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FACULTY OF SOCIAL SCIENCES

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Department of Sociology

Bachelor's Thesis

2025 **Tadeáš Turek**

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Validity of implicit measures of environmental attitudes

Bachelor's Thesis

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Supervisor: Mgr. Jan Urban, Ph.D.

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In Prague on 24.7. Tadeáš Turek

References

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Abstract

Climate change is a major concern in contemporary society, resulting in researchers investigating the mechanisms influencing pro-environmental behaviors. One approach involves examining implicit attitudes; however, their application within the environmental domain remains limited. This thesis explores the relationship between implicit and explicit environmental attitudes in order to assess the validity and usefulness of implicit measures in the environmental field. Specifically, I conducted a small pilot study, which used an Implicit Association Test focused on sustainable food (N = 28). In addition, I also analyzed the relationship between implicit attitude towards transportation and explicit pro-environmental attitude, using a secondary analysis of data from a larger study (N = 198). The first study found a moderate correlation between implicit and explicit attitudes, while the second study revealed a weak but statistically significant relationship between implicit and explicit environmental attitudes. The second study additionally included a product choice task, however, no relationship was found between implicit attitudes and green product choices, whereas explicit attitudes predicted green product preference. The results suggest implicit attitudes predict specific pro-environmental behavior but also that their content largely overlaps with explicit attitudes (both specific and general). These results are in line with previous findings that explicit attitudes are more predictive of deliberate behaviors than implicit attitudes. While implicit attitude may play a role in other types of behavior, my work and other studies show that they do not play an important role in deliberate pro-environmental behavior and that they do not explain it beyond and above explicit attitudes.

Abstrakt

Klimatická změna je v současné společnosti významným problémem, který vede vědce ke zkoumání mechanismů ovlivňujících pro-environmentální chování. Jedním z přístupů zahrnuje zkoumání implicitních postojů; jejich použití v oblasti životního prostředí je však stále omezené. Tato práce zkoumá vztah mezi implicitními a explicitními environmentálními postoji, s cílem posoudit validitu a užitečnost implicitních mír v environmentální oblasti. Konkrétně jsem provedl menší pilotní studii, kde byl použit Test implicitních asociací zaměřený na udržitelné potraviny (N = 28). Dále jsem analyzoval vztah mezi implicitním postojem k dopravě a explicitním pro-environmentálním postojem pomocí sekundární analýzy dat z rozsáhlejší studie (N = 198). První studie odhalila mírnou korelaci mezi

implicitními a explicitními postoji, zatímco druhá studie odhalila slabý, ale statisticky signifikantní vztah mezi implicitními a explicitními environmentálními postoji. Druhá studie navíc zahrnovala úlohu zaměřenou na výběr produktu, nicméně nebyl nalezen žádný vztah mezi implicitními postoji a preferencí ekologického produktu, zatímco explicitní postoje predikovaly preferenci ekologického produktu. Výsledky naznačují, že implicitní postoje předpovídají konkrétní pro-environmentální chování, ale také že jejich obsah se do značné míry překrývá s explicitními postoji (konkrétními i obecnými). Tyto výsledky jsou v souladu s předchozími zjištěními, že explicitní postoje jsou pro záměrné chování více prediktivní než implicitní postoje. Ačkoli implicitní postoje mohou hrát roli v jiných typech chování, moje práce a další studie ukazují, že nehrají významnou roli v záměrném pro-environmentálním chování a že jej nevysvětlují nad rámec explicitních postojů.

Keywords

implicit measures, explicit measures, implicit association test (IAT), environmental attitudes, secondary data analysis

Klíčová slova

implicitní měření, explicitní měření, test implicitních asociací (IAT), environmentální postoje, sekundární analýza dat

Title

Validity of implicit measures of environmental attitudes

Název práce

Validita implicitních měření environmentálních postojů

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INTRODUCTION

One of the greatest challenges our society currently faces is climate change, and sociologists have contributed by helping understand various elements of culture, social structure and individual opinions and behaviors (Dietz et al., 2020). Especially the various behaviors of individuals, or communities in the society are crucial factors influencing environmental issues (e.g., consumption; Ehrhardt-Martinez et al., 2015). Studying attitudes can help understand what factors influence these behaviors (Allport, 1935). As societies face environmental issues, understanding how attitudes shape behavior is critical for exploring and supporting social change towards sustainability. Attitudes can be differentiated into two categories: explicit and implicit, but the definition of implicit attitudes and relationship between explicit and implicit attitudes is still debated (Corneille & Hütter, 2020; Sherman & Klein, 2021). To understand implicit attitudes, implicit measures have been developed (Greenwald et al., 1998). However, their application in the environmental domain has been limited, potentially due to methodological errors, or due to the unclear nature of the implicit theory (Fiorenza et al., 2023). Is there a relationship between implicit and explicit environmental attitudes? To what extent could implicit attitudes predict pro-environmental behavior? This thesis aims to answer those questions.

Some studies have tried to find a relationship between implicit environmental measures and explicit environmental measures, but many of them did not find an effect (e.g., McGuire & Beattie, 2019; Piskóti, 2015; Steiner et al., 2018). Other studies managed to find a relationship (Levine & Strube, 2012; Panzone et al., 2016), however, the inconsistent results remain without a definite explanation (Fiorenza et al., 2023). The most commonly used tool to assess implicit attitudes is the Implicit Association Tests (IAT), and the studies often use specific versions of the IAT with variations of the environmental focus to measure the implicit environmental attitude, as well as various explicit methods (Fiorenza et al., 2023). Attempts have been also made to explore the predictive ability of implicit environmental measures on behavior, but the conclusions are not clear and seek further discussion (e.g., Geng et al., 2015; Songa et al., 2019).

The goal of this thesis is to examine the relationship of implicit environmental attitudes and explicit environmental attitudes, and implicit environmental attitudes and green product preference, in order to discuss the use of implicit measures in the environmental domain,

specifically the Implicit Association Test. Further aim is to help clarify the inconsistencies of implicit measures in the environmental domain and offer possible explanations or recommendations. To achieve the goals of this thesis, a secondary analysis was performed on data from two previous studies. One of these studies focused on implicit attitudes towards food, while the other focused on implicit attitudes towards transportation.

The thesis begins with a theoretical framework thoroughly explaining the fundamental concepts of this study, such as the whole concept of attitudes, implicit and explicit attitudes, and implicit measures and the critique on implicit attitudes and measures. It then continues by reviewing the use of implicit measures in the environmental domain and highlights previous findings and possible explanations. Based on the theoretical foundation, the methodological section covers the process of data collection of the pilot and the main study, which is followed by analysis method and results. Next, the results are discussed and interpreted in context of the theoretical framework, after which the possible theoretical and practical implications are considered. Finally, the limitations of this thesis are discussed.

1. THEORETICAL FRAMEWORK

Attitudes are essential for understanding individuals' behavior in society, as they predispose individuals to act in certain ways within social environments (Allport, 1935), and understanding them is a complex issue. Attitudes influence how people perceive, interpret and respond to the world around them, making them a fundamental concept in sociology and behavioral research. As relatively stable evaluations of people, objects or ideas, attitudes help predict verbal expressions and behaviors in different contexts.

In the environmental domain, attitudes are particularly relevant for explaining pro-environmental behavior, which are actions intended to minimize harm to or benefit the environment. Understanding environmental attitudes can help to identify barriers to sustainable behavior and inform interventions promoting more ecological lifestyles. Thus, studying both implicit and explicit attitudes offers a way to find and understand environmentally relevant decisions. This can be useful for law and policy makers, organizations and individuals to effectively promote pro-environmental behavior.

1.1 The Concept of Attitude

There are two main conceptualizations of attitude in social sciences and sociology in particular (Pestello, 2007). The positivist (deductive) conceptualization views attitudes as measurable, objective entities that can be quantified and analyzed (e.g., Fishbein & Ajzen, 1975). The phenomenological (inductive) conceptualization emphasizes understanding of attitudes from the subjective experiences of individuals (e.g., Deutscher, 1973).

The positivist (deductive) theorizing of attitude is represented, for instance, by work of Thomas and Znaniecki (1918), who introduced the concept of attitude and established it as a key theoretical concept in sociology. This conceptualization of attitude later informed now conventional definition of attitude as "a mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related" (Allport, 1935, pp. 804–805). The positivist theorizing of attitude is currently, represented by the theory of planned behavior (Ajzen, 1991), the theory of reasoned action (Fishbein & Ajzen, 1975) or by the attitude theory of the Campbell Paradigm (Kaiser et al., 2010; Kaiser & Wilson, 2019; for its introduction in sociology, see, e.g., Urban & Duda, 2024). These theories share in common that attitudes are mostly stable and measurable, and the notion that attitudes are built from

three main components: affective, cognitive, and behavioral reactions, and that they can be estimated from behavioral responses (Kaiser & Wilson, 2019; Rosenberg et al., 1960).

