A SELF-HEURISTIC BIASES REPRESENTATION OF NOVEL STIMULI

A SELF-HEURISTIC BIASES PERCEPTION AND REPRESENTATION OF NOVEL PEOPLE AND OBJECTS

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Lay Abstract

A highly accessible network of self-representation biases attention and memory in favour of self-relevant information. I investigated how this network mediates representation of *novel people* and *novel objects*, stimulus categories that have received little attention in the social cognitive literature. An implicit test of cognitive association strength (i.e. the Implicit Association Test) revealed that novel self-similar (versus self-dissimilar) people and owned (versus unowned) objects are immediately associated to the self network. The new representations led to perceptual biases through first-order associations, whereby strictly self-relevant information was generalized to self-similar people and owned objects. For instance, even minimal self-similarity to a novel individual biased memory retrieval and reconstruction so that the retrieved information was consistent with the expectation of self-similarity. Together, the findings highlight the ubiquity and automaticity with which self-associations mediate cognitive representations and consequent perceptions of novel people and objects in realistic social situations.

Abstract

A robust associative self network automatically biases attention, memory, and impression formation in a heuristic-like way. This thesis examines whether this self-heuristic underlies association formation of novel person and object representations to the self network and how this structure influences perceptions.

This was tested across three experiments. The first employed an implicit task to assess whether self-similar individuals were represented with greater association strength to self-concept than self-dissimilar individuals. The second used an implicit task to measure whether newly-owned, previously-owned, and unowned objects exhibited different association strength with self-concept. The third determined the impact of minimal self-similarity to another individual, presented either before or after encoding, on memory for encoded information about them.

Results of these experiments support three conclusions summarizing how a self-heuristic affects perceptions of novel stimuli. First, self-relevance automatically biases cognitive representation of novel self-similar (versus self-dissimilar) people and owned (versus unowned) objects, evidenced by stronger implicit association strength between these stimuli and self-concept. Next, this representation biases memory accuracy and errors in favour of heuristic-consistent information, even in contexts of minimal self-similarity. Finally, representation of self-similar people and owned objects relative to the self network biases perception through first-order effects, whereby unrelated concepts sharing an association to the self-network can influence one-another. Owned objects were automatically more favourably evaluated due to a first-order association with self-positivity. Perception of well-established self-knowledge was malleable based on response pairing with first-order associated self-similar or self-dissimilar individuals. Finally, when memory retrieval for self-similar and self-dissimilar individuals failed, responses were predicted based on first-order associated personality traits.

These conclusions provide novel support for the existence of an automatic and ubiquitous self-heuristic that biases representation formation and subsequent perception of novel people and objects.

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List of Abbreviations and Symbols

ANOVA: Analysis of Variance

ERP: Event-Related Potential

IAT: Implicit Association Test

M: Mean

mPFC: Medial Prefrontal Cortex

MSE: Mean Squared Error

NPI: Narcissism Personality Inventory

RT: Reaction Time

SD: Standard Deviation

SE: Standard Error

vmPFC: Ventral Medial Prefrontal Cortex

Preface and Declaration of Academic Achievement

This "sandwich thesis" consists of three empirical chapters of published and unpublished research bookended by General Introduction (Chapters 1) and General Discussion (Chapter 5) chapters. Chapters 2 and 3 are reprints of manuscripts published in peer-reviewed journals. Chapter 4 is a manuscript that is currently in review. I am the first author and my supervisor is my co-author for all three manuscripts; we have two additional co-authors on Chapter 1.

Chapter 2 is a reprint of LeBarr, A.N., Grundy, J.G., Ali, M., & Shedden, J.M. (2016). Conceptual organization of self-representation: A self-similarity heuristic for novel person representations. *Self and Identity, 15*(1), 1-18. I was the lead writer and primary contributor in each phase of the empirical research, which included experimental design, computer programming, data collection and analysis. Joseph Legere assisted by implementing and interpreting the ReAL model.

Chapter 3 is a reprint of LeBarr, A.N., & Shedden, J.M. (2017). Psychological ownership: the implicit association between self and already-owned versus newly-owned objects. *Consciousness & Cognition, 48*(1), 190-197. I was the lead writer and primary contributor to the empirical research, including experimental design, computer programming, data collection and analysis.

Finally, Chapter 4 is a manuscript under review for publication: LeBarr, A.N., & Shedden, J.M. (in review). A self-heuristic biases memory for personality traits of newly-learned individuals. *Consciousness & Cognition.* Manuscript ID: CONCOG_2017_168.

Again, I was lead writer and primary contributor to each research phase, including experimental design, computer programming, data collection and analysis.

Chapter 1: General Introduction

Limited cognitive resources necessitate strategies to help identify and encode salient stimuli from the wealth of information available in everyday life. Heuristics are efficient automatic strategies based on well-practiced cognitive pathways. Self-relevant stimuli are known to be both salient (Bargh, 1982; Berlad & Pratt, 1995; Brédart, Delchambre, & Laureys, 2006; Chen, et al., 2011; Cherry, 1953; Gray, Ambady, Lowenthal, & Deldin, 2004; Markus, 1977; Ninomiya, Onitsuka, Chen, Sato, & Tashiro, 1998; Shapiro, Caldwell, & Sorensen, 1997; Tacikowski & Nowicka, 2010; Turk, et al., 2011; Zhou, et al., 2010) and memorable (Bower & Gilligan, 1979; Klein & Kihlstrom, 1986; Klein & Loftus, 1988; Kuiper & Rogers, 1979; Symons & Johnson, 1997; Turk, Cunningham, & Macrae, 2008; Zhou, et al., 2010), suggesting that a self-heuristic may be employed to sift through the noise of incoming information. In this thesis, I suggest that people employ a self-heuristic when processing self-relevant people and objects, resulting in association of these stimuli to a robust self network. This representation relative to self can then bias attention, memory, and impression formation, among other cognitive processes.

This thesis aims to understand how stimulus self-relevance affects cognitive representation and how this underlying representation produces a self-heuristic. To support this idea, I summarize the evidence that a self-heuristic biases attention, memory, and impression formation. I follow this by presenting a theoretical framework along with a mechanistic discussion of how a self-heuristic would emerge from the underlying cognitive representation of a self network to produce these biases. Subsequently, I summarize the aims of the thesis and its novel contribution, before presenting three empirical chapters that support the core idea.

Attention

Allocation of limited attentional resources is simplified through the use of heuristics. A powerful example of how self-relevant stimuli receive preferential attentional resources is the well-known cocktail party effect. Participants' attention is easily captured by presenting highly self-relevant information such as one's name (Cherry, 1953; Moray, 1959; Shapiro, Caldwell, & Sorenson, 1997). Because of this, speech shadowing is facilitated by self-relevant words presented to the attended ear and interrupted by self-relevant words presented to the unattended ear (Bargh, 1982). Relatedly, one's own name as a flanker in a speeded identification task is more disruptive to performance than other flankers (Brédart, Delchambre, & Laureys, 2006), suggesting that self-relevant stimuli are difficult to ignore. Further supporting this automatic capture of attention, own-name targets in a visual search task lead to faster fixation and fewer saccades than non self-relevant targets (Yang, Wang, Gu, Gao, & Zhao, 2013).

Automatic capture of attention is observed very early in the neural processing of self-relevant information. Event-related potentials (ERP) reflecting early perceptual processing and attentional allocation including the N1 (Liu, He, Rotshtein, & Sui, 2016), N170 (Keyes, Brady, Reilly, & Foxe, 2010), and P2 (Caharel et al., 2002; Keyes, Brady, Reilly, & Foxe, 2010), are all sensitive to processing of one's own face versus other familiar and unfamiliar faces. Many studies also support that the P300, an event-related potential (ERP) reflecting degree of attentional allocation (Gray, et al., 2004; Johnson, 1988), is sensitive to self-relevant stimuli. Increased P300 amplitude is observed when processing autobiographical information (Chen, et al., 2011; Gray, Ambady, Lowenhal, & Deldin, 2004), one's own name or face (Berlad & Pratt, 1995; Ninomiya, et al., 2002; Tacikowski & Nowicka, 2010), personal pronouns (Zhou, et al., 2010), and self-associated objects (Turk, et al., 2011).

Greater attention to self-relevant targets is likely related to enhanced perceptual sensitivity towards these stimuli. For instance, perceptual judgments are facilitated for one's own face versus other faces (Ma & Han, 2010; Sui & Han, 2007). Additionally, pairing of shapes or unfamiliar faces with self versus familiar and unfamiliar others (e.g. triangle-me, circle-Mary) leads to greater perceptual sensitivity towards the self-related stimuli. That is, match/mismatch judgments are both faster and more accurate for self than other pairings (Payne, Tsakiris, & Maister, 2017; Sui, He, & Humphreys, 2012). The automaticity of the self-effect is evident when frequency and stimulus contrast of different shape-person (self versus other) pairings are manipulated. Lowering the frequency of self-shape trials does not produce the same performance detriment observed for low-frequency other-shape pairings (Sui, Sun, Peng, & Humphreys, 2014). When stimulus contrast is lowered, there is also an apparent performance advantage for self-shape over other-shape pairings, suggesting that self-similarity is affecting low-level perception (Sui, Sun, Peng, & Humphreys, 2014).

Subsequent research from Sui, Rotshtein, and Humphreys (2013) has identified that match responses to self-shape pairings are accompanied by increased activations in both the ventro-medial prefrontal cortex (vmPFC), a region believed to underlie self-representation (Jenkins & Mitchell, 2011; Lieberman, 2007), and the left posterior superior temporal sulcus, a region underlying the allocation of social attention (Allison, Puce, & McCarthy, 2000). Drawing on this, a recent theory proposes a self-attention network linking vmPFC with loci of attention (Humphreys & Sui, 2016). By way of this association, attention is believed to be automatically captured by self-relevant information, a bias with clear ecological utility (Cunningham, 2016).

Memory

Memory may also be sensitive to a self-heuristic, at encoding and retrieval stages. Memory is enhanced when words are processed according to their self-relevance compared to their semantic meaning (Bower & Gilligan, 1979; Klein & Loftus, 1988; Rogers, Kuiper & Kirker, 1977; Symons & Johnson, 1997). The benefit of self-referential encoding is believed to emerge from favourable encoding conditions afforded to stimuli that evoke the self network. To begin, self-relevant stimuli automatically capture attention (discussed above), making them more available for subsequent encoding. At encoding, attention to stimulus self-relevance is believed to generate a representation that is associated with the self network (Smith and Zárate, 1992). The association to this established network of well-elaborated information (i.e. superordinate schema; Symons & Johnson, 1997) promotes superior elaboration and organization in memory, and manifests as enhanced retrieval (Conway & Dewhurst, 1995; Klein & Kihlstrom, 1986; Klein & Loftus, 1988; Kuiper & Rogers, 1979; Rogers, Kuiper & Kirker, 1977; Symons & Johnson, 1997).

Most research on self-referential encoding focuses on trait information encoded relative to self. Memory is also superior for items that were recently associated with self, resulting in faster and more accurate item recognition in an old/new task (Allan, Morson, Dixon, Martin, & Cunningham, 2017; Cunningham, Brady-Van den Bos, & Turk, 2011; Cunningham, Turk, Macdonald, & Macrae, 2008; Turk, van Bussel, Waiter, & Macrae, 2011; van den Bos, Cunningham, Conway, & Turk, 2010). These results support the idea that the benefit of self-referential encoding also extends to external objects. Very recent research has also shown that self-referential encoding can enhance memory for novel self-similar individuals in a "by-proxy" effect (Allan, et al., 2017). Participants were exposed to self-similar and self-dissimilar others and asked to "mentalize" ownership by assigning objects to themselves and each individual based on preference. Overall accuracy was no different for objects assigned to self-similar or self-dissimilar characters. However, there was greater source confusion between objects assigned to self and to the self-similar character that was not observed for the self-dissimilar character. Allan and colleagues (2017) believe that despite increasing source confusion, this "by proxy" self-relevant encoding effect provides a functional benefit to social cognition. I argue that the benefit is in the form of a cognitive heuristic engaged when learning about self-similar people, allowing for representation relative to the highly salient and elaborated self network.

Supporting that an association with self benefits memory and in line with studies on attention, mPFC is activated during self-referential encoding (Kelley et al., 2002; Macrae, Moran, Heatherton, Banfield, & Kelley, 2004). Specifically, the degree of activation predicts the strength of the self-referential encoding effect on memory (Macrae, Moran, Heatherton, Banfield, Kelley, 2004; Turk, van Bussel, Waiter, Macrae, 2011). This area is also activated when retrieving information about others, to the degree that they are perceived to be self-similar and therefore associated with the self network (Benoit, Gilbert, Volle, & Burgess, 2010; Bergstrom, Vogelsang, Benoit, and Simons, 2015). This supports that the anchoring of new information to the robust and available self network has clear benefits in memory.

Representation in the automatic Spreading Activation Network

Self-concept biases attention, memory, and impression formation in a heuristic manner, but what is the underlying mechanism for this self-heuristic? The hypothesis is that a robust and ubiquitous self network offers an underlying framework (or "rule of thumb") allowing for heuristic-like processing and organization of novel stimuli. Support for this self network is reviewed, with a more specific discussion of how this hypothesized organization produces effects on attention, memory, and perception.

The self is described by some social psychologists as a central set of dynamic self-schemata (i.e. abstracted past experiences) that act to automatically interpret incoming social information (Markus, 1977; Markus, Smith, & Moreland, 1985; Markus & Wurf, 1987; Rogers, Kuiper, Kirker, 1977; Smith & Zárate, 1992). Traditional connectionist theories (Anderson, 1983; Rumelhart & McClelland, 1986; Smith, 1996) of the spreading activation network, would conceptualize a self network as a wide set of nodes sharing well-elaborated and therefore strong associations that are personally relevant to the individual. Current social cognitive theories take a similar view; the Social

Knowledge Structure is conceptualized as an automatic network of associations between person concepts and attributes that vary in strength. Self-concept is regarded as central because it shares associations with many other concepts in the network (Greenwald, et al., 2002; Kihlstrom & Klein, 1994). Relatedly, neural imaging research suggests that self is an automatically active "default network". The brain region most involved in self-processing, mPFC, has elevated baseline activation at rest that is *deactivated* in tasks that require inhibition of a self-heuristic (Gusnard & Raichle, 2001; Kelley et al., 2002; Raichle, et al., 2001). These theories all converge to describe the self as a robust representation that is automatically engaged for perception of incoming stimuli.

Due to the automatic nature of engagement of self-representation, novel stimuli activating a node associated to self will evoke spreading activations throughout this well-established network, making the stimulus salient and attention-capturing (Kelley et al., 2002). At encoding, novel self-relevant stimuli are incorporated as nodes with associations to a robust self network, leading to better elaboration and organization in memory (Smith & Zárate, 1992). Finally, ownership likely involves the formation of an association between the novel object and the self network, which accounts for why self-owned objects are processed differently than other-owned objects in the motor (Constable, Kritikos, & Bayliss, 2011) and reward systems (Hassall, Silver, Turk, & Krigolson, 2015).

First-order effects on impression formation

The effects discussed thus far are the result of direct associations with self. Spreading activations within a self network should also produce biases that act indirectly through shared first-order associations, in which two concepts are directly associated to self but not associated to one another (Gawronski & Bodenhausen, 2006; Greenwald, et al., 2002; Heider, 1958). For instance, association of a new individual with a specific group membership leads to the generalization of group-related stereotypes to that individual (Greenwald, et al., 2002; Ranganath & Nosek, 2008). Similarly, association of a novel stimulus with self-concept could lead to the generalization of self-attributes to this stimulus (Greenwald, et al., 2002; Gawronski, Bodenhausen, & Becker, 2007). For instance, unfamiliar others are rated as more self-similar on personality attribute judgments than chance would predict (Cadinu & Rothbart, 1996; Ross, Greene, & House, 1977). Some researchers have described this as an anchoring of self-associations onto people and objects sharing association with self (Gawronski, Bodenhausen, & Becker, 2007).

At a network level, researchers believe these effects are produced through the first-order association that results when two unrelated concepts (e.g. person, unrelated attribute) share a common node (i.e. self) (Greenwald, et al., 2002; Gawronski & Bodenhausen, 2006). The associative nature of the network has two important consequences. First, representations related by a first-order association can activate one another through the mediating self-node (Greenwald, et al., 2002; Gawronski & Bodenhausen, 2006). Second, over time, these representations become directly associated with one another due to frequent concurrent activation (Greenwald, et al., 2002; Gawronski & Bodenhausen, 2006; Heider, 1958). This is believed to be the mechanism behind the strong positivity biases observed for self-similar people. In these experiments, self-similar individuals benefit from a halo effect across several trait judgments including (but not limited to) general positivity / likeability, intelligence, morality, and desirability to work with (Byrne, 1961, 1969; Byrne & Griffitt, 1966; Byrne, Griffitt, & Stefaniak, 1967).

With respect to objects, participants tend to inflate both the attractiveness (mere ownership effect: Beggan, 1992; Kim & Johnson, 2014), and the value (endowment effect: Beggan, 1991; Dommer & Swaminathan, 2013; Gawronski, Bodenhausen, & Becker, 2007; Kahneman, Knetsch, & Thaler, 1990, 1991; Maddux et al., 2010; Morewedge, Shu, Gilbert, & Wilson, 2009) of self-owned objects. Implicit measures have revealed that the halo for owned objects is related to self-esteem, whereby self-associations, which are usually positive, are transferred to objects. For instance, ownership leads to elevated implicit object-positivity that correlates with implicit self-positivity (Gawronski, Bodenhausen, & Becker, 2007). Further, implicit positivity is greater for brands associated with self in a categorization task (Perkins & Forehand, 2012; Prestwich, Perugini, Hurling, & Richetin, 2010).

Aims and Framework

The literature suggests that the cognitive structure of self-concept leads to a self-heuristic that biases attention, memory, social perceptions, and other processes and systems. With a specific interest in understanding the underlying cognitive organization, this thesis examines how a self-heuristic mediates the formation of associations between self and novel stimuli and the implications of such associations. This section provides a deeper explanation of this aim, discussing theoretical framework and points of distinction from the extant literature.

