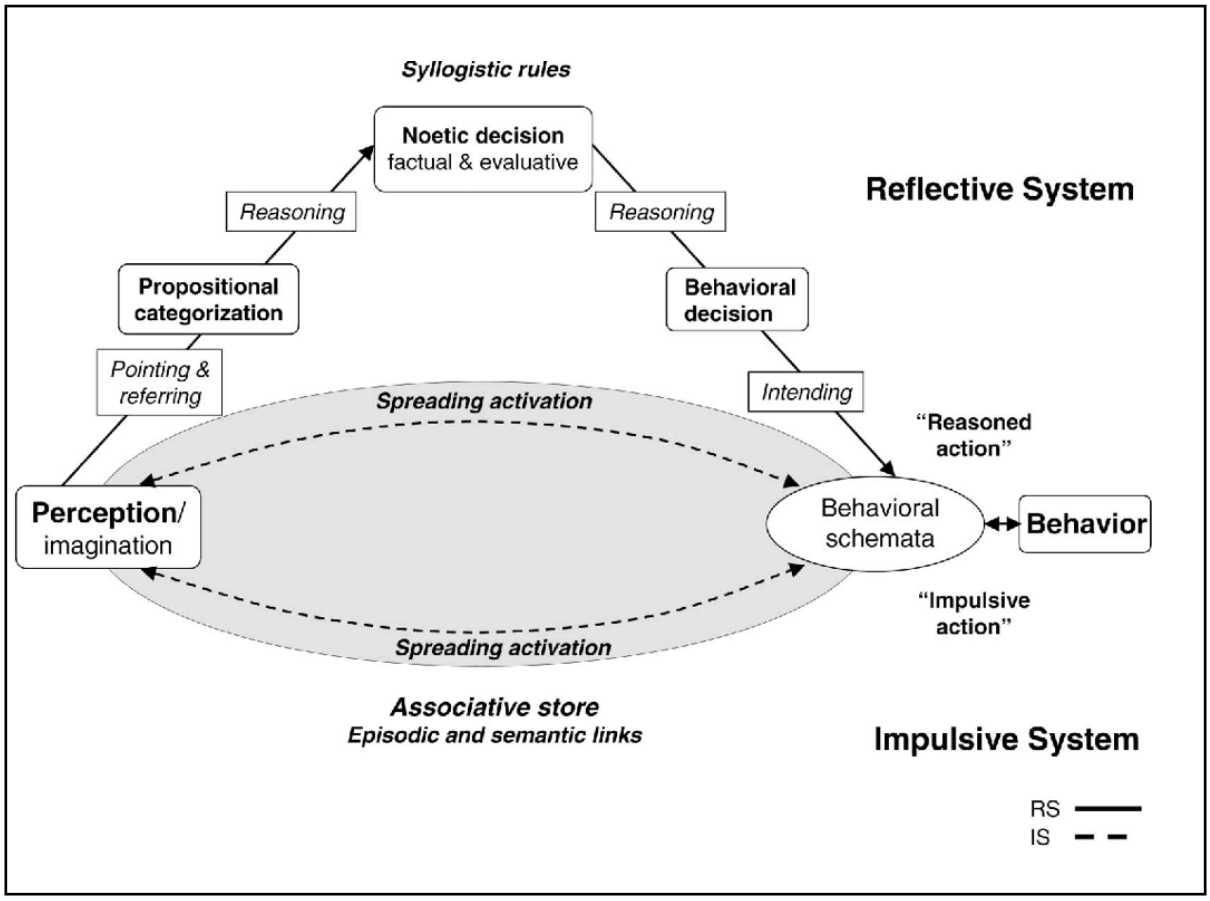


Figure 8 Overview of the complete reflective-impulsive model (adapted by Strack & Deutsch, 2004)

While positive affect can be caused by ambient stimuli such as scent and music, which in congruence activate impulsive processes (Mattila & Wirtz, 2001), Strack et al. (2006) claim that "if consumers are motivated to engage in thorough processing and the situation allows them to invest the necessary time and cognitive capacity, buying will most likely be determined by reflective operations" (p. 213). In line with this notion, I expect purchase decisions, especially those of unfamiliar nature, to be embedded within reflective processes and dependent on resources facilitating this procedure.

In the following sections, I will discuss the underlying mechanisms of the AE, the CE, and choice deferral and which process is responsible for the occurrence of the choice behavior within the framework established by the RIM. Next, I will discuss how the consumption of moderate levels of caffeine interacts with the decision-making process, specifically how it influences the above-noted phenomena. The developed hypotheses will be thoroughly evaluated in a series of conducted experiments as described in the following chapters.

3. Caffeine and consumer choice behavior

Bridging the gap between cognition, affect, and consumer choice has been a topic gaining interest in the field of marketing research over the past decades. Bartels and Johnson (2015) suggested four reasons for why cognition and consumer research should grow closer: (1) Consumer choices belong to the most consequential choices people make, (2) the interaction of people's lives and consumer choice can be better understood by researching underlying mechanisms of cognitive science, (3) insights on consumer behavior have high quality when the data is collected in original consumer settings (as opposed to laboratory settings), and finally, (4) consumer choice is a natural habitat to evaluate and comprehend basic cognitive processes. The role of affective processes, consisting of mood and emotional states, on consumer behavior has been investigated by numerous researchers (Bakamitsos & Siomkos, 2004; Bruner II, 1990; Cohen & Andrade, 2004; Holbrook & Shaughnessy, 1984; Lerner, Small, & Loewenstein, 2004). Previous research has supported caffeine's influence on affective and cognitive processes. The central nervous system stimulant has consistently shown to improve various aspects of affect, including arousal levels (Barry et al., 2005; Childs & De Wit, 2006; Doyle, Lutz, Pellegrino, Sanders, & Arent, 2016; Mikalsen, Bertelsen, & Flaten, 2001). Caffeine has especially shown to positively effect tasks requiring vigilance, where a dose of 200 mg improved performance in rested individuals (Lieberman, Mahoney, Carvey & Thompson, 2012). Consistent results have been observed in sleep-deprived subjects, as identical doses have improved the guiding of automobiles (Reyner & Horne, 1997, 2000) and aircrafts (Doan, Hickey, Lieberman, & Fischer, 2006). Doses between 12.5 mg to 400 mg improved reaction times for both rested and sleep-deprived subjects (Einöther & Giesbrecht, 2013) while a dose of 200 mg improved attention in rested subjects (Maridakis, Herring, & O'Connor, 2009; Maridakis, O'Connor, & Tomporowski, 2009). Furthermore, caffeine has significantly improved the speed of information processing (Bättig & Buzzi, 1986).

After having presented evidence on caffeine's impact on affective and cognitive processes, I will continue with hypothesizing the stimulant's influence on the AE, CE, and choice deferral by evaluating choice behavior within the RIM framework.

3.1. Caffeine and the attraction effect

Researchers have been ongoingly investigating the influence of choice set composition on consumer choice, which sometimes results in seemingly irrational effects (Prelec, Wernerfelt, & Zettelmeyer, 1997). Belonging to this domain of context effects, the AE can be observed when the addition of an inferior, asymmetrically dominated option increases the attractiveness of the dominating option (target) in the choice set (Ratneshwar, Shocker, & Stewart, 1987). More precisely, the addition of an asymmetrically dominated option to an existing binary core set will excessively increase the relative choice share of the target option, which dominates the newly introduced option (Huber et al., 1982). In other words, when rational decision makers engage in trade-offs between higher quality for higher price (and vice-versa), consumers will prefer the target option (M) more frequently relative to the low option (L) after extending the binary core set (L, M) by a decoy option (D), as previously described in the second chapter of the thesis.

The AE has been observed to persist over various fields of research, including online retail (Fasolo, Misuraca, McClelland, & Cardaci, 2006), diamond trading (Wu & Cosguner, 2018), cognitive psychology (Trueblood, Brown, Heathcote, & Busemeyer, 2013), and political decisions (Hedgcock et al., 2009), while remaining robust in consequential choice situations (Farmer et al., 2017). Although researchers have repeatedly tried to provide explanations to the occurrence of the AE (e.g., Ariely & Wallsten, 1995; Bhargava, Kim, & Srivastava, 2000; Sivakumar, 2016), a full explanation remains unsettled. Hadar et al. (2018) have recently observed the AE to be less prevalent in experienced-based than in description-based choice. Their findings are immersed in the ability of consumers to decipher the choice set's dominance relationship, which in turn guides decision makers through difficult trade-offs. As the dominance relationship is more difficult to encode in experience-based (vs. description-based) choice, the AE seemingly diminishes as the degree of encoding difficulty increases. Embedded in a further function of cognitive processes, the AE has shown to be more pronounced in settings with real economic consequences (vs. without) (Lichters et al., 2017), which motivate consumers to be more engaged in their decision process, inspecting all product options prior to selection (Huber, Payne, & Puto, 2014). Furthermore, Pettibone (2012) argues the AE to arise out of a continuous process of attribute-wise comparisons between alternatives and is mitigated when time is limited. Due to time constraints, decision makers face cognitive load forcing them to avoid usual decision strategies and opting for

simple alternatives (e.g. choice deferral) (Lichters et al., 2016; Olschewski & Rieskamp, 2021; Ordóñez & Benson, 1997). With increased cognitive capabilities, decision makers are expected to better cope with cognitive load and initially improve at encoding the dominance relationship, thus reversing the mitigation of the AE caused by time constraints. Accordingly, the AE has shown to operate as a function guided by deliberate thought process. All rationales are in line with the RIM, which identifies motivation and cognitive capacity as key drivers behind reflective activation. Without the motivation to engage in trade-off evaluations, the consumer will likely not be able to establish a dominance relationship, which in turn will not enable the choice phenomenon to occur. Additionally, activating the reflective system requires the availability of cognitive resources. Both systems are active in the decision-making process within the RIM framework. In an attempt to better comprehend the AE's underlying mechanisms, I expect the choice anomaly to be embedded in the more deliberate reflective system (Pettibone, 2012). Subsequently, after having established caffeine consumption to facilitate cognitive capabilities, the following is hypothesized:

H_{1a}: The AE holds in the placebo group: accordingly, consumers tend to switch from a low quality/low price option L in the binary choice sets (compromising low quality/low price and medium quality/medium price) to the medium quality/medium price option M in trinary choice sets (compromising low quality/low price and medium quality/medium price and medium quality/high price decoy option).

H_{1b}: The AE increases for caffeine consumers: accordingly, these consumers will show a more pronounced tendency (vs. non-caffeine consumers) to switch from a "low quality/low price" option L in binary choice sets to "medium quality/medium price" option M in trinary choice sets.

Additionally, I intend to further shed light on the AE's true underlying mechanisms. Both affect and cognition are identified as potential drivers of overt behavior within the RIM framework of consumer behavior. With caffeine positively impacting both dimensions (Barry et al., 2005; Childs & De Wit, 2006; Maridakis, Herring, et al., 2009; Maridakis, O'Connor, et al., 2009), the stimulant is a suitable treatment to directly test both cognition and affect's impact in competition. As established in H_1, I predict the AE to be embedded within the deliberate thought process, thereby mediated by reflective processes (Kelman,

Rottenstreich, & Tversky, 1996; Lichters et al., 2017; Maylor & Roberts, 2007). Subsequently, I hypothesize the following:

H_2: The AE is driven by reflective processes. Thus, the enhanced switching behavior of the treatment group's participants will be mediated by their cognitive capabilities.

3.2. Caffeine and the compromise effect

The CE can be described as an option increasing in market share when positioned as an intermediate (compromise), rather than a more extreme option in a choice set (Simonson, 1989). The phenomenon has been explained as a way to cope with loss aversion (Dhar, Menon, & Maach, 2004; Kivetz, Netzer, & Srinivasan, 2004; Simonson, 1989) or extremeness aversion (Chuang et al., 2013; Sheng, Parker, & Nakamoto, 2005; Simonson & Tversky, 1992) in choice instances where consumers experience decision conflict (Levav, Kivetz, & Cho, 2010). As described in the second chapter, following the CE, consumers will prefer the compromise option (M) more frequently relative to the low option (L) after extending the binary core set (L, M) by a high option (H) (Simonson, 1989).

Previous literature has defined the choice phenomenon to arise from the careful application of System 2 thinking (Jang & Yoon, 2016; Lichters et al., 2016a; Pocheptsova et al., 2009) and results from decision makers ability to engage in cognitively demanding choice tasks comparing choice alternatives (Khan, Zhu, & Kalra, 2011). Research has consistently observed a decrease in the CE interrelating with diminishing accessibility of cognitive resources (Lichters et al., 2016a; Pettibone, 2012; Pocheptsova et al., 2009; Simonson & Nowlis, 2000). In line with the RIM framework, the availability and accessibility of cognitive resources is paramount to activating reflective processes in the process of decision making. As caffeine has shown to improve access to cognitive resources and facilitate cognitive capabilities, I hypothesize the following:

H_{3a}: The CE will hold in the placebo group. Accordingly, consumers will show the tendency to switch from the low quality / low price option in the binary choice set (low quality / price and medium quality / price) to the medium quality / medium price option in the trinary choice set (low, medium and high quality / price).

H_{3b}: The CE will increase for caffeine consumers. Accordingly, consumers will show a more pronounced tendency to switch from the low quality / low price option in the binary choice set to the medium quality / medium price option in the trinary choice set.

Analogous to the evaluation of the AE, I intend to unfold the CE's true underlying mechanisms. Accordingly, both affect and cognition are identified as potential drivers. With caffeine positively impacting both dimensions (Barry et al., 2005; Childs & De Wit, 2006; Maridakis, Herring, et al., 2009; Maridakis, O'Connor, et al., 2009), the stimulant once more proves as a suitable treatment to directly test the application of cognitive and affective processes in competition. Building on H_3, I predict the CE to be embedded within the deliberate thought process, thereby resulting from activation and guided by the reflective system (Kelman et al., 1996; Lichters et al., 2017; Maylor & Roberts, 2007). Using caffeine as a suitable treatment, I hypothesize the following:

H_4: The CE is embedded in System 2 thinking. Thus, the enhanced switching behavior of the treatment group's participants will be mediated by their cognitive capabilities.

3.3. Caffeine and choice deferral

When engaging in choice, consumers in real-world situations usually have the option to defer from purchase. This especially holds for the rapidly growing environment of e-commerce, which made up 18% of global retail sales in 2020 and is projected to reach roughly 22% by 2024 (Statista, 2021). In the online retail space, choice deferral is measured by the concept of conversion, where the conversion rate is described as "the percentage of users who take a *desired* action. The archetypical example of conversion rate is the percentage of website visitors who buy something on the site." (Nielsen, 2021). In the third quarter of 2020, global online shopper conversion rates reached 2.17% (Statista, 2021). Although it is difficult to measure in a brick and mortar environment, choice deferral also occurs and is regularly investigated in traditional retail spaces, such as supermarkets (Fasolo, Hertwig, Huber, & Ludwig, 2010; Iyengar & Lepper, 2000).

Dhar (1996) suggests choice deferral to occur subsequent to the selection process, i.e., after all choice options have been evaluated. Accordingly, researchers trace choice deferral back to decision conflict, where consumers face difficulties in the generation of preference amongst choices due to their inability to properly engage in attribute trade-offs (Tversky & Shafir,

1992a). Embedded in the concept of decision conflict, overall attractiveness of alternatives has been accredited as an underlying driver of the phenomenon (Dhar & Nowlis, 1999). Furthermore, researchers have identified choice deferral to increase with preference uncertainty (Dhar, 1997a; Dhar & Nowlis, 1999), which may surface when decision makers face difficulties in trading off attributes amongst offered alternatives (Novemsky, Dhar, Schwarz, & Simonson, 2007). Novemsky et al. (2007) proceed to attribute preference fluency as a driver of choice deferral, where difficult decision tasks are harder to process, thus increasing choice deferral. These findings are generally in line with the notion of consumer's intention to minimize cognitive effort (Dhar, 1997a; Tversky & Shafir, 1992a). Embedded in decision conflict, preference uncertainty and preference fluency, choice deferral is deeply rooted in the resource depleting evaluation of choice alternatives contained within the decision task. This is further highlighted by the facilitation of choice deferral with the introduction of time pressure (Dhar & Nowlis, 1999), which can be seen as a variable impacting the level of task difficulty (Hwang, 1994). Within the scope of the RIM framework, choice deferral strongly hints at being a function deriving from reflective processes, increasing or decreasing with motivation and cognitive capabilities of dealing with the decision task at hand. With its cognition facilitating capabilities, caffeine consumers will be more likely to engage in deliberate thought processes and accordingly more capable of trading off attributes between given alternatives. Hence, with an increased capacity to cope with task difficulty, decision makers should be less susceptible towards choice deferral. Thus, I expect the following:

H5: Caffeine consumers will buy more compared to those in the placebo group. Accordingly, the rate of no-buy decisions will be lower in the treatment group compared to the placebo group.

4. Chapter summary and implications

In order to develop sound hypotheses, this chapter aimed at establishing the necessary foundation. To establish the framework of the experiments described and conducted in the upcoming chapters, I initially discussed the foundations of rational choice behavior. Establishing the boundaries of rational choice, I discuss the fundamental axioms of completeness, transitivity, continuity, and independence, which collectively go by *von*

Neumann-Morgenstern axioms. Rational consumers engage in purchase decisions with the intention to maximize their utility, implying the choice of a most preferable option. The ability to identify this utility maximizing choice will depend under which of the three identified the decision is made: certainty, risk, or uncertainty.

After establishing the foundations of choice behavior, traditional models of the consumer decision making process, including the Nicosia model and the EKB model were briefly evaluated. Acknowledging these models' limitations, I transition to a dual perspective, where decision making is evaluated from a perspective involving affective and cognitive processes. Dual-process models have been developed to comprehend decision making in various fields of research. In the domain of consumer psychology, Samson and Voyer (2012) assign dual process into three strands, of which the consumption and buying behavior strand is elementary for the development of my hypotheses. Within the aforementioned strand, the reflective-impulsive model as developed by Strack and Deutsch (2004) is identified as a suitable model for evaluating the consumer decision making process of product purchase.

With the ability to impact both affective and cognitive processes, caffeine proves to be a suitable treatment to manipulate levels of both domains. This chapter thoroughly evaluated previous caffeine research, especially studies on affective and cognitive effects of caffeine consumption. Finally, the transition to caffeine's impact on consumer choice behavior was made, where a straightforward connection of the CNS stimulant's influence within the RIM framework was established. As both the AE and CE are considered to be embedded within reflective processes, which are dependent on the motivation to decode the choice set and the availability of cognitive resources to engage this task, I expect an increase in cognitive resources to facilitate this process. I propose the consumption of moderate caffeine levels (i.e. 200 mg) as a suitable treatment to enhance the aforementioned properties. Thus, I hypothesize the intake of caffeine to promote the AE and CE, making caffeine consumers more susceptible towards the choice irrationality. Analogous to the context effects, choice deferral is found to be nested in cognitive processes. Accordingly, the CNS stimulant is expected to support consumer's ability to better cope with the underlying mechanisms promoting choice deferral, thereby improving their ability to engage in choice. As a result, the level of choice deferral is expected to reduce for caffeine consumers, leading to an increase in purchase rates.

The generated hypotheses will be evaluated in the following chapters. Over four studies, subjects' caffeine levels will be manipulated before conducting an array of product choice tasks in free choice and forced choice settings. By controlling the level of caffeine amongst consumers, I will be able to identify the impact caffeine has on the choice phenomena of interest.

Chapter 4

Literature Review: Recent Topics in Context Effect Research

1. Chapter overview

As the influence of contextual settings on consumer decision making has consistently gained interest in the field of marketing over the past four decades (Huber et al., 1982; Lichters et al., 2017; Lichters, Müller, et al., 2016b; Padamwar, Dawra, & Kalakbandi, 2021; Simonson, 1989), it is needless to point out the importance and relevance it has found towards marketing practice. With the intention of driving profits, businesses will forever find value in understanding their customers and the underlying mechanisms driving their decision-making behavior. Accordingly, any factor influencing consumer behavior deserves an in-depth exploration from a research and managerial perspective. This also holds for research in the field of context effects. However, due to their seemingly spurious design, the business application of experimental findings in the context effect realm have been heavily criticized by Yang and Lynn (2014) and Frederick, Lee and Baskin (2014). Specifically, Yang and Lynn (2014) observed consumers to be susceptible to the AE in situations where products and services are described by abstract and numerical attributes as opposed to more realistic descriptions. In line with Yang and Lynn (2014), Frederick et al. (2014) identified the AE to be less observable in situations where choice options are directly experienced or described by an image of attributes. These findings led to their conclusion, that the AE is observable in artificial choice settings and inapplicable to real world situations. The authors continued to advise practitioners and future researchers to reconsider implementing findings into their work, as both Yang and Lynn (2014) and Frederick et al. (2014) seriously question the ecological validity of context effect research. The critique sparked a serious debate and initiated various authors to respond, including Huber, Payne and Puto (2014), and Lichters, Sarstedt and Vogts' (2015) cautionary note and guidelines on context effect experiments. In this response, Lichters et al. (2015) argue that researchers need to initially distinguish between *effects application research* and *theory application research* before experimental findings can be considered as further implications. If effects application is a research goal, Lichters et al. (2015) introduced experimental guidelines promoting high internal and external validity to control for relevant background factors when conducting context effect experiments.