As opposed to the positivist conceptualization, the phenomenological conceptualization considers attitudes more contextual and fluid (Hogg & Smith, 2010; Pestello, 2007). The inductive theorizing of attitude is represented, among others, by the work of Blumer (1955) and Deutscher (1973; et al., 1993), who promoted a phenomenological (inductive) conceptualization that emphasizes the meanings individuals attribute to situations and their social interactions. These authors stressed that attitudes and behaviors are not static intrapersonal constructs but are continuously interpreted and reinterpreted within specific social contexts, challenging the core assumption of consistency in the positivist paradigm (Blumer, 1955; Deutscher, 1973; Deutscher et al., 1993; Pestello, 2007, p. 3). Broadly speaking, these authors suggest that a more qualitative approach, which accounts for the social construction of behavior and the meanings ascribed by individuals, is necessary for a comprehensive understanding of attitude (e.g., Blumer, 1955; Deutscher, 1973; Deutscher et al., 1993; LaPiere, 1934).

As we shall see in the next section, the current dominant theorizing of environmental attitude in sociology and social sciences more broadly draws mainly from the positivist tradition of attitude theory (Hadler et al., 2022).

1.2 Attitude in the Environmental Domain

The concept of attitude is often used in the environmental domain to capture individuals' evaluation, feelings, and predispositions towards environmental actions or topics (e.g., Brügger et al., 2011; Cruz & Manata, 2020; Dunlap et al., 2000; Kaiser, 1998; Kollmuss & Agyeman, 2002). As such, environmental attitude is sometimes defined as a collection of "evaluative beliefs, affect, and/or behavioral intentions about environmentally related activities or issues" (Milfont & Schultz, 2018, p. 338). Attitudes play a crucial role in shaping individuals' behaviors towards the environment and sustainability (Hadler et al., 2022). Research on attitudes in the environmental domain typically differentiates between two distinct types: general environmental attitudes (sometimes referred to as environmental concern) and attitudes towards specific pro-environmental behaviors/actions (Milfont & Schultz, 2018), for instance environmentally conscious transport (Gärling et al., 2018), recycling (Thøgersen, 1996), or food consumption (Muresan et al., 2021).

Attitudes towards specific pro-environmental actions, such as environmentally conscious travel, recycling, and food consumption, reflect how individuals evaluate and feel about these behaviors (Milfont & Schultz, 2018, p. 341). These attitudes have a significant impact on the likelihood of engagement in sustainable practices (Bamberg & Möser, 2007). For instance, the more positive attitude towards recycling an individual has, the more likely he is to recycle (Geiger et al., 2019). Similarly, supportive views on environmentally conscious travel may lead to an increase in the use of public transport or cycling (Hamidi & Zhao, 2020). Another example is that favorable attitudes towards sustainable food consumption can result in choosing organic or locally sourced products (Vermeir & Verbeke, 2006).

Unlike specific attitudes (e.g. attitude towards recycling), the attitude towards general pro-environmental behavior (sometimes referred to simply as "environmental attitude") captures overall commitment to sustainability across various behaviors (Kaiser, 1998). One measure of environmental attitude has been proposed by Kaiser (1998) – "A General Measure of Ecological Behavior". The revised version (GEB-50) assesses how often people engage in activities that benefit the environment, such as recycling, conserving water, using public transportation, and other sustainable practices (Kaiser, 2020).

Traditionally, attitudes towards specific pro-environmental behaviors as well as environmental attitudes have been measured using explicit measures and self-reports, such as questionnaires and surveys, which rely on individuals' conscious reflections and verbalizations of their attitudes and beliefs (e.g. Brügger et al., 2011; Cruz & Manata, 2020; Hadler et al., 2022; Kaiser, 2020). However, some studies have shown that self-report pro-environmental behavior measures are vulnerable to significant bias, as they may not accurately measure or predict behavior (Hadler et al., 2022; Kormos & Gifford, 2014). One of the reasons can be inaccurate self-reporting of pro-environmental behavior because respondents attempt to portray themselves in a more positive way (Bratt et al., 2015), this reason was also found to have a weak effect on environmental attitude (Milfont, 2009). Another problem may be the one-sided focus on the explicit aspect, as a growing volume of literature suggests that implicit attitudes, which are automatic and unconscious, also play an important role in shaping (environmental) behavior (Greenwald & Banaji, 1995; Levine & Strube, 2012; Schultz et al., 2004). One of the ways to address these shortcomings is to use implicit measures of attitude, such as the Implicit Association Test (IAT), that should complement explicit attitude measures (Greenwald et al., 1998) and help to get a more comprehensive understanding of how attitudes influence environmental actions.

1.3 Implicit Attitudes

The term "implicit attitude" is used to describe an individual's subconscious evaluation or preference towards an object or concept (Greenwald & Banaji, 1995). In contrast to explicit attitudes, which are conscious and intentional, implicit attitudes operate without conscious awareness or intentional control, and individuals are unable to self-report them (Greenwald, 1990). The theory of implicit attitudes suggests that individuals hold unconscious beliefs or biases that influence their behavior without their explicit awareness (Greenwald & Banaji, 1995). Implicit attitudes are grounded in dual-process theories of cognition, which differentiate between automatic and controlled processes (Gawronski & Bodenhausen, 2006, p. 692). The automatic processes are fast, involuntary, and often operate below the level of conscious awareness, forming the basis for implicit attitudes (Gawronski & Bodenhausen, 2006, p. 693). In contrast, controlled processes are deliberate, conscious, and reflective, forming the basis for explicit attitudes (Gawronski & Bodenhausen, 2006, p. 694). This differentiation is also part of the broader perspective of the model of dual-attitudes (Wilson et al., 2000). The impact of implicit attitudes on behavior is what highlights the importance of studying implicit attitudes (Greenwald et al., 2009).

Implicit attitudes influence a wide range of behaviors and decision-making processes (Greenwald et al., 2009), while being unavailable to introspection for the individuals (Greenwald & Banaji, 1995). For instance, implicit racial biases (or implicit gender stereotypes) can affect hiring decisions, academic achievements, and everyday interpersonal interactions (Greenwald & Krieger, 2006). Implicit biases also affect healthcare, resulting in inequity towards individuals based on their sexual orientation, race, ethnicity et al. (Shah & Bohlen, 2025). Another example is implicit stereotyping of adolescence, providing evidence of implicit biases based on the age of individuals (Gross & Hardin, 2007).

Since implicit attitudes operate at a subconscious level, they do not always align with an individual's consciously expressed beliefs (Greenwald et al., 1998; Wilson et al., 2000). This happens because individuals might not want to report some attitudes, since they do not want people to know about them (Nosek et al., 2007), or they may not know about these attitudes at all and are therefore unable to report them (Greenwald & Banaji, 1995). The explicit and implicit attitudes may differ for an individual, and changes in one of these attitudes might not be reflected in the other form of attitude, further suggesting that attitude should not be viewed as a unitary construct (Gawronski & Bodenhausen, 2006, p. 692; Wilson et al.,

2000). To better understand the impact of implicit attitudes, we need to understand how they are formed.

Same as explicit attitudes, implicit attitudes are formed through past experiences, such as repeated exposure to societal norms, cultural values, and personal experiences (Greenwald & Banaji, 1995). Research confirms that implicit attitudes are formed from a young age, individuals are socialized by family, peers, educators, and community members and these social actors may pass on attitudes, beliefs, and stereotypes that can become internalized and form implicit attitudes over time (Baron & Banaji, 2006). For example, cultural norms play an important role in shaping implicit attitudes. Media representations, societal narratives, and cultural symbols can implicitly influence how individuals perceive different groups and concepts (Yoshida et al., 2012).

1.3.1 Critique of the Theory of Implicit Attitudes

The theory of implicit attitudes is criticized mainly regarding its conceptualization, specifically for the debatable relationship of implicit attitudes and explicit attitudes (Sherman & Klein, 2021), and the ambiguity of implicit definitions (Corneille & Hütter, 2020). According to Sherman & Klein (2021), the problems with implicit attitude research originate in the framing of implicit and explicit evaluations and measures in dual process models of cognition, where the main problem is that these two types of attitude are seen as two contrasting constructs. Instead, they should be seen as interconnected and influenced by similar underlying processes (such as learning, context, and experience), and the key idea is that they are not fundamentally different types of attitudes, but rather reflect different ways in which attitudes can be expressed depending on the situation (Sherman & Klein, 2021).

Another type of critique questions whether implicit attitudes are actually “implicit” or unconscious (Gawronski et al., 2006). The evidence, that people are unaware of their implicit attitudes, usually comes from studies that compare a person's implicit attitude with their explicit attitude, which often results in conclusions suggesting that people are not aware of their implicit attitudes (Steiner et al., 2018; Sun et al., 2020). The research by Hahn et al. (2014) used a different method, which asked participants to predict their results of different implicit attitude tests, and across all four studies, the participants were highly accurate in their predictions. These results (Hahn et al., 2014) challenge the core assumption that implicit attitudes are unconscious (Greenwald, 1990; Greenwald & Banaji, 1995). This is also supported by the findings of Corneille & Hütter (2020), who distinguish between three

main views by which the term implicit is understood: indirect (procedural), automatic (functional), or associative (mental theory).

1. *Procedural View* (Implicit-as-Indirect): The procedural view defines implicitness based on how attitudes are measured - Implicit attitudes are those inferred from indirect measures rather than self-reports (Corneille & Hütter, 2020). This perspective emphasizes that implicitness is a feature of the measurement process rather than the underlying mental construct. The main representatives of implicit theorizing and the authors of the Implicit Association Test recently supported this view, by defining implicit as indirect and explicit as direct (Greenwald & Banaji, 2017).