To begin, the underlying cognitive organization of self is a specific point of interest here. The (previously discussed) Social Knowledge Structure theory was influential to current understanding of how associations between many social concepts (including self) and attributes give rise to cognitive biases such as stereotypes (Greenwald, et al., 2002). This framework conceptualizes the self network as highly automatic, therefore requiring implicit measurement (De Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009; Gawronski, LeBel, & Peter, 2007; Greenwald, et al., 2002) and has revealed associations between self and valenced attributes (i.e. self-esteem; Greenwald & Farnham, 2000; Karpinski, 2004), self and unvalenced attributes (i.e. self-concept; Greenwald et al., 2002; Greenwald & Farnham, 2000; Nosek, Banaji, & Greenwald, 2002), and self and group concepts (i.e. group membership; Devos & Banaji, 2005; Knowles & Peng, 2005). Other studies have also revealed evidence of implicit associations between self and brands that were consciously or unconsciously paired with self (Perkins & Forehand, 2012; Prestwich, Perugini, Hurling, & Richetin, 2010).

Fewer implicit studies have specifically focused on the association between self and *people* or self and *owned objects*. In direct support of this association, priming tasks reveal that choosing an object to own produces an implicit self-object association that correlates with implicit self-esteem (Gawronski, Bodenhausen, & Becker, 2007). With respect to people, existing associations between self and significant/familiar others (or ingroup) automatically facilitate responding in a speeded attribute-assignment task (Aron,

Aron, Tudor, & Nelson, 1991; Coats, Smith, Claypool, & Banner, 2000; Smith, Coats, & Walling, 1999; Smith & Henry, 1996;). With a few exceptions (e.g. Gawronski, Bodenhausen, & Becker, 2007), there is relatively little evidence of how a self-heuristic operates on cognitive association *formation* for novel people and objects.

The aim of the current research is to add to the literature by investigating how a self-heuristic mediates association-formation between self and novel stimuli and the implications of such associations. This thesis presents 3 empirical data chapters that speak to this aim. Specifically they examine how self-relevant (versus non self-relevant) person and object information is represented relative to self and how this representation affects memory and perceptions.

Flow of the thesis

To begin, Chapter 2 (person-IAT chapter) examines how novel self-similar and self-dissimilar individuals are represented relative to self-concept by using an implicit measure to reveal the underlying cognitive associations. The Implicit Association Test (IAT), which is described in detail in Chapter 2, is used to tap into automatic associations, the processing level at which a heuristic would presumably act. Newly encountered self-similar individuals are immediately more strongly associated with self-concept than self-dissimilar individuals, leading to faster categorization of the self-similar and self-dissimilar characters' personality traits. Moreover, the facilitation effect of the association is bidirectional. Compatible category pairing leads to faster categorization of well-elaborated self-relevant demographic information unrelated to the characters, providing evidence of a first-order association biasing perception.

This research supports the idea that self-concept biases representation of new individuals; the literature reviewed suggests that this should also be the case for objects. In Chapter 3 (object-IAT chapter), the hypothesis that ownership produces robust self-object associations is examined, again using the IAT. As with novel person associations, the self-object association produced by ownership induction is immediate and, interestingly, independent of length of ownership.

Chapter 4 (memory chapter) addresses the consequences of self-heuristics on memory, specifically, how memory for novel self-similar and self-dissimilar individuals is affected by an implicit self-heuristic. Even a minor indicator of self-similarity to another individual leads to superior recognition of their heuristic-consistent traits. In addition, engagement of a self-heuristic increases false-alarms for categorization of information that is unrelated to the initial indicator of self-similarity but consistent with the self-heuristic. This is further evidence that novel self-similar people share an indirect first-order association (via self) with unrelated self-relevant information. Parallels are drawn between this finding and the generalization of stereotypes.

Each chapter in this thesis provides converging evidence supporting the idea that the underlying self network produces a self-heuristic that in turn biases representation of and memory for newly encountered people and objects. Subsequently, the theoretical and practical implications of these findings are elaborated upon in Chapter 5 (General Discussion chapter).

Chapter 2: Conceptual Organization of Self-representation: A Self-similarity Heuristic for Novel Person Representations

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Abstract

Implicit measures have revealed that cognitive representations of familiar individuals share associations with self-concept; however, this has yet to be established for novel individuals. We examined how self-similarity affects representation of information learned about new individuals. A novel version of the implicit association test (IAT), the self-similarity IAT, was developed to estimate the extent to which cognitive representations of new self-similar and self-dissimilar individuals are associated with self-representation. Categorization was faster when the self-similar individual was paired with self, not only for trait words related to the novel individuals, but also for unrelated demographic information pertaining only to self. This provides the first evidence using an implicit task that self-similarity may act as a heuristic for creating representations of new individuals.

Introduction

The self as a construct exerts top-down influence over perception (e.g., Gillihan & Farah, 2005; Markus, 1977; Markus, Smith, & Moreland, 1985). Self-conceptualization derives from one's idiosyncratic experiences with the world, leading to vastly different biases with which to organize incoming information. These biases apply to many types of input, including information acquired through social interactions. The present paper examines the processes through which novel individuals become incorporated into one's cognitive network, hypothesizing that similarity to self serves as a readily available heuristic by which this is done. Most studies that examine how self-concept affects representations of novel individuals have relied on explicit measures (e.g., judgments about the new person), whereas studies using implicit measures have focused on familiar rather than novel individuals. Therefore, the extant literature does not address whether we efficiently incorporate representations of new individuals according to self-similarity or whether the effect of self-similarity extends only to deliberative processing of new individuals; the answer to this question may be revealed by the development and use of an implicit measure of self-representation. To address this idea, we designed a new version of the implicit association test (IAT), the self-similarity IAT, to examine the cognitive associations that develop when we encounter novel individuals that vary in their similarity to self.

Smith and Zárate's (1992) model of social perception suggests that we form unique exemplars to encode others and that these are incorporated into the cognitive network based on similarity to other previously encoded exemplars. Exemplars, in this context, refer to a cognitive representation of a person, including perceptual attributes that have been encoded for that person, which incorporate experiences with the person and biases of the perceiver (Smith & Zárate, 1992). In the present study, we show evidence for a self-heuristic consistent with this model, whereby we readily perceive self-similarity (i.e., having similar personality traits, interests, values, etc.) and automatically represent newly encountered individuals accordingly. We argue that representations of new individuals are organized according to degree of self-similarity; information about self-similar individuals is more strongly associated with one's self-concept than information about self-dissimilar individuals. Importantly, we would like to claim that the self-heuristic leads to a representation of the novel individual that not only affects the strength of association with concepts similar and dissimilar to self, but also affects processing of information that is distinct from that which determines the self-similarity. For example, suppose we know nothing about Kaleem, but we notice that he loves the same indie rock group that we do. This perception of similarity between ourselves and Kaleem may allow us to automatically form an association between representations of self and Kaleem, which could lead us to generalize some of our other attributes to him, even though they are completely unrelated to his music taste or our actual experience with him. This leads to the specific hypothesis tested in this paper, that this organization will bias categorization of information about self and others, including information that is both related and unrelated to the concepts that determine the initial self-similar or self-dissimilar associations.

Our concept of others is strongly related to our sense of self (see Decety & Sommerville, 2003; Markus & Wurf, 1987, for reviews), and therefore self-conceptualization should be viewed as an important mediator in social perceptions. For instance, research aimed at understanding social perceptions involving self and familiar individuals finds a positive correlation between participants' desire to be rated favorably on a personality dimension and the importance of this dimension when making judgments of significant others and acquaintances (Lewicki, 1983). Smith, Coats, and Walling (1999) have proposed a connectionist model of self–other overlap, hypothesizing that direct links exist between self-concept and representation of significant others. The model helps explain the finding that when participants make judgments about whether various traits are self-descriptive, performance is faster if those traits are also characteristic of a significant other (Aron, Aron, Tudor, & Nelson, 1991; Coats, Smith, Claypool, & Banner, 2000; Smith & Henry, 1996). This facilitation effect also occurs when the judgments are about the other instead of about the self; specifically, performance is facilitated on judgments of whether a relationship partner possesses a particular trait when there is a match with self (Smith et al., 1999). The observation of faster responses to these matches (i.e., both self and other have or do not have a trait) has been interpreted as evidence of an implicit process because traits possessed by the significant other affect reaction time for judgments that do not explicitly refer to that significant other. This line of evidence informs us that our cognitive representations of familiar others are structured by their similarity to self; however, it does not shed light on the processes that are involved in the formation of representations of novel individuals.

Studies examining the effect of self-relevant information on social perceptions of unfamiliar or newly encountered individuals have relied on more explicit self-report measures that imply the proposed organization but do not characterize it at a cognitive level. For example, when tasked to acquire information about a new individual, participants who identified strongly with a particular aspect of self-concept or self-schema (e.g., introversion, masculinity) chose to ask questions eliciting information related to that schema (Fong & Markus, 1982). Participants are also more likely to exaggerate differences and therefore make more extreme judgments of others for traits that are considered important to their sense of self (Tajfel & Wilkes, 1964). Moreover, participants who viewed bogus attitudinal questionnaires that were ostensibly completed by other individuals and varied in attitudinal similarity to themselves rated self-similar individuals more positively than self-dissimilar ones over several measures such as likeability, intelligence, morality, and adjustment (Byrne, 1961, 1969; Byrne & Griffitt, 1966; Byrne, Griffitt, & Stefaniak, 1967).

Research on both social projection (i.e., the false consensus effect) and self-anchoring offers additional examples of how self-perceptions may affect social perceptions of unfamiliar others. In both cases, participants hold the egocentric default belief that unfamiliar others are generally more self-similar than would be predicted by chance; favorable self-perceptions are automatically transferred to others in order to enhance self-esteem and feel a sense of belonging (Cadinu & Rothbart, 1996; Ross, Greene, & House, 1977). Interestingly, social projection and self-anchoring effects are most likely to occur for ingroups (which tend to be more associated with the self), implying that not only are we biased to think that others are similar to us, but that this bias is exaggerated when there is an established link between self and that group (Cadinu & Rothbart, 1996; Clement & Krueger, 2002; Krueger & Clement, 1996; Marks & Miller, 1987; Spears & Manstead, 1990; Ward, 1967).

This body of literature leads us to hypothesize that self-similarity acts as an automatic heuristic, so that new individuals are evaluated and categorized based on similarity to self-concept. The representation of the new individuals is biased by perceived similarity to self, leading to differences in strength of association between self and the other. We chose to measure this association implicitly because self-report and explicit judgments arise from conscious reflective processes that are subject to biases (Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005). Further, to our knowledge, no research has used an implicit measure to look at the formation of representations of new individuals. We tested the self-heuristic hypothesis by developing a new version of the IAT, a test of cognitive association strength. The self-similarity IAT allows us to tap into the automatic cognitive associations of interest (Greenwald, McGhee, & Schwartz, 1998).

The IAT is a forced-choice task in which participants must categorize words as quickly and as accurately as possible into pre-specified categories (Greenwald et al., 1998). The categories are manipulated so that two different categories may require the same or different responses (e.g., left versus right key press); thus, any two categories can be paired together by requiring the same response. For example, in a simple categorization task, participants might sort words into categories representing magnitude of sound (e.g., loud/quiet) or size (e.g., large/small). The categories are paired by requiring a left response for words that belong to either the loud or large categories, and a right key response for words that belong to either the quiet or small categories. The relative strength of association between particular concepts is measured by comparing reaction times between paired conditions. For example, categorizing words into the loud category is faster for cognitively compatible category pairings (e.g., loud paired with large) than cognitively incompatible pairings (e.g., loud paired with small).

Our participants performed the self-similarity IAT, in which they categorized demographic words according to self (me/not me) and personality traits belonging to newly encountered individuals (self-similar/self-dissimilar). Self-similarity was manipulated in a previous learning phase, via sets of personality traits associated with each character which included a greater number of matches to self for the self-similar than the self-dissimilar character. The learning phase was meant to capture the implicit knowledge of self-similarity that we gain through brief real-life social encounters, in which traits are not formerly learned, but implicit knowledge of these traits is abstracted from experience. Although the self-similarity manipulation was not revealed to participants, implicit sensitivity to this similarity should affect representations of the new individuals relative to self-concept, consistent with Smith and Zárate (1992). Our first prediction is that the condition in which me and the self-similar character share a response key (and not-me and the self-dissimilar character share a response key) would be cognitively compatible with participants' internal representation, resulting in faster reaction times compared to the opposite (cognitively incompatible) pairing of categories.

Our second prediction is related to the demographic words specifically. It is possible that the self-similarity IAT effect is driven by associations among the trait words only, suggesting that the associations between self and the novel individual are specific to the trait information that was learned, consistent with Aron et al. (1991; Smith et al., 1999). The demographic words, however, are specific to the participant (e.g., first name, last name, date of birth, age, etc.) and are not relevant to the novel individuals. Since the demographic words are highly self-relevant and extremely well-practiced, they produce very fast responses, and one might expect that response times to demographic words would not be a significant contributor to the IAT effect. The model proposed by Smith et al. (1999) does not address this point. If demographic words do contribute to the IAT effect, this suggests that the associations formed due to similarity to a novel individual are not limited to overlapping traits.

Methodology

Participants were told that the main purpose of the experiment was to collect personality information to contribute to a database of student profiles. For each participant, personality traits, photographs, and demographic information were used to generate two profiles for the learning phase (a self-similar character and a self-dissimilar character) and to generate word lists of demographic and personality traits for the IAT. Participants learned about the two characters (learning phase) and were tested on this information (recognition phase). Participants then completed the IAT. The session ended with a questionnaire. Each of these phases is described in detail below.

Participants

A total of 33 undergraduate students (9 males, mean age = 19, SD = 1.32) were recruited from the introductory psychology research course at McMaster University and compensated with course credit. Participants had normal or corrected-to-normal eyesight.

Materials

Demographic Information

A demographic questionnaire was used to collect 16 words belonging to the me category for the IAT (e.g., name, age, phone number, academic program, career aspiration). A corresponding set of 16 words for the not-me category was generated from a list of sample answers that participants confirmed did not describe them.

Personality Traits

We drew our personality-trait words from Anderson's (1968) list of 555 trait words, for which he obtained likeableness ratings from 100 university students. This list is still widely used and his likeableness ratings have been replicated in recent years (e.g., Cartwright, 1997; Fisak, Tantleff-Dunn, & Peterson, 2007; Krienen, Tu, & Buckner, 2010; Mobbs et al., 2009).We reduced the original 555 words to 40 words that were relevant to university student self-concepts and were neutral enough to minimize responding according to social desirability. This was done by selecting the most neutral words (2.25–4.75 mean ratings for likeableness on a seven-point Likert scale), and eliminating additional words rated by at least two of five independent judges to be overly negative or positive, or obscure. Trait words for the three profiles (16 words each) were drawn from this set of 40 neutral trait words as described in the next section (see Figure 1 for list of traits).

Profiles

Participants completed a questionnaire, indicating on a seven-point Likert scale how well each of the 40 personality traits described themselves. The ratings ranged from 1 (this trait describes me very poorly) to 7 (this trait describes me very well). For each participant, we selected traits for the self-profile, self-similar profile, and self-dissimilar profile from this list of 40 traits, sorted by most to least self-descriptive (traits 1–40). To create the participant's self-profile, we used the 16 most self-descriptive traits (traits 1–16). To create the self-dissimilar character's profile, we used the 16 traits that had been rated as least self-descriptive by participants (traits 25–40). To create the self-similar character's profile, we avoided an exact match with the self-profile by selecting only the first eight traits that were chosen for the self-profile (traits 1–8); the remaining traits were the eight next most self-descriptive traits (traits 17–24), which were not included in the self-profile. There was no repetition in traits assigned between the self-similar and self-dissimilar profiles, and between the participant's own and self-dissimilar profiles. Prior to the learning phase, participants were shown the self-profile and confirmed that it was representative of the traits that they possessed.

Participant 2

Which characteristics best describe you?			
	persuasive		perfectionistic
	obedient	x	forward
	sophisticated		excitable
x	thrifty		prideful
	sentimental		impulsive
x	objective	x	conservative
x	mathematical		unpredictable
	meditative	x	blunt
	fearless	x	emotional
	daring		bashful
x	sensitive		restless
	moralistic	x	choosy
	reserved		opportunist
	persistent		theatrical
	meticulous		impressionable
	bold	x	skeptical
	innocent	x	cunning
x	methodical	x	daydreamer
x	nonchalant	x	conventional
	self-contented	x	opinionated

Figure 1. Sample character profile. Each profile included a photo of the character (presented in colour in the experiment), their pseudonym ("Participant 1" or "Participant 2"), and a table listing all 40 personality traits, with X's indicating the 16 traits that best described that character.

Each self-similar and self-dissimilar profile was associated with a front-facing color photo of the character's face. For this purpose, four faces (two male and two female) with a neutral expression were selected from our laboratory database so that we could present faces of the same sex as the participant. One face was associated with the self-similar character's profile and the other with the self-dissimilar character's profile (counterbalanced across participants). During learning, the face was identified by a pseudonym (i.e., Participant 1) and presented along with a list of all 40 personality traits; an "X" marked each of the 16 traits that best described that character (see Figure 1, for example).

Learning Phase

Participants were told they would be learning about real people who had completed the same experiment. In the learning phase, participants studied each character's face and personality-trait profile for three minutes (order of profile presentation was counterbalanced).

After the three-minute study period, a memory test was administered. A photo array of six faces (including the two learned faces and four new faces) and a table listing all 40 personality traits was presented; the task was to (1) select the two learned faces and (2) complete the personality profile for each one by placing an "x" beside each applicable personality trait. Each time the participant failed to reach 100% accuracy, a shortened, one-minute learning phase was repeated. All participants reached 100% accuracy within two to six attempts ($M = 3.42$), demonstrating successful association between the faces and the profiles.

Implicit Association Test

Stimuli

Participants viewed stimuli in a dimly lit room. A chin rest maintained a 90 cm distance from the 19-inch color CRT display (resolution of 1600 x 1200, frame refresh rate = 75 Hz). Presentation experimental software (Version 15.0, www.neuro-bs.com) was used to control stimulus presentation and record responses on a Pentium 4 computer using the Windows XP operating system. Stimuli were presented on a black background; text stimuli were presented in 20-point Helvetica font, with a vertical visual angle of .458 (horizontal visual angle varied with the length of the word). The face photos associated with the self-similar and self-dissimilar characters were used as target faces in the IAT; photographs subtended a visual angle 2.998º wide and 3.758º high. Category labels appeared on the top left versus right sides of the screen (counterbalanced), 2.868º horizontally and 1.438º vertically from the center of the screen. Words to be categorized were presented at screen center. In all blocks, the trait words and the participant 1 (i.e., self-similar) and participant 2 (i.e., self-dissimilar) categories appeared in a different font color (white) than the demographic words and the me and not-me categories (green), to clarify which category pair to use for categorization on a particular trial.