Extending on the debate of implementing experimental context effect research findings, this chapter aims at evaluating current research in the field of context effect research and to assess the quality of the conducted research by means of a literature review. Upholding high levels

of internal and external validity is instrumental for applying experimental findings into business practice. To assess the quality level of recently conducted context effect experiments, I will evaluate to which degree the experimental guidelines for context effect research on product / service choice have been implemented upon being introduced by Lichters et al. (2015). Furthermore, a comparison of the experimental guidelines contained in research evaluated before their introduction vs. after the introduction of the guidelines will be conducted to assess the development of experimental quality. I then continue to evaluate current topics of context effect research that have been researched in the respective literature of the past six years. Furthermore, special notice will be paid to future trends of AE and CE research. The chapter closes with a brief summary of my findings.

2. Quality of recent context effect research

Upon having defined the principles of the AE and CE, the conducted literature review focuses on assessing the quality of conducted research on product / service choice by evaluating the aforementioned context effects in an experimental setting. After approximately three decades of context effect research, Frederick et al. (2014) and Yang and Lynn (2014) set out to criticize and question the applicability of researchers' findings on marketing practice. Evaluating literature between 1982 and 2014, Lichters et al. (2015) show that the majority of publications do not account for effects application research. Instead, only few of the context effect experiments conducted in high-ranking marketing journals include important background factors to uphold high levels of internal and external validity, as e.g. including economic consequences (4.94%). These findings strongly contradict Frederick et al.'s (2014) motivation of preserving ecological validity, as theory application's primary focus does not lay within finding effects that will translate to marketing practice (Lichters et al., 2015). In order to conduct research with the intention to transition findings to business reality, Lichters et al. (2015) proposed the following guidelines for future context effect experiments: (1) Introduce real economic consequences, (2) use real items or realistic and meaningful attributes and attribute levels in descriptions, (3) align the products / services with the target audience in the real-world application, (4) allow for a sensory pre-choice product evaluation, (5) offer a no-buy option, (6) control for subject's perception, and (7) avoid learning processes in repeated choices. Each criterion included a specific experimental

protocol which was to be noted when implementing the respective criteria in context effect experiments.

In an attempt to evaluate the quality of recent context effect research published upon introduction of the guidelines for implementing into context effect experiments, I replicate Lichters et al. (2015) analysis of experimental studies focusing on product or service choices in an AE or CE setting. In this replication, I will evaluate to which degree each of the guidelines was implemented into the experimental setting. Furthermore, I draw a comparison of the guideline inclusion of publications prior to the introduction and afterwards. The content of the collected literature will also be evaluated to gain insight on current topics in field of AE and CE research. Finally, I discuss implications of my findings for both practitioners and researchers while forecasting relevant topics of future context effect research as suggested by the authors of the included work.

2.1. Method

The conducted methodology of literature collection replicated the approach used by Lichters et al. (2015). Accordingly, the world-wide ranking of faculty perceptions (Hult, Reimann, & Schilke, 2009) was used to define the list of the top 30 marketing journals. This method of ranking is still commonly employed in literature reviews conducted in the field of marketing (Chen, Mandler, & Meyer-Waarden, 2021; Hult et al., 2018). I specifically focused on literature which was published succeeding the second quarter of 2015 until June 2021. Google Scholar, Web of Science, and the respective journal's electronic archives were used to identify potential articles of use. As my investigation solely focused on the AE and CE, the search terms were limited to the following: "Asymmetric-Dominance", "Attraction-Effect", "Compromise-Effect", and "Decoy-Effect" (also without hyphens and context sensitive). The initial search gave a total of 132 results. Upon initial evaluation of these articles, I identified 31 articles to be relevant for the conducted literature review. Next, I implemented Lichters et al. (2015) criteria to filter out irrelevant publications based on the following criteria: (1) Theoretical articles without own empirical application, (2) comments / replies to existing papers without own empirical examinations, (3) articles in an extended abstract format which (a) did not provide enough details in the methods section to evaluate all background factors or (b) were later on published as full papers, (4) articles that were not about product / service choice, (5) articles that did not manipulate choice sets in an experimental procedure but used the idea of context effects to explain observed behavior, (6) articles with empirical

examinations of other decoy and context effects besides the AE and CE, (7) articles which only refer to the two relevant context effects, and (8) articles that dealt with unavailable alternatives (e.g., out-of-stocks). Of the remaining 31 articles, 17 final publications across 9 journals were included in the literature review (see table 2).

The majority of the experiments conducted to investigate the AE or the CE focused on the specific impact or influence a certain variable made on the respective context effect. These variables ranged from country of origin (Chuang & Yen, 2007) to variable presentation (Kim, 2017). For example, Kim, Spence and Marshall (2018) investigated the impact of presenting product attributes in different colors has on the CE. Over a series of studies, Kim et al. (2018) were able to observe that consumer choice can be manipulated by implementing unique colors when presenting product information. Findings also encompassed physiological aspects of consumer behavior, as Lichters et al. (2016a) evaluated the influence cognitive impairment induced by reducing brain serotonin levels has on the CE. By systematically reducing subjects' serotonin levels by means of an acute tryptophan depletion, Lichters et al. (2016a) observed a reduction in serotonin levels to reduce the availability of subjects' cognitive resources, which in turn lead to an increase in choice deferral and also eliminated the CE. Furthermore, current context effect research focused on the robustness of the AE upon introducing economic consequences (Lichters et al., 2017), the relevance of brand names towards context effects (Gunasti & Devezer, 2016), and dyadic decision making in a CE setting (Boldt & Arora, 2017). The findings in the 17 included publications furthermore support the AE and CE to remain robust over multiple research topics and in various experimental settings.

Table 2 Published experimental full papers in the top 30 marketing journals on product / service choice in the domain of the attraction and compromise effect

European Journal of Marketing (EJM)	Gomez, Martinez-Molés, Urbano & Vila, 2016	***Journal of Marketing Research (JMR)***	***Marketing Letters (ML)***
Montaguti & Zammit, 2017	Lichters Müller, Sarstedt & Vogt, 2016	Evangelidis, Levav & Simonson, 2018	Kim, 2017
		Lichters et al., 2016	Lichters, Bengart, Sarstedt & Vogt, 2017
International Marketing Review (IMR)	***Journal of Consumer Psychology (JCP)***		Gunasti & Devezer, 2016
Kim & Park, 2017	Mao, 2015	***Journal of Retailing (JR)***	
		Kim, Spence & Marshall, 2018	***Marketing Science (MarSci)***
Journal of Business Research (JBR)	***Journal of Consumer Research (JCR)***		Boldt & Arora, 2017
Cui, Kim & Kim, 2021	Schley, de Langhe & Long, 2020	***Management Science (ManSci)***	
Padamwar, Damra, Kalakbandi, 2021	Nikolova & Lamberton, 2016	Hedgcock, Rao & Chen, 2016	

2.2. Results

Initially, at least one publication in three of the top four ranking marketing journals can be identified. Furthermore, it can be observed that at least one article was published in six of the top ten marketing journals, clearly highlighting context effects' relevance amongst marketing's leading research, especially featuring the CE. Identical to Lichters et al. (2015), the AE and CE along with the corresponding selection criteria are well established in the most valued top tier journals, as the majority of the publications (88%) are found in the top 13 journals. Only two publications are found in journals ranking below 15 (EJM, 16 & IMR, 28). Overall, the CE remains to be the context effect attracting the majority of research attention (13 examinations, 8 examinations of the AE).

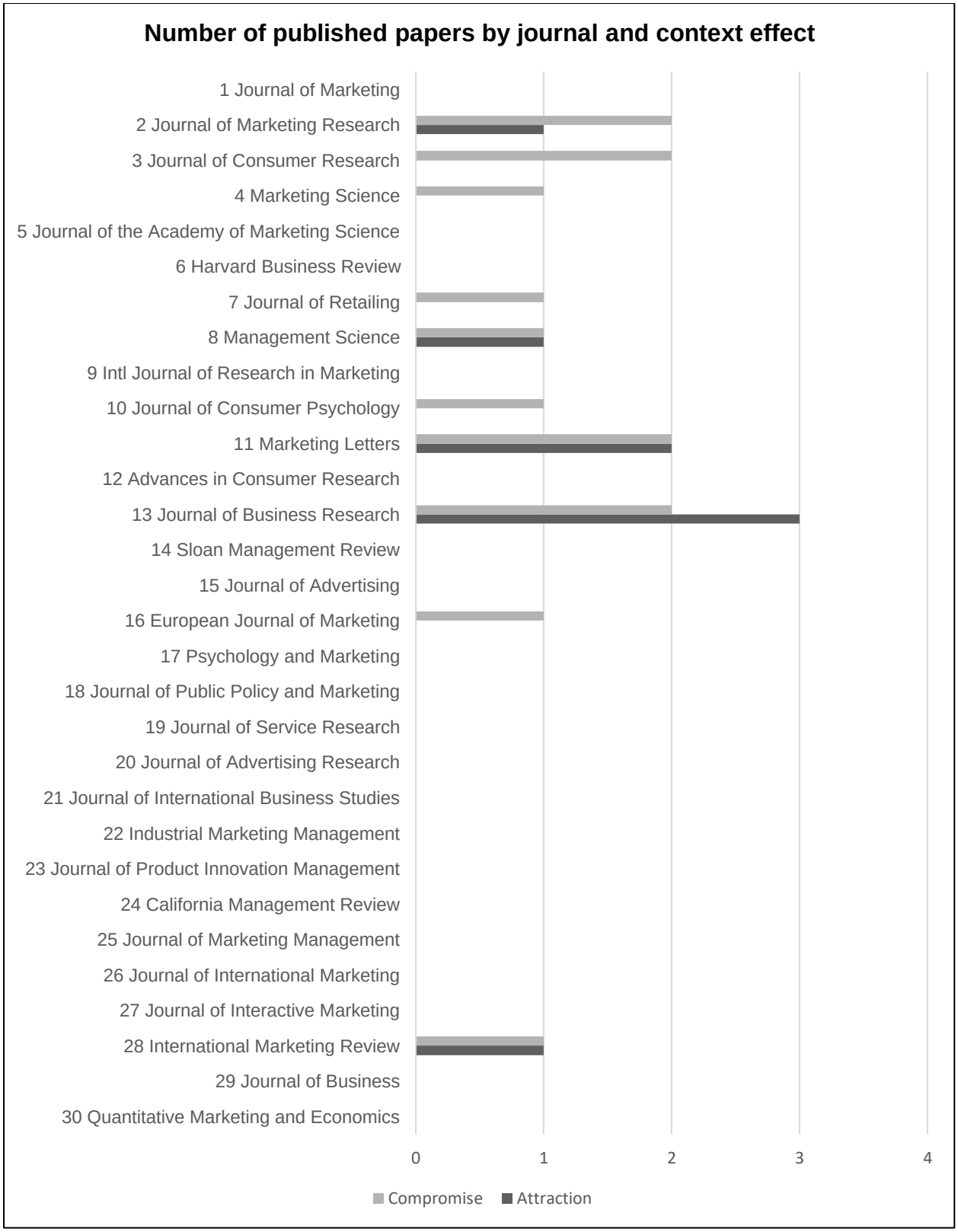


Figure 9 Number of published experimental full papers on product / service choices in the domain of the attraction and compromise effect

Next, I evaluated each studies consideration of the recommended guidelines for implementing context effect experiments. The guidelines included seven main criteria: (1) Introduction of real economic consequences, (2) use of real items or realistic attributes and attribute levels in descriptions, (3) alignment of products/services with the target audience in the real-world application, (4) allowing for a sensory pre-choice product evaluation, (5) inclusion of a no-buy option, (6) controlling for subjects' perception of choice options, and (7) avoiding learning processes in repeated choices. I expanded the consideration of selected background factors by specifically noting the experimental protocol of each criterion, giving a total of 13 extended control criteria as suggested by Lichters et al. (2015) (see table 3). This allows for a more in-depth analysis of included factors in context effect experiments. Identical to Lichters et al. (2015), each factor was coded on whether it was implemented at a realistic level in any experiment reported in the paper.

A first glance at the evaluated results are underwhelming, as the suggested criteria were not included in the majority of the literature. Just three of the 13 extended criteria were incorporated in the majority of included articles ((2b) include realistic product descriptions (88.24%), (6c) integrate measures in a way that will not exert an influence on choice outcomes (52.94%), and (7) limit the number of repeated choices, particularly when using consumer durables (94.12%)). A major criterion, (3a) make sure that the products / services are relevant to the target audience of the experiment and the population you want to generalize to, only found recognition in 6 of 17 articles (35.29%). A further key criterion for generalizing findings to real-word cases, (1a) ensure that the participants have to pay for the items they truly buy, was included in just 4 of 17 articles (23.53%). Adding to the list of neglected criteria, a somewhat alarming revelation is the lack of including a no-buy option, which was found in only 7 of 17 publications (41.18%). Including the option not to buy a product / service offering is crucial when intending to draw correspondence between the experimental setting and real-world extrapolation system (Lichters et al., 2015). Nonetheless, a relative comparison between the initial and current evaluation does indicate an increase of integration for the two aforementioned key criteria (Economic consequences: 4.94% (2015) vs. 23.53% (2021); No-buy options provided: 13.58% (2015) vs. 41.18% (2021)).

Table 3 Implementation of guidelines for context effect experiments on product / service choice

#	Criteria	Total	Attraction	Compromise
1a	Ensure that the participants have to pay for the items they truly buy.	23.53% (4/17)	25.00% (2/8)	15.38% (2/13)
1b	Consider using RPMs to render one decision per participant (or a fraction of all the decisions) as payoff relevant.	23.53% (4/17)	25.00% (2/8)	15.38% (2/13)
1c	To avoid house money effects, show-up fees should be paid two weeks prior to the experiment. If this is not feasible (e.g., due to diminishing interest in the product), the show-up fee should be paid at the last point of contact.	11.76% (2/17)	12.50% (1/8)	7.69% (1/13)
2a	Provide the participants with real items in a setting that occurs naturally in the market.	35.29% (6/17)	37.50% (3/8)	23.08% (3/13)
2b	For product descriptions, use a realistic number of meaningful attributes, including realistic attribute levels, to describe the items.	88.24% (15/17)	87.50% (7/8)	92.31% (12/13)
2c	If the consumers see pictorial descriptions of the choice items in real-world settings, also use images in the experiment. The same holds for customer-rating information.	29.41% (5/17)	62.50% (5/8)	15.38% (2/13)
3a	Make sure that the products / services are relevant to the target audience of the experiment and the population you want to generalize to.	35.29% (6/17)	50.00% (4/8)	23.08% (3/13)
3b	Control for the participants' willingness to buy (situational involvement) and other background variables that may interact with the effect under research.	17.65% (3/17)	25.00% (2/8)	7.69% (1/13)
4	If it is reasonable to assume that consumers will sensory evaluate products prior to a real buying decision, enable them to do so in the experiments as well.	23.53% (4/17)	25.00% (2/8)	15.38% (2/13)
5	Since consumers may opt not to buy a product / service in real-world situations, allow them to do so in experiments as well.	41.18% (7/17)	62.50% (5/8)	23.08% (3/13)
6a	Collect data on the perception of choice alternatives with regard to the desirability of the alternatives and specific dimensions. Especially, evaluate if dominance relationships are perceived by participants in the domain of the AE and PDE.	41.18% (7/17)	62.50% (5/8)	30.77% (4/13)
6b	If in doubt, implement manipulation checks (e.g., direct ratings of the choice alternatives). Make sure that a high quality/ high price option is perceived in the intended way in compromise settings.	29.41% (5/17)	50.00% (4/8)	23.08% (3/13)
6c	Best integrate measures in a way that will not exert an influence on choice outcomes.	52.94% (9/17)	62.50% (5/8)	46.15% (6/15)
7	Limit the number of repeated choices, particularly when using consumer durables.	94.21% (16/17)	100% (8/8)	92.31% (12/13)

2.2.1. Additional Findings

Following Lichters et al. (2015), I was interested in comparing the inclusion of relevant background factors amongst literature published in top 10 journals compared to publications of journals ranking between 11 – 20 (see table 4). Interestingly enough, I was able to observe a continuation of the trend already established in the previous evaluation. Especially key criteria 1a (12.50% included in top 10 journals, 37.50% included in 11 – 20), 3a (12.50%; 50.00%), and 5 (25.00%; 50.00%) indicated large discrepancies in implementing relevant background factors when conducting context effect experiments. As previously motivated by

Lichters et al. (2015), I further encourage editors and reviewers of the top 10 journals to focus on including relevant background factors in future studies to ensure a high level of research quality.

Evaluating the implemented experimental design, researchers clearly preferred a between-subjects design, where every publication included at least one study following this procedure. A mixed factorial design, including both a between-subjects and within-subjects design, was implemented in at least one study for 47.06% of the publications (e.g. Cui, Kim, & Kim, 2021; Gomez, Martínez-Molés, Urbano, & Vila, 2016; Lichters et al., 2016). At this point it is interesting to note the increase of researchers implementing both experimental designs (1982 – 2015: 11.11%, 2015 – 2021: 47.06%).

To gain insight on any further potential both AE and CE experiments hold, I evaluated the authors discussion on future research avenues. As the included topics ranged across various fields of research, the authors future outlook on context effect research was diverse. Interestingly enough, authors advised future researchers to implement more realistic experimental conditions, including economic consequences (Hedgcock, Rao, & Chen, 2016; Padamwar, Dawra, & Kalakbandi, 2021), which was the main contribution of Lichters et al.'s (2015) suggested guidelines. Other authors concentrated on relevant drivers of context effects, motivating future research to further unfold underlying mediations (Kim, 2017), or when certain processes are activated (Hedgcock et al., 2016), or the interaction of certain processes (Cui et al., 2021). A more in-depth proposal has been made by Lichters et al. (2016a), who challenge future researchers to investigate distinct neurotransmitter systems involved in the consumer decision-making process. Following this research avenue, the concept of different thought processes and their specific activation will be exhaustively discussed throughout chapters 5 – 8.

Table 4 Implementation of guidelines for context effect experiments on product / service choice (contrast of top 10 marketing journals vs. ranked 11-20)

#	Criteria	Rank 1-10 (n=8)	Rank 11-20 (n=8)
1a	Ensure that the participants have to pay for the items they truly buy.	12.50% (1/8)	37.50% (3/8)
1b	Consider using RPMs to render one decision per participant (or a fraction of all the decisions) as payoff relevant.	12.50% (1/8)	37.50% (3/8)
1c	To avoid house money effects, show-up fees should be paid two weeks prior to the experiment. If this is not feasible (e.g., due to diminishing interest in the product), the show-up fee should be paid at the last point of contact.	0% (0/8)	25.00% (2/8)
2a	Provide the participants with real items in a setting that occurs naturally in the market.	25.00% (2/8)	50.00% (4/8)
2b	For product descriptions, use a realistic number of meaningful attributes, including realistic attribute levels, to describe the items.	75.00% (6/8)	100% (8/8)
2c	If the consumers see pictorial descriptions of the choice items in real-world settings, also use images in the experiment. The same holds for customer-rating information.	12.50% (1/8)	50.00% (4/8)
3a	Make sure that the products / services are relevant to the target audience of the experiment and the population you want to generalize to.	12.50% (1/8)	50.00% (4/8)
3b	Control for the participants' willingness to buy (situational involvement) and other background variables that may interact with the effect under research.	0% (0/8)	37.50% (3/8)
4	If it is reasonable to assume that consumers will sensory evaluate products prior to a real buying decision, enable them to do so in the experiments as well.	12.50% (1/8)	37.50% (3/8)
5	Since consumers may opt not to buy a product / service in real-world situations, allow them to do so in experiments as well.	25.00% (2/8)	50.00% (4/8)
6a	Collect data on the perception of choice alternatives with regard to the desirability of the alternatives and specific dimensions. Especially, evaluate if dominance relationships are perceived by participants in the domain of the AE and PDE.	37.50% (3/8)	37.50% (3/8)
6b	If in doubt, implement manipulation checks (e.g., direct ratings of the choice alternatives). Make sure that a high quality/ high price option is perceived in the intended way in compromise settings.	12.50% (1/8)	37.50% (3/8)
6c	Best integrate measures in a way that will not exert an influence on choice outcomes.	62.50% (5/8)	37.50% (3/8)
7	Limit the number of repeated choices, particularly when using consumer durables.	87.50% (7/8)	100% (8/8)

3. Chapter summary and implications

The AE and the CE have continued to gain attention by scholars from various research strands over the past six years. Especially the CE has received much attention and was investigated in just above three quarters (76.47%) of all publications. Furthermore, the AE was investigated in 8 of the 17 included publications (47.06%), clearly rejecting Ferderick et al.'s (2014) motion to pause further research on the AE. The research contributions have been made in various fields and in different settings, providing further support for the effects'

robustness. With the introduction of suggested guidelines to be implemented in context effect experiments made by Lichters et al (2015), I have been able to observe an improvement in the quality of research by their application of suggested, more realistic experimental conditions. Nonetheless, the majority of studies did not consider implementing the suggested guidelines. Even when effects application is not the goal, implementing the guidelines will not hurt when focusing on theoretical applications, as suggested by Lichters et al. (2015). Accordingly, especially when considering the consistent development in this field of research, it is important to continue motivating researchers to implement the guidelines into their context effect experiments.

By evaluating the recent literature exploring the AE and CE, I was able to identify areas for future research. Better understanding the underlying mechanisms of both the AE and the CE especially stood out, i.e. what is driving the respective context effect and when are these processes active. This identified area for future research will receive special attention in the upcoming chapters 5 – 7, where I will investigate the impact of a central nervous system stimulant on the AE and the CE, and what underlying processes are activated for the corresponding context effect.