2. *Functional View* (Implicit-as-Automatic): The functional view relates implicit attitudes to automaticity, meaning they are evaluations that occur without conscious control, intention, or awareness (De Houwer, 2006). This approach views implicit attitudes as responses that are produced under conditions of automaticity, distinguishing them from deliberate and controlled evaluations (Corneille & Hütter, 2020).

3. *Mental Theory View* (Implicit-as-Associative): This view assumes that implicit attitudes are formed and stored as associative links in memory, which are activated when encountering relevant stimuli (Corneille & Hütter, 2020; Shoda et al., 2014). However, Corneille & Hütter (2020) critique this assumption due to a lack of strong empirical support for associative attitude learning.

Corneille & Hütter (2020) argue that the ambiguity of definitions makes conclusions about implicit attitudes misleading, and suggest avoiding the term implicit, and rather using specific definitions (such as indirect or automatic). Other than criticizing the concept of implicit attitude, some authors have criticized the measures (or specific measure) of implicit attitudes, which will be elaborated in the next section.

1.4 Implicit Attitude Measures

Since implicit attitudes are considered to be unconscious (Greenwald, 1990), self-report measures cannot be used to measure them and specific implicit measures had to be developed (Fazio et al., 1986; Greenwald et al., 1998). There are various ways to assess implicit

attitudes. One of the more well-used tools is the Evaluative Priming Task (also known as Affective Priming Test), which assesses implicit attitudes by measuring the speed of response to a target stimulus following a prime (attitude object; Fazio et al., 1986). Another instrument is the Affect Misattribution Procedure, which evaluates implicit attitudes by having participants rate a neutral stimulus that is briefly preceded by a presented category (Payne et al., 2005). While there are also more, less commonly used tools, e.g. the Go/No-go Association Task (Nosek & Banaji, 2001) or the Approach-Avoidance Task (Solarz, 1960), the Implicit Association Test (IAT) is probably the most frequently used instrument to assess implicit attitudes. The IAT, originally proposed by Greenwald and colleagues in 1998, assesses the strength of associations between different concepts or objects (e.g., race, gender, age, product) and the valence of their evaluation by measuring the reaction times. Specifically, in the IAT, people categorize words or images into groups that are paired together, such as "Black or Good" and "White or Bad," in one block, and then "Black or Bad" and "White or Good" in another block. Participants are instructed to respond as quickly as possible, and the IAT measures the speed and accuracy of their responses. Faster response times typically indicate stronger implicit associations between the concepts being paired, as the task aligns more closely with the participant's automatic mental associations. On the contrary, slower reaction times may suggest weaker or conflicting associations. By analyzing these reaction times, the IAT provides insight into implicit biases that individuals may not be consciously aware of, revealing the automatic associations that can influence perceptions and behaviors (Greenwald et al., 1998).

Widespread application of the Implicit Association Test spans various domains, including consumer preferences, clinical psychology, political preferences, or alcohol and drug use. For example, many research has been done regarding racial/ethnic bias – a study by McConnell and Leibold found that participants who had stronger negative attitudes towards Black (versus Whites) on the IAT also had stronger negative attitudes on the Explicit measures of prejudice while also having more negative social interactions with Blacks (McConnell & Leibold, 2001). There has been a vast amount of research supporting the validity and reliability of IAT (Greenwald et al., 2003; Kang & Lane, 2010; Nosek et al., 2007). Other researchers have also confirmed that IAT has strong predictive validity, while it may also often surpass the predictive validity of self-report measures (Greenwald et al., 2009).

However, other research has highlighted several methodological concerns with the IAT, particularly regarding its susceptibility to strategic manipulation and the interpretation of its scoring system. Fiedler et al. (2006) highlight significant concerns with the IAT's reliance on the D-score, which is a difference measure calculated from reaction times in compatible and incompatible trial blocks. The authors argue that this score is problematic, because it assumes equal contributions from both latency components, despite evidence that response times can be differentially influenced by external factors (Fiedler et al., 2006). Cognitive load (e.g. stress, fatigue, distractions) or general processing speed can disproportionately impact one block over the other, leading to distorted results (Nosek et al., 2005). Another concern is the susceptibility of the IAT to deliberate faking and strategic manipulation. Fiedler et al. (2006) argue that participants can intentionally slow down their responses in the supposedly "easier" blocks to reduce the gap between compatible and incompatible trials, thereby masking their true IAT score.

A few researchers have examined the types of behavior predicted by implicit and explicit attitudes, specifically whether implicit or explicit predict a different type of behavior than the other (e.g. Perugini, 2005; Spence & Townsend, 2007). Perugini (2005) conducted two studies, outcome of the first study supported the “multiplicative” model (implicit and explicit attitudes interact in influencing behavior), while the second second study supported the “double dissociation” model (implicit attitudes predict spontaneous behavior, while explicit attitudes predict deliberate behavior). Spence & Townsend (2007) supported the “double dissociation” model in the environmental domain, which could help explain discrepancies when analyzing implicit and explicit connections. For example, a study by Songa et al. (2019) found that explicit attitudes predicted self-reported emotions towards sustainable products, while implicit attitudes predicted spontaneous emotional reactions towards sustainable products. However, this area remains relatively underexplored, and further research is needed to fully understand how these attitudes interact and shape behavior.

1.5 Implicit Association Test in the Environmental Domain

The validity and reliability of the Implicit Association Test has been supported in many areas, such as race or ethnicity related attitudes (Nosek et al., 2007), gender related attitudes (Dunham et al., 2016), weight related attitudes (Sabin et al., 2015), and more (for more areas, see Nosek et al., 2007). However, application of the IAT to environmental attitudes has been

limited (for a discussion, see, e.g., Fiorenza et al., 2023; Schultz et al., 2004). The validity of IAT in this specific context remains an area of concern. There are a few studies, where the researchers have tried to examine the relationship between implicit and explicit environmental attitudes (e.g. Levine & Strube, 2012; Richetin et al., 2016). However, many studies failed to find any association between the Implicit Association Test and explicit attitude (Geng et al., 2015; Sánchez et al., 2016), behavior (Piskóti, 2015) or intention measures (Levine & Strube, 2012).

For instance, Steiner et al. (2018) did not find a statistically significant correlation between their version of IAT and self-report questionnaire towards climate change. Likewise, McGuire & Beattie (2019) found no statistically significant correlation between Carbon IAT and explicit preference of high or low carbon footprint products. Songa et al. (2019) also did not find a statistically significant correlation between IAT towards recyclability (i.e., positive or negative attitude towards recyclable or non-recyclable packaging) and self-reported measure of attitude towards recyclability. A study by Geng et al. (2015) indicates that explicit and implicit connectedness to nature are independent of each other, as they did not find a significant correlation between IAT and "Connectedness to Nature Scale" (CNS). Piskóti (2015) did not find a significant correlation between IAT-nature and any of the explicit measures, including the "New Ecological Paradigm" (NEP) scale (Dunlap et al., 2000; Dunlap & Van Liere, 1978), environmental identity scale and environmental purchasing habits.

In contrast, some researchers found an association between the Implicit Association Test and explicit measures. For instance, Panzone et al. (2016) found a significant correlation between Sustainability IAT and three explicit attitude scales, specifically Green Consumer Action, Environmental Concern and Sustainable Food Preference. While Geng et al. (2015) did not find a connection between IAT-nature and CNS, a strongly significant correlation was found between IAT and behavior, specifically bag usage. Schultz & Tabanico (2007) found a significant correlation between IAT-nature and Inclusion of "Nature in Self" (INS) scale. Likewise, Olivos & Aragonés (2013) also found a statistically significant relationship between IAT-nature and INS scale, while they also found a correlation between IAT and CNS, Environmental Identity scale and a self-report measure of pro-environmental behavior. Levine and Strube found a significant relationship between their version of IAT with NEP scale, Regulation Attitudes scale, Efficacy Attitudes scale, and Technology Attitudes scale (Levine & Strube, 2012).

A recent systematic review of IAT-based measures in the environmental domain revealed that implicit and explicit attitudes toward "climate change" appeared unrelated, and the relationship between IAT and climatic beliefs was inconsistent across studies (Fiorenza et al., 2023). Fiorenza et al. (2023) reported a positive correlation between implicit and explicit attitudes only in 38.5% of 14 studies, and no effect in the remaining 61.5%. The heterogeneity of the results could support a broader consensus of low correlations between implicit and explicit measures (Greenwald et al., 2009; Hofmann et al., 2005). A possible explanation of the heterogeneity could be the insufficient introspection of implicit attitudes (Nosek, 2005). Another explanation could be the independence of the fundamental constructs (Hofmann et al., 2005). Environmental topics and topics related to climate change have specific attributes compared to different areas (Beattie & McGuire, 2016), mainly the complexity of the topic (Hansen et al., 2013). The results could suggest that environmental topics might be an area where there is an "attitudinal dissociation" between implicit and explicit attitudes (Fiorenza et al., 2023; Greenwald & Nosek, 2008). The relationship between implicit and explicit attitudes remains a topic up for debate, as numerous studies have produced conflicting results. While some studies have revealed an effect, others have not, while no clear and definite explanation has been provided.

1.6 Research Questions and Hypotheses

In my thesis, I will attempt to answer to the following research questions:

Q1: Is there a relationship between an individual's implicit environmental attitude and an explicit environmental attitude?

Q2: Is there a relationship between an individual's implicit environmental attitude and preference for green products?