Procedure

Within each block, the relevant category labels and/or photographs remained on the screen for the duration of that block. For example, the me label might be on the left side of the screen, in which case the not-me label would be on the right. Likewise, the participant 1 label with photo might be on the left side of the screen, in which case the participant 2 label with photo would be on the right. On each trial, one word was presented in the center of the screen until a response was made. Participants indicated with a button press, as quickly and accurately as possible, whether the word belonged to the category presented on the left (requiring a left response: “z” key) or right (requiring a right response: “/” key) side of the screen. Demographic words were to be categorized according to the me or not-me categories. Trait words were to be categorized according to the participant 1 (i.e., self-similar) or participant 2 (i.e., self-dissimilar) categories. Accuracy and reaction time for categorization were recorded. Following incorrect responses, a red X appeared above the word, both of which remained on the display until the correct response was selected. The center word was removed from the display upon a correct response; the inter-trial interval was 500 ms.

Practice blocks consisted of 64 trials (32 demographic words presented twice or 32 trait words presented twice, in random order). There were five practice blocks. The first three provided practice with categorizing self-similar and self-dissimilar characters' traits; the characters' photographs and pseudonyms (participant 1 and participant 2) were displayed on the left versus right side of the screen (counterbalanced). The fourth practice block provided practice categorizing the demographic words; the category names me and not-me were displayed on the left versus right sides of the screen (counterbalanced). Participants were given more practice blocks for the trait than demographic information because knowledge of the trait information was new, whereas the demographic information represents a well-practiced and existing categorization. After the fourth practice block, the first experimental block was presented, followed by a fifth practice block (described below), and finally the second experimental block.

The two experimental IAT blocks consisted of 128 trials (32 demographic words and 32 trait words, each presented twice, in random order). Participants sorted both trait and demographic words across four categories, two represented on the left and two on the right side of the screen. There were two possible pairings of categories. One consisted of the self-similar and me categories on one side and the self-dissimilar and not-me categories on the other side (hypothesized compatible pairing). The other consisted of the self-similar and not-me categories on one side and the self-dissimilar and me categories on the other side (hypothesized incompatible pairing). The two category pairings were presented in two separate blocks, with block order and side of the screen of each pairing counterbalanced across participants. Thus for any particular participant, me was paired with the self-similar character in one IAT block, and with the self-dissimilar character in the other IAT block. In between the two experimental IAT blocks, the final practice block was presented to provide practice with the new mapping between the left and right responses for the categories that changed sides in the second IAT block. Table 1 presents a schematic representation of the sequence of blocks, and Figure 2 shows an example of a trial sequence in an experimental IAT block.

Block	**Task**	**Number of trials**	**Left response key category**	**Right response key category**
1, 2, 3	Practice categorizing traits	64	“Participant 1” photo (i.e., self-similar)	“Participant 2” photo (i.e., self-dissimilar)
4	Practice categorizing demographic information	64	“Me”	“Not-me”
5	IAT block 1 categorizing traits and demographic information	128	“Participant 1” and “Me”	“Participant 2” and “Not-me”
6	Practice (response remapping) categorizing demographic information	64	“Not-me”	“Me”
7	IAT block 2 categorizing traits and demographic information	128	“Participant 1” and “Not-me”	“Participant 2” and “Me”

Table 1. Schematic illustrating progression of blocks in the IAT phase.

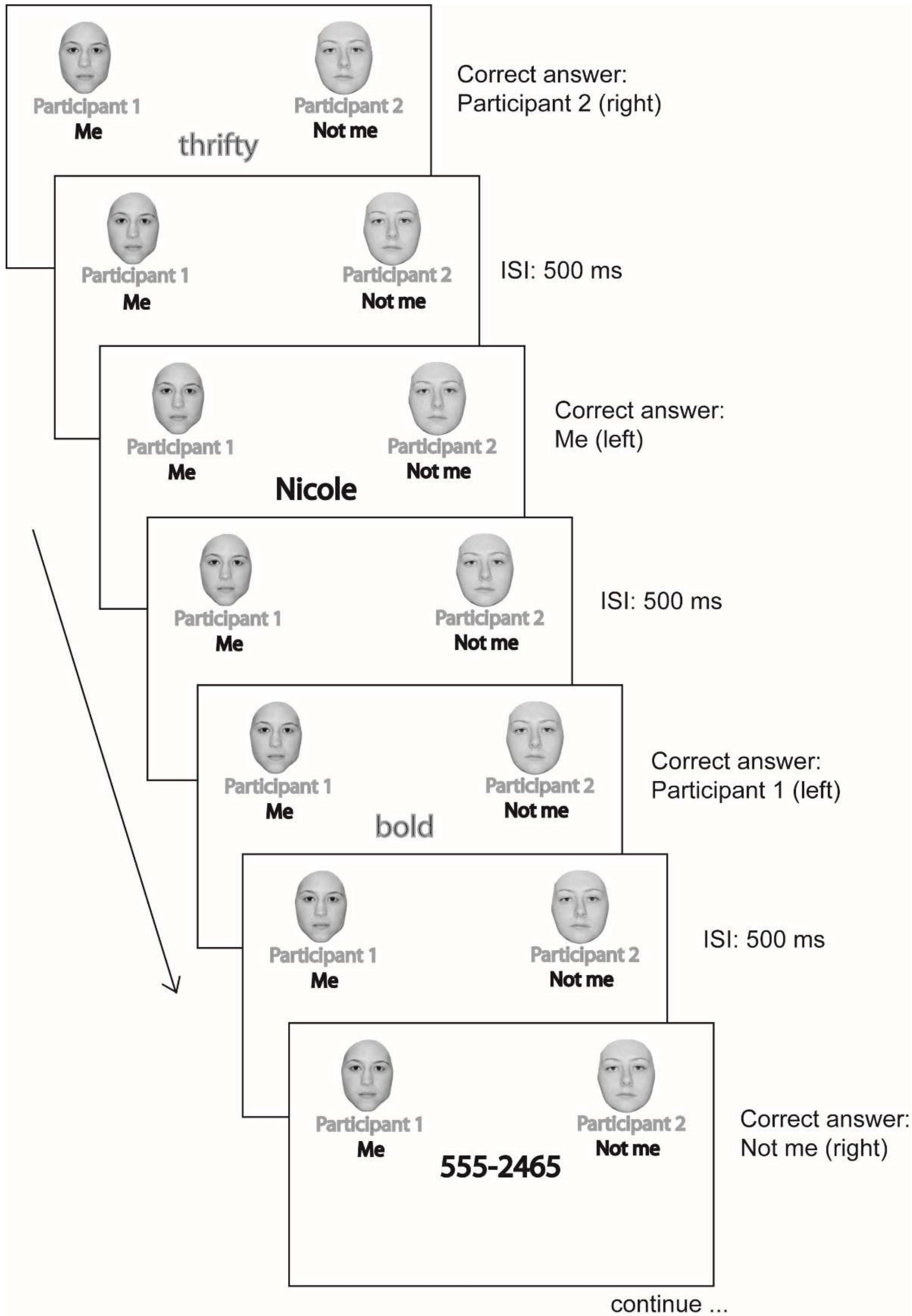

Figure 2. Example trial sequence for IAT block.

Follow-up Questionnaire

In the follow-up questionnaire, participants were asked to indicate which character they liked best, to replicate Byrne's (1969) finding that participants prefer self-similar to self-dissimilar individuals. This ensured that we had created characters that were self-similar and self-dissimilar to the participant. In addition, participants were asked to indicate which of the two characters they would rather (1) meet in person, (2) work with on a task in the lab, and (3) reward with $10. Along with the question asking which character they liked best, these questions were used to generate a composite score, indicating the degree to which participants preferred the self-similar character over the self-dissimilar character in a number of real-life situations. At the end of the questionnaire, participants were also asked to guess the experimental manipulation.

Results

Of the 33 participants, three participants accurately guessed the manipulation and four participants recognized that one of the characters was similar to themselves but felt that it was unrelated to the experiment. These seven participants are included in the data presented here, as removing them from analyses did not alter the results. All reaction-time analyses were conducted on mean values for correct trials for each participant, with a 3 standard deviation outlier cut-off.

IAT Results

We examined the effect of self-similarity on IAT categorization accuracy and reaction time. The category pairing variable is defined as compatible pairing (me paired with the self-similar character, and not-me paired with the self-dissimilar character) versus incompatible pairing (me paired with the self-dissimilar character, and not-me paired with the self-similar character). A 2 x 4 repeated-measures ANOVA tested within-subject factors of IAT category pairing (compatible pairing, incompatible pairing) and word type (self-similar character traits, self-dissimilar character traits, me words, not-me words). Where appropriate, Greenhouse-Geisser correction was applied; we report original degrees of freedom, mean squared error (MSE), and corrected p-values. Where appropriate, the Bonferroni correction for multiple comparisons was applied.

The ANOVA for accuracy data revealed several significant effects. A main effect of IAT category pairing, $F(1, 32) = 7.72$, $MSE = .004$, $p = .009$, showed greater accuracy for the compatible pairing compared to the incompatible pairing. Word type, $F(3, 96) = 38.40$, $MSE = .010$, $p = .001$, and the interaction of IAT category pairing and word type, $F(3, 96) = 3.64$, $MSE = .004$, $p = .037$, were also significant. Paired sample t-tests revealed that accuracy was significantly greater for self-similar character trait words in the compatible compared to the incompatible pairing, $t(32) = 2.73$, $p = .01$, while none of the other comparisons reached statistical significance. Table 2 presents a summary of the accuracy means and standard errors.

Word Type	Compatible pairing	Incompatibl e pairing	Mean difference
"Me"	0.95 (0.01)	0.95 (0.01)	**0 (0.01)**
"Not-me"	0.94 (0.01)	0.94 (0.01)	**0 (0.01)**
"Self-similar"	0.86 (0.02)	0.80 (0.02)	**0.06 (0.02)**
"Self-dissimilar"	0.82 (0.01)	0.80 (0.01)	**0.02 (0.01)**
Mean (all word types)	0.89 (0.004)	0.87 (0.004)	**0.02 (0.01)**

Table 2. Means for proportion accuracy data by IAT pairing and word type (numbers in brackets are within-subject standard errors). Note: Proportion Accuracy: Mean (SE).

The ANOVA for reaction-time data revealed a significant main effect of IAT category pairing, F (1, 32) = 8.48, MSE = 14,931, p = .006, showing faster reaction time for the compatible pairing compared to the incompatible pairing. Word type, F (3, 96) = 102.05, MSE = 16,467, p = .001, was also significant, but there was no significant interaction of IAT category pairing and word type, F (3, 96) = .93, MSE = 4190, p = .411. To further examine word-type differences, paired sample t-tests showed that me words (M = 670.91ms) were categorized faster than not-me (M = 733.92 ms), t (32) = 27.79, p = .001, self-similar (M = 991.19 ms), t (32) = 211.52, p , .001, and self-dissimilar words (M = 957 ms), t (32) = 212.46, p = .001. Not-me words were also categorized faster than self-similar, t (32) = 29.69, p = .001, and self-dissimilar words, t (32) = 29.49, p = .001, which did not significantly differ from one another. This gradient in reaction time likely reflects differential familiarity with these categories. For example, participants are most familiar with the demographic me words (a robust and established category of self-knowledge) and least familiar with the traits possessed by the self-similar and self-dissimilar characters (newly encountered individuals). Table 3 presents a summary of the reaction-time means and standard errors.

Word Type	Compatible pairing	Incompatibl e pairing	Mean difference
"Me"	658 (14)	684 (13)	**-26 (11)**
"Not-me"	714 (15)	754 (11)	**-40 (12)**
"Self-similar"	969 (20)	1014 (23)	**-45 (27)**
"Self-dissimilar"	925 (18)	989 (19)	**-64 (25)**
Mean (IAT effect)	816 (8)	860 (8)	**-44 (26)**

Table 3. Means for reaction time data by IAT pairing and word type (numbers in brackets are within-subject standard errors). Note: Reaction Time (ms): Mean (SE)

We were also interested in how our effect related to explicit measures and found that the size of the IAT effect correlated with character preference, as measured on the follow-up questionnaire. As expected, participants were significantly more likely to prefer the self-similar character than the self-dissimilar character, χ^2 (1) = 8.76, p = .003, replicating Byrne's (1969) preference finding. The degree of this preference effect was positively correlated with the size of the IAT effect for reaction time, r = .398, p = .022.

Several researchers have suggested an alternative scoring method for the IAT (Greenwald, Nosek, & Banaji, 2003; Lane, Banaji, Nosek, & Greenwald, 2007). This method uses the difference score between category pairing conditions (me/dissimilar block minus me/similar block) divided by the inclusive standard deviation to calculate D. Using this method, we calculated D = .34, which was significantly greater than zero, (M = .08, SD = .197), t (32) = 2.37, p = .024, indicating a significant IAT effect consistent with the analyses presented above.

The IAT effect calculation collapses over categories to compare responses in compatible and incompatible blocks. To address our second hypothesis, we analyzed whether word categories contributed differentially to the IAT effect. There are two possibilities: (1) the associations could be directional, so that only the trait words, and not the demographic words, are affected by the compatibility pairing; or (2) the associations could be bidirectional, so that both trait words and the more stable demographic words are affected by the compatibility pairing. The second possibility is most interesting, because it suggests that processing of the highly self-relevant demographic information does not dominate, and that the newly formed representations of the novel individuals can affect processing of self-relevant information. Thus, it is important to ask whether the IAT effect was driven solely by the self-similar/self-dissimilar trait words or also by the me/not me demographic words. We performed a repeated-measures ANOVA comparing the size of the IAT effect (incompatible RT minus compatible RT) across all four word types (me, not me, self-similar, self-dissimilar). We found no significant effect of word type on the size of the IAT effect, $F(3, 96) = .927$, $MSE = 8379$, $p = .431$, supporting the hypothesis that the size of the IAT effect was similar across all four word types. We address this important observation further in the discussion.

Recoding in the IAT

We addressed the recoding interpretation of IAT results that claims that one of the response tasks may be dominant, and that response speed differences are due to response activation conflict, similar to a Stroop task (De Houwer, 2001, 2003; De Houwer, Geldof, & De Bruycker, 2005; De Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009; Fazio & Olson, 2003; Meissner & Rothermund, 2013; Mierke & Klauer, 2001; Rothermund & Wentura, 2001). For example, if the demographic task is dominant, then the words belonging to the trait task might on some trials be categorized according to the me/not-me categories. This would produce faster responses for compatible pairings because trait words describing the self-similar character require the same response key as the demographic me words. In contrast, this strategy would activate an incorrect response for incompatible pairings, therefore producing greater response conflict, leading to slower categorization.

If participants were, in fact, recoding categories in the IAT, we would expect to find an effect of the degree of trait self-relevance on reaction time. Trait words rated as highly self-similar (or self-dissimilar) should be faster to categorize into the me (or not me) category than trait words rated as neutral with respect to self. To address this hypothesis, we examined whether categorization speed was affected by participants' original ratings of the trait words. In each case, we compared traits rated as strongly self-relevant (i.e., strongly self-similar or strongly self-dissimilar) to traits rated neutrally with respect to self. If trait words are categorized according to me/not-me, reaction time should be shorter for strongly self-similar (6–7 rating on scale) or self-dissimilar traits (1–2 rating on scale) compared to weakly self-similar (4–5 rating on scale) or self-dissimilar traits (3–4 rating on scale) for the compatible block. Paired sample t-tests revealed no significant differences in reaction time between strongly self-similar traits and weakly self-similar traits (mean difference = –10.747 ms), $t(31) = 2.251$, $p = .804$, nor between strongly self-dissimilar traits and weakly self-dissimilar traits (mean difference = –15.147 ms), $t(28) = 2.396$, $p = .695$.[1]

As a further test of the recoding hypothesis, we used the ReAL model to estimate variance explained by the recoding parameter (Re) of the model (Meissner & Rothermund, 2013). This is a multinomial processing model that uses correct and incorrect responses in the compatible and incompatible blocks, and takes into account task-repeat vs. task-switching trials, to estimate the contribution of three processes: recoding as described above (Re), evaluative associations based on categories, driven by the compatible and incompatible category pairings (A), and identification based on item labels, driven by the simple match between an item and its category label (L). The ReAL model is most appropriate for a modified IAT, which increases the number of errors; our design did not generate enough errors to test the model for individual participants, therefore we used the RT means. Another limitation to using the ReAL model, as described in Meissner and Rothermund (2013), is that it assumes that associations are directional so that no associations are activated from the trait words to the me/not-me categories. This assumption does not hold for our data; therefore, we modified the model to allow for bi-directional associations. The implementation of the ReAL model on our data provides a non-significant result for Re ($p = .98$), consistent with the other tests we performed above, suggesting that recoding is not a concern.[2]

Additional Analyses

Finally, we investigated two additional issues identified by reviewers. One was whether individual differences in ratings of the traits correlated with the IAT effect. Participants were slightly biased to rate traits as self-relevant ($M = 4.501$, $SD = .069$), $t\ (32) = 7.256$, $p = .001$, and some traits were rated more self-relevant than others, F (39,

1248) = 6.376, MSE = 1.758, $p = .001$. After Bonferroni correction, 6 of the 40 traits significantly differed from the average trait rating; however, there were no significant correlations between the 40 individual trait self-relevance ratings and the size of the IAT. The final analysis ruled out the possibility that the observed IAT effects might be due to differences in memory for self-similar compared to self-dissimilar characters. We ran paired sample t-tests comparing performance on participants' first attempt at the memory task before they were given feedback to correct their errors. There was no significant effect for hits, $t(32) = .072$, $p = .943$, false alarms, $t(32) = 2\ .937$, $p = .356$, and d' sensitivity, $t(29) = 2\ .131$, $p = .897$, nor for the total number of attempts required to reach the 100% accuracy criterion, $t(32) = 2\ .725$, $p = .474$.