Chapter 5

Study 1: Investigating the Influence of Caffeine Consumption on the Attraction Effect and the Compromise Effect – in Free Choices

1. Chapter overview

With context effects having received much attention over the past decades, the drivers and underlying mechanisms of this irrationality have been heavily investigated as addressed in previous chapters. Competing claims revolving around the processes in which the AE and the CE are embedded within have stirred an ongoing debate on the effects' true genesis. To understand their underlying mechanisms, it is paramount to comprehend the steps involved in the consumer decision making process. The RIM framework can be utilized to evaluate consumer behavior within a dual process framework, where reflective processes are contingent on the motivation of engaging with the choice task and availability of cognitive resources to execute the procedure. Due to previous research finding both effects to be embedded in reflective processes (Hadar et al., 2018; Lichters et al., 2017; Lichters et al., 2016a; Pettibone, 2012; Pocheptsova et al., 2009; Simonson & Nowlis, 2000), it is easy to establish a connection between CNS stimulants and the aforementioned phenomena, due to the stimulants' cognitive enhancing properties (Giles et al., 2013; Lorist et al., 1994; Smith, Clark, et al., 1999). Study 1 sets out to evaluate caffeine's influence on both the AE and the CE in purchase situations with real economic consequences (Lichters et al., 2015). To comprehend caffeine's influence on the AE and the CE, I decided to initially observe the stimulant's influence in a free-choice setting (Dhar & Simonson, 2003; Lichters et al., 2016a), thereby providing decision makers with the option to defer from purchase. With the addition of a no-buy option, the experiment provided decision makers facing an irrelevant decision task the opportunity to avoid purchase (Lichters et al., 2015), enabling an evaluation of caffeine's influence in an environment that provides realistic choice settings. Although purchase situations usually take place in a free-choice setting (Dhar & Nowlis, 2004), consumers may also be confronted by binding choice situations, e.g. when purchasing a gift on the eve of Mothers's Day without the option of postponing (Lichters et al., 2015). Accordingly, consumers do not have the opportunity to defer purchase, leaving them in a situation where they are forced to make a choice. The assessment of caffeine's influence on both context effects in a forced-choice decision situation will be evaluated in the following chapter.

Study 1 indicates caffeine consumers to be more susceptible to both the AE and the CE when purchasing fast moving consumer goods (FMCG). Furthermore, I was able to observe caffeine consumers to defer less from purchase. In the following subchapters, I will define

the experimental setup and materials included before discussing the experimental procedure. Next, the results of the study will be evaluated, ranging from the evaluation of participants' demographical background to the analysis of product choices made. The chapter will close with a brief summary before transitioning to the second experiment.

2. Methods and materials

2.1. Experimental design, stimuli and measures

Experimental design and product stimuli: To evaluate caffeine's influence on the AE and the CE, I initially introduced a between-subjects evaluation in a free-choice setting. Thus, subjects were able to either choose an option in the given choice set or to defer purchase for every purchase task. In order to simulate realistic choice scenarios, it was important to include products the experiment's participants were interested in (Lichters et al., 2015). Following previous context effect research (Lichters et al., 2017; Lichters et al., 2016a; Müller et al., 2012), product categories were selected based on face-to-face interviews with students from a major German university. As a result, trail mix (AE) and toothpaste (CE) were selected as the FMCG product categories adopted for Study 1.

The offered products were described by a product picture, quality rating (Stiftung Warentest), and price in order to select attributes that closely emulate decisions in realistic purchase situations, as shown in figures 10 and 11. Product sets were repeatedly offered at varying prices throughout the study (see Appendix 1). Similar to Lichters et al. (2016), a random-payoff mechanism (RPM) was implemented to incentive-align participants' decisions. According to the RPM, one randomly selected decision per participant resulted in an actual purchase. More precisely, for each participant, the choice selected by the RPM was one which the participant would pay the selling price in exchange for the corresponding product. As per the experimental design, participants were not forced to buy an item, as they were able to select the no-buy option if the offered products were irrelevant.

Artikel	**K-Classic Studentenfutter**	**Farmer´s Snack Studentenfutter**	**Ültje Studentenfutter**	
Stiftung Warentest Qualitätsurteil	2,7	2,4	2,2	Nein, ich möchte <u>keines</u> der Produkte kaufen!
Produktbild				
Preis	0,81 €	1,64 €	1,29 €	
Entscheidung	O	O	O	O

Figure 10 Example of a choice task on trail mix in the trinary setting (extended decoy set)

Artikel	**Colgate Dentagard**	**Colgate Total**	**blend-a-med**	
Stiftung Warentest Qualitätsurteil	2,2	1,9	1,6	Nein, ich möchte <u>keines</u> der Produkte kaufen!
Produktbild				
Preis	0,66 €	0,84 €	2,52 €	
Entscheidung	O	O	O	O

Figure 11 Example of a choice task on toothpaste in the trinary setting (extended high set)

Such RPM's are seen as a 'gold standard' in experimental economics, since they reveal realistic demand properties in sequential multistage decisions that a single participant makes. This is due to the fact that each purchase decision might become payoff relevant (e.g.,

Grether & Plott, 1979; Starmer & Sugden, 1991; Wilcox, 1993). By suppressing income- and portfolio-building effects (Braga, Humphrey, & Starmer, 2009), RPMs allow multiple observations per respondent to be interpreted as mutually independent (e.g., Cubitt, Starmer, & Sugden, 1998).

Treatment administration: Masked as a coffee tasting, all participants received a warm 200 ml coffee drink containing 180 ml decaffeinated coffee and 20 ml lactose-free milk. 200 mg of pure caffeine was administered into the treatment group's coffee drink. The selected caffeine dosage of 200 mg closely resembles the amount contained in a brewed coffee of a leading coffee chain (Foster, 2021). Both drinks tasted equally and were served in a paper coffee cup covered by a lid which was not to be removed during the drink evaluation.

Measures: To measure for the cognitive capabilities of our subjects, I adopted the long version of the Cognitive Reflection Test (CRT-L), which was introduced by Primi, Morsanyi, Chiesi, Donati and Hamilton (2016). As compared to the original CRT (Frederick, 2005), the CRT-L included six questions (original three of the CRT and an additional three), which in sum capture a wider range of the underlying cognitive ability construct (see Appendix 1 for full test). The final score of the CRT-L falls in the interval of zero to six. Participants were asked to complete the test approximately 60 minutes post drink consumption, thereby ensuring caffeine's effect (Mandel, 2002). Furthermore, the 11-point risk attitude measure used in the German Socio-Economic Panel (SOEP) (Dohmen, Falk, Huffman, & Sunde, 2010; Jaeger et al., 2010; van Winden, Krawczyk, & Hopfensitz, 2011) to test for the treatment's effect on risk-seeking was incorporated.

2.2. Experimental procedure

All participants were students from varying study fields at a major German university. Students were recruited on campus to participate in a coffee drink testing and were remunerated 15 EUR for participating in the study. All students were informed to only drink water and have a light breakfast on the day of the experiment. To avoid a house-money effect bias (Lichters et al., 2016a; Rosenboim & Shavit, 2012; Thaler & Johnson, 1990), the payment was made on the day of recruiting, approximately 14 days prior to the start of the experiment. Previous to the experiment, all subjects underwent a screening process to rule out any allergies or intolerances regarding caffeine, lactose-free milk, or coffee, in line with the studies front of being an evaluation of a coffee drink which will soon be introduced to the

German market. The study was spread across four sessions on three separate days with approximately 16 participants per round. On each day, the experiment opened at 8:30 A.M. with participants signing in and randomly receiving an even or odd place number. The place number indicated the experimental group they belonged to, which was not communicated to the subjects or instructors. Respectively, a double-blind study was conducted without unveiling the groups belonging before completing the experiment. All participants were initially asked if any drink besides water had been consumed prior to the start of the experiment.

The paper-and-pen experiment opened with the coffee tasting and the following drink evaluation. All subjects consumed the entire drink. In line with Lehmann and Pan (1994) and Lichters et al. (2015), participants had the opportunity to physically evaluate products offered in the study from a display shelf before the experiment started. The product offerings did not indicate prices, thereby avoiding any introduction of a price anchor in the following choice situations (Ariely, Loewenstein, & Prelec, 2006). An array of irrelevant distractor tasks followed the product evaluation. Approximately 45 minutes after consuming the coffee drink, thereby ensuring caffeine's impact (Bonati et al., 1982; Liguori et al., 1997), participants began evaluating the product choice tasks. Both the placebo and treatment group randomly were assigned either to the binary (CS_{binary}) or trinary choice set composition ($CS_{trinary}$). The binary product choice set for the AE and CE consisted of a competitor option (L) and a target option (M). While the trinary choice set for the AE was extended by a decoy option (D) dominated by the target option in price and quality, the trinary choice set of the CE was extended by a high option (H), superior in quality and inferior in price to both alternative options. In the trinary choice task's product display, the decoy option graphically was positioned between the low and target option for the trail mix product category (see figure 10). For product category toothpaste, the high option was positioned on the outside right (see figure 11). Six decision tasks at varying prices composed of the identical product options were made for each choice composition (see Appendix 1). The participants indicated which option they would purchase at the given price. Following Lichters et al. (2016), prices at the binary choice setting followed a systematic trade-off (see Appendix 1). At the trinary choice stage, the previous prices for L and M were reproduced. Option L was always priced below option M. For the trinary choice set, the additional options (decoy option and high option) always had the highest price. All participants were able to make their purchase decisions without facing time pressure, thereby avoiding potential confounders facilitating the context

effect (Dhar, Nowlis, & Sherman, 2000; Lin, Sun, Chuang, & Hung-Jen, 2008). After the choice tasks, an evaluation of participants' demographical background was followed by the CRT-L, which completed the questionnaire.

In line with Lichters et al. (2016), I included one duplicated choice task to measure the robustness of participant's preference in terms of choice consistency. Accordingly, each participant made 6 decisions from either the binary choice set or trinary choice set and was able to defer choice in every task (free-choice setting). After excluding the duplicated choice task, 5 decisions per respondent remained for the main analysis of the AE, while 5 decisions per respondent remained for the CE. Once completing the questionnaires, subjects drew a lot for the RPM and completed the experiment with the corresponding product purchase outcome. On average, the experiment lasted for approximately 90 minutes.

3. Results

3.1. Preliminary results

No participant consumed a beverage containing caffeine (e.g. coffee, tea, cocoa, etc.) prior to the experiment. Three subjects were excluded from the analyses due to straight-lining, yielding a total of 64 participants ($n_{treatment}$ = 31, $n_{placebo}$ = 33, 54% female, M_{age} = 22 [22.73, 2.42]). To avoid internal validity issues, the equality of subsamples was evaluated (Lichters et al., 2017; Lichters et al., 2016a). No significant differences between the experimental groups regarding height, weight, body-mass-index, product brand awareness, price-quality-orientation, monthly net income, age, gender constellation, and risk attitudes, were found (smallest p = .119; see Appendix 1for full analysis).
Furthermore, the equality of the subsamples of each choice setting (binary vs. trinary) for each condition (placebo vs. treatment) was evaluated. For the treatment group, a significant difference was found in general risk attitude (M_{Binary}=7.06, SD_{Binary}=1.44 vs. $M_{Trinary}$=4.60, $SD_{Trinary}$=2.47; $t_{(22.184)}$=3.362 p=0.002) and BMI (M_{Binary}=24.29, SD_{Binary}=3.49 vs. $M_{Trinary}$=21.84, $SD_{Trinary}$=1.60; $t_{(21.328)}$=2.538 p=0.019). No further significant difference regarding height, weight, product brand awareness, price-quality-orientation, monthly net income, age and gender constellation was found (smallest p = .086; see Appendix 1 for full analysis). For the placebo group, no significant difference regarding height, weight, body-

mass-index, product brand awareness, price-quality-orientation, monthly net income, age, gender constellation, and risk attitude was found (smallest p = .083; see Appendix 1 for full analysis).

3.2. Manipulation check

All participants completed the six item CRT-L scale. To assess caffeine's influence on cognitive performance, I contrasted the collected scores, which ranged between 0 (no items answered correctly) to 6 (all items answered correctly), between the treatment vs. the placebo group. Caffeine consumers (M = 4.10, SD = 1.83) showed significantly higher scores than their counterpart (M = 3.21, SD = 1.96). In line with previous research focusing on caffeine's influence on cognitive capabilities (Giles et al., 2013; Lorist et al., 1994; Smith et al., 1999), the findings indicate caffeine to successfully facilitate cognitive capabilities ($t(62) = -1.86$, $p = .034$ (one-tailed); $d = -0.77$). Observing no significant differences in demographics and having established a successful manipulation between the treatment and placebo group, I can proceed to evaluate the participants behavior as described by their purchase behavior in the following subchapter.

3.3. Main results

3.3.1. Analysis of the Attraction Effect

For each product category, the decisions at the binary and trinary level were contrasted separately for each experimental group. Introducing the decoy option for product category trail mix led to a non-significant increase of option M's relative choice share over those of L from 8% to 12.5% ($p_{directed} = .359$) in the placebo group. Accordingly, no support of H_{1a} was observed. In line with H_{1b}, introducing the decoy option significantly increased option M's relative choice share from 26.09% to 60.87% ($p_{directed} = .011$) in the treatment group. An overall chi-square test was performed with the intention to evaluate the relation between caffeine consumption and choice behavior across L and M counts of the four conditions (Biswas, Labrecque, Lehmann, & Markos, 2014). A significant relation between the variables was identified, X^2 (3, $n = 64$) = 40.17, $p < .001$, thereby further supporting H_{1b}.

Considering multiple observations per participant, individual target rates were established to measure the robustness of switching behavior at the individual level. The target rates were defined as how often the target option was selected relative to all relevant purchase decisions (L, D, or M). For the placebo group, no AE was observed, as subjects selected the target

option in the trinary formation (M = 0.06, SD = 0.25) only at a slightly higher frequency than in the binary formation (M = 0.05, SD = 0.19), thus providing no support for H_{1a} (t(31), p = .422; d = -0.06). On the contrary, the target option was significantly more attractive for treatment subjects making decisions in the trinary composition (M = 0.35, SD = 0.43) than in the binary composition (M = 0.08, SD = 0.25), thereby supporting H_{1b} (t(22.26), p = .023 (one-tailed); d = -0.77). Furthermore, in line with Dhar and Simonson (2003), I observed a significant difference in choice deferral rates for caffeine consumers after introducing the decoy option to the trinary composition (M = 0.36, SD = 0.47) as compared to the binary composition (M = 0.71, SD = 0.43) (p = .019 (one-tailed); d = 0.80).

Table 5 Study 1: Between-subjects attraction effect by experimental condition

	Purchase Counts[a]	
	Trail Mix	
	CS_{binary}	$CS_{trinary}$
Placebo		
(binary: n = 17; trinary = 16)		
L	46 (92.00%)	35 (87.50%)
M	4 (8.00%)	5 (12.50%)
D	-	0
No-buy	35	40
Attraction effect	p = .359 (one-tailed)	
(Fisher's exact test[b])		
Treatment (Caffeine)		
(binary: n = 16; trinary n = 15)		
L	17 (73.91%)	18 (39.13%)
M	6 (26.09%)	28 (60.87%)
D	-	2
No-buy	57	27
Attraction effect	p = .006 (one-tailed)	
(Fisher's exact test[b])		

[a]Each respondent contributed 5 decisions to the analysis shown in this table. Therefore, the overall number of decisions Is 165 in the placebo group and 155 in the treatment group.
[b] Alternative analysis based on Yates's Chi-Square yields identical findings (placebo: Chi-Square(1) = 0.125, p = .362; treatment: Chi-Square(1) = 6.095, p = .007, one-tailed).

3.3.2. Analysis of the Compromise Effect

Following the analysis of the AE, I contrasted the decisions at the binary and trinary level separately for each experimental group to assess for any CE. For the product category toothpaste, introducing the high option led to a non-significant decrease of option M's relative choice share over those of L from 84.37% to 80.00% ($p_{directed}$ = .623) in the placebo group. Accordingly, no support of H_{3a} was observed. In line with H_{3b}, introducing the high option did significantly increase option M's relative choice share from 25.42% to 90.57%

($p_{directed} < .001$) in the treatment group. An overall chi-square test identified a significant relation between caffeine consumption and purchase counts of L and M for the corresponding purchase setting (binary vs. trinary), X^2 (3, n = 64) = 74.41, p < .001, thereby further supporting H_{3b}.

Next, I defined individual compromise rates for each subject to again overcome for multiple decisions made per participant. The rates were defined by how often the compromise option was selected relative to all relevant purchase decisions (L, M, or H). For the placebo group, no CE was observed as the change in compromise rates for the placebo subjects from the trinary formation (M = 0.49, SD = 0.51) to the binary formation (M = 0.64, SD = 0.49) was negligible, thereby providing no support for H_{3a} (t(31) = 0.85, p = .200; d = 0.03). The compromise option was significantly more attractive for treatment subjects making decisions in the trinary composition (M = 0.64, SD = 0.48) than in the binary composition (M = 0.19, SD = 0.38), thereby supporting H_{3b} (t(29), p = .006 (one-tailed); d = -1.07).

3.3.3. Additional analysis

As previously mentioned, one duplicated product choice was made over all tasks for each product category to measure the consistency of participants choices. Of the 128 duplicated choice tasks collected, 93.75% were replicated, upholding an acceptable level of consistency throughout the decisions, which compares well to previous context effects studies (Lichters et al., 2016). All participants accepted the RPM and completed the purchase without negotiating the listed price.

Table 6 Study 1: Between-subjects compromise effect by experimental condition

	Purchase Counts[a]	
	Toothpaste	
	CS_{binary}	$CS_{trinary}$
Placebo (binary: n = 17; trinary = 16)		
L	10 (15.63%)	10 (20.00%)
M	54 (84.37%)	40 (80.00%)
H	-	10
No-buy	21	20
Compromise effect (Fisher's exact test[b])	p = .357 (one-tailed)	
Treatment (Caffeine) (binary: n = 16; trinary n = 15)		
L	44 (74.58%)	5 (9.43%)
M	15 (25.42%)	48 (90.57%)
H	-	6
No-buy	21	16
Compromise effect (Fisher's exact test[b])	p < .001 (one-tailed)	

[a]Each respondent contributed 5 decisions to the analysis shown in this table. Therefore, the overall number of decisions Is 165 in the placebo group and 155 in the treatment group.
[b] Alternative analysis based on Yates's Chi-Square yields identical findings (placebo: Chi-Square(1) = 0.131, p = .359; treatment: Chi-Square(1) = 45.533, p < .001, one-tailed).

3.4. Findings Study 1

Initially, upon comparing demographics amongst both the treatment and placebo group, no significant difference between the groups structure was identified, establishing a suitable ground for the comparison of choice behavior. Product choice tasks were conducted to evaluate the AE and the CE. To assess both context effects, purchases were contrasted at the aggregate level and the individual level. Analyzing cumulative choices and individual purchase rates, I was able to find support for both H_{1b} and H_{3b}. Accordingly, both the AE and the CE are more pronounced for subjects having previously consumed a caffeinated beverage. My findings show relevance as I was able to observe caffeine to have successfully manipulated consumers, which in turn lead to an increase in cognitive capabilities, as can be taken from the significant difference in CRT-L scores. Surprisingly, I was unable to find results in support of either H_{1a} or H_{3a}, as there is enough evidence for both context effects to hold in a between-subjects design for consumers free of any treatment (Chuang, Kao, Cheng, & Chou, 2012; Lichters et al., 2017; Müller et al., 2012; Sen, 1998).

4. Chapter summary and implications

Caffeine has consistently shown to positively influence cognitive capabilities (Giles et al., 2013; Lorist et al., 1994; Smith, Clark, et al., 1999). In an attempt to evaluate caffeine's influence on the AE and the CE, caffeine levels of certain participants were systematically manipulated by providing them with a decaffeinated or caffeinated coffee-drink. The study design allowed for a between-subjects evaluation in a free-choice purchase situation, in which I observed both context effects to be more pronounced for caffeine consumers. The results indicate an increase in cognitive performance to facilitate the choice anomaly. These findings are in line with my previous account for the AE and the CE both to arise from an activation in System 2 thinking. Furthermore, I was able to observe caffeine consumers to significantly purchase more in the trinary setting than in the binary setting for product category trail mix. This finding stimulates my interest towards comprehending the interrelation of caffeine and choice deferral, which will be investigated in chapter eight. The findings in Study 1 allow me to make the following contribution to marketing research and practice.

I provide ample evidence to support the hypotheses of caffeine consumers to be more susceptible to the AE and the CE due to their heightened cognitive capabilities, which in turn lead to an increased engagement in evaluating and deciphering the choice set. Thus, for marketing practitioners implementing either context effect strategies with the intention to increase sales of a specific target or intermediate option, the results suggest these strategies to be even more successful for customers with increased cognitive capabilities, e.g. via manipulation of caffeine levels. Providing customers with caffeine can be achieved in various ways, as caffeine is the most consumed psychostimulant worldwide and found in many edibles or drinks consumed on a regular basis. On the contrary, it is important to provide consumers with this knowledge to potentially avoid becoming susceptible towards systematic manipulations implemented by marketing practitioners.

Finally, I provide premiere findings of combining the CNS stimulant with context effects, thereby extending previous context effect literature focusing on the interrelations with neuromodulator systems in the human brain (Hedgcock & Rao, 2009; Lichters et al., 2016a). Accordingly, my findings are in line with previous research claiming the AE and the CE to be embedded within the more deliberate and cognitively demanding System II thought process

as opposed to the intuitive, quick System I thinking (Lichters et al., 2016a; Pocheptsova et al., 2009) at a between-subjects level.