To answer these research questions, I will test the following set of hypotheses. These hypotheses are based on the existing literature reviewed in the introduction.

H1: People with a higher level of explicit environmental attitude will have a more positive implicit environmental attitude.

H2a: People with a more positive implicit environmental attitude will be more likely to choose pro-environmental food products.

H2b: Implicit environmental attitude predicts the choice of green products above and beyond explicit environmental attitude.

2. RESEARCH OBJECTIVES

The purpose of my work was to explore and assess the relationship between implicit environmental attitudes and explicit environmental attitude or green product preference, to discuss the validity of implicit measures in the environmental domain, specifically the Implicit Association Test. In my thesis, I explored the findings from previous research, where an environmental IAT and an explicit environmental measure was used. After a literature review, I concluded that the findings were inconsistent across studies. To develop on this issue, I tried to find a relationship between implicit environmental attitudes and explicit environmental attitudes in other data. The data I chose to examine were different from other studies in terms of the specific environmental topics they covered (food preference and transportation).

The results of analyzing the data should show whether there is a positive relationship between individuals' implicit pro-environmental attitude and explicit pro-environmental attitude; and whether there is a relationship between an individual's implicit pro-environmental attitude and green product preference. The Implicit Association Test and other implicit measures of attitude are often used in other sociological domains rather than the environmental domain, and the theory of implicit attitudes in general was criticised by some researchers, thus my study should develop on the existing critique and discuss the usage of implicit measures in the environmental domain. The study should also help clarify the inconsistencies of implicit measures in the environmental domain and offer possible explanations or recommendations.

3. METHOD

3.1 Pilot Study

We ran a small pilot study with colleagues as a part of *The Practice in Quantitative Research* course. In this pilot study, I aimed to examine the association between implicit attitude towards environmentally significant behavior (eating of meat) and self-reported food preference (meat or non-meat food) or self-reported frequency of consumption of various types of meat. For the purpose of this research, I further analyzed the data using *R* (R Core Team, 2024).

3.1.1 Participants

A sample of respondents was recruited through email and social media of the research team. Participants were also asked to forward the invitation to the study to their contacts. Forty-one participants entered the study and 31 completed it, for the completion rate of 75.6 %. Based on a recommendation of Sabin et al. (2012), I removed IAT trials that were faster than 350 milliseconds or slower than 10,000 milliseconds because such responses are considered to imply careless participation. This led to exclusion of three participants for the final sample of 28 participants ($N = 28$). The sample was younger ($M_{age} = 25$, $SD = 10.50$) and consisted of 19 women, 8 men and one non-binary person. Three respondents reported having obtained a university degree as their highest level of education, while 25 respondents reported having high school as their highest completed level of education.

3.1.2 Materials

Explicit meat consumption. To measure meat consumption, a form was adopted from Mackenzie & Shanahan (2018) that asks participants how frequently they consume each of the following meat types: meat in general, poultry, red meat, and fish. For each of the meat categories, participants indicated their usual meat consumption (*rarely or never; 1 to 3 times a week; 2 to 4 times a week; 5 to 6 times a week; once a day; 2 to 3 times a day; 4 times a day or more*).

Explicit dietary preference. The respondents were asked a direct question, whether they prefer products that contain meat or products that do not contain meat.

Implicit measure of attitude to meat. I used the Implicit Association Test (IAT) to measure respondents' implicit attitude towards meat or meat-free products (Greenwald et al., 1998). Four categories of stimuli were developed, two categories contain various pictograms, one category contains pictograms of meat products, the other category contains meat-free/vegetarian products ("Picture categories"). The other two categories both contain 8 words each, one category is labeled as "Good" and the other category as "Bad" ("Word categories"). The "Good" category contains words: *Attractive, Love, Joyful, Laughter, Smiling, Friend, Kind, Excited*; the "Bad" category contains words: *Rotten, Hate, Humiliate, Horrible, Selfish, Negative, Annoying, Disaster*. The test is divided into 7 blocks, some are practice blocks and some are test blocks. Each test block contains a combination of one of the Picture categories and one of the Word categories. The respondents are shown one of the pictures/words (e.g. *Disaster*) and are asked to place them into the corresponding category.

3.1.3 Procedure

The study was run in the Czech language, respondents were invited to the study through various forms, such as social media and word of mouth. Upon entering the study, respondents were welcomed with an introduction and short description of the study, as well as with an informed consent. They were informed about the estimated time the study could take, which was set at circa 20 minutes, after piloting the study with colleagues. The respondents were also informed about the need of a physical keyboard, which was necessary for completing the implicit association test. This eliminated all respondents which might have tried to complete the study via a mobile phone or a tablet. They were also informed that their data was anonymized, as we did not collect any personal data.

After the introduction, respondents were asked to continue to the first part of the study. The first part was a socio-demographic questionnaire, where the respondents were asked to type in their age, which was followed by two multiple choice questions, asking them which gender category they best align with and their highest completed level of education.

The next part was a questionnaire, which asked about the respondents' explicit dietary preferences. The respondents were asked how often they eat certain types of meat, the first question was meat in general, the second was poultry, then we followed with red meat and the last type was fish. In each type, they chose on a 7-point scale from rarely or never to 4 times a day. Then the participants were asked if they would prefer a product that does not contain meat, if they had a choice.

Following the completion of the explicit questionnaire, respondents continued to the last part of the study, which was the Implicit Association Test (IAT). The respondents were informed that this part is used to measure their implicit attitude towards meat and meat-free products. In the introduction, they were also told that they would see the result of the implicit measure after they complete the study.

The respondents were first shown all four categories of stimuli used in the IAT, to make sure that respondents know which stimuli corresponds with which category (“good” words, “bad” words, pictures of vegetarian products and pictures of meat products). The respondents were instructed on how to put the stimuli into the correct category, which was done using two keys on a physical keyboard (keys “E” and “I”). They are asked to sort the stimuli as fast as possible, but correctly. When the participants put a stimuli into the wrong category, a large red letter “X” appears. They are instructed to put the stimuli into the correct

category when this happens. We also told them the test has seven blocks and the instructions are different in each part, to avoid the respondents not reading new instructions.

After the introduction to IAT, participants continue to the first block of trials (a trial represents each time the respondent is shown a new stimuli; a block is a set of trials, with different rules in each block). In each block, the stimuli appear in randomized order.

The first block is a practice block, which does not enter the analysis. The respondents are asked to put shown stimuli into the correct category, they press "E" when shown a vegetarian product and "I" when shown a meat product. This block contains 40 trials.

The second block is also a practice block. The respondents are now asked to press "E" when shown a bad word and "I" when shown a good word. This block has 32 trials.

The third block is also a practice block. The respondents are now asked to press "E" when shown a bad word or a vegetarian product, and to press "I" when shown a good word or a meat product. This block has 36 trials.

The fourth block is a test block, which enters the analysis. The rules are the same as in the third block, but there are 36 trials 2 times (72 in trials in total).

The fifth block is another practice block. This block is the same as the first one, but the rules are reversed (the respondents press "E" when shown a meat product, "I" when shown a vegetarian product). It also has 32 trials.

The sixth block is the last practice block, where participants are asked to press "E" when shown a bad word or a meat product, and to press "I" when shown a good word or a vegetarian product. This block has 36 trials.

The seventh block is the final test block, which enters the analysis. The rules are the same as in the sixth block, but there are 36 trials 2 times (72 in trials in total).

Upon completing the final block, respondents are given thanks for their participation in the study. They are shown their average response times for different combinations of categories. We also tell them their "score of implicit attitude" (D-score) and its interpretation, which varies from strong positive attitude towards products with meat, to strong positive attitude towards vegetarian products. If the respondents seek more information about implicit attitudes, they are referred to the Resources section on the Project Implicit website (Resources – Project Implicit, 2024).

3.1.4 Analysis

The data were analyzed using R (R Core Team, 2024). The IAT output gave us the response time respondents had when shown a combination of certain stimuli in milliseconds (Bad word or Meat product + Good word or Vegetarian product; Bad word or Vegetarian product + Good word or Meat product). This time is an average of response times respondents had when sorting each stimuli in test blocks 4 and 7. From this output, the D-score was calculated (the difference between the averages of test blocks divided by the standard deviation of latencies across both test blocks; Greenwald et al., 2003). The D-score ranges from more than 1 (more than 0.65 meaning strong positive preference towards meat products), to -1 (less than -0.65 meaning strong positive preference towards vegetarian products).

From the explicit questionnaire, the output is a 7-point scale and a 2-point scale. In the 2-point scale, 0 means meat-free preference, 1 means meat preference. In the 7-point scale, the closer the number is to 0, the less often the respondent consumes meat products.

A Spearman correlation analysis was performed to examine the relationship between the implicit measure and the two explicit measures, and the Shapiro-Wilk test to assess the normal distribution of the variables.

3.2 Main Study

To expand on the pilot study with a small sample size, a secondary data analysis was performed on data from a different, larger study (Urban et al., 2023). The study specifically examined individuals' explicit environmental attitude and the judgment of morality of pro-environmental behavior; and green food product choice. However, the researchers also included a measure of implicit attitude toward personal car transportation in the original data collection in 2017, which has never been analyzed. For the purpose of this thesis, only the implicit environmental attitude, explicit environmental attitude and green food product choice was analyzed using *R* (R Core Team, 2024).