Discussion

Previous research suggests that unique self-conceptualizations can bias our perceptions of others, indicating that self may be an important heuristic used in structuring our cognitive representations of the outside world (e.g., Byrne, 1961; Hoyle, 1993; Lewicki, 1983; Markus et al., 1985; Ross et al., 1977). We used a self-similarity IAT to determine whether new representations of others are structured relative to self-concept. Our findings suggest that representations of others relative to self-concept are formed soon after the first encounter and that this process may be considered a default heuristic used in acquiring information about other people. Moreover, the results show that the newly formed associations between self and the self-similar character affect categorization of self-relevant knowledge that shares no overlap with the new individual.

Collectively, the results provide support for the idea that self-similarity is an important mediator in social perceptions.

Participants were introduced to two new individuals who were presented as other students participating in the same study but were actually characters constructed to be self-similar or self-dissimilar to the participant, based on personality traits varying with respect to self-relevance. Participants learned to recognize the newly encountered individuals by studying face photos and personality traits. Following the learning phase, the self-similarity IAT was used to estimate associations of self with the two characters. More specifically, under different category pairing conditions, the self-similarity IAT required categorization of demographic words into me and not-me categories, and categorization of personality-trait words into the newly learned self-similar and self-dissimilar character categories.

Response pairing with the categories me versus not me influenced categorization of the self-similar and self-dissimilar trait words describing the new individuals. Items were categorized faster when self was paired with the self-similar character compared to the self-dissimilar character. Faster reaction time for a category pairing in the IAT represents greater associative strength between those categories (Greenwald et al., 1998). In this case, the IAT effect was sensitive to the cognitive associations established during the learning phase (via trait overlap) between me and the self-similar character versus the self-dissimilar character. This finding is consistent with previous research using other implicit measures, specifically, the facilitation of judgments for trait matches between self and a significant other (or ingroup) (Aron et al., 1991; Coats et al., 2000; Smith & Henry, 1996; Smith et al., 1999). Smith et al. (1999) attributed this effect to the idea that shared traits can proliferate network activations to self-representation in two ways: directly from the trait to self-representation, and indirectly by way of the link between the representations of the significant other (or ingroup) and self.

Importantly, the influence of the category pairing was bidirectional. In addition to the effect on shared traits, we found that categorization of demographic me and not me words was also influenced by the category pairing with self-similar versus self-dissimilar characters. Indeed, we found that me, not-me, self-similar, and self-dissimilar words showed similar-sized reaction time differences between the compatible (me/self-similar character and not-me/self-dissimilar character) and incompatible (me/self-dissimilar character and not-me/self-similar character) pairings, indicating that all four word types contributed to the IAT effect. Note that the demographic words were specific to the participant (e.g., first name, last name, date of birth, hometown, age, etc.) and were unrelated to the newly learned individuals.

It is important to understand why the self-similarity IAT effect was evident not only for traits that are shared between self and the self-similar character, but also for demographic information that was solely self-relevant. We would like to argue that the IAT compatibility effect occurs due to the enhanced association strength between self-concept and the self-similar character representation, and that this representation goes beyond possessing particular traits. Although our findings align with the trait self-relevance judgment tasks, which show facilitation when self and other either both possess or both do not possess a trait (Aron et al., 1991; Coats et al., 2000; Smith & Henry, 1996; Smith et al., 1999), our results also suggest that association between self and newly encountered others can affect processing of other information in the network. Therefore, our implicit measure offers a novel contribution to the literature, indicating that cognitive representation of novel individuals relative to self-concept can lead us to go beyond the information given.

This idea is consistent with literature on self-referencing, whereby simply leading participants to associate self with a particular stimulus results in enhanced positivity toward related stimuli (Gawronski, Bodenhausen, & Becker, 2007; Perkins & Forehand, 2012; Prestwich, Perugini, Hurling, & Richetin, 2010). For instance, when participants completed an IAT block in which they categorized self-relevant stimuli and brand A using one response key and non-self-relevant information and brand B using a second response key, subsequent implicit and explicit measures revealed that they viewed brand A more favorably than brand B (Perkins & Forehand, 2012); the authors theorize that this effect is due to the mere cognitive association between self and the previously unrelated target object. This self-referencing effect is comparable to our observed effect, which is that the similarity between self and other on a few traits affects cognitive associations with other concepts in the network.

Our results suggest that person representations are incorporated into our cognitive networks according to self-similarity, consistent with Smith and Zárate's (1992) model of social perception. Smith and Zárate (1992) hold that representation of an individual as an exemplar in one's cognitive network is based on the perceived similarity of that individual to existing exemplars. Perceptions of similarity are based on the specific dimension that one is attending to at the time of encoding. Most of the participants in our experiment were unaware that the characters varied with respect to self-similarity and yet they were highly sensitive to this manipulation, representing self-similar and self-dissimilar individuals with varying association strength to a self-exemplar. This observation implicates self-relevance as a dimension upon which exemplars are encoded, providing support for Smith and Zárate (1992) model, as well as the finding that social perceptions are generally based on dimensions and traits that participants possess, find desirable, or for which they have expertise (Fong & Markus, 1982; Lewicki, 1983; Markus et al., 1985).

We have shown that implicit associations between self and other influence retrieval of information that is related to the other person, but also information about self that is unrelated to the other person. This finding exemplifies our tendency to use self-similarity as a heuristic to "go beyond the information given" (Andersen, Reznik, & Chen, 1997). Research on the false consensus effect and social projection suggests that participants possess the egocentric default belief that others are more self-similar than they are in reality (Hoyle, 1993; Ross et al., 1977). Interestingly, more recent research has demonstrated that the false consensus effect is more likely to be engaged for judgments of the ingroup than the outgroup (Cadinu & Rothbart, 1996; Clement & Krueger, 2002; Krueger & Clement, 1996; Marks & Miller, 1987; Spears & Manstead, 1990; Ward, 1967). The exaggeration of this bias may occur due to the strong prior link between self and the ingroup, which could drive the projection of unrelated self-relevant traits upon the ingroup. This process resembles the result presented here: that the link between self and the self-similar character facilitates IAT performance even for demographic words that are unrelated to the newly encountered individual. In this way, the false consensus effect may exemplify a downstream consequence of the implicit processes observed in our experiment.

Another link with existing literature relates to an explicit measure that correlated with the self-similarity IAT effect. Specifically, the IAT effect was positively correlated with preference for the self-similar character in a variety of real-life scenarios. When others are already familiar, faster categorization for shared traits in a self-relevance judgment task is mediated by an explicit measure of relationship closeness with the other, which represents the participant's own estimate of how much they overlap with the other (Smith et al., 1999). Even though the participants in our study do not have a relationship with the characters, it may be that character preference offers a similar index of the cognitive association strength between self and newly encountered individuals.

It was important to ensure that the IAT effect was not due to recoding, whereby in the compatible pairing block, the participants could use the me/not-me categories while ignoring the self-similar/self-dissimilar character categories (De Houwer, 2001, 2003; De Houwer et al., 2005, 2009; Fazio & Olson, 2003; Mierke & Klauer, 2001; Rothermund & Wentura, 2001), since traits were by definition related to self. If this were the case, we would expect reaction time to vary based on ratings of trait self-descriptiveness (Markus, 1977). We found no such effect on reaction time when comparing strongly self-similar and -dissimilar traits to weakly self-similar and -dissimilar traits. Support against the recoding hypothesis for the present data is also provided using a multinomial processing tree model (ReAL model; Meissner & Rothermund, 2013), which separates influences from evaluative associations and recoding processes. Therefore, the assumption remains that participants were attentive to all four categories in completing the IAT and that we have not obtained a result confounded by participants' use of the wrong category set for classifying the self-similar and self-dissimilar trait words.

Our study offers a novel use of the IAT to explore associations regarding self-similarity. In Greenwald and colleagues (2002) social knowledge structure, self is central and is linked to various person, group, and attribute concepts (which themselves are interlinked) with varying associative strengths. The IAT has typically been used to measure associative strengths between self and a valenced attribute concept (i.e., positive versus negative words) to determine implicit self-esteem (Greenwald & Farnham, 2000; Karpinski, 2004), between self and a non-valenced attribute concept (e.g., masculinity versus femininity) to uncover implicit self-concept (Greenwald et al., 2002; Greenwald & Farnham, 2000; Nosek, Banaji, & Greenwald, 2002), and between self and a group concept (e.g., White versus non-White) to reveal implicit group identity (Devos & Banaji, 2005; Knowles & Peng, 2005). The present study is the first to use the self-similarity IAT, which served as a tool in measuring the associative strength between self and person concepts (i.e., self-similar versus self-dissimilar character) to infer the relationship between self-concept and the incorporation of new person representations into the social network.

Conclusions

In summary, we provide evidence to suggest that new individuals are quickly incorporated into cognitive representational networks according to self-similarity. Specifically, participants easily formed associations between their self-concept and a self-similar character despite learning relatively little information about the character a short time before performing the IAT, thereby substantiating the importance of self-conceptualization for social perceptions of newly encountered individuals. Importantly, this cognitive association affected the categorization of knowledge that shared no overlap with the new individual, indicating that the effect of self-similarity goes beyond the available information to alter other associations in the network. In addition, these findings suggest that even an established categorization of self-knowledge is sensitive to representations of newly learned individuals. In this way, we support the idea that when making judgments about self, we are likely to implicitly access representations of self-similar others. This study is one of the first to use an implicit technique to directly access the cognitive relationship (i.e., association strength) between self and representations of newly encountered individuals to demonstrate this type of bias, thus avoiding methodologies inherently biased by conscious awareness. Future research could use the self-similarity IAT to test hypotheses about relations between self and familiar others, or to explore sensitivity to very small and subtle manipulations of self-similarity (i.e., same birthday).

Footnotes

Footnote 1: This conclusion is also supported by comparing two types of self-similar traits. Of the 16 traits that described the self-similar character, 8 traits were selected as self-similar stimuli on the basis that they were the highest rated traits by participants (more similar; traits 1–8 of the sorted 40 traits) and 8 traits were selected as self-similar stimuli that were not among participants' 16 highest rated traits (less similar; traits 17–24). Recoding would produce faster categorization of the 8 more similar vs. less similar traits. A paired sample t-test performed for the compatible block revealed no significant difference (mean difference = 231.128 ms), $t\ (32) = 21.149$, $p = .259$, lending support to the idea that the IAT effect was not driven by recoding.

Footnote 2: The four L parameters (me, not-me, self-similar, self-dissimilar) all differed from zero (all $p = .0001$). The A parameters representing me and self-similar associations differed from .5 (all $p = .01$). The A parameters representing the not-me ($p = .16$) and self-dissimilar ($p = .93$) associations did not differ from .5. This suggests that the me and self-similar associations contributed more to the IAT effect than the not-me and self-dissimilar associations. Converging evidence from an analysis of switch costs in our experiment lends confidence to our interpretation of the ReAL model results. A paired sample t-test revealed no significant difference in the size of switch costs across the compatible ($M = 90.36$ ms) and incompatible ($M = 104.99$ ms) blocks, $t\ (32) = 2\ .925$, $p = .362$.

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Chapter 3: Psychological ownership: the implicit association between self and already-owned versus newly-owned objects

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Abstract

Evidence from explicit measures (e.g. favourability ratings, valuations) has led to the prevalent hypothesis that owned objects become cognitively associated with self-concept. Using a novel version of the Implicit Association Test (self-object IAT), wherein participants categorized objects by colour, we evaluated implicit cognitive associations involving self with already-owned and newly-owned objects. We observed faster responses when self-related words required the same response key as the colour that incidentally corresponded to self-owned objects, irrespective of length of ownership. These findings suggest that participants efficiently form cognitive associations between self and self-owned objects within mere minutes of ownership induction and inspire questions about the extent to which length of ownership drives the strength of this association.

Introduction

Psychological ownership is the sensation that a target object belongs to a specific person (Pierce, Kostova, & Dirks, 2001; 2003). Evidence supporting this phenomenological experience comes from effects such as the mere ownership and endowment effects, wherein participants *explicitly* assess self-owned objects to be qualitatively different (e.g. more attractive, more valuable) from unowned and other-owned objects. The widely accepted mechanism for such effects is the elaboration of a strong cognitive association between the object representation and self-concept (Beggan, 1992; Belk, 1988; Belk, 1991; Dittmar, 1989; Dittmar, 1991; Furby, 1978; Pierce, Kostova, & Dirks, 2001; Pierce, Kostova, & Dirks, 2003). There are only a few studies that have used *implicit* measures to test this hypothesis (Constable, Kritikos, & Bayliss, 2011; Gawronski, Bodenhausen, & Becker, 2007). The present study makes novel use of the Implicit Association Test (self-object IAT) to (1) measure the proposed cognitive associations between owned objects and self-concepts, and (2) access how an object property (i.e. length of ownership) mediated this association.

Explicit Evidence

Much of the explicit evidence for self-association with owned objects comes from studies of the mere ownership and endowment effects. The mere ownership effect reflects a bias whereby participants rate objects that they own as more *attractive* than objects that they do not own (Beggan, 1992). The magnitude of the mere ownership effect positively correlates with the activation elicited by the object in the medial pre-frontal cortex (mPFC), an area of the brain associated with self-reflection (Kim & Johnson, 2014).

The endowment effect is observed when participants are asked to provide valuations of the *prices* at which they would buy or sell various items, and tend to overvalue self-owned objects (Beggan, 1991; Kahneman, Knetsch, & Thaler, 1990; Kahneman, Knetsch, & Thaler, 1991). The endowment effect was traditionally explained by loss aversion: a loss is viewed more negatively than the same sized gain is viewed positively (Beggan, 1991; Kahneman, Knetsch, & Thaler, 1991). However, the original endowment effect experiments confounded the role as a buyer or seller with ownership; only the sellers were owners, thus the observation that sellers value the items more than buyers might be due to ownership rather than loss aversion. When this confound was eliminated by including buyers who owned an identical object, the owner-buyers valued the items as much as owner-sellers (Morewedge, Shu, Gilbert, & Wilson, 2009). Moreover, the endowment effect is enhanced when ownership is more salient, for example, when owners write about the object's personal meaning (Maddux, et al., 2010) or when the object shares a prior link to self (i.e. a mug displaying the individual's university logo; Dommer & Swaminathan, 2013). These insights support a role for ownership in the endowment effect, leading researchers to question whether the mere ownership and endowment effects could be measuring the same phenomenon in different ways (Gawronski, Bodenhausen, & Becker, 2007). At the root of these effects, positive self-associations are believed to be transferred onto owned objects in a halo effect (associative self-anchoring; Gawronski, Bodenhausen, & Becker, 2007).

Much of the research supporting the association between self and owned possessions does so by measuring explicit ratings of the objects rather than implicitly accessing the underlying cognitive organization. Explicit knowledge is subject to validation processes, conscious reflection, contextual factors, and the influence of other related implicit activations (Gawronski & Bodenhausen, 2007; Gawronski, LeBel, & Peters, 2007; Strack & Deutsch, 2004). Our understanding of ownership is improved through the use of implicit measures which tap into a different level of knowledge and awareness. Implicit measures are a proxy for the network activations that are the basis for explicit knowledge, and therefore implicit measures offer a potentially less biased approach to examine the self-object association.

Implicit Evidence

Self-tagging refers to the formation of associations between self and novel arbitrary stimuli or concepts. Evidence for self-tagging helps to support the idea that physical objects in ownership contexts might become quickly and easily associated to self. When words are paired with geometric shapes via associative learning, later match/mismatch testing of these shape-word pairs is faster and more accurate for self- than for other-associated shapes (Sui, He & Humphreys, 2012). Additionally, consumer research experiments demonstrate enhanced implicit favourability towards brands implicitly associated with self via a categorization task (Perkins & Forehand, 2012; Prestwich, Perugini, Hurling, & Richetin, 2010), as well as an implicit self-association with brands incidentally related to self (i.e. appeared on their Facebook page; Perkins & Forehand, 2012, experiment 3). Though these experiments did not induce ownership, per se, the idea that self is easily associated with abstract stimuli implies that the same may be true for physical stimuli.

When interacting with physical objects, object ownership results in biased grasping actions (e.g. trajectory and acceleration measures) which suggest that the visual-motor system is sensitive to associations between self and the object (Constable, Kritikos, & Bayliss, 2011). Further, ownership is accompanied by enhanced implicit object-positivity (compared to a rejected object) that correlates with implicit self-positivity (Gawronski, Bodenhausen, and Becker, 2007). This correlation strongly suggests that ownership leads to the transfer of self-associations onto the owned object through a self-object association. In the present experiment, we used a new design to measure this self-object association within a *single* implicit task.

The present experiment

Using a self-object Implicit Association Test (self-object IAT) we examined the nature of the cognitive relationship between self-representation and ownership, and whether this measure differed between short-term and long-term owned objects. In the IAT, participants categorize stimuli into four categories, using two response keys (Greenwald, McGhee & Schwartz, 1998). The categories are paired so that two categories require a left key press, while the other two require a right key press. Speed of response reflects associations. For instance, participants categorizing words into categories representing magnitude of sound (e.g. loud versus quiet) and size (e.g. large versus small) would likely perform faster when the categories are compatibly paired (i.e. loud/large and quiet/small) than when they are incompatibly paired (i.e. loud/small and quiet/large). The IAT effect is calculated as reaction time difference between compatible and incompatible blocks, and represents the strength of association between the categorized concepts.

The ownership IAT developed for this experiment measured the relative strength of association between self-representation and self-owned versus other-owned objects. If self-owned objects are cognitively associated with self-concept, then participants should show faster categorization for the compatible pairing in which self and self-owned objects are paired than the incompatible pairing in which self and other-owned objects are paired.

Length of ownership has positive effects on object valuations and attractiveness ratings for currently-owned possessions (Shu & Peck, 2011; Strahilevitz & Loewenstein, 1998). Further, the endowment effect persists for items owned in the past and is enhanced for longer lengths of past ownership, even when the individual no longer owns them (Strahilevitz & Loewenstein, 1998). This effect on an explicit measure related to ownership leads us to question how such variations are reflected in the implicit cognitive associations since a longer length of ownership allows more experience with the object for greater elaboration of the memory trace. To test this hypothesis, participants completed two IATs, each assessing the association between self-concept and self-owned/experimenter-owned objects. One IAT was used to measure the association to already-owned objects (e.g. the participant's shoes) and the other to newly-owned objects assigned to the participant within the experimental session (e.g. a notebook). A longer time-frame for enhanced elaboration of the owned object with respect to self-concept could result in a greater IAT effect for the already-owned object than for the newly-owned object.