Chapter 6

Study 2a: Investigating the Influence of Caffeine Consumption on the Attraction Effect and the Compromise Effect – in Forced Choices

1. Chapter overview

Study 1 focused on purchases made in a free-choice setting in which participants had the option to defer from purchase. This setting was selected as it closer resembles realistic choice scenarios. However, real world decision making also entails situations where decision makers are forced to choose amidst available options (Lichters et al., 2016a), therefore the option to defer purchase does not exist. So-called forced choices also occur in marketing practice, most often when the considered goods or services are necessities. For example, when selecting a mobile phone plan, many options from different service providers are available. Deferring from choice in this situation would lead to limited, if any, availability by phone. As such, forced choice situations usually occur in situations of immediate demand, when delaying a purchase is not feasible, e.g. when purchasing a present at the evening of Mother's Day (Lichters et al., 2016a). Furthermore, researchers have identified the mere presence of a no-choice option to alter consumers choice behavior (Parker & Schrift, 2011). Accordingly, it makes sense to evaluate the choice phenomena within a binding framework. To assess the robustness of the findings regarding H_1 and H_3, Study 1 was replicated in a forced-choice setting with newly introduced product categories, thereby adjusting the experimental setting to prior context effect research (Lichters et al., 2016a; Malkoc, Hedgcock, & Hoeffler, 2013; Mao, 2016; Müller et al., 2012). The purchase scenarios of Study 2a follow the identical design of Study 1, with the exception of omitting the no-buy option to defer from purchase. The study's findings provide further support of caffeine consumers being more susceptible to the AE and the CE when purchasing fast moving consumer goods.

2. Methods and materials

2.1. Experimental design and stimuli

Experimental design and product stimuli: Study 2a introduced a 2x2 between-subjects design with condition (treatment vs. placebo) and choice set composition (binary vs. trinary) acting as between-subjects factors. Participants of both experimental groups were able to evaluate either binary or trinary choice tasks for each product category. Again, the selected product categories were based on prior face-to-face interviews with students from a major German university. Spiced cookie (AE) and ketchup (CE) were selected as the product categories adopted for Study 2a (see Appendix 2 for full product description). As described in figure 12,

the offered products were described by relevant attributes analogous to Study 1. By assessing both free-choice and forced-choice purchase scenarios, the robustness of findings achieved in Study 1 regarding caffeine's influence on the AE and the CE can be evaluated.

Artikel	Borggreve	Kinkartz	Bahlsen
Stiftung Warentest Qualitätsurteil	2,2	1,7	1,6
Produktbild			
Preis	0,80 €	1,49 €	1,20 €
Entscheidung:	O	O	O

Figure 12 Example of a choice task on spiced cookie in the trinary setting (extended decoy set)

In Study 1, the focus was solely set upon the reflective processes involved in the decision-making process. To further comprehend the mechanisms behind the AE and the CE, I include a further measure to capture affective processes corresponding to the choice phenomena of interest. Again, caffeine establishes itself as a suitable treatment to manipulate affective processes occurring within the human's CNS. To extend the measures previously applied in Study 1, I included the Self-Assessment Manikin (SAM) to evaluate the treatment's influence on affect (see Appendix 2). The non-verbal pictorial scale was implemented to directly measure any alteration in the dimensions pleasure, arousal and dominance (Bradley & Lang, 1994). Participants completed the SAM once shortly after treatment administration, before caffeine's effect sets in (SAM-pre) and again approximately 60 minutes after caffeine was consumed (SAM-post) to ensure full absorption and bioavailability within the CNS (Alsabri, Mari, Younes, Elsadawi, & Oroszi, 2018). This allows for an evaluation at two different time points between consumers and non-consumers. Furthermore, it enables evaluation of changes within the participant groups, signaling a change in affective processes based on caffeine consumption.

2.2. Experimental procedure

The selection and screening of participants was conducted analogous to Study 1. Participants again were remunerated 15 EUR approximately 14 days prior to the experiment. Identical to Study 1, the paper-and-pen experiment opened with the coffee tasting and the following drink evaluation. All subjects consumed the entire coffee drink. Prior to the treatment group being affected by the administered caffeine, all participants filled out the SAM-pre questionnaire. Next, they continued with the physical evaluation of all products being offered before proceeding with various unrelated filler tasks and the purchase tasks included in Study 2b[5] (see Appendix 2 for complete experimental flow of Study 2). Approximately 45 minutes after consuming the coffee drink, participants completed the SAM-post questionnaire before transitioning to the respective product choice stage. Study 2a implemented purchase tasks with both the placebo and treatment group randomly being assigned either to the binary (CS_{binary}) or trinary choice set composition ($CS_{trinary}$). The binary product choice tasks again consisted of a competitor option (L) and a target option (M). For the AE, the trinary choice tasks were extended by a decoy option (D), which was dominated by the target option in price and/or quality. For the CE, the trinary choice tasks were extended by a high option (H), superior to the target option in quality while inferior in price. The participants indicated which option they would purchase at the indicated price. As Study 2 focuses on choice in binding situations, participants had to select an option in every choice task and did not have the option to defer choice. In line with Lichters et al. (2016a), prices at the binary choice stage followed a systematic trade-off (see Appendix 1). At the trinary choice stage, the prices for L and M were reproduced, but an additional option (decoy option or high option) was added, which allowed for contrasts of purchases from both scenarios (see Appendix 2 for all price scenarios). Participants were able to select without time pressure. After the product choice tasks of Study 2a, demographics were followed by the CRT-L.

Each participant provided a total of 12 product choices (five decisions, plus an additional validation decision for each product category at both stages). The duplicated choice tasks again served as an assessment of choice consistency. All duplicated decision tasks were excluded from the main analyses. Once completing the questionnaires, the subjects drew their

[5] Study 2 consisted of an evaluation at the between-subjects level (Study 2a) and also implemented a within-subjects evaluation of the respective context effects (Study 2b)

lot for the RPM and completed the experiment with the product purchase. As the participants faced binding choice situations, a product purchase was inevitable. All participants accepted the RPM and completed the purchase without re-negotiating the listed price. On average, the experiment lasted for approximately 120 minutes.

3. Results

3.1. Preliminary results

The preliminary analysis was conducted analogous to Study 1. No participant consumed a caffeinated beverage prior to the experiment. Two participants were excluded from the analyses due to straight-lining, yielding a final sample size n = 51 ($n_{treatment}$ = 25, $n_{placebo}$ = 26, 29% female, M_{age} = 22 [22.24, 2.19]) participating in Study 2. No significant differences between the experimental groups in terms of height, weight, body-mass-index, product brand awareness, monthly net income, age, gender constellation, and risk attitudes, potentially confounding the observed main results (analysis of purchase decisions), were identified (smallest p = .111, see Appendix 2 for full analyses).

Furthermore, the equality of the subsamples of each choice setting (binary vs. trinary) for each condition (placebo vs. treatment) was evaluated. For the treatment group, no significant difference regarding height, weight, BMI, product brand awareness, price-quality-orientation, monthly net income, age, gender constellation and general risk attitude was found (smallest p = .255; see Appendix 2 for full analysis). For the placebo group, no significant difference regarding height, weight, body-mass-index, product brand awareness, price-quality-orientation, monthly net income, age, gender constellation, and risk attitude was found (smallest p = .395; see Appendix 2 for full analysis).

3.2. Manipulation check

To assess any alteration in cognitive capabilities due to caffeine consumption, I compared the CRT-L scores identically to Study 1. Results exhibit caffeine consumers (M = 4.35, SD = 1.47) to score significantly higher than non-consumers (M = 3.44, SD = 1.78), indicating better ability to cope with cognitive demanding tasks (t(49) = 1.99, p = .027 (one-tailed); d = -0.56).

For the measure of affect (SAM), I defined and evaluated the scores of the dimensions pleasure, arousal, and dominance, both within the subjects (pre- versus post-treatment exposure) and between the groups (treatment vs. placebo) by means of a repeated measures ANOVA. The pre and post survey scores were defined as the within-subjects factors while experimental condition acted as a between-subjects factor. In line with previous caffeine research (Barry et al., 2005; Childs & De Wit, 2006; Doyle et al., 2016; Mikalsen et al., 2001), a significant time (pre vs. post) by condition (treatment vs. placebo) interaction effect for arousal [$F(1,49) = 6.67$, $p = .013$ $d = .74$] was identified, indicating caffeine consumers to have significantly elevated their levels between the two measurement periods (see figure 13 for graphical visualization of interaction effect). I did not observe any significant interaction effect (time by condition) for the dimensions pleasure [$F(1,49) = 3.61$, $p = .063$ $\eta^2_p = .07$] or dominance [$F(1,49) = 1.97$, $p = .167$ $\eta^2_p = .04$].

The successful manipulation of both subjects' cognition and arousal levels justifies an evaluation of the choice phenomena's underlying mechanisms in competition, which will be evaluated in Study 2b.

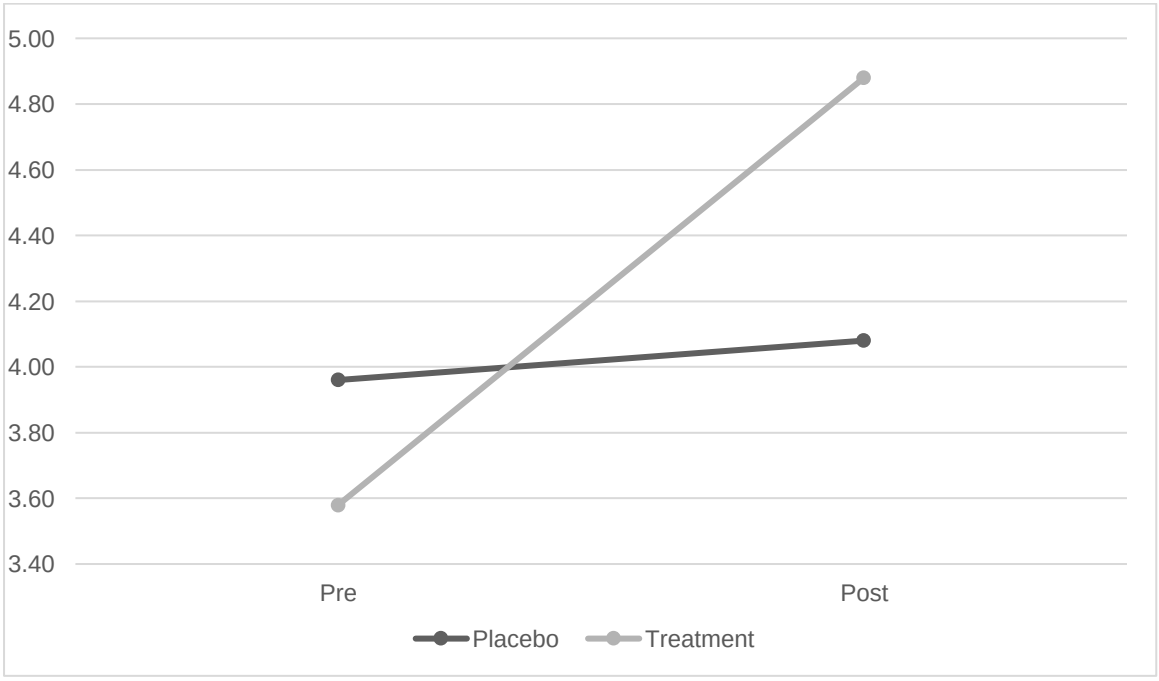


Figure 13 Study 2a: Interaction effect by estimated marginal means of arousal pre- vs. post-drink consumption

3.3. Main results

3.3.1. Analysis of the Attraction Effect

I initially evaluated the AE at the between-subjects level analogous to Study 1. Accordingly, the decisions between the binary and trinary level were contrasted separately for each experimental group. For the placebo group, introducing the decoy option led to a significant repulsion effect (Frederick et al., 2014; Liao et al., 2020; Spektor et al., 2018), decreasing option M's relative choice share from 53.85% to 17.24% ($p < 0.001$) as indicated by a Fisher's exact test (see table 7). Accordingly, no support of H_{1a} was observed. The introduction of the decoy option in the treatment group, however, increased option M's relative choice share from 32.00% to 82.00% ($p < 0.001$), providing support for H_{1b} at the aggregate level. Furthermore, an overall chi-square test identified a significant relation between caffeine consumption and purchase counts of the target option for the corresponding purchase setting (binary vs. trinary), X^2 (3, n = 51) = 52.04, $p < .001$, further supporting H_{1b} at the aggregate level.

Considering the multiple observations made per participant, I established individual target rates identical to Study 1. For the placebo group, a repulsion effect was also identified at the individual level, as the participants selected the target option in the trinary formation (M = 0.15, SD = 0.38) at a significantly lower frequency than in the binary formation (M = 0.58, SD = 0.49), thus providing no support for H_{1a} (t(20.71) = -2.46, p = .012 (one-tailed); d = -1.00). I did however find support for H_{1b}, as the target option was significantly more attractive for treatment subjects making decisions in the trinary composition (M = 0.72, SD = 0.40) than in the binary composition (M = 0.30, SD = 0.44) (t(24) = 2.45, p = .011 (one-tailed); d = 0.99).

Table 7 Study 2a: Between-subjects attraction effect by experimental group

	Purchase Counts[a]	
	Spiced Cookie	
	CS_{binary}	$CS_{trinary}$
Placebo (binary: n = 12; trinary = 13)		
L	25 (41.67%)	48 (82.76%)
M	35 (58.33%)	10 (17.24%)
D	-	7
Attraction effect (Fisher's exact test[b])	p < .001 (one-tailed) (repulsion effect)	
Treatment (Caffeine) (binary: n = 16; trinary n = 10)		
L	56 (70.00%)	9 (20.00%)
M	24 (30.00%)	36 (80.00%)
D	-	5
Attraction effect (Fisher's exact test[b])	p < .001 (one-tailed)	

[a]Each respondent contributed 5 decisions to the analysis shown in this table. Therefore, the overall number of decisions is 125 in the placebo group and 130 in the treatment group.
[b] Alternative analysis based on Yates's Chi-Square yields identical findings (placebo: Chi-Square(1) = 19.402, p < .001; treatment: Chi-Square(1) = 26.878, p < .001, one-tailed).

3.3.2. Analysis of the Compromise Effect

To evaluate the CE, I contrasted the choice task of the respective product category at the binary and trinary level separately for each experimental group. For the placebo group, introducing the high option led to a significant repulsion effect, decreasing option M's relative choice share from 34.00% to 25.00% ($p < .001$) as indicated by a Fisher's exact test (see table 8). Accordingly, no support of H_{1a} was observed. Introducing the high option in the treatment group increased option M's relative choice share from 9.00% to 54.00% ($p < 0.001$), providing support for H_{3b} at the aggregate level. Furthermore, an overall chi-square test identified a significant relation between caffeine consumption and purchase counts of the target option for the corresponding purchase setting (binary vs. trinary), X^2 (3, n = 51) = 33.50, $p < .001$, thereby further showing support of H_{3b}.

Next, I evaluated the individual target rates between the compositions. For the placebo group, I observed a repulsion effect, as the participants selected the target option in the trinary formation (M = 0.20, SD = 0.39) at a significantly lower frequency than in the binary formation (M = 0.37, SD = 0.47), thus providing no support for H_{1a} (t(23) = -0.96, p = .018 (one-tailed); d = 0.44). The target option was significantly more alluring to caffeine consumers choosing in the trinary composition (M = 0.58, SD = 0.50) than in the binary

composition (M = 0.09, SD = 0.25) (p = .011 (one-tailed); d = 1.34), supporting H_{1b} at the individual level.

Table 8 Study 2a: Between-subjects compromise effect by experimental group

	Purchase Counts[a]	
	Ketchup	
	CS_{binary}	$CS_{trinary}$
Placebo (binary: n = 17; trinary = 16)		
L	38 (63.33%)	40 (72.73%)
M	22 (36.67%)	15 (27.27%)
D	-	8
Compromise effect (Fisher's exact test[b])	p = .322 (one-tailed)	
Treatment (Caffeine) (binary: n = 16; trinary n = 15)		
L	73 (91.25%)	25 (46.30%)
M	7 (8.75%)	29 (53.70%)
D	-	5
Compromise effect (Fisher's exact test[b])	p < .001 (one-tailed)	

[a]Each respondent contributed 5 decisions to the analysis shown in this table. Therefore, the overall number of decisions Is 165 in the placebo group and 160 in the treatment group.
[b] Alternative analysis based on Yates's Chi-Square yields identical findings (placebo: Chi-Square(1) = 0.770, p = .380; treatment: Chi-Square(1) = 30.910, p < .001, one-tailed).

3.3.3. Additional Analysis

The evaluation of choice consistency by means of replicated purchase decisions for Study 2 was conducted in the within-subjects part and will be assessed in Study 2b.

3.4. Findings Study 2a

At first, I was able to establish a successful impact of the implemented manipulation for both cognitive and affective processes. This allows me to interpret the study's findings in relation to caffeine's impact on consumer behavior. Furthermore, the structure of both experimental groups showed no significant differences, providing a suitable basis for comparison of the main analyses. Unable to find the AE and CE to occur at either the aggregate or individual level for the placebo group, I was however able to discover both choice phenomena to hold in the treatment group. The findings of Study 2a thereby further strengthen those previous identified in Study 1, providing further support of both H_{1b} and H_{3b}. Thus, caffeine consumers are more susceptible towards the AE and the CE in both free-choice and forced-choice purchase situations. Both hypotheses were supported at the aggregate level and the individual level. The

findings indicate the robustness of caffeine facilitating both context effects, as I was able to again identify the treatment to have successfully manipulated the caffeine consumers.

4. Chapter summary and implications

In line with previous research findings (Giles et al., 2013; Lorist et al., 1994; Smith et al., 1999), results of Study 1 identified caffeine's ability to positively influence cognitive capabilities. Extending on this account, I evaluated the treatment's impact on affective processes by means of the SAM. To evaluate caffeine's influence on the AE and the CE, I systematically manipulated caffeine levels of the participants by providing them with a decaffeinated or caffeinated coffee-drink, identical to the method implemented in Study 1. Again, the study design allowed for a between-subjects evaluation, however this time considering purchase choices in a forced-choice situation. Supporting the findings of Study 1, both context effects were more pronounced for caffeine consumers. The results indicate that caffeine consumption, increasing both cognitive reflection and arousal levels, facilitates the choice anomalies. However, the findings also motivate further research to evaluate if the phenomena are driven by reflective or impulsive activation, which will be addresses in the following chapter. Extending on the managerial implications given in in Study 1, the findings of Study 2a highlight that the implementation of context effect strategies and their susceptibility to caffeine consumption also hold for binding choice situations.

Chapter 7

Study 2b: Investigating the Underlying Mechanisms of the Attraction Effect and the Compromise Effect

1. Chapter overview

After evaluating the relationship between caffeine, the AE, and the CE, I intend to further investigate the phenomena's underlying mechanism in an impulsive vs. reflective competition. Researchers have ongoingly attempted to comprehend the mechanisms behind both context effects since the choice phenomena have been first observed, identifying various drivers behind the choice irrationalities. Ratneshwar et al. (1987) argued that meaningfulness, which can be seen as a function of a consumer's ability to differentiate stimuli from one another, and familiarity with a product category moderate the AE, with lower levels contributing towards the context effect's occurrence (and vice-versa). Mishra, Umesh, and Stem (1993) extended this notion by establishing familiarity and expertise with a product class to positively affect the level of task involvement. With their information processing approach, Mishra et al. (1993) state that low levels of involvement will lead to an AE due to the lack of effort towards sound decision-making. Thus, the AE has been portrayed as an irrationality interrelated with low levels of cognitive effort at an early stage. More recent studies have observed the AE to result from trade-off aversion and avoiding negative emotion, as this unfavorable sensation associated with trade-offs decreases when choice sets are enriched by a decoy option (Hedgcock & Rao, 2009), supporting the effect's embeddedness within affective processes. In support of these findings, Mao and Oppewal (2012) observed the AE to be more pronounced for consumers depending on intuitive reasoning. Nonetheless, Pocheptsova et al. (2009) identified the AE to increase for decision makers with depleted cognitive resources, which suggests the phenomenon to potentially be driven by cognitive processes.

Embedded in the name itself, the CE is conceptually in line with the idea of compromise. As such, the occurrence of the anomaly is strongly dependent on the decision makers motives in the pursuit of value maximization. For instance, the CE has shown to diminish for consumers with high confidence due to their certainty in the process of choice (Chuang et al., 2013), which is generally in line with the notion of high confidence levels decreasing the perception of risk (Siegrist, Gutscher, & Earle, 2005). The CE being driven by certainty is further highlighted by Sinn, Milberg, Epstein and Goodstein (2007), who identified consumers to prefer the compromise option when the corresponding brand is more familiar while preferring extreme brands in situations where they are unfamiliar with the compromise brand. With brand familiarity influencing confidence towards the respective brand (Laroche, Kim, &

Zhou, 1996), it is easy to connect certainty as the underlying driver of this behavior. Taken together, when facing decision conflict (Levav et al., 2010), consumers are inclined to choose the compromise option as method of dealing with extremeness aversion (Chuang et al., 2013; Sheng et al., 2005; Simonson & Tversky, 1992), which involves the ability to engage in cognitively demanding choice tasks comparing choice alternatives (Khan et al., 2011).

Study 2b intends to extend the ongoing debate of the AE's and CE's true origin by investigating both impulsive and cognitive processes' in competition. To evaluate the underlying mechanisms of both context effects, I decided to analyze the choice behavior isolated from any confounders (e.g. choice deferral, see, Dhar & Simonson, 2003). Thus, the choice tasks were conducted in a forced choice setting, without a no-buy option (c.f., Study 4 in Lichters et al., 2016a), as the option to defer from purchase has shown to alter context effects (Dhar & Simonson, 2003). In contrast to the previous studies, Study 2b was conducted in a within-subjects design, serving as a gateway to evaluate the underlying mechanism by means of a parallel mediation with both cognition and arousal as potential choice drivers. I was able to observe further robustness of caffeine's impact on both context effects, as the treatment group showed to be more susceptible to the AE and CE in a within-subjects setting. Furthermore, the findings indicate the AE to be mediated by cognition, as the scores of the CRT-L fully mediate the switching rates from option L to option M when introducing the decoy option.