3.2.1 Participants

From a laboratory's pool of respondents, a convenience sample of 245 was invited to participate in an online questionnaire, which was then followed by a laboratory session approximately one week later. From this sample, 237 people completed the questionnaire,

from which 201 participants were randomly chosen to attend the laboratory study. The laboratory part was completed by all participants, but three were excluded due to a technical malfunction. The final sample used for the analysis consisted of 198 participants (N = 198), and was diverse in its characteristics of age (M = 24.30, SD = 7.66), education (6.56% with primary education, 56.57% with secondary education, and 36.87% with tertiary education), and gender (25.76% were men).

3.2.2 Materials

Explicit measure of environmental attitude. Explicit environmental attitude was measured in the pretest with 48 self-reports of environmentally significant behaviors and 48 evaluations of the same activities. The activities were adopted from the 50-item GEB scale (adopted from Byrka et al., 2017). Specifically, a translation of the measure in the Czech language was used (Urban et al., 2019). Participants indicated how frequently they engaged in each behavior (example of an item "I sort glass wastes for recycling") using a six-point Likert-type scale (1 = *never*, 2 = *rarely*, 3 = *sometimes*, 4 = *frequently*, 5 = *very frequently*, 6 = *always*), and they indicated how they assess each activity (example of an item: "Sorting glass wastes for recycling") on a six-point Likert-type scale (1 = very bad, 2 = quite bad, 3 = rather bad, 4 = rather good, 5 = quite good, 6= very good). The scale had a good reliability (α = .88), person separation reliability (*rel* = .88).

Explicit attitude towards sustainable transportation. A subset of 11 behavioral items (e.g., “I ride a bicycle or take public transportation to work or school.”, “I drive my car in or into the city.”) and 11 evaluative items (evaluations of the 11 behavior items) from the GEB scale was used to construct an ad hoc measure of attitude to sustainable transportation. This scale had a sufficient reliability (α = .77), person separation reliability (*rel* = .77).

Implicit attitude measure towards transportation. Implicit attitude towards personal car transportation is measured with an implicit association test (Greenwald et al., 1998). This test assesses the association between words with positive and negative valence and pictures representing either personal cars or means of public transportation. Ten words with positive valence were used (*attractive, love, joyful, laughter, smiling, friend, kind, enthusiastic, pleasure, wonderful*) and ten words with negative valence (*rotten, hate, humiliate, horrible, selfish, negative, annoying, disaster, pain, ugly*), ten black and white pictures representing personal cars and ten black and white representing two examples of each of the five means of public transportations (ferry boats, subways, buses, tramways, and trains).

Product choice task. Green product preference was measured with a product choice task consisting of 36 trials. Participants were shown pairs of product options (i.e., low-cost and high-cost conventional options, green and low-cost conventional options, green and high-cost conventional options) one by one in random order for all 16 product types (for a total of 48 pairs shown over 48 trials). Only product pairs that include a green product (32 product pairs) were used in the analysis.

3.2.3 Procedure

The study consisted of two steps. Firstly, an online questionnaire was distributed to participants, which was used to assess the environmental attitude of the participants via a version of the General Environmental Behavior (GEB) scale (Kaiser, 2020). After approximately one week, the respondents who completed the questionnaire were invited for participation in a laboratory session lasting approximately one hour. The laboratory session started with participants seating in cubicles and filling out informed consent. Respondents at first completed an unrelated choice blindness task, and then proceeded to the Implicit Association Test (IAT). These studies, as well as the following ones, were completed via a desktop computer, provided to the participants.

The respondents were first shown all four categories of stimuli used in the IAT, to make sure that respondents know which stimuli corresponds with which category ("good" words, "bad" words, pictures of public transport vehicles and pictures of cars). The respondents were instructed on how to put the stimuli into the correct category, which was done using two keys on a physical keyboard (keys "E" and "I"). The attachment of keys to stimuli starts randomly for each respondent, but switches in the same way. For better understanding, the description of each block in later text is not general, but from a possible version of IAT the participants might have had. They are asked to sort the stimuli as fast as possible, but correctly. When the participants put a stimuli into the wrong category, a large red letter "X" appears. They are instructed to put the stimuli into the correct category when this happens. We also told them the test has seven blocks and the instructions are different in each part, to avoid the respondents not reading new instructions.

After the introduction to IAT, participants continue to the first block of trials (a trial represents each time the respondent is shown a new stimuli; a block is a set of trials, with different rules in each block). In each block, the stimuli appear in randomized order.

The first block is a practice block, which does not enter the analysis. The respondents are asked to put shown stimuli into the correct category, they press “E” when shown a picture of public transport and “I” when shown a picture of a car. This block contains 20 trials.

The second block is also a practice block. The respondents are now asked to press “E” when shown a bad word and “I” when shown a good word. This block has 20 trials.

The third block is also a practice block. The respondents are now asked to press “E” when shown a bad word or public transport, and to press “I” when shown a good word or a car. This block has 20 trials.

The fourth block is a test block, which enters the analysis. The rules are the same as in the third block, but there are 40 trials.

The fifth block is another practice block. This block is the same as the first one, but the rules are reversed (the respondents press “E” when shown a car, “I” when shown public transport). It has 40 trials.

The sixth block is the last practice block, where participants are asked to press “E” when shown a bad word or a car, and to press “I” when shown a good word or public transport. This block has 20 trials.

The seventh block is the final test block, which enters the analysis. The rules are the same as in the sixth block, but there are 40 trials.

In contrast to the pilot study, the respondents were not shown their average response times, nor their D-score and its interpretation. Upon completing the Implicit Association Test, respondents continued with two more unrelated studies, consisting of study of Perceived morality of actors’ behavior and environmental attitude, a Moral Foundation Questionnaire and then a product choice task.

The product choice task consisted of 36 trials, where in each trial, participants selected a product from a pair of products that they would prefer to obtain. For each of 16 grocery product types (ground coffee, coffee beans, milk chocolate, dark chocolate, dark chocolate with high cocoa content, milk chocolate with hazelnuts, green loose tea, selection of black tea in bags, black tea in bags, green tea in bags, müsli bar, fruit bar, dried dates, cashews, apple juice, orange juice), one product available on the market that had an organic label was chosen (i.e., a green option), one conventional product with the same or slightly smaller packaging size (weight) that was cheaper than the green option (low-cost conventional

option), and one conventional product with the same or slightly larger packaging size (weight) than the green option and with a higher price than the green option (high-cost conventional option). Products were displayed side by side (with sides randomized) in product pairs. Each product was represented by a picture, information about package size (i.e., weight or volume), and the market price of the product. Product information was adopted from the web pages of retailers.

After a debriefing, a reward of 200 CZK was awarded to participants who completed all studies, small gifts were also given to randomly selected respondents.

3.2.4 Analysis

Firstly, the data exclusion criteria were established. Data from participants from whom it would have been impossible to estimate their explicit environmental attitude level because they will provide only extreme answers (the attitude level of such individuals lies between the magnitude of the difficulty of the most difficult item on the scale and infinity). Only valid trials from the Implicit Association Test would enter the analysis; the deletion was set for trials with latencies smaller than 350 ms or larger than 10,000 ms (Sabin et al., 2012), or participants with more than 30% of invalid IAT trials (Sabin et al., 2012).

The IAT output was response time respondents had when shown a combination of certain stimuli in milliseconds. The time is an average of response times respondents had when sorting each stimuli in test blocks 4 and 7. For further analysis, the D-score was calculated (the difference between the averages of test blocks divided by the standard deviation of latencies across both test blocks; Greenwald et al., 2003).

To find a relationship between the implicit and explicit attitude, Spearman's rank-order correlation was used between explicit environmental attitude and implicit attitude toward personal car transportation.

To assess whether implicit and explicit attitudes predict product choice, Spearman's rank-order correlations were conducted between each attitude measure and the number of green products chosen to first find a relationship between them. To further explore these relationships, a linear regression analysis was performed with the total number of green products selected as the dependent variable and both implicit and explicit attitudes as independent variables.

4. RESULTS

4.1 Results of the Pilot Study

Spearman's rank correlations were computed between the variables (reported in Table 1). A statistically significant Spearman's rank correlation was found between implicit attitudes towards meat products and self-reported meat consumption ($r_s = .49, p = .008$). A statistically significant correlation was also found between the implicit attitude towards meat or vegetarian products and explicit dietary preference ($r_s = .41$, $p = .029$). In addition, the Shapiro-Wilk test was used to assess the normal distribution of the variables because of the small sample, which confirmed their normal distribution.

The results of the pilot study were surprising, mainly since the study did not have many respondents and it was predicted that at least 198 respondents would be needed to have an 80% chance to find a significant effect, and the analysis was performed on a final sample of 28 participants. The results suggest that there is a monotonic relationship between both implicit attitude towards meat products and self-reported meat consumption; and implicit attitude towards meat products and explicit dietary preference.

Table 1

Correlations between Implicit attitudes towards meat and Explicit meat consumption frequency or Explicit meat preference (Spearman's rank correlations).

Independent variable	Dependent variable	r_s	p
IAT meat	Meat consumption	.49	.008
IAT meat	Meat preference	.41	.029

Note. $N = 28$. All tests were two-tailed. Shapiro-Wilk test indicated normal distribution of the variables. r_s stands for Spearman's rank correlation coefficient. *IAT meat* refers to the Implicit Association Test measuring implicit attitude towards meat. *Meat consumption* refers to the frequency scale of meat consumption of participants. *Meat preference* refers to the explicit dietary preference of meat.