Method

Participants were told that the purpose of the experiment was to examine individual differences in object perception. Demographic information and photos of each participant's already-owned objects (i.e. shoes, keys, wallet, and cell phone) were collected to be used as stimuli for the IAT. Subsequently, ownership was induced for the newly-owned objects (i.e. pencil case, notebook, pencil, and pencil sharpener). Participants then completed 2 IATs (already-owned objects and newly-owned objects) and an explicit measure of object preference.

Participants

Thirty-five McMaster undergraduate students (5 males, mean age = 18.91, SD = 2.17) participated for course credit. The study was approved by the McMaster Research Ethics Board.

Stimuli

Each IAT required stimuli for four categories: two self-related categories (i.e. Me and Not me), and two colour categories, which incidentally corresponded to ownership status (i.e. self-owned and experimenter-owned). Self-related category words were used in both IATs and collected via demographic questionnaire (see LeBarr, Grundy, Ali, & Shedden, 2015). From this, 16 words were generated for the Me category and participants confirmed that a corresponding set of responses (i.e. Not Me words) were not self-relevant.

To create the colour-category stimuli for the already-owned object IAT, we took photographs of participants' shoes, keys, wallet, and cell phone and used matched photographs of the experimenter's objects. Two different and randomly selected border colours (i.e. either red, blue, green, or black) were applied to photographs of the subject's and the experimenter's objects, providing the basis for categorization in the IAT. Stimuli in the newly-owned object IAT consisted of photographs of four objects (i.e. pencil case, notebook, pencil, and pencil sharpener) of the same colour (i.e. either red, blue, green, or black) presented to participants at the beginning of the session. There was a corresponding set of photographed objects in a different colour owned by the experimenter. The colours were randomly assigned with the constraint that they did not match the colours already selected for the already-owned object IAT.

Colour was used as the basis for object categorization to avoid recoding in the IAT. Recoding occurs when one of the two response tasks is prioritized over the other, so that the IAT effect is due to response activation conflict, rather than association strength between the categories (De Houwer, 2001, 2003; De Houwer, Geldof, & De Bruycker, 2005; De Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009; Fazio & Olson, 2003; Meissner & Rothermund, 2013; Mierke & Klauer, 2001; Rothermund & Wentura, 2001). For instance, in the compatible block, prioritizing the me/not me categorization task and ignoring the ownership categorization task would allow for fast and accurate performance. In contrast, participants would be unable to use this strategy in the incompatible block and would instead have to perform both categorization tasks, therefore enhancing response conflict. By having participants categorize the ownership items by colour, our design set out to reduce at least some of this inherent response similarity.

The IAT stimuli were presented on a 19-inch colour CRT display (resolution of 1600 x 1200, frame refresh rate = 75 Hz), at a distance of 90cm in front of the chin rest in a dimly lit room. The experiment was controlled by Presentation experimental software (Version 15.0, www.neuro-bs.com) run on a Pentium 4 computer under the Windows XP operating system. Relevant category labels remained on either side of the screen for the duration of each block (vertical visual angle = 2.9º, horizontal visual angles = $\pm$4º from screen centre). Demographic words and photos of objects appeared at screen centre. The category labels and demographic words were presented in 20-point Helvetica font, with a vertical visual angle of 0.4º (horizontal visual angle varied with word length). Object photographs subtended a vertical visual angle of 4.2º and a horizontal visual angle of 3.2º. All stimuli were presented on a black background.

Procedure

Ownership induction

To induce ownership for the newly-owned object IAT, participants were told they would view objects that would be used in a subsequent object perception task. The experimenter placed two pencil cases on the table and explained that one belonged to the experimenter and that the other was a thank you gift to the participant. Participants were invited to open their pencil case and to examine the objects inside, which included a notebook, pencil, and a pencil sharpener. At the same time, the experimenter opened their own pencil case to reveal the same items of a different colour. The experimenter recorded her name and contact information in her notebook and asked the participant to do the same to identify the other notebook as their own. The objects were then removed from the room, with the assurance that they would be returned later.

Implicit Association Test

Participants' task was to categorize words and photographs as quickly and as accurately as possible into categories presented on the left or right side of the display ("z" key = left; "/" key = right). Category labels were presented on the left and right of the screen for the duration of the block, with assignment counterbalanced across participants. On each trial, a demographic word or object photograph appeared at the centre of the screen until a response was made. Following incorrect responses, a red "X" appeared above the centre stimulus and participants were required to make the correct response to continue. Following correct responses, a blank screen was presented for 500 ms before the next trial began.

Participants each completed two 5-block IATs in random order; one IAT tested self-association with the already-owned object and the other with the newly owned object. The first two blocks (64 trials each) served as practice with the individual sets of category mappings that would then be combined in block 3, the first of two IAT blocks. In one practice block, participants categorized 32 demographic words (each presented twice) into the Me/Not me categories, while in the other, participants categorized 8 object photos (each presented 8 times) by object/border colour, which incidentally corresponded to ownership status.

Each IAT contained two critical blocks (i.e. IAT blocks 3 and 5) of 128 randomly ordered trials (32 demographic words presented twice and 8 object photos presented 8 times) where participants categorized stimuli into all 4 categories using the two response keys. The 4 categories could be combined compatibly or incompatibly, the order of which (block 3 or block 5) was counterbalanced. In the compatible block, the Me category was paired with the participant-owned object colour and the Not me category was paired with the experimenter-owned object colour. In the incompatible block, the category pairing was reversed. In block 4, participants were presented with a final single-category practice block for the category set that would reverse in the second IAT block. Table 4 illustrates a summary of the sequence of blocks, and Figure 3 illustrates an IAT block trial sequence.

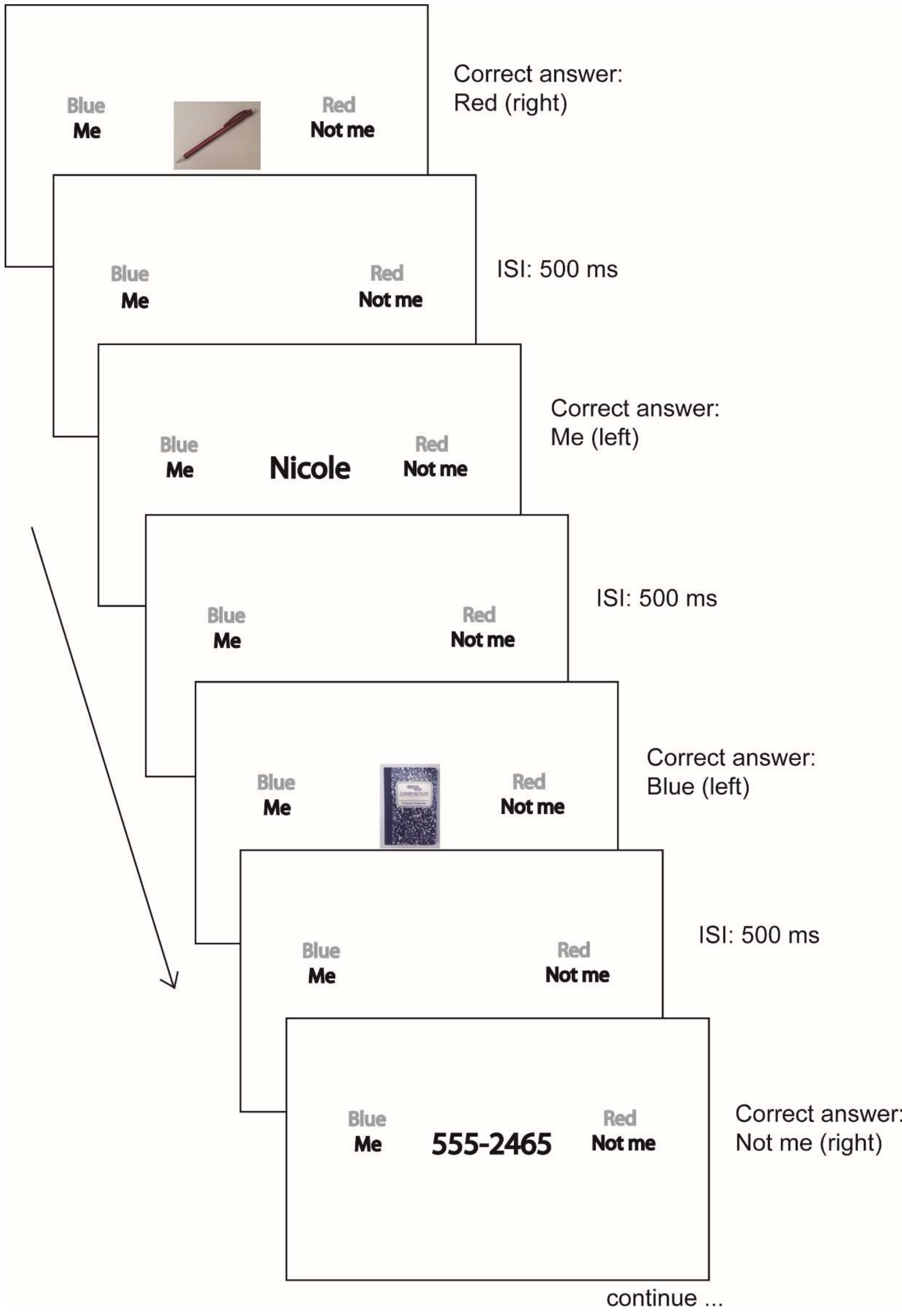

Figure 3. Sample trial sequence in the self-object IAT.

Block Order	Categorization Task	Number of trials	Left response key category	Right response key category
1	Practice: newly-owned object photos	64	“My object” colour	“Experimenter’s object” colour
2	Practice: demographic words	64	“Me”	“Not-me”
3	Compatible categorization of newly-owned objects and demographics	128	“My object” colour and “Me”	“Experimenter’s object” colour and “Not-me”
4	Practice: demographics	64	“Not-me”	“Me”
5	Incompatible categorization of newly-owned objects and demographics	128	“Me object” colour and “Not-me”	“Experimenter’s object” colour and “Me”

Table 4. Each participant completed the IAT twice; once using the newly-owned objects as stimuli (as shown in this table) and once using the already-owned objects (IAT order counterbalanced across participants). Within each IAT, block order was counterbalanced so that the compatible pairing was either presented first (as block 3, as shown in this table) or second (as block 5).

Explicit measures

Participants estimated the length of ownership for each of their already-owned objects, and rated how much they liked their own and the experimenter’s objects on a 6-point Likert scale. A final question probed awareness of the experimental manipulation or hypothesis.

Results

One of the 35 participants was removed from analyses because they terminated the experiment before the IAT was completed. Eight participants guessed that the experiment was about responses to owned objects; excluding these participants did not change the results, therefore reported analyses include 34 participants. Reaction time analyses were conducted on mean values for correct responses with a 2.5 standard deviation outlier cut off.

Implicit measures

We performed a 2 x 2 repeated measures ANOVA on reaction time, using the within-subject factors of length of ownership (already-owned and newly-owned object IATs) and IAT category pairing. This revealed a highly significant effect of IAT pairing, $F(1,33) = 62.491$, $p < .001$, $\eta^2 = .654$. In line with predictions, reaction time was faster for the compatible than the incompatible pairing for both the already-owned object IAT, $t(33) = -7.092$, $p < .001$, $d = 0.796$ (compatible = 635.32 ms, SD = 17.16; incompatible = 730.86 ms, SD = 20.70) and the newly-owned object IAT, $t(33) = -4.534$, $p < .001$, $d = 0.675$ (compatible = 651.98 ms, SD = 13.44; incompatible = 719.22 ms, SD = 18.54). There were no significant effects of length of ownership, $F(1,33) = .055$, $p = .816$, and no interaction between IAT pairing and type, $F(1,33) = 2.115$, $p = .155$. Proportion accuracy was high for both already-owned (compatible = 0.95; incompatible = 0.95) and newly-owned (compatible = 0.96; incompatible = 0.94) conditions, providing support that there was no speed-accuracy trade-off.

We then asked whether the IAT effect differed for newly-owned and already-owned objects and ruled out order effects. The IAT effect was computed as the difference in reaction time between the incompatible and compatible blocks. We ran a 2 x 2 mixed model ANOVA on the reaction time IAT effect, using the within-subjects factor of length of ownership and the between-subjects factor of IAT order. We found no significant effects of length of ownership, $F(1,32) = 1.944$, $p = .173$, of IAT order, $F(1,32) = .004$, $p = .950$, nor the interaction of these two factors, $F(1,32) = .843$, $p = .365$.

As it is common practice in IAT research, effect size, D, was computed as the difference score between compatible and incompatible category pairing conditions divided by the inclusive standard deviation (Greenwald, Nosek, & Banaji, 2003; Lane, Banaji, Nosek, & Greenwald, 2007). The D statistics for both the already-owned ($D = .598$, $M = .295$; $sd = .272$; $t(33) = 6.326$, $p < .001$, $d = 1.085$) and the newly-owned object IATs ($D = .515$, $M = .184$; $sd = .312$; $t(33) = 3.440$, $p = .002$, $d = 0.590$) were significantly greater than zero and considered moderate in magnitude. A 2 x 2 mixed-model ANOVA showed no effect of ownership condition, $F(1,32) = 2.5$, $p = .124$, of IAT order, $F(1,32) = .441$, $p = .512$, nor the interaction, $F(1,32) = .155$, $p = .696$.

Explicit measures

Analyses of explicit responses were done by averaging across participants' ratings of the individual objects to obtain mean preference for self-owned and experimenter-owned objects in both the newly-owned and already-owned object conditions. We then created preference scores by subtracting preference for the experimenter-owned objects from preference for the self-owned objects, so that a positive score denoted preference for one's own over the experimenter's objects. Single-sample t-tests revealed that for the already-owned objects this score was significantly greater than zero, $t(33) = 4.971$, $p < .001$, $d = 0.334$; participants therefore preferred their own objects over those belonging to the experimenter. This effect was marginally significant for the newly-owned object condition, $t(33) = 1.950$, $p = .06$, $d = 0.853$, indicating that preference for one's own object over the experimenter's object was stronger for a longer length of ownership, $t(33) = -4.077$, $p < .001$, $d = 0.807$.

Discussion

We used a new version of the IAT to assess the association between self and owned objects within a single implicit task. Specifically, responses were faster when self-related words required the same response as self-owned objects than when they required different responses. This implicit effect reflects the hypothesized internal organization characterized by enhanced cognitive association strength between self-concept and self-owned objects relative to experimenter-owned objects. Within this same group of participants, we replicated the explicit preference for self-owned over other-owned objects (i.e. the mere ownership effect; Beggan, 1992) and the enhanced explicit favourability displayed towards objects owned over a longer span of time (Shu & Peck, 2011; Strahilevitz & Loewenstein, 1998). Importantly, length of ownership did not have an observable effect on the strength of the implicit self-object association. Thus, there is a tentative conclusion that the cognitive association measured by the IAT between self and owned objects is independent of length of ownership. At the very least, we suggest that self-associations are definitely present for the newly-owned objects and may arise simply due to ownership induction.

The instant endowment effect (Kahneman, Knetsch, & Thaler, 1990) is just one of many experiments that use explicit measures to reveal the immediate effects of ownership for newly-owned objects (Beggan 1992; Dommer, & Swaminathan, 2013; Gawronski, Bodenhausen, & Becker, 2007; Kahneman, Knetsch, & Thaler, 1990; Kahneman, Knetsch, & Thaler, 1991; Maddux, et al., 2010; Morewedge, Chu, Gilbert, & Wilson, 2009; Strahilevitz, & Loewenstein, 1998). These effects occur quickly even when ownership is simply imagined (Cunningham, Brady-Van den Bos, & Turk, 2011; Cunningham, Turk, Macdonald, & Macrae, 2008; Huang, Wang, & Shi, 2009; Kim & Johnson, 2012; Kim & Johnson, 2014; Shi, Zhou, Han, & Liu, 2011; Van den Bos, Cunningham, Conway, & Turk, 2010). The present finding that the cognitive self-object association occurs almost immediately (i.e. within minutes) following ownership induction is consistent with these effects. The strength and automaticity with which associations between self and owned objects are formed has important implications for the real world, as this association is believed to be at the root of psychological feelings of ownership.

We found that longer length of ownership had a positive effect on explicit object preference, but found no significant difference between the size of the IAT effect observed for already-owned and newly-owned objects. Although this is a null effect, it inspires questions about the extent to which length of ownership drives the strength of the self-object association. Note also that this observation was made by comparing effects across separate IATs; to further support the finding that the associations between self and owned objects are independent of length of ownership, an important next step will be to more directly compare association strengths between self and already-owned versus newly-owned objects within the same IAT.

One factor that could have led to the rapidly formed association in the newly-owned object condition was the opportunity during ownership induction to touch one's own objects, but not the experimenter's. Physically touching or using an object is known to produce explicit ownership effects (Belk, 1998; Peck & Shu, 2009; Prelinger, 1959; Wolf, Arkes, & Muhanna, 2008). However, effects observed as a result of imagined ownership (Cunningham, Brady-Van den Bos, & Turk, 2011; Cunningham, Turk, Macdonald, & Macrae, 2008; Huang, Wang, & Shi, 2009; Kim & Johnson, 2012; Kim & Johnson, 2014; Shi, Zhou, Han, & Liu, 2011; Van den Bos, Cunningham, Conway, & Turk, 2010) and self-association to non-physical objects (Perkins & Forehand, 2012; Prestwich, Perugini, Hurling, & Richetin, 2010; Sui, He & Humphreys, 2012) suggest that the observed effect is likely to have occurred in the absence of physical touch. There is, however, a possibility that touching accelerated or strengthened the association formed.