2. Methods and materials

2.1. Experimental design, stimuli and measures

Experimental design and product stimuli: Study 2b introduced a 2x2 mixed factorial design with experimental condition (treatment vs. placebo) acting as a between-subjects factor while the number of products per choice (first two and then three) was set as a within-subject factor. By assessing both a within-subjects and between-subjects design, I was able to overcome potential confounding influences, such as participants' ambition towards consistent choice, background contrast effects, or demand characteristics resulting in hypotheses guessing in a within-subjects design, or aggregation bias when only analyzing between-subjects designs (e.g., Hedgcock, Rao, & Chen, 2016; Hutchinson, Kamakura, & Lynch, 2000; Lichters et al., 2016a). Product categories were selected identically to the previous

studies. Chewing gum (AE) and mulled wine (CE) were selected as adopted product categories (see Appendix 3 for full product description). The offered products again were described by means of a product picture and "Stiftung Warentest" rating, as in the previous studies.

2.2. Experimental procedure

Studies 2a and 2b were conducted together and followed the same procedure. Accordingly, all participants included in Study 2a were also included in Study 2b. The experiment opened with the consumption of the coffee drinks which was followed by the completion of the SAM-pre questionnaire. Approximately 45 minutes after consuming the coffee drink and completing various filler tasks, participants started the binary choice tasks, which comprised of L and M options. Six decision tasks at varying prices (including 1 replication) composed of the identical two product options were made for each product category. The participants indicated which option they would purchase at the indicated price. In line with Lichters et al. (2016a), prices at the binary choice scenario (first stage) again followed a systematic trade-off (see Appendix 1). At the trinary choice stage (second stage), the previous prices were reproduced for L and M (first stage), but added the additional option (decoy option, high option), enabling a contrast between purchases from both scenarios. Participants were able to select without time pressure. After the binary choice tasks, subjects completed the post version of the SAM before transitioning to the purchase tasks included in Study 2a. The experiment continued with the evaluation of participants' demographical background before subjects completed the CRT-L questionnaire. Analogous to the previous studies, these tasks work as distractors ensuring participants to lose memory for their product selections in the binary tasks. Participants, subsequently, had to leave the room in order to familiarize themselves with the additional product that was later on included in the trinary tasks. The products were prepared on a product shelf without showing any prices. Study 2b was completed by the trinary-choice task, where for each product category six decision tasks at varying prices composed of the identical three product options were made. Appendix 3 provides all price scenarios offered throughout the Study 2b.

Each participant provided a total of 12 product choices (five decisions, plus an additional validation decision for each product category at both stages). The duplicated choice tasks from Study 2b again served for an assessment of choice consistency. All duplicated decision tasks were excluded from the main analyses. Once completing the questionnaires, the subjects drew their lot for the RPM and completed the experiment with the product purchase.

On average, the entire experiment lasted for approximately 120 minutes.

3. Results

3.1. Preliminary analysis

Preliminary analyses were previously conducted in Study 2a (see Appendix 2). Accordingly, no potential confounding influences were identified.

3.2. Manipulation check

The manipulation checks were previously conducted in Study 2a (see Appendix 2). Accordingly, both cognition levels and arousal levels of caffeine consuming subjects were successfully manipulated.

3.3. Main results

3.3.1. Analysis of the Attraction Effect

The within-subjects aspect of the study focused on the participants' switching behavior considering the participants binary decisions first, followed by their trinary decisions. I begin by testing H_1 on a within-subjects basis, contrasting the participants' switches from the binary to the trinary stage (i.e., whether they switched their preference between options L and M when option D was added to the set). The statistical analysis focused exclusively on switches between the options L and M (see Huber et al., 1982), to evaluate whether switching occurred asymmetrically.

Table 9 indicates that 4.88% of the placebo subjects' choices began at the low quality / price option L (binary level) and switched their product decisions to the medium quality / price option M (target option) at the trinary choice level. Of the made decisions for option M in the binary sets, 4.23% showed switches into the opposite direction. To evaluate the switches from L to M contrasted against what is to be expected by chance, I conducted a directed exact McNemar test (e.g. Agresti, 1992; Lichters et al., 2016a). The results do not provide support for H_{1a}, $p_{directed} = .500$. Thus, the AE does not hold on a within-subjects basis for the placebo group. The treatment group's switches from option L at the binary choice stage to option M at the trinary choice stage occurred at 32.56%, while only 3.70% switched into the opposite

direction[6]. The results indicate the AE to hold as a within-subjects choice anomaly for the treatment group, $p_{directed}$ = .003, thereby supporting H_{1b}. Next, I defined individual switching rates based on the difference between participants' choices originating at option L in the binary choice set switching to option M in the trinary choice set and switches in the opposite direction (Lichters et al., 2016b). Accordingly, switching rates range from -1 (opposite switches only) to 1 (all switches conforming to attraction effect). The results indicate switching rates of caffeine consumers (M = 0.10, SD = 0.22) to be significantly higher than those of the placebo group[7] (M = - 0.02, SD = 0.15), t(49) = -2.129, p = .019 (one-tailed); d = 0.60. Thus, in line with H_{1b}, the AE holds and is more pronounced for participants having consumed caffeine.

Table 9 Study 2b: Within-subjects switching by experimental group AE

	$CS_{trinary}$[a]		
Chewing gum	*L*	*M*	*D*
Placebo (n = 26)[b]			
CS_{binary}	1 switch omitted due to missing value		
L	39 (95.12%)	2 (4.88%)	5
M	3 (4.55%)	63 (95.55%)	13
Treatment (Caffeine) (n = 25)[b]			
CS_{binary}			
L	29 (67,44%)	14 (32,56%)	4
M	2 (3,34%)	57 (96,66%)	24

[a]This table presents switches. Multiplying each cell by a factor of 2 yields the number of choices across both decision stages.
[b]Placebo group's switches from L to M: p = .500; treatment group's switches from L to M (Target): p = .003, one-tailed (both based on an exact version of the McNemar test).

[6] 23% of treatment subjects (6 of 26) indicated switching behavior in line with the attraction effect.

[7] I initially evaluated if the mean tendency to switch from L to M is significantly different from zero for each experimental group. Our analysis of Study 2 data reveals that this is not the case for the placebo group (mean difference = -0.02 (SD = 0.15), t(24) = -0.53; p = 0.603; d = 0.15), but does hold for the treatment group (mean difference = 0.10, (SD = 0.23) t(25) = 2.24; p = 0.035).

3.3.2. Analysis of the Compromise Effect

On a within-subjects basis, I focused on the participants' switching behavior from decisions made in the binary choice set to decisions made in the trinary choice set. To test H_3 on a within-subjects basis, I initially contrasted the participants' switches (i.e., whether they switched their preference between options L and M when option D was added to the set). Analogous to the AE, the statistical analysis focused exclusively on switches between the options L and M (see Huber et al., 1982), to evaluate whether switching occurred asymmetrically.

Table 10 indicates that 37.04% of the placebo subjects' choices began at the low quality / price option L (binary level) and switched their product decisions to the medium quality / price option M (target option) at the trinary choice level supporting the CE. Of the made decisions for option M in the binary sets, 9.71% showed switches into the opposite direction. To evaluate the switches from L to M contrasted against what is to be expected by chance, a directed exact McNemar test was conducted analogous to the evaluation of the AE. The results do not provide support for H_{3a}, as the CE does not hold as a choice inconsistency on a within-subjects basis for the placebo group ($p_{directed} = .004$). The treatment groups' switches from option L at the binary choice stage to option M at the trinary choice stage occurred at 33.00%, while only 3.00% switched into the opposite direction[8]. The results indicate the CE to hold as a within-subjects choice anomaly for the treatment group, $p_{directed} = .013$, thereby supporting H_{3b}. Next, I defined individual switching rates based on the difference between participants' choices originating at option L in the binary choice set switching to option M in the trinary choice set and switches in the opposite direction (Lichters, Müller, et al., 2016). Accordingly, analogous to the previous analysis of the AE, switching rates range from -1 (opposite switches only) to 1 (all switches conforming to the CE). The results establish the treatment participants' switching rates (M = 0.06, SD = 0.17) to be significantly higher than those of the placebo group[9] (M = - 0.1, SD = 0.22), t(49) = -2.91, p = .003 (one-tailed); d = 0.53. Thus, in line with H_{3b}, the CE holds and is more pronounced for participants

[8] 19% of treatment subjects (5 of the 26) indicated switching behavior in line with the compromise effect.

[9] I initially evaluated if the mean tendency to switch from L to M is significantly different from zero for each experimental group. Our analysis of Study 2 data reveals that this is not the case for the placebo group (mean difference = -0.02 (SD = 0.15), t(24) = -0.53; p = 0.603; d = 0.15), but does hold for the treatment group (mean difference = 0.10, (SD = 0.23) t(25) = 2.24; p = 0.035).

having consumed caffeine.

Table 10 Study 2b: Within-subjects switching by experimental group CE

	$CS_{trinary}$[a]		
Mulled wine	*L*	*M*	*D*
Placebo (n = 26)[b]			
CS_{binary}	5 switches omitted due to missing value		
L	17 (100.00%)	0 (0.00%)	1
M	10 (9.71%)	93 (90.29%)	8
Treatment (Caffeine) (n = 25)[b]			
CS_{binary}	1 switch omitted due to missing value		
L	5 (35.71%)	9 (64.29%)	0
M	1 (0.90%)	110 (99.10%)	7

[a]This table presents switches. Multiplying each cell by a factor of 2 yields the number of choices across both decision stages.
[b]Placebo group showed no switches from L to M. Instead, a repulsion effect with switches from M to L took place: p = .002; treatment group's switches from L to M (Target): p = .013, one-tailed (both based on an exact version of the McNemar test).

3.4. Mediation Effects – cognition and affect as drivers of the AE and the CE

After observing the AE and CE to hold on a within-subjects basis, I investigated the proposed parallel mediation of cognition and affect on participants' switching behavior for both the AE and the CE.

I conducted the analysis of parallel mediating effects based upon Preacher and Hayes's PROCESS Model 4 with 5,000 bootstrapped samples (Hayes, 2012) for both context effects. Table 11 presents all total, direct, and indirect effects alongside their corresponding test statistics. Supporting H_2, I observed scores of the CRT-L (implemented as a measure of cognitive capabilities) to fully mediate participants' switching behavior for the AE (b = 0.041; SE = 0.02; 95% CI (.00, .10)), as opposed to affective processes, which were defined by the variation in arousal level measured by the difference of both SAM scores (b = -0.033; SE = 0.02; 95% CI (-.10, .00), see figure 14 for full model). The findings directly oppose

previous claims of the AE being embedded in the impulsive System 1 thought process (Hedgcock et al., 2009; Pocheptsova et al., 2009), while providing ample evidence for the AE to be embedded within the application of cognitive processes.

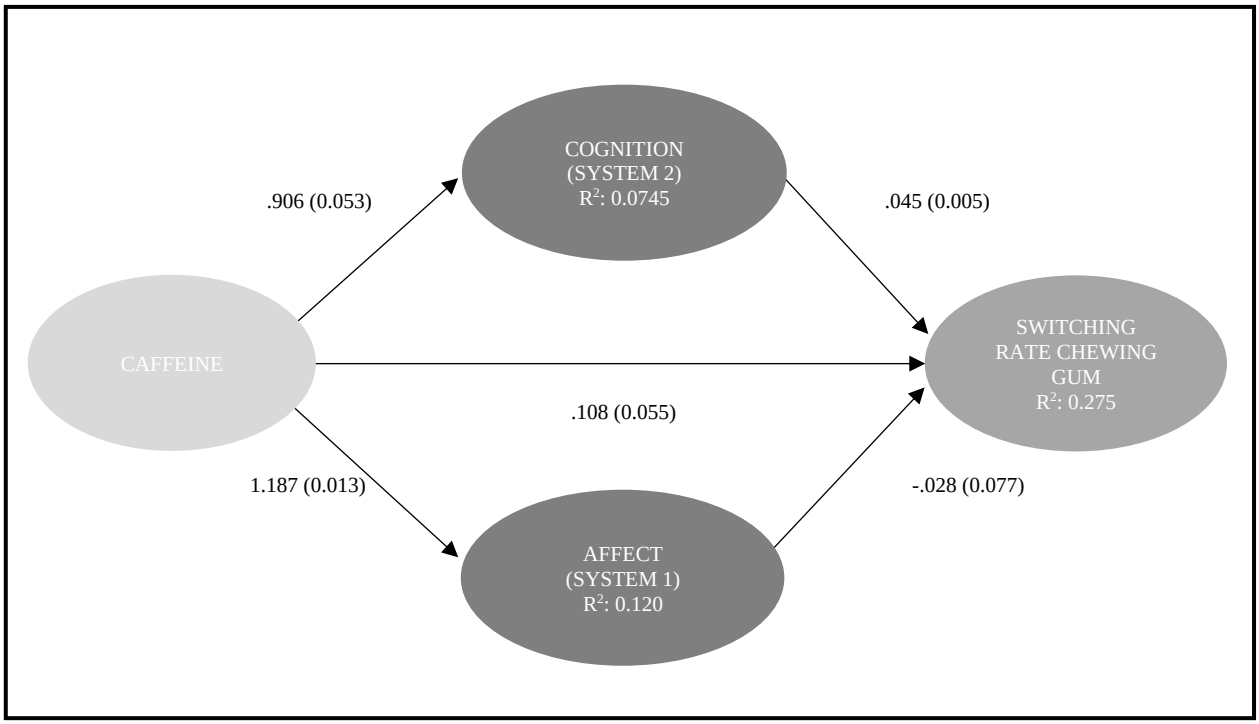


Figure 14 Study 2b: Mediation model of AE for product category chewing gum

Next, I evaluated the mediating effects for the CE analogous to the AE. I was not able to find support for H_4, as the observed scores of the CRT-L did not mediate participants' switching behavior (b = -0.005; SE = 0.02; 95% CI (-0.039, .015)). The same holds for affective processes, which were measured analogous to the AE and did not show a mediating effect for participants switching behavior (b = -0.006; SE = 0.02; 95% CI (-.032, .064)).

Table 11 Study 2b: Total effects of mediation model of AE for product category chewing gum

	Chewing Gum		
Path	Total Effect	Direct Effect	Indirect Effect
CAFF→ SWITCH	0.116 (2.129/0.038)	0.108 (1.968/0.055)	0.008 (0.253/0.800)
CAFF → COG	0.906 (1.986/0.053)	0.906 (1.986/0.053)	-
CAFF → AFF	1.188 (2.582/0.013)	1.188 (2.582/0.013)	-
COG → SWITCH	0.045 (2.928/0.005)	0.045 (2.928/0.005)	-
AFF → SWITCH	-0.028 (-1.807/0.077)	-0.028 (-1.807/0.077)	-

Notes: t-values/p-values in parentheses.
CAFF = Caffeine; SWITCH = Chewing Gum Switching Rate; COG = Cognition; AFF = Affect

3.5. Additional analysis

To assess choice consistency, 102 duplicated choices were collected (1 for each product category). Of these, 92.16% were replicated, upholding an acceptable level of consistency throughout the decisions made in the purchase tasks. As in Study 1, all participants accepted the RPM and completed the purchase without re-negotiating the listed price.

3.6. Findings Study 2b

Initially, I again successfully observed an impact of the implemented manipulation for both cognitive and affective processes. This allows me to interpret the further findings based on caffeine's significant impact on behavior as measured by the CRT-L and SAM. The structure of both experimental groups showed no significant differences, providing a suitable basis for comparison of the main analyses. By extending the experimental design of investigating caffeine's influence on both the AE and the CE on a within-subjects basis, I was able find further support for both H_{1b} and H_{3b} both at the aggregate and individual level, highlighting the robustness of my previous findings. Furthermore, by means of a parallel mediation, I was able to identify cognitive processes as measured by the CRT-L as an underlying driver of the AE. The findings show great promise as they directly contribute to the ongoing debate of whether the AE is embedded within affective or cognitive processes, while providing neurobiological evidence of the latter.

4. Chapter summary and implications

As in the previous studies, I systematically manipulated caffeine levels of the participants by providing them with a decaffeinated or caffeinated coffee-drink. I further extended the study design by means of a within-subjects setting, allowing for an evaluation of caffeine's influence on both context effects in forced-choice purchase scenarios. While adopting realistic purchase scenarios, I was able to identify caffeine consumers to be more susceptible towards the AE and the CE, indicating the CNS stimulant to facilitate the choice anomaly. These findings indicate the robustness of the previous account that the AE and the CE to both arise from activation of reflective processes. In an attempt to directly unravel the underlying mechanisms of both context effects, my findings towards the AE are paramount and contribute to the ongoing debate of context effects' origins within the psychological process of decision making. Accordingly, the observed results allow me to make to following implications:

First, the results exhibit caffeine to increase both cognitive and affective capabilities, which was demonstrated by means of the CRT-L and the SAM. Again, I observed caffeine consumers to be more susceptible towards the AE and the CE at both the individual and aggregate level. While introducing a within-subjects design, the findings show further robustness, as caffeine's promotion of the choice phenomena has shown to hold in various settings. Accordingly, all findings encourage me to suggest marketing strategies implementing the AE or the CE with the intention to increase sales of a target option or compromise option, respectively, to previously adopt methods of increasing caffeine levels when implementing these strategies (e.g. offering a caffeinated beverage or caffeine rich food in hospitality establishments). When considering this method to facilitate either context effect, it is of great importance to regard the impact time of caffeine before it reaches peak level within the consumers cognitive system (Bonati et al., 1982; Liguori et al., 1997).

To assess the underlying mechanism of the AE, I set up a parallel mediation investigating caffeine consumers switching behavior from the low option in a binary choice set to the target option in a trinary choice set. The mediation model considered both a cognitive construct (CRT-L scores) and affective construct (difference of arousal scores pre- and post-caffeine effect as defined by the SAM), giving me the opportunity to directly contest both processes and their impact on the AE's switching behavior. As the main finding, I was able to

identify scores of the CRT-L to fully mediate the switching behavior of the AE. While this indicates the phenomenon of irrational choice behavior to be rooted within the cognitively demanding reflective system, the discovery contributes valuable results extending the debate on the AE's underlying mechanisms. As human brain activity measures (e.g. fMRI) have recently taken the focus, the conducted study implements the multi-method approach of neuromarketing (Golnar-Nik, Farashi, & Safari, 2019; Plassmann, Venkatraman, Huettel, & Yoon, 2015; Smidts et al., 2014). The implemented treatment manipulation aids as an attempt to overcome methodological constraints limiting the testability of theories linking psychological state variables to consumer behavior causally (Lichters et al., 2016a).

Chapter 8

Study 3: Investigating the Influence of Caffeine Consumption on Choice Deferral

1. Chapter overview

When confronted with a product purchase, consumers usually have the option to defer from choice. As such, choice deferral belongs to the fundamental pathways of consumer decision making and has been investigated in various settings to better understand the underlying mechanisms facilitating the choice phenomenon (Dhar & Nowlis, 1999; Dhar & Simonson, 2003; Etkin & Ghosh, 2018; Novemsky et al., 2007). Choice deferral is generally associated with uncertainty, including consumer's uncertainty towards the value of attribute preference, especially in situations where attributes are high in tradeoff difficulty amongst equal options (Luce, 1998). As such, engaging in attribute trade-offs amongst available options will be a task dependent on the availability of cognitive resources. In an attempt to extend the findings of caffeine's impact on consumer behavior, I investigate the psychostimulant's influence on choice deferral when purchasing durable products. Upon observing the findings of the previously conducted studies 1 and 2, it is easy to connect the caffeine's potential influence towards choice deferral. Study 3 will evaluate this relationship in a realistic purchase setting, assessing the impact of caffeine consumption on choice deferral.

The current chapter discusses the conducted procedure of the experiment at hand, detailing stimuli and measures applied within the experiment. Next, preliminary analyses will be executed before transitioning to the main analyses focusing on differences in purchase rates amongst subjects having received a caffeinated beverage and placebo subjects. The chapter will conclude with a brief summary and implications for marketeers and consumers of durable goods.

2. Methods and materials

2.1. Experimental design, stimuli and measures

Experimental design and product stimuli. The conducted experiment had a between-subjects design with caffeine treatment (or placebo) as the between-subjects factor. In order to identify proper product categories, face-to-face interviews were conducted with participants resembling key characteristics of the target audience analogous to the previous studies. To broaden the existing product range, I decided to include a durable good for this study's product choice tasks. Product category Bluetooth speakers was identified as a durable good

relevant to the experiment's target audience (see Appendix 4 for full product description), and as such selected as the durable good for the conducted experiment.

The product choice tasks again replicated realistic purchase situations. Accordingly, the product offerings were described similar to those of the previous studies. Instead of describing the product by means of a "Stiftung Warentest" rating, the durable was described by means of a star-rating procedure identical to Amazon's online rating. In line with Lichters et al. (2016a), product prices were discounted by approximately 10% from the current cheapest actual market price to facilitate purchase in the experimental setting (see Appendix 4 for all price scenarios of Study 3). In addition to the offered products, subjects had the option to defer from purchase. Concluding the choice tasks, a random-payoff mechanism (RPM) was implemented to best replicate a realistic purchase situation (Lichters et al., 2016a). In the experiment, one choice task was randomly selected as a purchase. As each subject had 10 purchase tasks in total, the randomly selected number was between 1 and 10. If the subject had selected the no-buy option for the random selection, no purchase took place. Alternatively, if the subject had chosen one of the buying options, the specific product choice at the given price now became binding for the subject. Thus, the respective price for the selected option was to be paid after the experiment concluded.