4.2 Results of the Main Study

A total of 15,840 trials was recorded (80 trials multiplied by 198 participants) in the Implicit Association Test. 11 valid trials with latencies smaller than 350 ms or larger than 10,000 ms were excluded (Sabin et al., 2012; there were max. 2 invalid trials per participant, so no participants were excluded) for a total of 15,829 valid trials. No respondents provided only extreme answers in the explicit attitude questionnaire, so the final sample of 198 participants entered the analysis ($N = 198$).

The Rasch-calibrated scale of environmental attitude that combined behavioral and evaluative items had an excellent internal consistency validity ($\alpha = .88$), and a good separation reliability ($rel = .79$).

Next, based on the difference between average person-level latencies in good-personal car vs. bad-personal car association normalized by standard deviation of latencies, the D score (Greenwald et al., 2003; or D statistics) for each participant was computed ($M = 0.11$, $SD = 0.45$).

Spearman's rank correlations were computed between the variables (reported in Table 2). As expected, a small but statistically significant negative Spearman's rank correlation was found between positive implicit attitude towards car use and explicit pro-environmental attitude ($r_s = -.17$, $p = .036$). Note that the association between implicit attitude towards car use and the subset of items from the explicit scale that measured attitude to environmental car use was essentially the same and also statistically significant ($r_s = -.17$, $p = .015$). There was a negligible and statistically insignificant association between implicit attitude to transportation and the number of green products that participants selected ($r_s = -.09$, $p = .233$). However, as expected, there was a moderately sized association between explicit environmental attitude (GEB scale) and the number of green products selected ($r_s = .38$, $p < .001$).

Table 2

Correlations between Implicit attitudes towards car use and Explicit pro-environmental attitudes or Green product preferences; Explicit pro-environmental attitudes and Green product preferences (Spearman's rank correlations).

Independent variable	Dependent variable	r_s	p
IAT car	GEB	-.17	.036
IAT car	GEB transport	-.17	.015
IAT car	Product choice	-.09	.233
GEB	Product choice	.38	< .001

Note. N = 198. All tests were two-tailed. r_s stands for Spearman's rank correlation coefficient. *IAT car* refers to the Implicit Association Test measuring implicit attitude towards transportation. *GEB* refers to the adopted General Ecological Behavior scale measuring explicit environmental attitude. *GEB transport* is the subset of sustainable transport related items from the GEB scale. *Product choice* refers to the number of green products that participants selected in the product choice task.

The results of the previous analysis were replicated when the number of green products chosen by each participant on a person's explicit environmental attitude and implicit attitude to transportation were regressed (reported in Table 3). Explicit attitude had a positive effect on the number of chosen green products (B = 1.82, SE = 0.34, p < .001). However, the implicit attitude had no effect on the number of chosen green products (B = -0.33, SE = 0.64, p = .620).

Table 3

Effect of Implicit attitudes towards car use and Explicit pro-environmental attitudes on Number of green products selected (Linear regression).

Independent variable	*B*	*SE*	*p*
GEB	1.82	0.34	< .001
IAT car	-0.33	0.64	.620

Note. $R^2 = 0.136$; $N = 198$. *B* stands for unstandardized beta, *SE* stands for standard error. *GEB* refers to the adopted General Ecological Behavior scale measuring explicit environmental attitude. *IAT car* refers to the Implicit Association Test measuring implicit attitude towards transportation.

5. DISCUSSION

This thesis examined the relationship between implicit environmental attitudes, specific pro-environmental behavior and environmental attitudes. More specifically, this work aimed to create a better understanding of the validity of implicit measures of environmental attitude and implicit measures and attitudes in general.

In the first phase, the pilot study explored whether implicit attitudes towards meat were associated with explicit dietary preferences (i.e., meat or non-meat products) and self-reported meat consumption frequency. A moderate correlation was found between implicit attitude and explicit dietary preference, as well as implicit attitude and explicit meat consumption frequency. This result attested to criterion validity of the implicit attitude measure.

Secondly, to expand on the pilot study with small sample size, the main study managed to find a relationship between implicit attitude towards transportation and explicit environmental attitude or self-reported product preference (i.e., conventional or green product). A weak, but statistically significant correlation was found between the implicit attitude and explicit environmental attitude. No relationship was found between the implicit attitude and green product preference. The results align with theoretical expectations and

prior research, as they suggest that the implicit measure has low criterion validity and low predictive validity in the environmental domain.

5.1 Implicit Environmental Attitudes

Several previous studies have examined the relationship between implicit and explicit environmental attitudes (e.g., meta-analysis; Fiorenza et al., 2023), however, in many cases, no relationship was found (e.g. McGuire & Beattie, 2019; Piskóti, 2015; Sánchez et al., 2016; Steiner et al., 2018). In contrast, in this work, I found the theoretically expected relationship between the implicit environmental attitude (towards food) and the explicit environmental attitude in the pilot study, as well as implicit environmental attitude (towards transportation) and explicit environmental attitude in the main study, similar to a few other studies (e.g. Levine & Strube, 2012; Panzone et al., 2016; Schultz & Tabanico, 2007). While the outcome of the pilot study suggested a moderate monotonic relationship between the implicit and explicit attitude, the main study proved the theoretical expectations of this thesis when only a weak, yet statistically significant monotonic relationship was found between the implicit and explicit attitudes. The results suggest that individuals with stronger positive implicit attitudes towards sustainable transportation tend to have a more pro-environmental explicit attitude. While the effect size is small, this aligns with prior findings in general implicit attitude research, which often shows rather modest correlations between implicit and explicit attitudes due to the different cognitive systems the measures examine (Greenwald et al., 2009). The results suggest that with a well-designed IAT, a certain type of implicit environmental attitude can be captured.

It is possible that the stimuli used in the pilot study were more significant or relevant to the participants, which would have enhanced the sensitivity of the IAT. Alternatively, cultural or sample-specific factors may have contributed to the stronger correlations than correlations observed in previous studies. The usage of the General Ecological Behavior scale (Kaiser, 2020) in the main study might have played a significant role for the results. The GEB is a validated instrument focused on behavior that captures ecological behaviors rather than abstract values or opinions, and it is rarely used in combination with the Implicit Association Test. The inclusion of this measure may have enhanced the characteristics of the explicit attitudes, enabling the detection of a relationship that often remains obscured when tools less focused on behavior are used. The ability to detect a weak, but statistically

significant correlation between implicit and explicit attitudes in the main study may also be attributed to the methodological alignment of the two measures. The IAT used was specifically designed to assess attitudes towards sustainable transport, and explicit attitudes were measured using the GEB scale, which includes transport related actions. This overlap, combined with a well-designed IAT, may have enhanced construct validity and increased the sensitivity needed to reveal subtle relationships that often remain undetected in prior research.

To further explore the role of domain alignment, an additional analysis was conducted using only the items related to transportation from the GEB scale (Explicit attitude towards sustainable transportation). Interestingly, the correlation between the implicit attitude towards transportation and the transport-specific GEB items was nearly identical to the correlation with the full GEB scale. This suggests that the relationship between implicit environmental attitudes and explicit environmental attitudes is not driven solely by a thematic overlap, but may reflect a broader implicit environmental orientation. It also supports the internal coherence of the GEB scale, indicating that individuals who show pro-environmental automatic associations in one domain (e.g., transport) may also engage in a wider range of ecological behaviors. Thus, while domain alignment and careful IAT design probably helped to detect the link between the implicit and explicit attitudes, the findings could suggest a broader connection between implicit attitudes and environmentally responsible behavior.

Overall, conclusions regarding the implicit attitudes are limited, as there is an ongoing debate regarding the whole implicit theorizing. The debate is also regarding whether implicit attitudes truly operate unconsciously, therefore the implicit definitions are seen as problematic. To discuss the problematic definitions and provide a clearer conclusion for the results of this study, future studies should observe the unconsciousness factor. This would be possible by asking the participants to predict the outcome of their Implicit Association Test. The results of comparing the prediction and the IAT could contribute to the ongoing discussion between procedural and functional views of implicit attitudes, and help clarify whether implicit attitudes are actually unconscious or not.

5.2 Deliberate and Non-deliberate Behavior

Furthermore, no relationship was found between implicit attitudes and the product choice task in the main study, specifically the number of green products selected. This finding

indicates that implicit environmental attitudes may not directly predict environmentally responsible consumer behavior in this context. On the other hand, a moderate relationship was found between explicit environmental attitudes and green consumer choices, indicating that individuals who self-report stronger environmental values tend to make more environmentally friendly purchasing decisions. This relationship was further confirmed via regression analysis, which indicated that explicit attitudes significantly predicted the number of green products chosen, while implicit attitudes had no significant predictive value. These findings reinforce the dual-process perspective (model of dual-attitudes, Wilson et al., 2000): while implicit attitudes may reflect automatic evaluations, explicit attitudes appear to be more closely tied to deliberate behavioral intentions and decisions. This is consistent with theoretical frameworks suggesting that explicit attitudes are more predictive of controlled behaviors, such as product selection tasks, whereas implicit attitudes may be more predictive of spontaneous or non-deliberate behaviors (Perugini, 2005; for environmental domain, see, e.g., Songa et al., 2019; Spence & Townsend, 2007).