The development and testing of a self-object IAT offers an important contribution to the field of implicit ownership research. Further research should explore variations of the ownership IAT as well as additional implicit measures to assess ownership. Here we tested whether length of ownership affected the ownership IAT; but it would be useful to look at other factors known to produce ownership effects, such as having chosen the object (Belk, 1988; Gawronski, Bodenhausen, & Becker, 2007; Huang, Wang, & Shi, 2009), investing creative labour into the object (Kanngiesser, Gjersoe, & Hood, 2010) and having an existing emotional tie to the object (e.g. family keepsakes).Though our IAT design reduced the opportunity for recoding, we cannot be certain it was removed entirely. As such, replication using implicit techniques that eliminate recoding (e.g.

associative priming, Extrinsic Affective Simon Task) would strengthen the present findings and provide important new designs for the implicit study of ownership.

Conclusions

A novel adaptation of the IAT (the self-object IAT) found that individuals efficiently form associations between self and owned objects within mere minutes of ownership induction. This is one of the few non self-report studies to provide support for the prominent hypothesis that ownership leads to the formation of self-object associations. Interestingly, newly-owned object associations did not differ from already-owned object associations, therefore it is possible that self-object associations do not depend on length of ownership. Therefore, long-term ownership may be sufficient, but not necessary to forge strong associations between self and owned objects.

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Chapter 4: A self-heuristic biases memory for personality traits of newly-learned individuals

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Abstract

Stereotypes bias person memory in favour of heuristic-consistent information when cognitive load is high (Snyder and Uranowitz, 1978). An important question is whether self-concept serves a similar purpose in the form of a self-heuristic. Participants learned personality traits of two equally self-similar individuals. A bogus indicator of self-similarity or self-dissimilarity was presented either pre- or post-learning. At test, accuracy was higher for heuristic-consistent than heuristic-inconsistent traits for the bogus self-similar character. It did not matter whether the biasing information was presented pre- or post-learning, suggesting that the self-heuristic bias acts at retrieval. Errors were more likely to be heuristic-consistent than heuristic-inconsistent, which supports a mechanism of stereotype-based guessing. This research has important implications for our understanding of self-concept and how it contributes to cognition.

Introduction

Self-relevance is both highly salient (Bargh, 1982; Berlad & Pratt, 1995; Brédart, Delchambre, & Laureys, 2006; Chen, et al., 2011; Cherry, 1953; Gray, et al., 2004; LeBarr, Grundy, Ali, & Shedden, 2016; Markus, 1977; Ninomiya, et al., 1998; Shapiro, Caldwell, & Sorensen, 1997; Tacikowski & Nowicka, 2010; Turk, et al., 2011; Zhou, et al., 2010) and memorable (Bower & Gilligan, 1979; Klein & Kihlstrom, 1986; Klein & Loftus, 1988; Kuiper & Rogers, 1979; Symons & Johnson, 1997; Turk, Cunningham, & Macrae, 2008; Zhou, et al., 2010), making it an important heuristic for conserving cognitive resources. Less clear are the realistic consequences of this heuristic when gathering information about other people in social interactions. There is, however, a large body of literature showing that social stereotypes (e.g. sexual orientation) act as heuristics to bias person-memory in favour of stereotype-consistent information (Bodenhausen & Lichtenstein, 1987; Cohen, 1981; Dijksterhuis & Van Knippenberg, 1995; Macrae, Hewstone, & Griffiths, 1993; Rothbart, Evans, & Fulero, 1979; Snyder & Uranowiz, 1978; Stangor & Duan, 1991; Stangor & McMillan, 1992). Perceived *self-similarity* to other individuals may act similarly to stereotypes to produce this effect on memory. We investigated whether a simple indicator of self-similarity to another individual might have an influence on subsequent recognition of their personality traits, and whether that influence differs depending on the time at which the indicator was available, either before or after learning.

The effects of a self-heuristic on memory have been investigated by testing it as a general information-processing strategy acting at encoding. Research on self-referential encoding is abundant, whereby memory is superior for lists of words categorized according to self-relevance (i.e., does this word describe you?) than by semantic meaning (i.e., is this word the same as X?) (Bower & Gilligan, 1979; Klein & Loftus, 1988; Rogers, Kuiper & Kirker, 1977; Symons & Johnson, 1997). This benefit is superior for self-relevant words, but also reflected in the recall of non self-relevant words. Mechanisms for these effects focus on favourable encoding conditions. Association with self-concept is believed to grant both superior elaborative and organizational processing of information in memory (Benoit, Gilbert, Volle, & Burgess, 2010; Bower & Gilligan, 1979; Kelley et al., 2002; Klein & Kihlstrom, 1986; Klein & Loftus, 1988; Kuiper & Rogers, 1979; Macrae, Moran, Heatherton, Banfield, & Kelley, 2004; Mitchell, Banaji, & Macrae, 2005; Symons & Johnson, 1997). Specifically, organizational processing is believed to function by encouraging participants to group items based on their relevance to self (i.e. relevant to me versus not relevant to me), which increases relational encoding between items within a group (Heatherton, Macrae, & Kelley, 2004; Howell & Zelenski, 2017; Klein & Kihlstrong, 1986; Klein & Loftus, 1988). At retrieval, this clustering functions as a top-down mnemonic that structures the way in which memory is searched. In addition to the elaborative and organizational processing strategies thought to underlie self-referential encoding, preferential attention to self-relevant stimuli (Bargh, 1982; Berlad & Pratt, 1995; Chen, et al., 2011; Cherry, 1953; Gray, et al., 2004; Markus, 1977; Ninomiya, et al., 1998; Shapiro, Caldwell, & Sorensen, 1997; Tacikowski & Nowicka, 2010; Zhou, et al., 2010) likely also guides the selection of information for further encoding.

The stereotype literature has focused heavily on how heuristics bias memory for people. In a seminal experiment, Snyder and Uranowitz (1978) had participants read a biographical vignette about a fictional character Betty K. Some participants were later presented with the additional information of Betty K.'s sexual orientation (homosexual vs. heterosexual) that biased memory of the original vignette details in favour of stereotype-consistent information. Snyder and Uranowitz (1978) suggested that stereotype labels act as a reconstruction theme, making the stereotype-consistent information in long-term memory more available. On recognition tasks, not only were correct responses more likely to be stereotype-consistent, but errors as well. This finding and subsequent research led to the hypothesis that participants used stereotype-based guessing to generate plausible responses (Bellezza & Bower, 1981).

Research suggests that in addition to stereotypes, self-concept can also drive heuristic-based guessing. Social projection (i.e. the false consensus effect) and self-anchoring biases lead us to assume that unfamiliar others are more self-similar than chance would predict (Cadinu & Rothbart, 1996; Ross, Greene, & House, 1977), especially for ingroup judgments, due to an existing perception of self-similarity (Cadinu & Rothbart, 1996; Clement & Krueger, 2002; Krueger & Clement, 1996; Marks & Miller, 1987; Spears & Manstead, 1990; Stotland & Hillmer, 1962). Further, learning that an individual shared attributes (i.e. political views, opinion statements) in common with them led participants to generalize this expectation in a mentalizing task. Specifically, when participants were asked to predict the individual's responses on new items measuring views on personal and societal issues, there was more overlap with participants' own opinions on these items for self-similar than for self-dissimilar individuals (Allan, Morson, Dixon, Martin, & Cunningham, 2017; Mitchell, Banaji, & Macrae, 2005; Wheeler, Allan, Tsivilis, Martin, & Gabbert, 2013). Further, self-similarity was also used as a basis for predictions about which objects novel individuals would prefer; there was greater overlap with participants' own object preferences for the self-similar individual than the self-dissimilar individual (Allan, Morson, Dixon, Martin, & Cunningham, 2017). Critically, a surprise memory test following object preference predictions revealed greater recognition of objects that were selected for the self-similar individual. This finding converges with evidence from the self-referential encoding literature, prompting the authors to coin it as a "proxy" self-reference effect for objects encoded with reference to a self-similar person (Allan, Morson, Dixon, Martin, & Cunningham, 2017). In support of heuristic-based guessing, source confusion for self-associated objects (i.e. incorrectly believing that an individual preferred an object that was preferred by self) was stronger for the self-similar than the self-dissimilar individual. Together, these findings support that self-similarity can bias both memory accuracy and reconstruction for novel people.

The present research sought to understand whether self-concept acts as a heuristic for encoding and reconstructing memory of newly-encountered individuals. To this end, we applied the approach used in the stereotype literature to examine the implications of minimal self-similarity on person-memory. Specifically, we investigated whether perceptions of self-similarity to other individuals formulated pre- or post-learning could bias recognition memory of personality traits to be heuristic-consistent. Participants studied personality trait profiles of two characters who were equally self-similar to the participant. They were also presented with a minimal indicator (i.e. a bogus personality label) of self-similarity for one character and self-dissimilarity for the other. This indicator was provided before (pre-learning condition) or after (post-learning condition) participants studied the profiles. Use of a self-similarity heuristic predicts that memory would favour character traits consistent with one's expectation (self-similar vs. self-dissimilar) of that character. Further, participants should make a greater number of heuristic-consistent than heuristic-inconsistent errors.

Participants were given an expectancy of self-similarity either before (i.e. pre-learning condition) or after (i.e. post-learning condition) exposure to personality traits, allowing the potential to isolate either an encoding bias or a retrieval bias, respectively. An effect in the pre-learning, but not the post-learning condition would provide evidence that the heuristic is producing an encoding bias. An effect in both the pre-learning and post-learning conditions would support a retrieval bias, but would be inconclusive with respect to an encoding bias, as the indicator presented at encoding would also be available at retrieval.

Method

Participants were told the purpose of the experiment was to collect information for a database of student profiles; their photo was taken and they completed a personality trait questionnaire and the Narcissism Personality Inventory (NPI). Personality traits were used to construct the participant's own profile and two character profiles, each of which were of equal self-similarity to the participant's profile. We showed participants their own profile accompanied by bogus information about their "personality type" (i.e. randomly either Type 1 or 2) on the NPI. Participants then studied the character profiles. Bogus information about each character's personality type on the NPI was provided either immediately before (pre-learning condition) or after (post-learning condition) the study phase. This bogus information alone determined whether the character was similar or dissimilar to the participant. Finally, participants were tested on their knowledge of each character.

Participants

Participants were 59 undergraduate students from the McMaster University introductory psychology research pool, all with normal or corrected-to-normal vision. Each participant provided informed consent prior to the experiment; all practices were approved by the McMaster Research Ethics Board and consistent with the Tri-Council policy. We eliminated data from 11 participants who failed to complete the experiment as instructed and in the allotted time, leaving 27 in the pre-learning condition (22 females, mean age = 18.7, SD = 1.7) and 21 in the post-learning condition (12 females, mean age = 18, SD = 1.6).

Character profiles

Participants completed a personality trait questionnaire (see LeBarr, Grundy, Ali, and Shedden, 2016), rating 40 personality traits according to their relevance to self on a 7-point Likert scale. These data served as the basis to create the participant's own profile and two character profiles that were equally self-similar to the participant.

To construct the participant's own profile, we ranked the 40 traits by self-relevance and selected the top 16. Participants viewed their own profile (e.g. a list of all 40 personality traits with "X"s denoting the chosen traits) to confirm the profile was indeed self-representative. At this time, the experimenter mentioned the bogus personality information (i.e. Type 1 or 2), which was also indicated on the profile, but did not provide any interpretation (e.g. "Your result from the other test is Type 1").

Character profiles consisted of a photograph and a list indicating the 16 traits relevant to that character. Both characters were the same sex as the participant; front-facing photos were drawn from the lab face database. To create two equally self-similar character profiles, a unique set of 16 traits were selected for each character according to the participant's own self-relevance ratings for those traits. Of the 16 traits assigned to each character, approximately 8 were rated highly self-relevant, 4 were rated neutral, and 4 were rated as not self-relevant, (i.e.. ratings of 6-7, 3-5, and 1-2, respectively). Because we were working with traits that were specific to each participant, there was some variance across participants in this pattern, however, an analysis of the average trait self-relevance rating across all traits did not differ significantly between the pre- ($M = 4.484$, $SD = 0.420$) and post-learning ($M = 4.545$, $SD = 0.511$) conditions, $t(46) = -0.453$, $p = 0.670$. Notably, both pre-, $t(26) = 5.983$, $p < 0.001$, and post-learning, $t(20)=4.882$, $p < 0.001$, condition means were significantly greater than the scale midpoint (4), indicating that character profiles were generally more self-relevant than not. This is consistent with participants' average trait rating across all 40 personality traits ($M = 4.501$, $SD = 0.450$), which also biases in favour of self-relevance, $t(47) = 7.715$, $p < 0.001$. Since we did not use negative traits, this bias is in line with established self-positivity biases (Mezulis, Abramson, Hyde, & Hankin, 2004).

Character-Learning

Participants were told that they would be learning about the profiles of two real individuals who had also completed the experiment. In the learning phase, participants were shown two character profiles in random order for 3 minutes each. They were instructed to remember as much as they could about each individual, including their face and the 16 traits.

Immediately before and after learning, participants were shown side-by-side photos of the characters; these phases served to introduce the self-similarity manipulation. Bogus information about personality type (i.e. Type 1 or 2) on the NPI questionnaire appeared as a label beneath each character's photograph either pre- or post-learning. One character was labeled Type 1 and the other Type 2; the assignment was random and this was the only information that determined whether the character was self-similar or self-dissimilar to the participant. The experimenter drew participants' attention to these personality types but made no reference to participants' own personality type at this time. It is important to emphasize again that the two character profiles were equally self-similar except for this one piece of bogus information.

Memory test

Participants completed the memory test in a dimly lit room, 90 cm from the 19-inch colour CRT display (resolution of 1600 x 1200, frame refresh rate = 75 Hz) on a Pentium 4 computer using the Windows XP operating system. EPrime experimental software (version 2.0, http://www.pstnet.com/eprime.cfm) was used to control stimulus presentation and response recording.

Participants were shown photographs of each character side-by-side on a white background. The 32 total personality traits assigned to the two characters were serially presented in random order at the centre of the display. Participants categorized each trait as belonging to the character on the left ("/" key) or right ("z" key). Upon a correct response, the trait word disappeared from the display and after a 1 second delay the next trait word was presented. For incorrect responses, the word "Incorrect" appeared above the trait word for 1.5 seconds; both words then disappeared from the display and after a 1 second delay the next trait word was presented. Participants repeated the set of 32 words until a 100% accuracy criterion was reached. Analyses focused on block 1 data, which is when the heuristic bias should be most apparent.

Results

Reaction time analyses were conducted on correct responses with a 2.5 SD outlier cutoff. The Bonferroni correction was applied for multiple comparisons. Self-relevance was considered high for traits with ratings of 6-7 and low for traits with ratings of 1-2.

Number of blocks to criterion

Participants required between 3 and 21 blocks to reach the 100% accuracy criterion on the memory test (M = 11.021, SD = 4.738). To determine if number of blocks required to reach this criterion varied across conditions, we performed a 2x2 mixed-model ANOVA with the within-subjects factor of character type (similar and dissimilar) and the between-subjects factor of learning condition (pre- and post). There was no significant effect of character type, $F(1,46) = 1.722$, $p = .196$, learning condition, $F(1,46) = 1.035$, $p = .314$, nor the interaction, $F(1,46) = .439$, $p = .511$, on number of blocks required to reach criterion. Learning was equally difficult across conditions, supporting that differences in accuracy were due to the influence of the self-similarity manipulation, determined entirely by the bogus information presented before or after learning.

Accuracy

We began by examining block 1 accuracy, to determine if participants were more accurate for heuristic-consistent than heuristic-inconsistent information. A 2x2x2 ANOVA assessed the within-subjects factors of character type (similar and dissimilar), trait self-relevance (low and high), and the between-subjects factor of learning condition (pre- and post-). Use of trait self-relevance as a heuristic would be supported by a significant character type x trait self-relevance interaction, as this would indicate that high and low self-relevant traits were recalled differently for self-similar and dissimilar characters.

There were no significant main effects of character type, $F(1,33) = .725$, $p = .401$, trait self-relevance, $F(1,33) =1 .037$, $p = .316$, nor learning condition $F(1,33) = .375$, $p = .544$. However, as predicted, memory for self-relevant traits depended on whether the traits belonged to the self-similar or the self-dissimilar character. We observed a significant character type by trait self-relevance interaction, $F(1,33) = 11.541$, $p = .002$, supporting the hypothesis that trait self-relevance was used as a heuristic at recognition. Paired-sample t-tests showed that participants were more accurate for high than low self-relevant traits for the self-similar character, $t(34) = -3.538$, $p = .001$, but only marginally more accurate for low than high self-relevant traits for the self-dissimilar character, $t(34) = 1.913$, $p = .064$. Importantly though, the bias was significantly more pronounced for the self-similar than self-dissimilar character, $t(34) = 3.390$, $p = .002$. Block 1 accuracy data is shown in Table 5.

Character	**Low self-relevance trait**		**High self-relevance trait**		**Bias**
	Mean	**SE**	**Mean**	**SE**	**Mean**
Self-similar character	0.55	0.07	0.79	0.04	**0.24**
Self-dissimilar character	0.81	0.06	0.68	0.04	**0.13**

Table 5. Means and standard errors for Block 1 proportion accuracy by character and trait self-relevance. A positive value for bias (accuracy for heuristic-consistent traits – heuristic-inconsistent traits) represents a heuristic-consistent trend for accuracy.

We also examined block 2 accuracy, using the same 2x2x2 ANOVA. Again, there were no significant main effects of character type, $F(1,33) = .005$, $p = .942$, trait self-relevance, $F(1,33) =.055$, $p = .816$, nor learning condition $F(1,33) = .315$, $p = .578$. Akin to block 1, there was a significant character type by trait self-relevance interaction, $F(1,33) = 6.756$, $p = .014$. Paired sample t-tests comparing high and low self-relevant traits for the self-similar character, $t(34) = 1.733$, $p = .092$, and the self-dissimilar character, $t(34) = -1.603$, $p = .118$, failed to reach significance, indicating a tapering off of the effect after block 1. In light of this, we focus the remaining analyses on block 1 data, where the heuristic is more pronounced.

Errors can be categorized in terms of stereotype consistency. Similarly to Snyder and Uranowitz (1978), and in line with the stereotype-based guessing hypothesis (Bellezza & Bower, 1981), we predicted that heuristic-consistent errors would be more common than heuristic-inconsistent ones. We coded errors as heuristic-consistent if participants incorrectly categorized a self-similar trait to the self-similar character or a self-dissimilar trait to the self-dissimilar character. In contrast, heuristic-inconsistent errors were made when participants incorrectly categorized a self-similar trait to the self-dissimilar character or a self-dissimilar trait to the self-similar character.