Treatment administration: 200 mg of pure caffeine was again selected to be administered as a treatment. Contrary to studies 1 and 2, the caffeine was mixed into 150 ml of decaffeinated Coca-Cola. Thus, the amount of caffeine consumed by all treatment subjects was identical to the previous studies. The soft drink was covered by an opaque lid to ensure any possible caffeine residue remained unobservable. Subjects either received a treated soft-drink or a regular decaffeinated soft-drink. The subjects received various filler tasks (e.g. demographic questionnaires) to ensure caffeine's impact prior to conducting the purchase tasks and measurement of the manipulation check (Bonati et al., 1982; Liguori et al., 1997).

Measure: To measure for any changes in the cognitive capabilities of the subjects, I decided to implement one of the questions included in the previously adopted CRT-L as a manipulation check. Participants were asked to solve the cognitive reflective task "A bat and a ball cost **$1.10** in total. The bat costs **$1.00** more than the ball. How much does the ball cost?" approximately 60 minutes post drink consumption, thereby ensuring caffeine's bioavailability for the treatment group (Mandel, 2002). Participants could either answer the

question correctly or incorrectly, which was later compared between the two experimental groups.

Additionally, the 11-point risk attitude measure used in the SOEP (Dohmen et al., 2010; Jaeger et al., 2010; van Winden et al., 2011) was included to measure for any differences in risk-seeking amongst regular and non-regular caffeine consumers.

2.2. Experimental Procedure

In total, 60 students ($n_{placebo} = 31$, $n_{treatment} = 29$) participated in Study 3. All students were enrolled in a full-time study program at a major German university at the time of the experiment. Prior to beginning the experiment, all participants were subject to a screening process to rule out any intolerance towards the soft-drink's ingredients. To forgo a house-money effect (Thaler & Johnson, 1990), participants received the 15 EUR participation fee at least 14 days prior to the experiment on the day they were recruited. Participants were told the experiment involved product evaluations of newly introduced Bluetooth loudspeaker products. The study was spread across four sessions on three days consisting of 15 participants per round. On each day, the experiments began at 9:00 A.M. All subjects were able to physically evaluate the offered products outside of the experiment room in order to get familiar with the offerings in the purchase part of the study. No prices were indicated at this stage of the experiment, thus eliminating any potential price anchoring for the further duration of the study (Kumar & Pandey, 2015; Oechssler, Roider, & Schmitz, 2009; Simonson & Drolet, 2004). Following the evaluation of the products, the subjects received a place number. The place number indicated if a participant received a caffeinated or decaffeinated beverage. The participants and instructors were not informed of the place number's indication; thus, a randomized double-blind procedure was ensured. After receiving their place number, the subjects were asked to enter the study room and stay seated until the experiment began. The experiment opened with all subjects receiving standardized oral instructions on the time schedule and content of the study. All subjects were informed of the soft-drink's ingredients. After having the opportunity to ask questions, the subjects needed to sign an agreement stating that they were informed of the contained ingredients and that they showed no intolerances or allergies towards these nutrients.

Upon completing the introduction, the experiment began at approximately 9:15 A.M. Three instructors were in the study room at all time to ensure no interaction between the subjects

occurred during the experiment. The study consisted of a compilation of questionnaires targeted at enabling the proper evaluation of the research hypotheses at hand. After all subjects consumed the 150 ml soft-drink, which was served cold, a 10-minute informational video of a city in Saxony-Anhalt was played. As a filler-task, the subjects received a questionnaire with detailed questions regarding the video. At approximately 10:15 A.M., all subjects began the product choice tasks. Thus, the induced caffeine contained in the treated soft-drinks was in full effect by the time the purchases took place. All subjects were able to make their purchase decisions without facing any time pressure. The product choice tasks consisted of a low option and medium option, thereby limiting subjects to easily form a preference for an easily preferable option. Additionally, a no-buy option was included for every choice task. Subjects made five choices with alternating prices for every product category. Following Lichters et al (2016a), the price scenarios followed a systematic trade-off, which was established by modifying the prices of the low and medium option. For each subject, 10 total product choices were made, consisting of five price stages at both the binary and trinary setting. The duplicate choice task was omitted from the main analysis. After the choice tasks, unrelated filler tasks were followed by the single cognitive reflection task. Finally, all participants completed a quality and price assessment of the offered products. The study concluded with the implementation of the RPM, identical to the previous studies 1 and 2.

3. Results

3.1. Preliminary results

The preliminary analysis was conducted analogous to the previous studies. No participant consumed a caffeinated beverage prior to the experiment. Three participants were excluded from the analyses due to straight-lining, yielding a final sample size of n = 57 ($n_{treatment}$ = 28, $n_{placebo}$ = 29, 63.20% female, M_{age} = 22 [21.49: 2.35]) participating in Study 3. No significant differences between the experimental groups in terms of height, weight, body-mass-index, product brand awareness, monthly net income, age, gender constellation, price-quality orientation and risk attitudes, potentially confounding the observed main results (analysis of purchase decisions), were found (smallest p = .073, see Appendix 4 for full analyses).

3.2. Manipulation check

Before engaging in main analyses, I evaluated for changes in subjects' cognitive performance due to caffeine consumption. The selected measure consisted of the bat and ball question of the CRT-L. The collected score, either 0 (answered incorrectly) or 1 (answered correctly), was contrasted between both experimental groups. As indicated in table 12, consumers having received the treatment were better able to correctly respond to the question than their counterpart ($p = .043$ (one-tailed), $V = 0.263$). In line with previous findings, the results indicate caffeine consumption to facilitate cognitive capabilities.

Table 12 Study 3: Total responses to manipulation check

	Counts[a]	
	Incorrect	*Correct*
Placebo (n = 29)	19 (65.52%)	10 (34.48%)
Treatment (Caffeine) (n = 28)	11 (39.29%)	17 (60.71%)
Fisher's exact test (one-tailed)[b]	p = .043	

[a]The counts were based on subjects having correctly responded to the manipulation check task, or not.
[b]Alternative analysis based on Yates's Chi-Square yields identical findings (Chi-Squared(1) = 2.95, p = .043, one-tailed).

3.3. Analysis of purchase decisions: Choice deferral

The main analysis of Study 3 focused on the choice deferral rates. To evaluate for differences in deferral rates amongst both experimental groups, I first assessed the total purchases (and deferrals) at the collective level. Table 13 indicates the total purchases (and deferrals) made over all choices for both groups at both the binary and trinary choice level. Evaluated by means of a Fisher's exact test, the treatment group was identified to significantly purchase more Bluetooth speakers at the binary level ($p = .002$ (one-tailed), $V = 0.177$) and trinary level ($p < .001$ (one-tailed), $V = 0.198$), thus being less susceptible towards choice deferral than the placebo group. I extended the analysis by evaluating choice deferral rates amongst both groups at the individual level. The implemented independent samples t-test indicates placebo subjects to have significantly higher deferral rates compared to caffeine consumers at the binary level ($t(45.52) = 1.68$, $p = .050$ (one-tailed); $d = -0.447$) and the trinary level ($t(40.01) = 1.74$, $p = .047$ (one-tailed); $d = -0.459$). These findings are in line with previous literature identifying choice deferral to be embedded in reflective processes (Dhar, 1997b; Dhar & Nowlis, 1999; Lichters et al., 2016) and support H_5.

Table 13 Study 3: Total purchase counts per experimental group for binary and trinary choice setting

	Purchase Counts[a]	
	Bluetooth speakers	
CS Binary	Placebo (n = 29)	Treatment (n = 28)
L	6	14
M	6	15
H	-	-
Total buys	12 (8.28%)	29 (20.71%)
No-buys	133 (91.72%)	111 (79.29%)
Fisher's exact test (one-sided)	p = .002	
CS Trinary	Placebo[b] (n = 29)	Treatment (n = 28)
L	1	15
M	0	0
H	5	9
Total buys	6 (4.17%)	24 (17.14%)
No-buys	138 (95.83%)	116 (82.86%)
Fisher's exact test	p < .001	

[a]Each respondent contributed 5 decisions at each setting for the analysis of this table (five in the binary stage and five in the trinary stage).
[b]One count for the placebo group was omitted due to a missing value

3.4. Additional analysis

To assess choice consistency, a total of 57 duplicated choices were collected. Of these, 100% were replicated, upholding a perfect level of consistency throughout the decisions made in the purchase tasks. As in all previous studies, participants accepted the RPM and completed the purchase without re-negotiating the listed price.

3.5. Findings Study 3

Study 3 provides interesting results to further expand the previous findings of Study 1 and 2. The successful manipulation check allows me to interpret caffeine's impact on subjects' purchase behavior. Identical to the previous studies, the structure of both experimental groups shows no significant differences, providing a suitable basis for comparison of the main analyses. By implementation of a between-subjects design, I was able find support for H_5 both at the aggregate and individual level.

4. Chapter summary and implications

The majority of decisions made by consumers entail the ability to defer purchase. Choice deferral has been investigated in various settings with researchers aiming at comprehending the underlying drivers contributing towards this behavior in choice (Etkin & Ghosh, 2018;

Lichters et al., 2016a; Novemsky et al., 2007). As choice deferral has been identified to be embedded within reflective processes (Dhar, 1997b; Dhar & Nowlis, 1999; Lichters et al., 2016), Study 3 focused on evaluating the relationship between caffeine consumption and choice deferral. Expected to facilitate access to cognitive resources, caffeine consumers should be less susceptible towards choice deferral, and respectively be more prone to purchase. The conducted study evaluated the purchase behavior of students from a large university in Germany. I investigated purchases made for a durable good relevant to the target group (Bluetooth loudspeakers) in a binary and trinary setting. Contrary to the previously conducted studies, the treatment was administered via a decaffeinated Coca-Cola soft-drink. Half of the participants received a beverage treated with 200 mg of caffeine. I was able to establish caffeine to successfully manipulate the treatment subjects by means of a cognitively demanding task. The ability to correctly solve the task was compared amongst both experimental groups. The main analysis indicated caffeine consumers to significantly purchase more as opposed to the subjects having consumed the placebo beverage.

Chapter 9

Discussion

1. Summary and main findings

The final chapter of my thesis will establish the motivation driving the evaluated hypotheses before summarizing the findings of all conducted studies. I will discuss the limitations of the experiments and suggest improvements before transitioning to marketing implications which can be deduced from my findings. The thesis will close with a detailed analysis assessing avenues of future research.

My thesis seized the opportunity to combine research from various disciplines, thereby enabling an in-depth insight into the research question at hand. Comprehending the impact of caffeine on consumer behavior will assist consumers to comprehend the potential risks involved with the psychostimulant's consumption. Especially when considering the behavioral decision impact of caffeine, it is crucial for consumers to be aware of any influence caffeine may have on purchase decisions. As such, the initial motivation of my thesis was to establish awareness of caffeine-based influences on consumer purchase behavior. More specifically, I focused on how consumption of the psychostimulant may influence context sensitive decision making for FMCGs and choice deferral of durable goods. Combining insights on caffeine's physiological influence with the AE, the CE, and choice deferral should be considered an instrumental step towards better understanding the behavioral impact of the psychostimulant itself while simultaneously gaining insight towards the underlying mechanisms of the aforementioned choice phenomena, which defines the secondary motivation of my thesis. As context effects have been heavily investigated over the past four decades (Huber & Puto, 1983; Lichters et al., 2016a; Lin, Yen, & Chuang, 2006; Masicampo & Baumeister, 2008; Simonson, 1989; Wernerfelt, 1995), the anomalies' origins remain unclear. By exploring the effects via neurobiological pathways, I am able to contribute research on underlying drivers of choice deferral, the CE, and specifically the AE.

By evaluating the principles on which the AE and the CE are built upon, chapter 1 introduces how the composition of a choice set may influence consumers to behave in a manner deviating from what is to be expected by rational choice behavior (Huber & Puto, 1983; Simonson, 1989). The initial step was to identify boundaries of rational choice behavior, which is done by addressing the underlying axioms holding decision makers accountable for making consistent choices (Levin, 2006). The violation of the aforementioned boundaries exposes unstable preferences, as in the case of context effects. Gaining more insight on the

underlying mechanisms of context effects will enable researchers to better comprehend the foundations of decision making.

The composition of a choice set has been identified as an impactful driver of choice in a multitude of domains (Bateson et al., 2002; Hedgcock et al., 2009; Trueblood et al., 2013). By combining behavioral influences of a CNS stimulant with context effect and choice deferral research, my thesis extends on this notion by the physiological evaluation of underlying mechanisms driving this behavior. Chapter 2 focuses on the properties of the psychostimulant caffeine and its influence on human behavior. The implementation of such a prominent psychoactive drug establishes relevance to a large fraction of the global population, as approximately 80% of the world's population consumes caffeine in form of food or beverage on a daily basis (Ogawa & Ueki, 2007). The significant influence of caffeine on the human CNS establishes the psychostimulant as a suitable pathway to better understand what drives choice, specifically in the realm of context effects and choice deferral. As researchers have already identified affect and cognition as two distinct circuits of the AE and the CE, I was especially interested in caffeine's impact on affective and cognitive processes. Findings indicated moderate levels of caffeine ($\leq$ 200 mg) to facilitate both affective (Peeling & Dawson, 2007) and cognitive processes (Lorist et al., 1994; Smith, Clark, et al., 1999).

Upon evaluating caffeine's impact on affective and cognitive processes, chapter 3 generates the hypotheses evaluated in the conducted experiments. I implement previous findings of caffeine's influence on the human nervous system, specifically affective and cognitive processes, into the decision-making process. In this process I evaluated overt behavior resulting from the interplay of the CNS and PNS. My hypotheses are embedded within the decision-making scheme of dual process theory, which evaluates choice as an interplay of cognition and affect. As dual process models are categorized into three strands (Samson & Voyer, 2012), I focus on models of the buying and consumption behavior strand. The suitable RIM (Deutsch et al., 2006) is selected as the appropriate framework to consider the impact of caffeine on consumer choice behavior. The generated hypotheses target the psychostimulant's influence on choice deferral and the context effects of interest. With its physiological influence, I hypothesize that caffeine will amplify the AE and the CE, while diminishing choice deferral rates, as the behavior of these phenomena are embedded within and dependent on cognitive processes (Alexander Chernev, Hamilton, & Hong, 2007; Dhar &

Gorlin, 2013; Lichters et al., 2016a; Pettibone, 2012; Pocheptsova et al., 2009), which in turn are invigorated by the CNS stimulant.

Prior to transitioning to the conducted experiments, chapter 4 evaluates current research in the field of context effects. By means of a literature review, I specifically evaluated context effect experiments conducted in the realm of the AE and the CE. The literature review focuses on articles published in high ranking marketing journals since the second quarter of 2015 until June 2021. In addition to gaining insight on current AE and CE topics, the review evaluates the quality level of context effect experiments as measured by Lichters et al. (2015). With only three of the suggested guidelines implemented in the majority of the context effect experiments, there is still room for improving the quality level of current experimental context effect research targeting effects application. However, key criteria in the form of introducing economic consequences (18.59%) and providing a no-buy option (27.60%) increased in the degree of which they have been implemented in comparison to literature prior to the second quarter of 2015.

After having established the necessary foundation to motivate my hypotheses, I transitioned to the conducted experiments. In the first experiment of three, chapter 5 presents the investigation of caffeine on both the AE and the CE in free-choice situations (add free-choice design sources of CE). I selected the free-choice setting as it resembles the most common decision situations consumers face. Study 1 introduced a between-subjects design with 64 potential consumers making choices of FMCGs trail-mix (AE) and toothpaste (CE) in a decision framework with real economic consequences. Subjects were able to evaluate the products prior to choosing. The access to participant's cognitive resources was manipulated by administration of a caffeinated (vs. decaffeinated) coffee beverage prior to offering the products. The between-subjects design of product offerings distinguished between one condition in which subjects chose from binary core sets (L; M) that comprised a low quality / low price option L and a medium quality / medium price variant M for each product category and the second condition which was exposed to an extended trinary set. For the AE, subjects in the second experimental condition chose from an extended decoy set that additionally contained a medium quality / high price extreme decoy option D, which placed M in a less extreme position. For the CE, subjects in the second experimental condition chose from an extended set that additionally contained a high quality / high price extreme option H, which placed M in a compromise / less extreme position. In line with H_{1b}, the results show that

caffeine consumers were more susceptible towards the AE, as an overall chi-square across the L and M counts of the four conditions (Biswas et al., 2014) indicated a significant relation between the variables, X^2 (3, n = 64) = 40.17, p < .001. For caffeine consumers, the addition of option D to the binary core set (L; M) overall caused an increase in the relative choice share of the target option M from 26.09% to 60.87% for product category trail-mix. In line with H_{3b}, the results show that caffeine consumers were more susceptible towards the CE, as an overall chi-square across the L and M counts of the four conditions indicated a significant relation between the variables, X^2 (3, n = 64) = 74.41, p < .001. For caffeine consumers, the addition of option H to the binary core set (L; M) overall caused an increase in the relative choice share of the target option M from 25.42% to 90.57% for product category toothpaste. As I was able to observe caffeine to have successfully manipulated consumers' access towards their cognitive resources, I see my results supporting the notion that both the AE and the CE result from a more deliberate and cognitive resource demanding decision making.

Building on my findings in the initial experiment, chapters 6 and 7 extend on chapter 5 by implementation of a similarly structured experiment on both context effects. Where the initial study focused on a free-choice setting, the choice scenarios in studies 2a and 2b are presented in a forced-choice setting. Accordingly, consumers were forced to choose from one of the product offerings and did not have the opportunity to defer purchase. Study 2 evaluated the AE and the CE in a between-subjects (2a) and within-subjects design (2b). For both experimental designs, the composition of the offered products was presented identical to study 1. Study 2b (within-subjects) initially presented products in a binary setting before presenting subjects the extended trinary set at a later stage. Identical to Study 1, subjects' access to cognitive resources was manipulated by administration of a caffeinated (vs. decaffeinated) coffee beverage prior to offering the products. Furthermore, caffeine showed significant impact on consumers arousal levels. Study 2a comprised of 51 consumers making choices of FMCGs spice cookie (AE) and ketchup (CE) in a decision framework with real economic consequences which previously allowed subjects to evaluate the products before engaging in purchase. The between-subjects design of the product offerings distinguished between one condition in which subjects chose from binary core sets (L; M) that comprised a low quality / low price option L and a medium quality / medium price variant M for each product category, and the second condition which was exposed to an extended trinary set. For the AE, subjects in the second experimental condition chose from an extended decoy set that additionally contained a medium quality / high price extreme decoy option D, which placed

M in a less extreme position. For the CE, subjects in the second experimental condition chose from an extended set that additionally contained a high quality / high price extreme option H, which placed M in a compromise / less extreme position. In line with H_{1b}, the results show that caffeine consumers were more susceptible towards the AE, as an overall chi-square across the L and M counts of the four conditions indicated a significant relation between the variables, X^2 (3, n = 51) = 52.04, p < .001. For caffeine consumers, the addition of option D to the binary core set (L; M) overall caused an increase in the relative choice share of the target option M from 32.00% to 82.00% for product category trail-mix. In line with H_{3b}, the results show that caffeine consumers were more susceptible towards the CE, as an overall chi-square across the L and M counts of the four conditions indicated a significant relation between the variables, X^2 (3, n = 51) = 33.50, p < .001. For caffeine consumers, the addition of option H to the binary core set (L; M) overall caused an increase in the relative choice share of the target option M from 9.00% to 54.00% for product category toothpaste. In line with Study 1, I was able to observe caffeine to have successfully manipulated consumers' access towards their cognitive resources. Accordingly, I see my results supporting the notion that both the AE and the CE result from a more deliberate and cognitive resource demanding decision making.

Study 2b was based on the same 51 consumers from Study 2a, now making choices of FMCGs chewing gum (AE) and mulled (CE) in a decision framework with real economic consequences. Subjects were able to evaluate the products prior to choosing. Study 2b introduced a 2x2 mixed factorial design with experimental condition (treatment vs. placebo) acting as a between-subjects factor while the number of products per choice (first two and then three) was set as a within-subjects factor. Consumers initially chose from a binary core sets (L; M) that comprised of a low quality / low price option L and a medium quality / medium price variant M for each product category before choosing from the second condition, which was extended by a third option, at a later stage. For the AE, subjects in the second experimental condition chose from an extended decoy set that additionally contained a medium quality / high price extreme decoy option D, which placed M in a less extreme position. For the CE, subjects in the second experimental condition chose from an extended set that additionally contained a high quality / high price extreme option H, which placed M in a compromise / less extreme position. To contrast the susceptibility towards the AE between both experimental groups, I defined individual switching rates based on the difference between participants' choices originating at option L in the binary choice set

switching to option M in the trinary choice set and switches in the opposite direction (Lichters et al., 2016b). The results indicate switching rates of caffeine consumers (M = 0.10, SD = 0.22) to be significantly higher than those of the placebo group (M = - 0.02, SD = 0.15), t(49) = -2.129, p = .019 (one-tailed); d = 0.60, providing further support of H_{1b}. To contrast the susceptibility of the CE for both experimental groups, I defined individual switching rates analogous to the previous analysis of the AE. The results identify the treatment participants' switching rates (M = 0.06, SD = 0.17) to be significantly higher than those of the placebo group (M = - 0.1, SD = 0.22), t(49) = -2.91, p = .003 (one-tailed); d = 0.53. Thus, in line with H_{3b}, the CE holds and is more pronounced for participants having consumed caffeine.