5.3 Theoretical and Practical Implications of the Thesis

The results of this thesis support the idea that implicit and explicit attitudes are related, but distinct concepts, which is yet to be established in the environmental domain. The weak correlation found between implicit environmental attitudes and explicit environmental attitudes is consistent with dual-process theories, which suggest that implicit attitudes reflect automatic reactions, while explicit attitudes are based on conscious thinking. The fact that the implicit attitude towards transportation showed an almost identical correlation with both the full GEB and with only the transport-related items suggests that implicit attitudes in one area, in this case transportation, may reflect a broader environmental attitude, not just a domain-specific attitude. This challenges the assumption that only closely matched implicit and explicit measures can be meaningfully compared. Many past studies did not find correlations between implicit and explicit attitudes, possibly because they used general or abstract measures of explicit attitudes. When using the GEB scale, which focuses on specific environmental behaviors, this study was able to detect a relationship. This suggests that using tools focused on behavior could improve the validity of implicit attitude research.

The finding that explicit attitudes predicted green product choices, while implicit attitudes did not, suggests that efforts to change consumer behavior should focus on influencing

people's conscious environmental values. Pro-environmental education, marketing and green policies might be more effective if they target explicit beliefs and encourage deliberate decision-making. At the same time, implicit attitudes might still be important in situations where decisions are made non-deliberately. Although this study did not find a link between implicit attitudes and consumer behavior, future research should look more at spontaneous or emotional decisions, where implicit attitudes may have more influence. Future studies should further explore the usage of both implicit and explicit measures when studying environmental attitudes. Each gives different information, and together they can provide a broader picture of how people think and behave in relation to the environment.

5.4 Limitations

There are multiple limitations this study has. Firstly, the sample size of the pilot study was small, and the convenience sampling resulted in a younger sample of mostly university students which limits the generalizability of the findings. Even though the convenience sample of the main study was larger and diverse in its characteristics, the sample may still not reflect broader population, as it is possible that it consisted of participants with similar backgrounds.

Another potential limitation concerns the length of the main study questionnaire. Since the study was part of a longer session involving multiple measures, participants may have experienced fatigue or reduced concentration. This could have affected the quality or consistency of responses, especially the Implicit Association Test, which required sustained attention, but possibly also the GEB and the product choice task. While no clear evidence of this was observed, the possibility of decreased response accuracy due to cognitive overload cannot be ruled out. This also complicates comparing the main study with the pilot study that was much shorter, which could have also contributed to the strong correlations found.

All explicit measures used in the study, including the GEB scale and self-reported dietary or consumer preferences, were based on self-reporting. Because of that, they may be subject to various biases, including social desirability, self-perception inaccuracies, and recall bias, which could affect the reliability of the explicit attitude data.

The implicit method poses quite a few limitations for this study. The Implicit Association Test relies on the D-score, which assumes equal contributions from both latency components, possibly resulting in inaccurate or incorrect data. Same as the explicit methods,

the IAT could have been subject to deliberate faking. However, there is no evidence suggesting that any of the participants deliberately faked their responses, and the participants of the main study all received a reward regardless of results. The participants of the main study were also not shown the result of the IAT, which could have encouraged some participants to attempt faking.

Moreover, the choice of stimuli in the IAT could also pose some limitations. Especially the main study, which used photos of real vehicles. This could have resulted in inaccurate results, as some participants might have faster responses for a certain type of vehicle over another, not necessarily because of the environmental connection (e.g., someone might have a faster response time when shown a sports car and a positive word, over when shown a boat and a positive word, because they are afraid of deep sees). The choice of using pictograms as stimuli in the pilot might have been perceived as more neutral for some participants, which could have influenced the results. The choice of words used as stimuli could be another possible factor influencing the results. However, the order in which the stimuli were presented was random in both studies and the number of the stimuli could have helped lower this possible effect.

While it may also be an advantage for validity, another limitation involves the differences between the Implicit Association Tests used in the pilot and main studies. The IATs focused on different domains, meat consumption in the pilot study and transportation in the main study, which complicates direct comparison of the results. The set of words was the same for both studies, but the main study used two additional words per category. Additionally, there were minor differences in the number of trials in some IAT blocks. Although these variations are relatively small, they may have influenced task difficulty, participant engagement, or measurement sensitivity, and should be considered when interpreting the results.

Overall, conclusions regarding the implicit attitudes are limited, as there is an ongoing debate regarding the whole implicit theorizing. The debate is also regarding whether implicit attitudes truly operate unconsciously, therefore the implicit definitions are seen as problematic. To discuss the problematic definitions and provide a clearer conclusion for the results of this study, future studies should observe the unconsciousness factor. This would be possible by asking the participants to predict the outcome of their Implicit Association Test. The results of comparing the prediction and the IAT could contribute to the ongoing

discussion between procedural and functional views of implicit attitudes, and help clarify whether implicit attitudes are actually unconscious or not.

The next limitation is that the product choice task likely does not accurately reflect a real life scenario. Even though some participants were randomly selected to receive a product they had preferred, which added an element of real-world consequence, it still occurred in an artificial setting on a computer. The choice was always only between two products, which is lower than the usual amount of options in a supermarket. Another problem could be the familiarity of the products, which could have resulted in a preference solely based on the participants taste. There was no financial cost or long-term commitment involved in the choices, so the task may not fully reflect actual consumer decision-making.

Lastly, the different setting of the pilot study and the main study provide another potential limitation. While the main study was conducted in a laboratory setting with controlled conditions, the pilot study was carried out online. This introduces variability in the environments of participants, such as differences in distractions, device types or screen sizes, which may have influenced performance on the IAT or even self-report accuracy. Some participants could have also been familiar with the settings of the laboratory, while others have not. The different settings could help explain the stronger correlations found in the pilot study, but they complicate direct comparisons between the two studies.

CONCLUSION

The goal of this thesis was to explore the relationship between implicit and explicit environmental attitudes, in order to assess the use of implicit measures in the environmental domain. The main results of this thesis showed that individuals with stronger positive implicit attitudes towards sustainable transportation tend to have a more pro-environmental explicit attitude. Moreover, no relationship was found between the implicit attitude and product preference, while a relationship was found between the explicit attitude and product preference.

This thesis shows that a certain type of environmental attitude can be captured by an implicit measure, specifically the Implicit Association Test. The study also supports the idea that explicit environmental attitudes are more predictive of deliberate behaviors, such as product choice tasks, whereas implicit attitudes could potentially be more predictive of spontaneous behaviors. The effects of implicit attitudes on non-deliberate behaviors should be further examined. The findings highlight the potential importance of methodological alignment between implicit and explicit measures when examining relationships between environmental attitudes. In future research, it would be ideal to further explore the unconsciousness of implicit attitudes, to help assess the practical implications of implicit research. In conclusion, the findings help to establish the use of implicit measures in the environmental domain, which could help explain patterns of ecological and non-ecological behavior in society.

SUMMARY

Cílem této práce bylo prozkoumat vztah mezi implicitními a explicitními environmentálními postoji, aby bylo možné posoudit využití implicitních mír v environmentální oblasti. Hlavní výsledky této práce ukázaly, že jedinci se silnějšími pozitivními implicitními postoji k udržitelné dopravě mají tendenci mít více proenvironmentální explicitní postoje. Dále nebyl nalezen žádný vztah mezi implicitním postojem a preferencí produktu, zatímco mezi explicitním postojem a preferencí produktu byl vztah nalezen.

Tato práce ukazuje, že pomocí implicitní míry, konkrétně testu implicitních asociací lze zachytit určitý typ environmentálního postoje. Studie také podporuje koncepci, že explicitní

environmentální postoje lépe predikují záměrné chování, jako jsou úkoly týkající se výběru produktu, zatímco implicitní postoje by mohly být potenciálně více prediktivní pro spontánní chování. Vliv implicitních postojů na jiné, než záměrné chování by měl být dále zkoumán. Zjištění zdůrazňují potenciální důležitost metodického souladu mezi implicitními a explicitními mírami při zjišťování vztahů mezi environmentálními postoji. V budoucím výzkumu by bylo ideální dále zkoumat, zda jsou implicitní postoje opravdu nevědomé, což by pomohlo posoudit praktické důsledky implicitního výzkumu. Závěrem lze říci, že tato zjištění pomáhají při stanovení využití implicitních mír v environmentální oblasti, což by mohlo pomoci vysvětlit vzorce ekologického a neekologického chování ve společnosti.

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List of Appendices

APPENDICES

Appendix no. 1: SZZ Sociologie

Vybraná témata k okruhům SZZ ze Sociologie

Okruh 2: POJMY

Klíčové slovo: Klimatická změna

Okruh 4: PROCESY

Klíčové slovo: Sociální změna

Okruh 5: IDENTITY

Klíčové slovo: Spotřebitelská

Seznam literatury ke SZZ ze Sociologie

1. Dietz, T., Shwom, R. L., & Whitley, C. T. (2020). Climate Change and Society. *Annual Review of Sociology*, *46*(Volume 46, 2020), 135–158. https://doi.org/10.1146/annurev-soc-121919-054614
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5. Sassateliová, R. (2014). Sociologie spotřeby: Jednání, distinkce a identita. In *P. Zahrádka (Ed.), Spotřební kultura: Historie, teorie a výzkum* (Vyd. 1). Academia.