We ran a 2x2x2 mixed-model ANOVA on block 1 error rates, with the within-subjects factors of trait self-relevance (low and high) and character chosen (similar and dissimilar), and the between-subjects factor of learning condition (pre- and post). There was a main effect of trait self-relevance, $F(1,46) = 19.620$, $p < 0.01$, whereby there were more errors for self-similar traits than self-dissimilar traits, $t(47) = 4.165$, $p < .001$. In contrast, there were no significant main effect of character, $F(1,46) = .245$, $p =.623$. The ANOVA also revealed the critical interaction between trait self-relevance and character chosen, $F(1,46) = 4.340$, $p = .043$. Errors were more likely to be heuristic consistent than inconsistent for the self-similar character, $t(47) = -5.131$, $p < .001$, whereas this was not the case for the self-dissimilar character, $t(47) = 1.766$, $p = .084$. Error rates are presented in Table 6.

Character	Low self-relevance trait		High self-relevance trait		Bias
	Mean	SE	Mean	SE	Mean
Self-similar character	0.011	0.003	0.046	0.006	**0.035**
Self-dissimilar character	0.023	0.004	0.037	0.007	**-0.014**

Table 6. Means and standard errors for Block 1 error rate data by trait self-relevance and character chosen. A positive value for bias (heuristic-consistent errors – heuristic-inconsistent errors) represents a heuristic-consistent trend for errors.

Reaction time

Since categorization was more accurate for heuristic-consistent traits, we tested whether this was accompanied by faster responses to correct recognition. We performed the same 2x2x2 ANOVA on reaction time values for block 1 of the categorization task. We found no significant effects of character, $F(1,19) = 2.194$, $p = .155$, trait self-relevance, $F(1,19) = 1.431$, $p = .246$, learning condition, $F(1,19) = 3.221$, $p = .089$, nor any interactions. Reaction time data is presented in Table 7.

Character	Low self-relevance trait		High self-relevance trait		Bias
	Mean	SE	Mean	SE	Mean
Self-similar character	1627	143	1790	97	**163**
Self-dissimilar character	1620	102	1740	97	**-120**

Table 7. Means and standard errors for Block 1 reaction time by character and trait self-relevance. A negative value for bias (reaction time for heuristic-consistent traits – heuristic-inconsistent traits) represents a heuristic-consistent trend for reaction time.

Discussion

Research suggests that self-similarity is highly salient, guiding attention and memory in favour of self-relevant information (Bargh, 1982; Berlad & Pratt, 1995; Brédart, Delchambre, & Laureys, 2006; Bower & Gilligan, 1979; Chen, et al., 2011; Cherry, 1953; Gray, et al., 2004; Klein & Kihlstrom, 1986; Klein & Loftus, 1988; Kuiper

& Rogers, 1979; LeBarr, Grundy, Ali, & Shedden, 2016; Markus, 1977; Ninomiya, et al., 1998; Shapiro, Caldwell, & Sorensen, 1997; Symons & Johnson, 1997; Tacikowski & Nowicka, 2010; Turk, Cunningham, & Macrae, 2008; Turk, et al., 2011; Zhou, et al., 2010). We investigated the effect of self-similarity in a social context: memory for novel individuals. Heuristics such as stereotypes are known to bias recall of biographical details of other individuals (Bellezza & Bower, 1981; Rothbart, Evans, & Fulero, 1979; Snyder & Uranowitz, 1978). Using a similar methodology, a minimal indication of self-similarity was manipulated to measure the influence of a self-heuristic on recognition memory for personality trait information of newly-learned individuals.

Participants learned trait information about two individuals that they would later be tested on. Importantly, the two individuals were carefully constructed to be equal in terms of similarity to the participant, except for a single piece of bogus information which indicated that one individual was self-similar and the other individual was self-dissimilar. The bogus information was introduced outside of the main learning phase (pre- or post-learning) with the intent of triggering a self-heuristic bias in memory.

The self-heuristic influenced performance on the memory test. Participants were more accurate at remembering the self-similar character's profile traits that were consistent with the bias of self-similarity set up by the bogus information. At retrieval, heuristics can act by biasing reconstruction of encoded information or by guiding stereotype-consistent guessing when initial encoding was not successful. We found that the errors that participants made on the recognition task were more likely to be consistent with the heuristic, implying that stereotype guessing is contributing to the bias. When participants were unable to remember which character a given trait belonged to, a self-heuristic guided their guessing (Bower & Ballazza, 1981; Snyder and Uranowitz, 1978). Interestingly, the bias was strong for the self-similar character but much weaker and not significant for the self-dissimilar character. This is likely due to the more tangible nature of an association between self-similar concepts and self, compared to the more diverse association between self-dissimilar concepts and *all* that is regarded as *not me*.

Our results support Allan and colleagues' (2017) finding that source confusion with self was higher for a self-similar than a self-dissimilar character. We extend upon this finding to demonstrate that this bias functions even in situations of minimal self-similarity. Further, in Allan and colleagues' (2017) experiment, the memory test evaluated recognition of information that been generated by the participants themselves in a mentalizing exercise (i.e. which object do you think this individual would prefer?). Here, we show this same bias on more objectively learned personality traits that were presented to and not generated by participants.

It did not matter whether the single piece of bogus similarity information was provided before or after the personality trait learning phase. We conclude that when processing resources are at a premium, heuristics aid reconstruction of non-optimally encoded information by way of a retrieval bias. It is possible that encoding was also sensitive to the self-heuristic, but because information learned at encoding is available at the time of retrieval our results are inconclusive with respect to an encoding bias.

Importantly, the observation of a memory bias in the post-learning condition cannot be explained by a self-referential encoding strategy alone. Self-referential encoding is hypothesized to encourage favourable encoding conditions through elaborative and organizational processing, which were likely at play in the pre-learning condition. In the post-learning condition, participants had no expectation about self-similarity at the time of encoding since the minimal indicator of self-similarity presented following encoding offered the only difference between the two individuals with respect to self-similarity. We hypothesize that participants incidentally employed a self-referential encoding strategy for learning about both individuals, thereby categorizing the personality traits into "relevant to me" and "not relevant to me" categories for each individual. Subsequent provision of a minimal indicator of self-similarity or self-dissimilarity likely led to divergent heuristic-consistent strategies for retrieving this information. The self-similar individual, who shared an association with self would have driven retrieval of "relevant to me" information, whereas the self-dissimilar individual, who likely shared an inhibitory association with self would have driven retrieval of "not relevant to me" information. Subsequent research is required to truly validate this hypothesis. A promising avenue of research would be to vary participants' inclination to incidentally employ self-referential encoding at learning and determine whether this affects their use of a self-heuristic to cue retrieval.

The contribution of this research to the literature is two-fold. First, this study fills a void in the literature by examining how a self-heuristic can bias memory for information about other individuals. Research specific to self-concept focuses mostly on how this construct affects *perceptions* of others (Cadinu & Rothbart, 1996; Ross, Greene, & House, 1977), especially for ingroup judgments, due to an existing perception of self-similarity (Cadinu & Rothbart, 1996; Clement & Krueger, 2002; Krueger & Clement, 1996; Marks & Miller, 1987; Spears & Manstead, 1990; Stotland & Hillmer, 1962) or how it acts as a *general* information processing strategy leading to enhanced encoding (Bower & Gilligan, 1979; Klein & Loftus, 1988; Rogers, Kuiper & Kirker, 1977; Symons & Johnson, 1997). In contrast, the literature devoted to understanding how heuristics bias *person memory* in particular has focused on the use of social stereotypes (Bower & Ballazza, 1981; Snyder and Uranowitz, 1978), with no research on a self-heuristic in particular (see Allan, Morson, Dixon, Martin, & Cunningham, 2017). The present study adds to the literature by supporting that a self-heuristic biases recognition memory to be heuristic-consistent when individuals are perceived to be even minimally self-similar. Second, this work offers a novel and important methodological contribution by adapting methodology from the social psychological literature (i.e. Betty K. experiment; Snyder and Uranowitz, 1978) to the cognitive study of self.

This novel methodology for measuring a self-heuristic introduces several avenues of research. For instance, it would be valuable to experiment with presenting the indicator of self-similarity to participants in a more social context (e.g. in place of characters, having confederates that interact with the participant) to better understand the ubiquity of a self-similarity heuristic in more realistic situations. Additionally, we used neutral traits in our study to avoid interactions due to self-positivity bias. Incorporating self-relevant traits of varied valence would uncover whether a self-heuristic behaves differently for positive and negative traits. Finally, we found some evidence in our study suggesting an encoding bias, but were unable to truly isolate this effect from a retrieval bias. Subsequent research will be required to determine whether a self-heuristic acts both at encoding and retrieval to bias memory for self-similar individuals.

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Chapter 5: General Discussion

Stimulus self-relevance is known to bias attention, memory, and impression formation. These effects are believed to be downstream consequences of the organization of a self network that guides low-level perception and cognitive representation (Greenwald, et al., 2002; Kihlstrom & Klein, 1994). As described in Chapter 1 (General Introduction), this self network is a robust set of highly practiced and elaborated associations that are personally relevant to the individual. It is believed to be central to cognition, owing to vast interconnection with other representations (Greenwald, et al., 2002; Markus, 1977; Markus, Smith, & Moreland, 1985; Markus & Wurf, 1987; Rogers, Kuiper, Kirker, 1977; Smith & Zárate, 1992). In addition, it is considered a default network due to strong and continuous baseline activation at rest (Gusnard & Raichle, 2001; Kelley et al., 2002; Raichle, et al., 2001). These properties of the self network all converge to suggest that it may yield heuristic-like effects on cognition. Using a social cognitive approach, this thesis investigated how a self-heuristic, emerging from underlying cognitive associations, functions to bias representation and perception of novel stimuli. Three key conclusions can be drawn which support the validity of existing theories of self-representation (e.g. Gawronski & Bodenhausen, 2006; Greenwald, et al., 2002; Kihlstrom & Klein, 1994) within the context of representation formation for newly-encountered people and objects.

1) **The self-heuristic biases representation:** An automatically-engaged self-heuristic biases cognitive representation of novel people and objects even in situations of minimal self-similarity.

2) **The self-heuristic biases memory:** Representation of new individuals relative to the self network produces a heuristic-consistent memory effect biasing both correct retrieval of information and reconstruction when retrieval fails.

3) **The self-heuristic has first-order effects on perception:** This representation leads to perceptual biases through first-order effects, whereby unrelated concepts (i.e. novel person/object, self-attribute) that both share an association to a concept in the self network can influence one-another.

Each conclusion is discussed in greater detail, with a summary of how it is supported by the empirical chapters. The implications of each conclusion on the extant literature, limitations of the research, and questions remaining unanswered are also considered.

The self-heuristic biases representation

Associative representation of novel stimuli within the cognitive network is based on perceived similarity to existing exemplars (Anderson, 1983; Rumelhart & McClelland, 1986; Smith, 1996; Smith and Zárate's, 1992). The specific exemplar used as the basis for representation is dependent on how attention is directed at the time of stimulus encoding (Smith & Zárate, 1992). Because self-relevant stimulus properties are known to capture attention (Bargh, 1982; Berlad & Pratt, 1995; Brédart, Delchambre, & Laureys, 2006; Chen, et al., 2011; Cherry, 1953; Gray, Ambady, Lowenthal, & Deldin, 2004; Ninomiya, Onitsuka, Chen, Sato, & Tashiro, 1998; Shapiro, Caldwell, & Sorensen, 1997; Tacikowski & Nowicka, 2010; Turk, et al., 2011; Zhou, et al., 2010), novel self-relevant people and objects should be automatically represented relative to a self network.

Consistent with this idea, current social cognitive research considers the self as a network of inter-connected representations that impose automatic influences on stimulus perception and representation (De Cuyper, et al., 2017; Greenwald, et al., 2002; Kihlstrom & Klein, 1994; Ye & Gawronski, 2016). Implicit methodologies are frequently used in this field to unconsciously access the underlying organization of self-concept and other social information, while avoiding the conscious biases inherent to self-report techniques (De Cuyper, et al., 2017; De Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009; Gawronski, LeBel, & Peter, 2007; Greenwald, et al., 2002). Previous implicit research has revealed cognitive associations between the self network and attributes (e.g. general positivity, identities, personality traits; Greenwald et al., 2002; Greenwald & Farnham, 2000; Karpinski, 2004; Nosek, Banaji, & Greenwald, 2002), merchandise brands (Perkins & Forehand, 2012; Prestwich, Perugini, Hurling, & Richetin, 2010), and perceptual shapes (Sui, He, & Humphreys, 2012). In addition, research on social representation has revealed implicit associations between self and familiar people (Aron, Aron, Tudor, & Nelson, 1991; Coats, Smith, Claypool, & Banner, 2000; Smith, Coats, & Walling, 1999; Smith & Henry, 1996) and ingroups (Devos & Banaji, 2005; Knowles & Peng, 2005). Less research has been devoted to understanding *representation formation* and therefore how *novel people* and *objects* are spontaneously associated with self (Allan, Morson, Dixon, Martin, & Cunningham, 2017; Gawronski, Bodenhausen, & Becker, 2007).

Evidence from all three empirical chapters supports that a self-heuristic has an immediate influence on representations of novel people and objects. Specifically, Chapters 2 (person-IAT chapter) and 3 (object-IAT chapter) present *implicit* evidence of immediate (i.e. within minutes) association formation between self and self-relevant stimuli, therefore supporting the automatic nature of a self-heuristic. Chapter 4 (memory chapter) revealed a memory bias (elaborated upon below) consistent with the induced belief that another person was self-similar. This bias favouring heuristic-consistent information supports (albeit less directly than implicit studies) that the self-similar person was represented with a shared association to self. In both Chapters 2 and 4, self-relevant cues were presented somewhat incidentally, providing support that the bias reflects an *automatic* effect on representation. Together, the immediacy and automaticity with which representational biases are formed support the idea that a self-heuristic is at play.

A surprising finding in Chapter 3 further supports the ease and efficiency with which novel stimuli are representationally associated with self. The magnitude of the implicit self-object association did not differ between newly-owned and already-owned objects, despite the latter having been owned 1.75 years longer on average. Though caution should be taken in interpreting null effects, at the very least, this suggests that an important self-object association is apparent immediately after ownership induction. This finding offers early implicit support (see Gawronski, Bodenhausen, & Becker, 2007) that cognitive representation of novel owned objects relative to self may underlie *explicit* ownership effects that are forged with the same immediacy (Kahneman, Knetsch, & Thaler, 1990).

A point that remains somewhat unexplored in the literature is the degree of stimulus self-relevance necessary to bias person and object representation. Social Identity

Theory research using minimal group paradigms has demonstrated that little self-relevant information is necessary to bring about perceptual biases like ingroup favouritism. In these studies, heuristic-driven processing strategies favouring one's own group are engaged even if the group distinction is based on a minimal and meaningless criterion (see Diehl, 1990 for a review). Researchers have taken this as evidence that self-concept is a highly salient and automatically-engaged "evaluative base" (Gramzow & Gaertner, 2005; Gramzow, Gaertner, & Sedikides, 2001; Otten & Wentura, 1999). Small indicators of self-relevance are known to be attentionally salient (Bargh, 1982; Berlad & Pratt, 1995; Brédart, Delchambre, & Laureys, 2006; Chen, et al., 2011; Cherry, 1953; Gray, Ambady, Lowenthal, & Deldin, 2004; Ninomiya, Onitsuka, Chen, Sato, & Tashiro, 1998; Shapiro, Caldwell, & Sorensen, 1997; Tacikowski & Nowicka, 2010; Turk, et al., 2011; Zhou, et al., 2010), suggesting that a rather minimal degree of self-similarity to another individual may be sufficient to engage a self-heuristic. In line with existing research (Allan, Morson, Dixon, Martin, & Cunningham, 2017; Wheeler, Allan, Tsivilis, Martin, & Gabbert, 2013), Chapter 2 found that participants used a self-heuristic after learning that a novel person possessed a moderate number (i.e. 15-16) of self-similar traits. However, in Chapter 4, a single piece of self-similar information (i.e. personality type) biased memory in favour of heuristic-consistent information. The fact that even a minimal indicator of self-similarity affects representation of novel person information supports that the cognitive system is highly sensitive to self-similarity and that the heuristic is easily engaged as an "evaluative base".

The self-heuristic biases memory

Self-referential encoding (i.e. is this trait descriptive of you?) of personality traits improves retrieval accuracy for both self-relevant and non self-relevant traits when compared with other encoding strategies (e.g. semantic encoding: does this trait mean the same as outgoing?) (Bower & Gilligan, 1979; Klein & Loftus, 1988; Rogers, Kuiper & Kirker, 1977; Symons & Johnson, 1997). The elaborative processing theory proposes that self-referential encoding reflects a typical depth-of-processing effect (Craik & Tulving, 1975), eliciting strong elaboration of information and therefore generating a greater number of item-specific retrieval cues (Bower & Gilligan, 1979; Gillihan & Farrah, 2005; Klein & Loftus, 1988; Rogers, Kuiper, & Kirker, 1977). A second theory suggests another benefit of self-referential encoding in addition to elaborative processing. The organizational processing theory proposes that the self network also acts as a superordinate framework that guides superior organization of learned information. Self-referential encoding is believed to prompt organization of information into "relevant to me" and "not relevant to me" categories, therefore encouraging relational encoding among words within a given category. This clustering of information into two categories that have been related to a highly salient concept (i.e. self) affords a structured top-down approach for searching memory, therefore providing mnemonic support (Heatherton, Macrae, & Kelley, 2004; Howell & Zelenski, 2017; Klein & Kihlstrong, 1986; Klein & Loftus, 1988). Both elaborative and organizational processing strategies are used in a multitude of contexts and not only when stimuli are perceived to be self-relevant. However, because the self network is a salient, central, and default network to cognition, it is believed to be very readily accessed, allowing both deep elaborative and organizational processing strategies to be engaged concurrently, therefore leading to a favourable encoding context (Kim, 2012; Klein & Loftus, 1988; Symons & Johnson, 1997). In support of this dual processing explanation, neural evidence suggests that in addition to the activations typical of deep semantic encoding, self-referential encoding elicits unique activations in medial prefrontal cortex (mPFC) proportionate to the size of the self-referential memory benefit (Benoit, Gilbert, Volle, & Burgess, 2010; Kelley et al., 2002; Macrae, Moran, Heatherton, Banfield, & Kelley, 2004; Mitchell, Banaji, & Macrae, 2005).