As caffeine was identified to significantly impact both cognitive and affective processes, I was able to evaluate each drivers' influence on the AE and the CE in competition by means of a parallel mediation analysis. Supporting H_2, I observed scores of the CRT-L (implemented as a measure of cognitive processes) to fully mediate participants' switching behavior for the AE (b = 0.045; SE = 0.02; 95% CI (.02, .08)), as opposed to affective processes, which were defined by the variation in arousal level measured by the difference of both SAM scores (b = -0.028; SE = 0.02; 95% CI (-.07, .00)) Respectively, my findings directly contest previous claims of the AE to be embedded within affective processes (Hedgcock et al., 2009; Pocheptsova et al., 2009).

The final experiment fully focuses on caffeine's influence on choice deferral. Study 3 evaluated the purchase behavior of 57 participants. Contrary to the inexpensive FMCGs implemented in the previous studies, I introduced a more expensive durable electronic product category in the form of portable Bluetooth loudspeakers. Identical to the previous studies, participants faced real economic consequences when making their purchase decisions. Subjects access to cognitive resources was manipulated by administration of a caffeinated (vs. decaffeinated) soft-drink beverage prior to the product choices. In a between-subjects design (treatment vs. placebo), participants first were able to choose between two products comprised of a low quality / low price option L and a medium quality / medium price option M before selecting a product from a trinary choice set extended by a high quality / high price option H. In line with the initial study, all participants were able to defer from choice by selection of the no-buy option. As previous research has identified the CE to be attenuated by the addition of a no-buy option, I specifically established both choice scenarios

(binary and trinary) to provide robust insight. The results show that caffeine consumers were less prone to defer from purchase for both choice scenarios. To evaluate choice deferral rates amongst both groups, I implemented an independent samples t-test. The results expose placebo subjects to have significantly higher deferral rates compared to caffeine consumers at the binary level ($t(45.52) = 1.68$, $p = .050$ (one-tailed); $d = -0.447$) and the trinary level ($t(40.01) = 1.74$, $p = .047$ (one-tailed); $d = -0.459$). Supporting H_5, my findings are in line with previous literature identifying choice deferral to be embedded in reflective processes (Dhar, 1997b; Dhar & Nowlis, 1999; Lichters et al., 2016a).

2. Implications, limitations and future research avenues

Due to its interdisciplinary approach, my research provides various implications. I will begin by evaluating my thesis' implications from the viewpoint of marketing practice before focusing on the implications for market research practice and academic research. My dissertation's biggest finding is the discovery of the AE and the CE being more pronounced for caffeine consumers while choice deferral rates diminished upon caffeine consumption. As indicated within my experimental research, a caffeine dosage at 200 mg has a positive impact on the accessibility of cognitive resources. Thus, it is reasonable to connect the underlying mechanisms to the observed phenomena to be embedded within cognitive processes. This has been directly identified for the AE via the mediation analysis conducted in Study 2b. Based on these findings, marketeers should consider methods of improving consumers' access to cognitive resources, e.g. by means of a caffeinated beverage or snack, when implementing AE or CE applications for FMCGs into their marketing strategies. This especially holds for retailers implementing the AE and the CE into their assortment strategy (Ailawadi & Keller, 2004; Lourenço & Gijsbrechts, 2013; Simonson, 1999). For the durable product Bluetooth loudspeakers, caffeine consumers showed to be less prone to defer from purchase. Accordingly, strategies of improving access to cognitive resources should be implemented to increase consumers ability to engage into the purchase decision prior to giving in to deferral due to cognitive limitations (e.g. decision conflict, (Dhar & Nowlis, 1999; Tversky & Shafir, 1992b)). The key of marketeers implementing my findings into their marketing strategies will base upon the ability of consumers to access caffeine, which could potentially be granted in the form of coffee drinks, chocolate snacks, or chewing gum containing caffeine at the store's entry point. Establishing an environment of a caffeine offerings within the traditional retail

setting (e.g. supermarkets) will be a challenge for retailers, as it will take approximately 45 minutes for the psychostimulant to impact the human CNS (Bonati et al., 1982; Liguori et al., 1997). However, retail environments as we experience within shopping malls provide an excellent setting for prior caffeine administration. Here, it should be considered to position cafés in a way so customers access these spots prior to shopping as opposed to afterwards. Additionally, shops within a shopping mall should consider partnering with local cafés or restaurants where caffeinated beverages are consumed by offering specific benefits (e.g. discounts) for these guests to attract potential customers having already ingested caffeine towards their shops.

As for market research applications, the results of my literature review indicate that both AE and CE research is still heavily covered in high-ranking marketing journals. Nonetheless, as the implementation of the suggested guidelines for context effect experiments overall showed little improvement since being introduced in 2015, my findings indicate further room to improve the quality of experimental context effect research. As previously stated by Lichters et al. (2015), to provide high quality experimental context effect research it is key for editors and reviewers to consider the implementation of these background factors in the review process.

My research provides ample evidence implementing physiological methods to observe the AE's underlying mechanisms. The major implication for academic research is the observation of the AE to be driven by cognitive processes. As this finding is in line with previous research (Chernev et al., 2007; Pettibone, 2012), it directly contests previous findings arguing in favor of affective processes driving the choice irregularity (Dhar & Gorlin, 2013; Pocheptsova et al., 2009), even previous findings implementing neurophysiological methods (Hedgcock & Rao, 2009). Accordingly, my research directly contributes to the ongoing debate of the underlying mechanisms of the AE.

My research faces limitations in its theoretical foundations and experimental design. Although scientific research in the field of neuroscience has vastly improved in recent years, the scientific state as to which regions of the human CNS are involved in the decision-making process, specifically within the brain, are not fully clarified (Beam et al., 2021; Eisenberg et al., 2019). Accordingly, it is difficult to fully measure and assess if cognitive or affective processes are impacted by the consumption of the CNS stimulant, which in turn leads to

limitations of further evaluation of the choice phenomena's true origins. Additionally, I implemented the CRT-L and SAM as measurements to evaluate for an impact on cognitive and affective processes. As more advanced, neurophysiological methods for evaluating any impact caffeine has on brain regions involved with cognitive and affective processes are available (e.g. fMRI, EEG, eye-tracking), my research is limited to traditional measurement methods. Regarding my experimental design, the conducted studies were subject to university students only. As such, the findings are limited to a very specific subpopulation. Furthermore, the analysis of AE and CE choice behavior was limited to specific FMCGs, avoiding managerial implications of these specific findings towards durable products. A major limitation of my experimental design was the time of day at which the studies were conducted. At approximately 9:00 AM, subjects may have generally been confronted with limited access towards cognitive resources, which could have impacted participants' choice behavior. As the AE and the CE have been observed to be less pronounced for consumers with diminished cognitive resources, this limitation could explain both context effects not occurring for the placebo groups of all studies as a rule.

Future research should build on the aforementioned limitations by implementing study designs allowing for neurophysiological measurement of caffeine's impact on the CNS (Koppelstaetter et al., 2010, 2008; Landolt, Dijk, Gaus, & Borbély, 1995; Liu et al., 2004; Mulderink, Gitelman, Mesulam, & Parrish, 2002; Smith, Brice, Nash, Rich, & Nutt, 2003). Besides obtaining further insight on involved brain regions, including the interplay between various regions that are activated in the decision-making process, advanced methods of neurophysiological measurements could extend on traditional scale measurement methods. Future researchers should also try to establish realistic field experiments to demonstrate caffeine's impact on the AE, the CE, and choice deferral in more realistic settings. Field experiments should strongly consider the retail environment and evaluate the manipulation in various settings. Furthermore, the AE has been observed after introducing various forms of decoys, including inferior quality asymmetrically dominated decoys and relative inferior decoys (Doyle, O'Connor, Reynolds, & Bottomley, 1999; Milberg et al., 2014; Padamwar et al., 2021). As such, future research could extend on my findings of cognitive reflection mediating the AE's switching behavior by introducing different types of decoys into the research design. Additionally, investigating caffeine's influence on consumer choice behavior could be extended by investigating further context effects, e.g. the phantom decoy effect (Pettibone & Wedell, 2007; Trueblood & Pettibone, 2017) or the common-attribute effect

(Chernev 1997). As caffeine is an exceptional manipulation to alter both affective and cognitive processes, investigating the psychostimulant's impact on further context effects would improve the understanding of the phenomena's underlying mechanisms. Finally, future research should also focus on caffeine's impact on further areas of consumer behavior, e.g. willingness to pay (Eberhardt, Fojcik, Hubert, Linzmajer, & Kenning, 2010; Sauer & Fischer, 2010; Wertenbroch & Skiera, 2002; Yang, Vosgerau, & Loewenstein, 2013).

Conclusively, my thesis combines two instrumental aspects constituting the daily life cycle of our western civilization, namely purchase and consumption. By focusing on the consumption of the most consumed psychostimulant worldwide, my research is relevant to a large part of the global population. As choice, especially product choice, is a crucial aspect of our life, understanding the impact caffeine may have on choice deferral at any scale gives valuable insight on better understanding the decision-making process and therefore enables decision makers to protect themselves from such an influential nutrient. Furthermore, understanding caffeine's impact on context sensitive decision making also provides valuable insight on the decision-making process, providing a step towards better comprehending the underlying mechanisms of alterations in preference construction. The responsibility of properly applying these findings into marketing practices should thoroughly be considered by marketeers in future.

Appendix 1: Investigating the Influence of Caffeine Consumption on the Attraction Effect and the Compromise Effect – in Free Choices

Table A1.1. Study 1: Product price scenarios

		Price in EUR					
		1	**2**	**3**	**4**	**5**	**Replication of 2**
	Toothpaste						
L	Dentagard Original	0.67	0.66	0.65	0.69	0.63	0.66
M	Colgate Total	0.83	0.84	0.85	0.81	0.82	0.84
H	blend-a-med	2.40	2.52	2.45	2.35	2.55	2.52
		1	**2**	**3**	**4**	**5**	**Replication of 2**
	Trail Mix						
L	K-Classic Trail Mix	0.79	0.81	0.83	0.87	0.89	0.81
D	Farmer's Snack Trail Mix	1.59	1.64	1.55	1.67	1.49	1.64
T	Ültje Trail Mix	1.39	1.29	1.25	1.21	1.19	1.29

Figure A1.1. Extended CRT

Frage 1
In einem Kaufhaus kosten ein Tischtennisschläger und ein Tischtennisball zusammen 1,10 Euro. Der Schläger ist 1 Euro teurer als der Ball. Wie viel Cent kostet der Tischtennisball?

Preis des Tischtennisballs in Euro: _____

Frage 2
In einer Textilfabrik benötigen 5 Maschinen genau 5 Minuten, um 5 Hemden herzustellen. Wie viele Minuten brauchen 100 Maschinen, um 100 Hemden zu produzieren?

Anzahl der Minuten: _____

Frage 3
In einer Sportmannschaft sind große Spieler drei Mal wahrscheinlicher eine Medaille zu gewinnen als kleine Spieler. Dieses Jahr hat die Mannschaft insgesamt 60 Medaillen gewonnen. Wie viele davon wurden von kleinen Spielern gewonnen?

Anzahl der Medaillen: _____

Frage 4
Wenn 3 Elfen 3 Spielzeuge in einer Stunde einpacken können, wie viele Elfen benötigt man um in 2 Stunden 6 Spielzeuge einzupacken?

Anzahl der Elfen: _____

Frage 5
Lennart erhielt zugleich die fünftzehnt beste und die fünftzehnt schlechteste Note in seiner Klasse. Wie viele Schüler sind insgesamt in seiner Klasse?

Anzahl der Schüler: _____

Frage 6
Auf einem Weiher wachsen Seerosen. Sie vermehren sich ziemlich schnell, jeden Tag verdoppelt sich die bedeckte Fläche. Es braucht 48 Tage, bis der Weiher vollständig mit Seerosen bedeckt ist. Wie viele Tage dauert es, bis die Hälfte des Weihers bedeckt ist?

Anzahl der Tage: _____

Figure A1.2. Systematic price trade-off for AE/CE

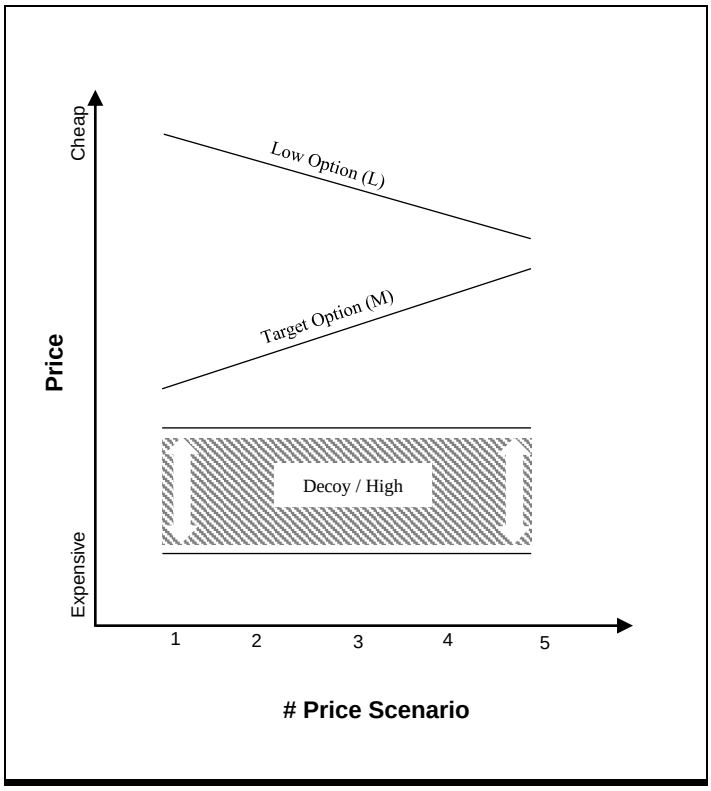


Figure A1.3. Demographics

Platznummer: ____ Datum: _____

Bitte beachte:

In diesem Befragungsteil triffst du *keine* Kaufentscheidungen, die später verbindlich abgewickelt werden könnten.

Vielmehr sind wir an einigen Angaben über deine Person interessiert. Natürlich werden wir deine Angaben streng vertraulich behandeln und nicht weitergeben.

Statistische Angaben zu deiner Person

1. Dein gegenwärtiges Alter in Jahren: _____

2. Dein Geschlecht:
   (Bitte kreuze das für dich zutreffende an!)
   - ◯ Frau
   - ◯ Mann

3. Deine ungefähre Körpergröße in cm: _____

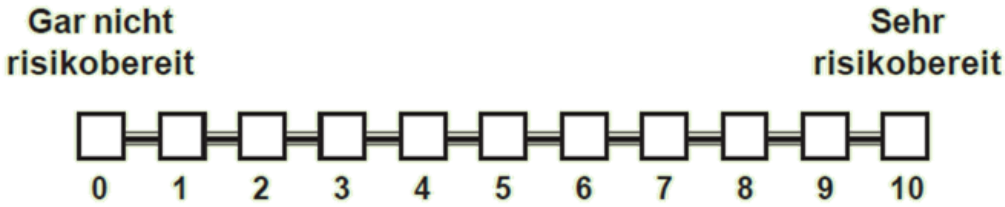
4. Dein ungefähres Gewicht in kg: _____

5. Dein gegenwärtiges ungefähres Monatseinkommen (netto) in Euro aus allen Quellen:
   _____

6. Woher stammst du ursprünglich?
   (Bitte kreuze das für dich zutreffende an!)
   - ◯ alte Bundesländer
   - ◯ neue Bundesländer (ehemalige DDR)
   - ◯ nicht aus Deutschland

7. Bist du im Allgemeinen ein risikobereiter Mensch oder versuchst du, Risiken zu vermeiden?

(Auf der Skala bedeutet der Wert 0: „gar nicht risikobereit“ und der Wert 10: „sehr risikobereit“. Mit den Werten dazwischen kannst du deine Einschätzung abstufen.)



8. Hier möchten wir etwas über deinen regelmäßigen Getränkekonsum erfahren. Nimm dir bitte einen Moment Zeit, um deine Konsumgewohnheiten möglichst genau anzugeben.

Welche der folgenden Getränke konsumierst du regelmäßig?	Softdrinks ○	Saft ○	Kaffee ○	Wasser ○	Tee ○	Energy Drinks ○

Denke bitte an einen deiner typischen **Wochentage** von Montag bis Sonntag: Wie viel von den einzelnen Getränken konsumierst du an einem solchen Tag in etwa? (Angabe bitte in Liter: 500 ml = 0,5 l)

Getränk	Softdrinks	Saft	Kaffee	Wasser	Tee	Energy Drinks
Konsumierte Menge	___ Liter	___ Liter	___ Liter	___ Liter	___ Liter	___ Liter

Vielen Dank. Verhalte dich ruhig an deinem Platz und warte auf weitere Anweisungen des Interviewerpersonals!

Details on the preliminary analysis of Study 1 in Chapter 5

No significant differences were found between subjects in the treatment and the placebo group in terms of age in years ($M_{Treatment}$=22.23, $SD_{Treatment}$=2.05 vs. $M_{Placebo}$=22.24, $SD_{Placebo}$=2.37; $t_{(49)}$=-0.015 p=.988), height in cm ($M_{Treatment}$=181.69, $SD_{Treatment}$=9.19 vs. $M_{Placebo}$=178.48, $SD_{Placebo}$=10.94; $t_{(49)}$=1.138, p=.261), weight in kg ($M_{Treatment}$=77.20, $SD_{Treatment}$=11.02 vs. $M_{Placebo}$=71.64, $SD_{Placebo}$=13.36; $t_{(49)}$=1.624, p=.111), BMI ($M_{Treatment}$=23.30, $SD_{Treatment}$=2.30 vs. $M_{Placebo}$=22.29, $SD_{Placebo}$=2.39; $t_{(49)}$=1.531, p=.132), monthly net income in EUR ($M_{Treatment}$=734.23, $SD_{Treatment}$=286.69 vs. $M_{Placebo}$=764.80, $SD_{Placebo}$=380.59; $t_{(49)}$=-0.325, p=.747), daily coffee consumption in ml ($M_{Treatment}$=0.47, $SD_{Treatment}$=0.45 vs. $M_{Placebo}$=0.50, $SD_{Placebo}$=0.44; $t_{(49)}$=-0.196, p=.845) or general risk attitude ($M_{Treatment}$=5.73, $SD_{Treatment}$=2.09 vs. $M_{Placebo}$=5.96, $SD_{Placebo}$=1.65; $t_{(49)}$=-0.434, p=.666). Furthermore, I tested whether caffeine affected consumer's cognitive capabilities. Caffeine consumers scored significantly higher than participants of the placebo group ($M_{Treatment}$=4.10, $SD_{Treatment}$=1.83 vs. $M_{Placebo}$=3.21, $SD_{Placebo}$=1.96; $t_{(62)}$=1.86, p=.034, one-tailed).

No significant differences were found between subjects in the treatment condition for the binary vs. trinary choice set composition in terms of age in years (M_{Binary}=22.88, SD_{Binary}=2.73 vs. $M_{Trinary}$=22.40, $SD_{Trinary}$=2.77; $t_{(29)}$=0.481 p=.634), height in cm (M_{Binary}=173.00, SD_{Binary}=11.06 vs. $M_{Trinary}$=172.60, $SD_{Trinary}$=8.66; $t_{(29)}$=0.112 p=.912), weight in kg (M_{Binary}=72.88, SD_{Binary}=13.23 vs. $M_{Trinary}$=65.27, $SD_{Trinary}$=10.35; $t_{(29)}$=1.775 p=.086), monthly net income in EUR (M_{Binary}=728.13, SD_{Binary}=309.28 vs. $M_{Trinary}$=674.00, $SD_{Trinary}$=212.83; $t_{(29)}$=0.564 p=.577) or daily coffee consumption in ml (M_{Binary}=0.34, SD_{Binary}=0.28 vs. $M_{Trinary}$=0.39, $SD_{Trinary}$=0.48; $t_{(29)}$=-0.318 p=.752). A significant difference for general risk attitude (M_{Binary}=7.06, SD_{Binary}=1.44 vs. $M_{Trinary}$=4.60, $SD_{Trinary}$=2.47; $t_{(22.184)}$=3.362 p=.002) and BMI (M_{Binary}=24.29, SD_{Binary}=3.49 vs. $M_{Trinary}$=21.84, $SD_{Trinary}$=1.60; $t_{(21.328)}$=2.538 p=.019) was identified.

No significant differences were found between subjects in the placebo condition for the binary vs. trinary choice set composition in terms of age in years (M_{Binary}=22.76, SD_{Binary}=1.79 vs. $M_{Trinary}$=22.88, $SD_{Trinary}$=2.53; $t_{(31)}$=-0.146 p=.885), height in cm (M_{Binary}=176.24, SD_{Binary}=9.30 vs. $M_{Trinary}$=175.19, $SD_{Trinary}$=9.83; $t_{(31)}$=0.315 p=.755), weight in kg (M_{Binary}=69.88, SD_{Binary}=11.19 vs. $M_{Trinary}$=72.44 $SD_{Trinary}$=14.77; $t_{(31)}$=-0.562 p=.578), BMI (M_{Binary}=22.36, SD_{Binary}=1.82 vs. $M_{Trinary}$=24.02, $SD_{Trinary}$=3.21; $t_{(23.460)}$=-1.810 p=.083), monthly net income in EUR (M_{Binary}=848.53, SD_{Binary}=371.30 vs. $M_{Trinary}$=787.50,

$SD_{Trinary}$=270.20; $t_{(31)}$=0.537 p=.595), daily coffee consumption in ml (M_{Binary}=0.45, SD_{Binary}=0.37 vs. $M_{Trinary}$=0.33, $SD_{Trinary}$=0.24; $t_{(31)}$=0.537 p=.595) or general risk attitude (M_{Binary}=5.53, SD_{Binary}=2.40 vs. $M_{Trinary}$=5.13, $SD_{Trinary}$=2.03; $t_{(31)}$=0.521 p=.606) was identified.