Appendix no. 2: SZZ Metodologie

Vybraná témata k okruhům SZZ z Metodologie

Okruh 1: Teoretická východiska výzkumu

Téma: Kvantitativní výzkum: Měření v sociologii, jejich charakteristika a kritika

Okruh 2: Příprava a organizace výzkumu

Téma: Kvantitativní výzkum: Research design (strategie výzkumu, kauzalita a korelace)

Okruh 3: Vytváření a sběr dat

Téma: Kvantitativní výzkum: Metody sběru dat (CAWI, CATI, PAPI). Online dotazování. Online panely a jejich kritika.

Okruh 4: Analýza dat

Téma: Kvantitativní výzkum: Příprava dat pro analýzu (transformace a čištění)

Okruh 5: Reflexivita, etika a prezentace výzkumu

Téma: Kvantitativní výzkum: Ohrožení validity a reliability ve kvantitativním výzkumu

Seznam literatury ke SZZ z Metodologie

1. Jeřábek, H. (1992). Uspořádání výzkumu. Typy výzkumných projektů. In *Úvod do sociologického výzkumu: Skripta pro posl. Fak. Sociálních věd Univ. Karlovy* (1. vyd, pp. 46-53.). Karolinum.
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3. Bronner, F., & Kuijlen, T. (2007). The Live or Digital Interviewer—A Comparison between CASI, CAPI and CATI with Respect to Differences in Response Behaviour.

International Journal of Market Research, *49*(2), 167–190. https://doi.org/10.1177/147078530704900204

4. Vodáková, A. (1972). Kategorie validity. *Sociologický Časopis / Czech Sociological Review*, *8*(4), 425–435.
5. Soukup, P., Rabušic, L., & Mareš, P. (2023). Kapitola 6: Úpravy proměnných a příbuzné procedury. In *Statistická analýza sociálněvědních dat v R* (1. vydání, pp. 187-210.). Masarykova univerzita.

Appendix no. 3: SZZ Studia současných společností

Téma SZZ ze specializace Studia současných společností

Téma: Klimatická změna a chování spotřebitelů

Navazuje na předmět/y: Společnost a spotřeba

Seznam literatury ke SSZ ze specializace Studia současných společností

1. Beattie, G., & McGuire, L. (2016). Consumption and climate change: Why we say one thing but do another in the face of our greatest threat. *Semiotica*, *2016*(213), 493–538. https://doi.org/10.1515/sem-2015-0109
2. Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, *8*(3), 239–260. https://doi.org/10.1080/13504620220145401
3. Vermeir, I., & Verbeke, W. (2006). Sustainable Food Consumption: Exploring the Consumer "Attitude – Behavioral Intention" Gap. *Journal of Agricultural and Environmental Ethics*, *19*(2), 169–194. https://doi.org/10.1007/s10806-005-5485-3
4. McGuire, L., & Beattie, G. (2019). Talking green and acting green are two different things: An experimental investigation of the relationship between implicit and explicit attitudes and low carbon consumer choice. *Semiotica*, *2019*(227), 99–125. https://doi.org/10.1515/sem-2017-0138
5. Sassateliová, R. (2014). Sociologie spotřeby: Jednání, distinkce a identita. In *P. Zahrádka (Ed.), Spotřební kultura: Historie, teorie a výzkum* (Vyd. 1). Academia.

Appendix no. 4: Teze bakalářské práce

Projekt bakalářské práce

Jméno a příjmení studujícího: Tadeáš Turek

Studijní program: Sociologie (B0314A250005)

Předpokládaný název práce: Validita implicitních environmentálních postojů

Předpokládaný název práce v angličtině: Validity of implicit measures of environmental attitudes

Klíčová slova: implicitní míry, explicitní míry, test implicitních asociací (IAT), environmentální postoje

Klíčová slova v angličtině: implicit measures, explicit measures, implicit association test (IAT), environmental attitudes

Vedoucí práce: Mgr. Jan Urban, Ph.D.

Námět práce

There are various ways of measuring environmental attitude, most studies use explicit measures, mainly self-report methods – for example the GEB scale (Kaiser, 1998), which has the following scopes of action: Energy saving, Mobility, Waste avoidance, Consumption, Recycling and Social engagement. Another well-used measure is the NEP scale, which also uses general topics of environmental attitude (Dunlap & Van Liere, 1978). However, not all aspects of attitudes in general are accessible via explicit measures, therefore some studies use implicit measures of attitudes, which reveal associative information people might not be conscious of or are unwilling to report (Nosek et al., 2007). The most common method for measuring them is the Implicit Attitudes Test, or IAT for short. It measures the

degree of association between concepts (such as vegetarian products, public transport, black people, or thinness) and various classifications or stereotypes (such as good and bad, or handy and clumsy) (Greenwald et al., 1998).

Outside of environmental attitude research, implicit measures are widely used and successful in terms of predictive and discriminant validity. Many research has been done regarding racial/ethnic bias – a study by McConnell and Leibold found that participants who had stronger negative attitudes towards Black (versus Whites) on the IAT also had stronger negative attitudes on the explicit measures while also having more negative social interactions with Blacks (McConnell & Leibold, 2001). However, in terms of environmental attitudes, this has not been the case. A recent systematic review of IAT-based measures in the environmental domain revealed that implicit and explicit attitudes toward "climate change" appeared unrelated, whereas the relationship between IAT and climatic beliefs was inconsistent across studies (Fiorenza et al., 2023).

These inconsistencies persist in more general research of environmental attitude, which may be issue. Some studies also discuss whether IAT can or cannot predict specific pro-environmental behavior. Results of a recent research (which examined implicit attitudes, explicit attitudes and "green" consumption in supermarket shopping) suggest that implicit attitudes towards environmentally friendly food are not always associated with sustainable consumption (Panzone et al., 2016). Another study examined the relationship between connection with nature and pro-environmental behavior. The results of the study showed that explicit connection with nature was positively correlated with intentional environmental behavior, and implicit connection with nature was positively correlated with spontaneous environmental behavior. However, implicit and explicit connections with nature were independent of each other (Geng et al., 2015). A different study investigated the relationship between explicit and implicit attitudes towards carbon footprint and self-reported environmental behavior and low-carbon choices. Results indicated that self-report attitudes toward carbon footprint were only associated with self-report environmental behavior. However, self-report attitudes were not significantly associated with the choice of low-carbon alternatives in the simulated purchases. Most studies work with self-report environmental attitudes, so the authors suggest that research results may indicate environmental attitude bias. They also did not find a significant association for implicit attitudes, but respondents with strong implicit attitudes towards low-carbon economy chose

more low-carbon items, but only under time pressure. Without time pressure, the opposite trend was found for explicit attitudes (McGuire & Beattie, 2019).

On the contrary, some studies have shown a positive association of explicit and implicit measures. One of them argues that individuals have environmental attitudes based on how much they consider themselves to be part of nature. Its results indicate a moderate association even in a replicated study (Schultz et al., 2004).

Most studies use more general scales of environmental attitude, which may be the reason for low predictive and discriminant validity. In my research, I will focus on a specific area – in other studies of attitude, researchers have focused on more specific things (for example racism towards a specific ethnic group), while environmental attitude is a much broader topic. I will try to discover how implicit measures work in different contexts of generality, by focusing on a specific area (for example food consumption or transport). The purpose of this work is to explore the predictive and discriminant validity of IATs in the context of pro-environmental behavior (to what extent can IAT predict other constructs and how does differ from these construct) and to explain why IATs do not work well in the environmental field.

Předpokládané metody zpracování

We have already done a pilot study on a small sample with some colleagues as a part of *The Practice in Quantitative Research* course. The study had interesting results, showing that explicit environmental attitude significantly correlates with implicit environmental attitude (which other studies failed to prove). I will then do a systematic review of pertinent literature and formulate hypotheses why IAT works or does not work in the environmental field. Next step will be the main study, which will be conducted on a larger sample of participants within a study run by my supervisor. The analytical methods this study will use will be correlational analysis and/or regression analysis.

Etické souvislosti zvažovaného projektu

The study has a negligible risk for participants comparable to Internet browsing. No personal or sensitive data will be collected. All data will be anonymous. The study will be reviewed by the Institutional review board of the Charles University Environment Center.

Orientační seznam literatury

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3. Dunlap, R. E., & Van Liere, K. D. (1978). The "New Environmental Paradigm." *The Journal of Environmental Education*, *9*(4), 10–19. https://doi.org/10.1080/00958964.1978.10801875

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5. Geng, L., Xu, J., Ye, L., Zhou, W., & Zhou, K. (2015). Connections with Nature and Environmental Behaviors. *PLoS ONE*, *10*(5), 1–11. https://doi.org/10.1371/journal.pone.0127247

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11. Milfont, T. L., & Duckitt, J. (2010). The environmental attitudes inventory: A valid and reliable measure to assess the structure of environmental attitudes. *Journal of Environmental Psychology*, *30*(1), 80–94. https://doi.org/10.1016/j.jenvp.2009.09.001

12. Nosek, B. A., Greenwald, A. G., & Banaji, M. R. (2007). The Implicit Association Test at Age 7: A Methodological and Conceptual Review. In *Social psychology and the unconscious: The automaticity of higher mental processes* (pp. 265–292). Psychology Press.

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