In Chapter 4 (memory chapter), we induced self-referential processing by giving participants a minimal expectation of self-similarity for a novel individual. Consistent with the predictions of both elaborative and organizational processing theories, we found a memory benefit for self-similar (i.e. heuristic-consistent) over self-dissimilar (i.e. heuristic-inconsistent) traits for the self-similar individual. This offers an important contribution because unlike most research on self-referential encoding, we did not explicitly ask respondents to use this strategy as a basis for encoding (see Turk, Cunningham, & Macrae, 2008). Instead, perception of minimal self-similarity to another individual seems to have led participants to incidentally engage self-referential encoding as a processing strategy. The incidental nature of self-referential encoding further supports the automaticity with which a self-heuristic biases perception.

We have discussed that in Chapter 4 self-referential encoding biased memory of personality traits for a minimally self-similar individual. In addition, we also examined memory performance for a minimally *self-dissimilar* character. In this situation, an *opposite* bias to self-referential encoding could be considered strategic, yet current theories do not explicitly speak to this hypothesis. Indeed, we found a marginally significant accuracy benefit for heuristic-consistent over heuristic-inconsistent information for the self-dissimilar individual, albeit to a lesser degree than the self-similar character. This meant that for the self-dissimilar individual, self-dissimilar traits were *better* remembered than self-similar traits, an opposite bias to that predicted by self-referential encoding. For instance, Paul is better able to remember that Heather, a self-dissimilar person, is perfectionistic because he does not consider this trait to be characteristic of himself. As a mechanism for this effect, we hypothesize that the self-dissimilar individual shares an inhibitory association with the self network, therefore decreasing the likelihood of retrieving self-similar (versus self-dissimilar) traits, which share a strong excitatory association in the self network. Chapter 4 is only the second exploration of the effects of a "proxy" self-referential encoding effect on memory for self-similar and self-dissimilar individuals, and therefore offers an important contribution to this new topic (see Allan, Morson, Dixon, Martin, & Cunningham, 2017).

Another interesting finding from Chapter 4 was that accuracy was biased in favour of heuristic-consistent traits when the self-similarity manipulation was presented both before (pre-learning condition) and after (post-learning condition) encoding. It is important to remember that the personality traits of self-similar and self-dissimilar individuals learned in the encoding phase were *equally* self-relevant. This means that in the post-learning condition, information should have been encoded similarly for both characters and that only the minimal indicator of self-similarity provided after encoding biased retrieval. Both deep elaboration and organizational processing accounts predict advantages at encoding and therefore cannot exclusively account for this finding. We hypothesize that, consistent with organizational processing, attributes for both characters were encoded as clusters that were tagged as "relevant to me" and "not relevant to me". Subsequently, the minimal indicator of self-similarity (or self-dissimilarity) forged an association (or inhibitory association) between this individual and the self network. This association (or inhibitory association) produced a memory bias whereby "relevant to me" (or "not relevant to me") information was preferentially retrieved. This idea is consistent with the action of heuristic-consistent memory biases observed in the stereotype literature (Bellazza & Bower, 1981; Snyder & Uranowitz, 1978).

Finally, there is a limitation in Chapter 4 that deserves further discussion. In this experiment, participants' expectation of self-similarity was manipulated through an ambiguous personality trait (i.e. Type 1 vs. 2) shared with the self-similar character. Similarly to minimal group paradigms (see Diehl, 1990 for a review), this bogus indicator of self-similarity was meant to reflect meaningless information that was unrelated to the memory measure. However, because the memory test also made use of personality traits, participants may have made assumptions about how these traits related to the minimal indicator of self-similarity. This may have led to the influence of group stereotypes on our results. For instance, Anna learns that a novel individual (Lesley) shares the same bogus personality type as her, Type 1. Anna may assume that both she and Lesley are members of a specific group (e.g. Type 1 people) that are similar to one another across a number of personality attributes. The heuristic bias observed may therefore reflect Anna's use of a group stereotype rather than a self-heuristic. To control for this, future research should test memory on dimensions that are assumed to be independent of the minimal indicator of self-similarity. For instance, instead of personality traits, memory for objects associated with each novel individual may be used, as others have done (Allan, Morson, Dixon, Martin, & Cunningham, 2017). Such replication would provide strong evidence that a self-heuristic is indeed driving the memory effect.

The self-heuristic has first-order effects on perception

What are first-order associations?

Two concepts share a first-order association when they are each associated with a common concept but not with one-another (see figure 4 for an example) (Gawronski & Bodenhausen, 2006; Greenwald, et al., 2002; Heider, 1958). For example, people and objects associated to the self-network share a first-order association with a wealth of self-knowledge that is not directly relevant to these people and objects. Associative models affirm that first-order associations have two consequences. First, because activation propagates through associations in the cognitive network, activation of one concept can activate other concepts connected through a first-order association. Second, the concurrent activation of concepts sharing a first-order association encourages formation of a direct association between them over time (Greenwald, et al., 2002; Gawronski & Bodenhausen, 2006; Heider, 1958). These properties mean that representations of novel people/objects and unrelated self-knowledge have the ability to influence one another even when they are not initially directly associated. This idea is consistent with traditional social psychological theories suggesting that self-concept is used "to go beyond the information given" when making new inferences (Andersen & Chen, 2002; Andersen, Reznik, & Chen, 1997; Markus, 1977). All three chapters provide empirical support for first-order effects on perception mediated by shared association to a concept in the self-network. We summarize each of three distinct lines of evidence below:

1. First-order associations result in transfer of self-positivity to newly-owned objects.
2. First-order associations result in transfer of self-attributes to a novel self-similar person.
3. Perception of highly familiar self-knowledge is affected by first-order association to a novel self-similar person.

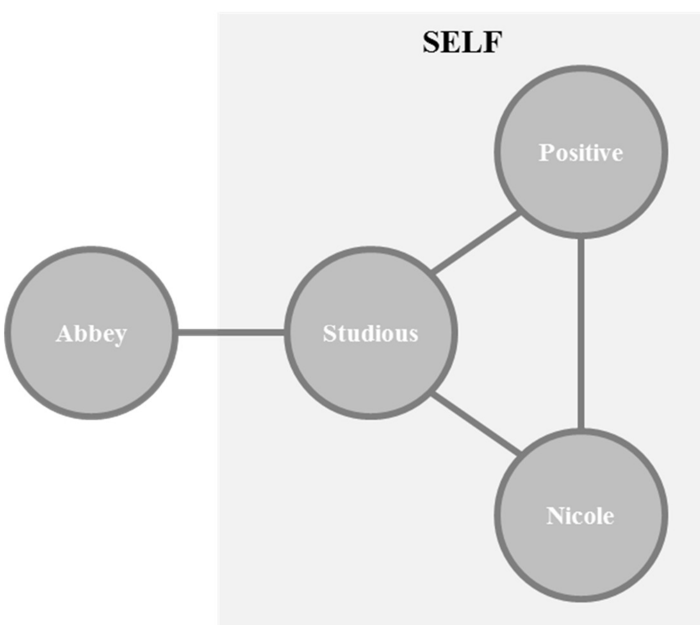

Figure 4. Diagram of a simplified associative network that illustrates direct and first-order associations between concepts. In this example, self consists of a network of interconnected associations including a valenced concept (Positive), demographic

information (the name Nicole), and a personality trait (studious). Each of these self nodes shares direct associations to the others, represented by the individual lines connecting them. A novel person (Abbey) who is also perceived as studious shares a direct association to the studious node. Because they each share a common association (studious), Abbey, positive, and Nicole all share first-order associations with one-another. Abbey may, for example, be perceived as positive by way of the shared first-order association to studious, through which activations may propagate. Over time, concurrent activation of the Abbey and positive nodes may lead to the formation of a direct association between them.

First-order associations result in transfer of self-positivity to newly-owned objects

A first-order association mediated by shared association to self-concept is believed to drive the transfer of positive self-associations onto novel self-relevant people and objects, therefore enhancing implicit valuation of these targets (Beggan, 1992; Gawronski, Bodenhausen, & Becker, 2007; Pierce, Kostova, & Dirks, 2003). This associative self-anchoring is hypothesized to be at the root of several the self-positivity effects discussed in Chapter 1, including the mere ownership effect, endowment effect, and ingroup favouritism (Gawronski, Bodenhausen, & Becker, 2007). Explicit positivity effects observed for owned objects are more pronounced for longer lengths of ownership (Perkins & Forehand, 2012; Prestwich, Perugini, Hurling, & Richetin, 2010; Strahilevitz & Loewenstein, 1998; Shu & Peck, 2011). This is presumably because these objects are afforded greater elaborative experience in a number of contexts over time, which should enhance integration of the object representation into the self network (Beggan, 1992; Pierce et al., 2001, 2003).

In Chapter 3 (object-IAT chapter), we replicated the finding that length of ownership has a positive effect on explicit object valuations; previously-owned objects were valued more than newly-owned ones, both of which were valued more than unowned objects. Surprisingly, though, we found no implicit evidence to support the proposed mechanism that objects owned over a longer time span become more associated with the self-network. Results from our implicit task revealed no difference in self-object association strength between previously-owned and newly-owned objects. This goes against the observation that there is a positive effect of length of ownership on explicit object valuations (Strahilevitz & Loewenstein, 1998). The fact that we observed that newly-owned objects show as strong an implicit association to self as the previously-owned objects is very interesting and may be due to the ease with which the associations are formed. The explicit measure may be influenced by self-presentation bias and therefore more apt to show a length of ownership effect, whereas the implicit measure avoids conscious strategy to enhance self-esteem.

First-order associations result in transfer of self-attributes to a novel self-similar person

In addition to self-positivity effects, first-order associations can also provide important predictive value in impression formation. A common example of this is the generalization of stereotypes that occurs when a novel person is cognitively associated with the representation of a particular social group (e.g. McCauley, Stitt, & Segal, 1980). Stereotype attributes for that group are transferred to the person through a first-order association mediated by the group representation (Greenwald, et al., 2002). Additionally, first-order transfer of self-relevant information may underlie the false consensus effect, whereby participants assume that others are more self-similar than predicted by chance (Cadinu & Rothbart, 1996; Ross, Greene, & House, 1977). Indeed, the false consensus effect is amplified when the target person is already perceived to be self-similar (Allan, Morson, Dixon, Martin, & Cunningham, 2017; Cadinu & Rothbart, 1996; Clement & Krueger, 2002; Krueger & Clement, 1996; Marks & Miller, 1987; Spears & Manstead, 1990; Ward, 1967; Wheeler, Allan, Tsivilis, Martin, & Gabbert, 2013), highlighting the importance of an association to self in producing first-order effects. Finally, the use of first-order associations is also supported when participants predict objects that newly-encountered individuals would prefer. There is more overlap with own object preferences for self-similar individuals (versus self-dissimilar individuals), indicating that participants are likely accessing the self network to make their predictions (Allan, Morson, Dixon, Martin, & Cunningham, 2017).

In Chapter 4 (memory chapter), use of a self-heuristic generated more heuristic-consistent than heuristic-inconsistent memory errors for the self-similar individual, a pattern that was not observed for the self-dissimilar individual. This source confusion has been attributed to a heuristic-based guessing strategy that is employed when retrieval fails. This involves participants guessing at (i.e. predicting) the correct response in a manner that is consistent with their initial representation of the person (Bower & Ballazza, 1981; Snyder and Uranowitz, 1978). For instance, imagine that a participant fails to recall whether a given personality trait is characteristic of the self-similar character, but knows that this personality trait is characteristic of self. First-order associations between self-related personality traits and the self-similar character should allow proliferation of activations between these two representations. This should in turn increase the number of heuristic-consistent false alarms, whereby self-relevant personality traits are incorrectly associated with the self-similar individual. In Chapter 4, this heuristic-based guessing was not observed for the self-dissimilar individual because they presumably shared an inhibitory association to self and therefore did not possess a first-order association to self-attributes that could be accessed to shape predictions.

Perception of highly familiar self-knowledge is affected by first-order association to a novel self-similar person

Thus far, we have reviewed ways in which self-associations can alter perceptions of novel self-similar individuals and owned objects. However, first-order associations should also function bidirectionally, enabling *self-associated people* and *objects* to bias unrelated self-perceptions by way of a first-order association. In a recent test of this hypothesis, Payne, Tsakiris, and Maister (2017) repetitively paired an unfamiliar face with a "self" label, producing a cognitive association between that person and the self network. Participants were subsequently presented with morphed faces comprised of the participant's own face and the self-associated face (or a control face), morphed to varying degrees. Their task was to explicitly rate how much each facial morph resembled their own face. Payne and colleagues (2017) hypothesized that association of a novel face to self-concept should, through first order association, drive the novel face to become incorporated into representation of the participant's own face. Thus they predicted that ratings of facial self-similarity would be higher for morphs of own face with the self-associated face than morphs of own face with the control face. However, ratings were no different, leading the researchers to conclude that novel self-associated person representations do not affect representation of one's own face.

In contrast, we found evidence that association to a self-similar individual produced malleability of responses to self-knowledge. In Chapter 2 (person-IAT chapter), categorization in the Implicit Association Test was faster when self / a self-similar individual (and not self / a self-dissimilar individual) required the same response, compared to when self / a self-dissimilar individual (and not self / a self-similar individual) required the same response. The effect was observed across all four classes of categorized information: personality traits of the self-similar and self-dissimilar individuals, and self-relevant and non self-relevant demographic information (e.g. name, hometown, etc.). The latter finding supported that categorization of *self-knowledge* was influenced by a first-order association with the self-similar individual. This was remarkable because demographic self-knowledge, similarly to one's own face, presumably already shares robust and extremely well-practiced associations with self. We would have predicted that response time for categorization of demographic self-knowledge would not be sensitive to compatible versus incompatible category pairing. The differences between Chapter 2 results and those of Payne and colleagues (2017) may be attributable to our use of an implicit measure that was more sensitive to underlying representation than their explicit rating task. There is also the possibility that representation of one's own face is more rigid and therefore resilient to the influence of first-order associations than demographic self-knowledge.

Summary

An extensive literature suggests that stimulus self-relevance biases attention, memory, social perceptions, and other cognitive processes. Given the ubiquity and automaticity with which perceptions of self-relevance bias cognitive processing, this thesis aimed to provide a deeper understanding of the underlying cognitive organization that gives rise to these effects. Specifically, we investigated whether a self-heuristic mediates association formation between self and novel stimuli, while also examining the implications of this cognitive association on perception. Although research on underlying self-representation has been abundant in recent years, this thesis aimed to fill a gap by focusing on understanding *association formation* of representations for novel self-similar people and owned objects.

Findings from the empirical chapters support three main conclusions on how a self-heuristic operates to bias representation and perception of self-similar people and owned objects. First, and central to the main hypothesis, a salient self-heuristic is automatically applied at representation formation, leading to greater implicit association strength between the self network and self-similar people and owned objects. Second, and in line with research on stereotypes, this representation underlies a self-heuristic that biases the information retrieved from memory and how reconstruction proceeds when retrieval fails. Finally, the biased representation has indirect consequences through first-order associations. Effects of unrelated concepts (i.e. novel person/object, self-attribute) demonstrate the ability of a self-heuristic to alter cognitive processing beyond the *original* association with self.

The conclusions support social cognitive theories of self-representation, which view the self network as a central set of associations acting as a framework for representation of social information (e.g. Greenwald, et al., 2002). A main contribution of this thesis is in applying these theories to understand processes underlying representation formation for novel people and objects, a context that had received relatively little attention in the wider field of self research. Another high level contribution is the perspective brought by understanding how self-representation biases perception and representation through heuristics. The cognitive approach used here borrowed theory and methodology from the social psychological study of stereotypes, therefore providing a fresh and integrative perspective on self-theory.

Importantly, to better approximate how a self-heuristic operates in real world interactions, we put great effort into infusing a sense of realism into our methodologies. In contrast with recent studies that have used conscious pairing paradigms to generate cognitive associations between self and novel stimuli (e.g., Ma & Han, 2010; Payne, Tsakiris, & Maister, 2017; Perkins & Forehand, 2012; Prestwich, Perugini, Hurling, & Richetin, 2010; Sui & Han, 2007; Sui, He, & Humphreys, 2012; Sui, Sun, Peng, & Humphreys, 2014), in Chapters 2 and 4, self-similarity was *incidentally* induced when participants learned personality traits of novel individuals that they believed to be other real participants. As discussed, this supports the automatic role of a self-heuristic in creating representational biases. Chapter 3 examined the effect of long-term ownership on cognitive representation of objects, therefore necessitating use of participants' unique already-owned objects as stimuli. This is unique in the ownership literature (see Constable, Kritikos, & Bayliss, 2011), which is characterized by heavy use of ownership induction procedures, therefore limiting the scope of research to newly-owned objects that were assigned to the participant or chosen from a rather limited set. Finally, to measure association of novel stimuli to the self network in Chapters 2 and 3, we created stimuli for the self category using a rich set of individual demographic data that was unique to each participant. In contrast with other studies that have employed the same personal pronouns as categorization stimuli across participants (e.g., Greenwald & Farnham, 2000; Mitchell, Macrae, & Banaji, 2006; Nosek, Banaji, & Greenwald, 2000), our approach was tedious but likely more effective in evoking each participant's rich and idiosyncratic sense of self.

In sum, we framed the cognitive representation of a self network as a mechanism that automatically gives rise to a self-heuristic. This robust structure allows for more cognitively efficient representation formation and perception of social information (e.g. people and objects). First-order effects indicate that a self-heuristic, like any heuristic, is an optimized but imperfect solution. It can therefore be disruptive when applied in inappropriate contexts like when heuristic-based guessing led to errors on the recognition memory task in Chapter 4. Despite the self-heuristic occasionally disrupting performance, it offers the important advantage of cognitive efficiency, which is likely why we found overwhelming evidence of its use across all three empirical chapters. Overall, the empirical findings of this thesis highlight the ubiquity and automaticity with which a self-heuristic is employed in realistic social situations; these findings, along with the vast literature on self-relevancy effects, suggest that a self-heuristic is fundamental to human cognition.

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