Appendix 2: Investigating the Influence of Caffeine Consumption on the Attraction Effect and the Compromise Effect – in Binding Choices

Figure A2.1. Experimental flow Study 2

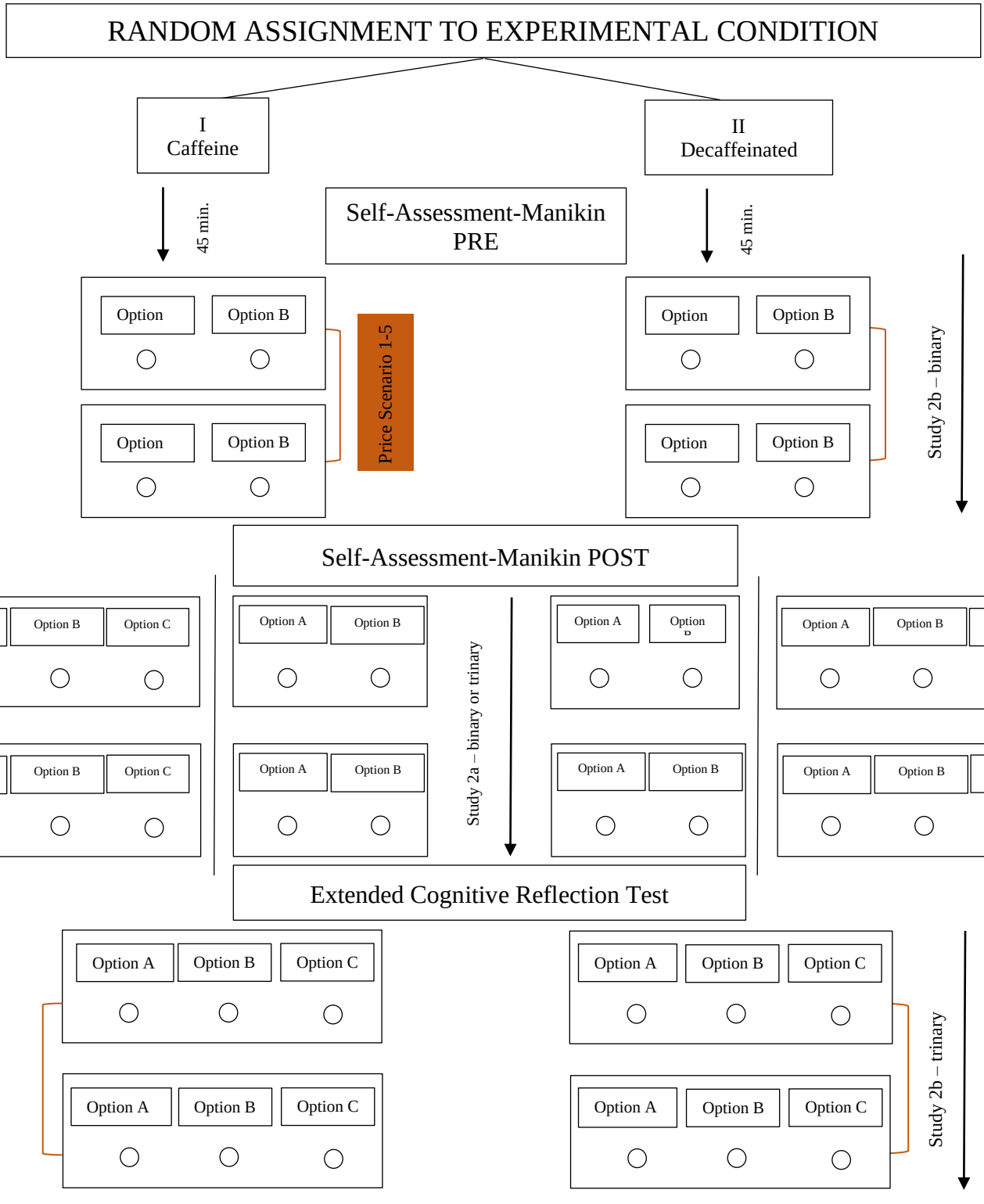


Figure A2.2. Choice task on spiced cookies in the trinary setting (extended decoy set)

Artikel	Borggreve	Kinkartz	Bahlsen
Stiftung Warentest Qualitätsurteil	2,2	1,7	1,6
Produktbild			
Preis	0,80 €	1,49 €	1,20 €
Entscheidung:	O	O	O

Figure A2.3. Choice task on ketchup in the trinary setting (extended high set)

Artikel	K-Classic	Knorr	Kraft
Stiftung Warentest Qualitätsurteil	1,9	1,7	1,4
Produktbild			
Preis	0,99 €	1,24 €	1,99 €
Entscheidung:	O	O	O

Figure A2.4 Self-assessment-manikin

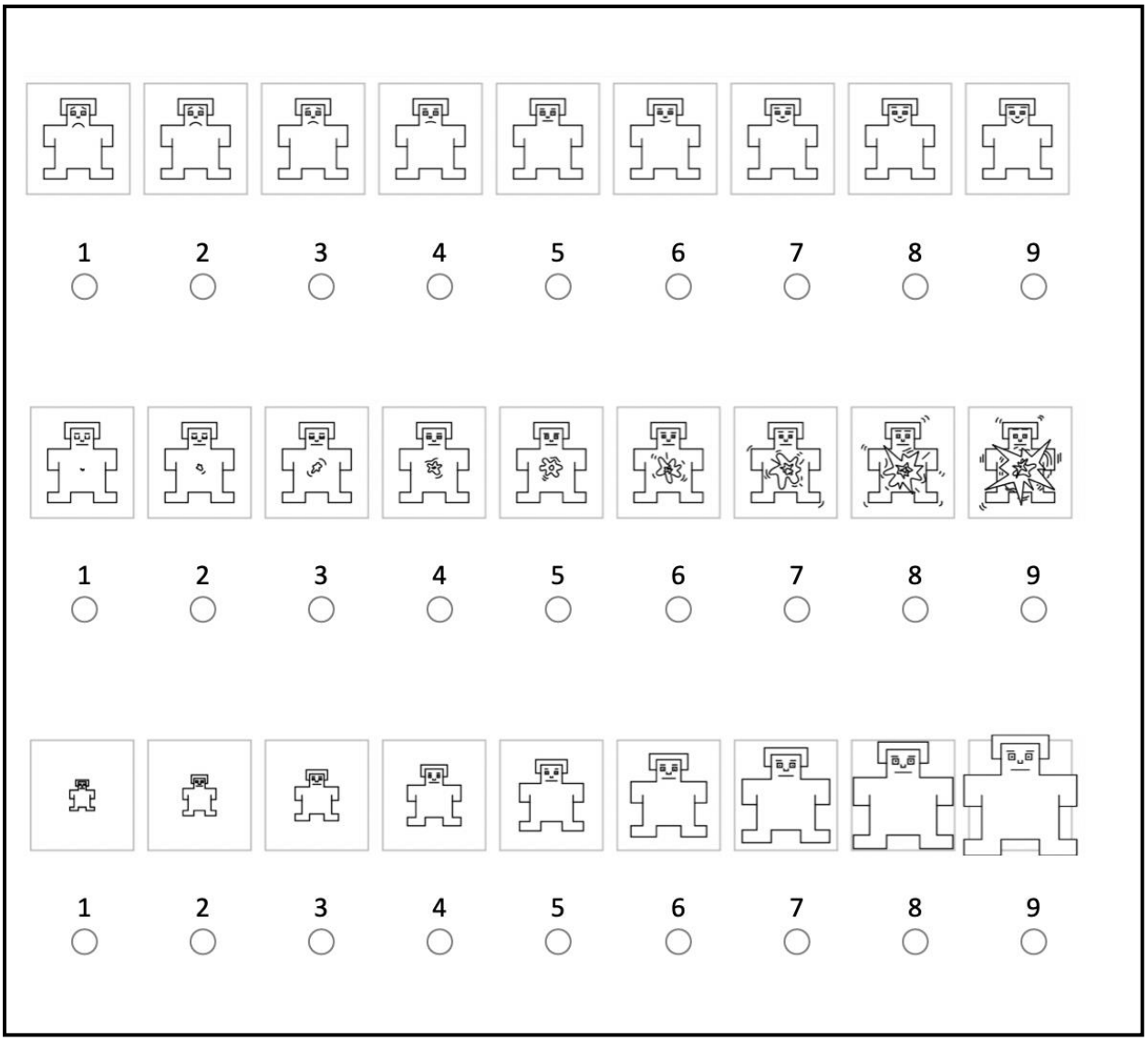


Table A2.1. Study 2: Product price scenarios

		Price in EUR				
	Spiced Cookie	**1**	**2**	**3**	**4**	**5**
L	EDEKA Butter Spekulatius	0.80	0.81	0.83	0.85	0.86
D	Kinkartz Butter Spekulatius	1.49	1.45	1.37	1.32	1.29
T	Bahlsen Feinster Spekulatius	1.20	1.19	1.14	1.12	1.09
	Ketchup	**1**	**2**	**3**	**4**	**5**
L	K-Classic Tomaten Ketchup	0.85	0.99	0.71	0.92	0.78
T	Knorr Tomaten Ketchup	1.38	1.24	1.52	1.31	1.45
H	Kraft Tomaten Ketchup	1.90	1.99	1.79	1.96	1.86

Details on the preliminary analysis of Study 2 & 3 in Chapters 6 & 7

The pre-analysis in Study 2 was analogous to that in Study 1. No significant differences between subjects in the treatment and the placebo group in terms of age in years ($M_{Treatment}$=22.65, $SD_{Treatment}$=2.71 vs. $M_{Placebo}$=22.82, $SD_{Placebo}$=2.14; $t_{(62)}$=-0.284, p=.777), height in cm ($M_{Treatment}$=172.81, $SD_{Treatment}$=9.81 vs. $M_{Placebo}$=175.73, $SD_{Placebo}$=9.42; $t_{(62)}$=-1.215, p=.940), weight in kg ($M_{Treatment}$=69.19, $SD_{Treatment}$=12.35 vs. $M_{Placebo}$=71.12, $SD_{Placebo}$=12.91; $t_{(45)}$=-.610, p=.138), BMI ($M_{Treatment}$=23.10, $SD_{Treatment}$=2.97 vs. $M_{Placebo}$=23.16, $SD_{Placebo}$=2.69; $t_{(62)}$=-, p=.940), monthly net income in EUR ($M_{Treatment}$=701.94, $SD_{Treatment}$=264.05 vs. $M_{Placebo}$=818.94, $SD_{Placebo}$=322.66; $t_{(62)}$=-1.582, p=.119), and daily coffee consumption in ml ($M_{Treatment}$=0.366, $SD_{Treatment}$=0.387 vs. $M_{Placebo}$=0.388, $SD_{Placebo}$=0.317; $t_{(62)}$=-0.257, p=.798) were found in Study 1. I continued to compare subjects' quality (versus price) orientation, and subjects' aided brand awareness of all products, but found no significant differences. Subjects do not differ in terms of quality (versus price) orientation for trail mix ($M_{Treatment}$=2.13, $SD_{Treatment}$=0.86 vs. $M_{Placebo}$=2.09, $SD_{Placebo}$=0.89; $t_{(61)}$=0.157, p=.875). Likewise, subjects do not differ in aided brand awareness as indicated by a Fisher's exact tests for brands K Classic (p=.552), Ültje (p=.443), and Farmer's Snack (p=.250). Results did not reveal any significant differences in the general risk attitudes between the treatment and placebo groups as measured by the risk-attitude scale ($M_{Treatment}$ = 5.87, $SD_{Treatment}$ = 2.33 vs. $M_{Placebo}$ = 5.33, $SD_{Placebo}$ = 2.20; t(62) = 0.948; p = .347). Furthermore, we tested whether caffeine affected consumer's cognitive capabilities, which, in turn, could have an effect on the AE. Following Primi et al. (2016), we had participants execute the extended Cognitive Reflection Test (CRT-L), which showed caffeine consumers to score significantly higher than participants of the placebo group ($M_{Treatment}$=4.10, $SD_{Treatment}$=1.83 vs. $M_{Placebo}$=3.21, $SD_{Placebo}$=1.96; $t_{(62)}$=1.86, p=.034, one-tailed).

No significant differences were found between subjects in the treatment condition for the binary vs. trinary choice set composition in terms of age in years (M_{Binary}=22.06, SD_{Binary}=2.29 vs. $M_{Trinary}$=22.50, $SD_{Trinary}$=1.65; $t_{(23.395)}$=-0.564 p=.578), height in cm (M_{Binary}=180.06, SD_{Binary}=8.96 vs. $M_{Trinary}$=184.30, $SD_{Trinary}$=9.39; $t_{(24)}$=-1.152 p=.261), weight in kg (M_{Binary}=77.13, SD_{Binary}=11.20 vs. $M_{Trinary}$=77.32, $SD_{Trinary}$=11.34; $t_{(24)}$=-0.43 p=.966), BMI (M_{Binary}=23.71, SD_{Binary}=2.54 vs. $M_{Trinary}$=22.64, $SD_{Trinary}$=1.78; $t_{(24)}$=1.166 p=.255), monthly net income in EUR (M_{Binary}=741.88, SD_{Binary}=277.11 vs. $M_{Trinary}$=722.00, $SD_{Trinary}$=316.33; $t_{(24)}$=0.169 p=.868) or daily coffee consumption in ml (M_{Binary}=0.37,

SD_{Binary}=0.25 vs. $M_{Trinary}$=0.59, $SD_{Trinary}$=0.65; $t_{(10.728)}$=-0.897 p=.389) or general risk attitude (M_{Binary}=5.50, SD_{Binary}=2.28 vs. $M_{Trinary}$=6.10, $SD_{Trinary}$=1.79; $t_{(24)}$=-0.705 p=.487) was identified.

No significant differences were found between subjects in the placebo condition for the binary vs. trinary choice set composition in terms of age in years (M_{Binary}=21.92, SD_{Binary}=2.39 vs. $M_{Trinary}$=22.54, $SD_{Trinary}$=2.40; $t_{(23)}$=-0.648 p=.523), height in cm (M_{Binary}=179.08, SD_{Binary}=9.45 vs. $M_{Trinary}$=177.92, $SD_{Trinary}$=12.51; $t_{(23)}$=0.260 p=0.797), weight in kg (M_{Binary}=72.17, SD_{Binary}=15.13 vs. $M_{Trinary}$=71.15 $SD_{Trinary}$=12.10; $t_{(23)}$=0.186 p=.854), BMI (M_{Binary}=22.25, SD_{Binary}=2.95 vs. $M_{Trinary}$=22.34, $SD_{Trinary}$=1.86; $t_{(23)}$=-0.097 p=.923), monthly net income in EUR (M_{Binary}=695.83, SD_{Binary}=412.01 vs. $M_{Trinary}$=828.46, $SD_{Trinary}$=353.58; $t_{(23)}$=0.866 p=0.395), daily coffee consumption in ml (M_{Binary}=0.44, SD_{Binary}=0.59 vs. $M_{Trinary}$=0.54, $SD_{Trinary}$=0.27; $t_{(23)}$=-0.569 p=.575) or general risk attitude (M_{Binary}=6.08, SD_{Binary}=1.62 vs. $M_{Trinary}$=5.85, $SD_{Trinary}$=1.72; $t_{(23)}$=0.353 p=.727) was identified.

Appendix 3: Study 2b: Investigating the Underlying Mechanisms of the Attraction Effect and the Compromise Effect

Table A3.1. Study 2b: Product price scenarios

		Price in EUR					
	Chewing Gum	**1**	**2**	**3**	**4**	**5**	**Replication of 2**
L	Orbit Peppermint	0.50	0.52	0.55	0.59	0.60	0.52
D	Airways Menthol	0.79	0.77	0.76	0.75	0.73	0.77
T	5 Gum Mint	0.96	0.99	0.87	0.92	0.85	0.99
	Mulled Wine	**1**	**2**	**3**	**4**	**5**	**Replication of 2**
L	Oma´s Glühwein	1.13	1.15	1.17	1.19	1.21	1.15
D	Nürnberger Christkindl	1.55	1.52	1.50	1.48	1.45	1.52
T	Freixenet Mederano	2.24	2.26	2.28	2.30	2.20	2.26

Figure A3.2. Choice task on chewing gum in the trinary setting (extended decoy set)

Artikel	Orbit Peppermint	5 Gum Sweet Mint	Airwaves Menthol
Stiftung Warentest Qualitätsurteil	2,3	1,9	1,7
Produktbild			
Preis	0,59 €	0,92 €	0,75 €
Entscheidung:	O	O	O

Figure A3.3. Choice task on mulled wine in the trinary setting (extended high set)

Artikel	Omas Glühwein	Nürnberger Christkindl	Freixenet Mederano
Stiftung Warentest Qualitätsurteil	2,7	1,9	1,7
Produktbild			
Preis	1,21 €	1,45 €	2,20 €
Entscheidung:	O	O	O

Appendix 4: Study 3: Investigating the Influence of Caffeine Consumption on Choice Deferral

Table A4.1. Study 3: Product price scenarios

		Price in EUR					
	Bluetooth speaker	**1**	**2**	**3**	**4**	**5**	**Replication of 2**
L	TaoTronics TT-SK09	16.99	17.84	19.54	20.39	18.69	17.84
D	DOSS SoundBox	31.44	32.29	33.14	29.74	30.59	32.29
T	TaoTronics TT-SK12	29.74	28.89	27.19	26.34	28.04	28.89

Figure A4.1. Choice task on Bluetooth speakers in the trinary setting (extended high set)

Artikel	TaoTronics TT-SK09	DOSS SoundBox	TaoTronics TT-SK12	
Batterielaufzeit (in Stunden)	6h	12h	24h	
Ausgangsleistung (in Watt)	6W	12W	16W	
Bluetooth Version	4.0	4.1	4.2	
Reichweite (in Meter)	10m	10m	10m	
Amazon Bewertung	★★★★☆	★★★★½	★★★★½	
Produktbild				Nein, ich möchte keines der Produkte kaufen!
Preis	18,69 €	30,59 €	28,04 €	
Entscheidung:	O	O	O	O

Details on the preliminary analysis of Study 3 in Chapter 8

The pre-analysis in Study 3 was analogous to that in Study 1. In terms of age in years ($M_{Treatment}$=21.93, $SD_{Treatment}$=2.31 vs. $M_{Placebo}$=21.07, $SD_{Placebo}$=2.34; $t_{(55)}$=1.394 p=.169), height in cm ($M_{Treatment}$=175.11, $SD_{Treatment}$=8.89 vs. $M_{Placebo}$=174.59, $SD_{Placebo}$=11.28; $t_{(55)}$=0.193, p=.848), weight in kg ($M_{Treatment}$=67.13, $SD_{Treatment}$=12.49 vs. $M_{Placebo}$=69.22, $SD_{Placebo}$=12.26; $t_{(55)}$=-0.640, p=.525), BMI ($M_{Treatment}$=21.78, $SD_{Treatment}$=2.86 vs. $M_{Placebo}$=22.71, $SD_{Placebo}$=3.53; $t_{(53.379)}$=-1.099, p=.277), monthly net income in EUR ($M_{Treatment}$=545.36, $SD_{Treatment}$=256.83 vs. $M_{Placebo}$=677.62, $SD_{Placebo}$=292.34; $t_{(55)}$=-0.325, p=.075), daily soft-drink consumption in ml ($M_{Treatment}$=0.14, $SD_{Treatment}$=0.26 vs. $M_{Placebo}$=0.13, $SD_{Placebo}$=0.24; $t_{(55)}$=0.214, p=.832), price-quality orientation ($Mdn_{Treatment}$=3.00 vs. $Mdn_{Placebo}$=3.00, $U(N_{Treatment}$=28, $N_{Placebo}$=29)=323.50, z=-1.51, p=.132) or general risk attitude ($M_{Treatment}$=5.25, $SD_{Treatment}$=2.46 vs. $M_{Placebo}$=5.21, $SD_{Placebo}$=1.84; $t_{(55)}$=-0.075, p=.940), no significant differences between the treatment and placebo groups were identified.

Ehrenerklärung (Declaration of Honor)

Ich versichere hiermit, dass ich die vorliegende Arbeit ohne unzulässige Hilfe Dritter und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe; verwendete fremde und eigene Quellen sind als solche kenntlich gemacht. Insbesondere habe ich nicht die Hilfe eines kommerziellen Promotionsberaters in Anspruch genommen. Dritte haben von mir weder unmittelbar noch mittelbar geldwerte Leistungen für Arbeiten erhalten, die im Zusammenhang mit dem Inhalt der vorgelegten schriftlichen Promotionsleistung stehen.

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- fremde Ergebnisse oder Veröffentlichungen plagiiert,
- fremde Forschungsergebnisse verzerrt wiedergegeben.

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Ich erkläre mich damit einverstanden, dass die Dissertation ggf. mit Mitteln der elektronischen Datenverarbeitung auf Plagiate überprüft werden kann.

Magdeburg, 28.06.2022
Michael Canty

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