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Simulation Requires Activation of Self-Knowledge to Change Self-Concept

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Simulating other people can shift one's self-concept, an effect known as simulation-induced malleability. How does imagining others shift the self? We propose that the activation of self-knowledge is the key factor by which simulation of others alters one's self-concept. We test this possibility across four studies that each manipulate self-knowledge activation indirectly during simulation and measure the impact on subsequent self-ratings. Results demonstrate that increasing activation of self-knowledge during simulation is associated with increased self-concept change. People experienced greater self-concept change when simulating similar others (Studies 1 and 2). People also generalized simulation-induced changes to aspects of the self-concept that were semantically similar to the simulated content (Study 3). Finally, people who are less likely to recruit self-knowledge (i.e., older adults) during simulation were less susceptible to self-concept change (Study 4). These studies highlight self-knowledge activation as an essential component of the effects of simulation on self-rated change.

Public Significance Statement
These studies suggest that self-knowledge is a key component in shifting self-perceptions. When thinking about others—their mental states, experiences, and traits—the more people draw from their own-knowledge, the more they can shift their self-perceptions. This is essential for understanding the underlying mechanisms involved in simulation.

Keywords: social cognition, simulation, self-concept, malleability

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Social interactions constitute a substantial proportion of people's daily routines. American adults spend an average of 7 ½ hours with their partners, coworkers, or children (Koop, 2021). These social interactions shape all aspects of people's self-concept, from behaviors (Chartrand & Bargh, 1999; Ploderer et al., 2014) to thoughts (Fazio et al., 1981; W. B. Swann & Hill, 1982) and self-esteem (Denissen et al., 2008). Interactions are not the only way for the social world to shape the self: Simply thinking about others can likewise shift how people perceive themselves (Meyer et al., 2019; Rubin-McGregor et al., 2022). How does social thought shape people's internal worlds?

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All open data and open code are publicly available on the Open Science Framework at https://osf.io/etq7u/. Preregistrations are also included for Studies 2 (https://osf.io/juwq9), 3 (https://osf.io/c8rx9/), and 4 (https://osf.io/x2j5d/). The authors report how they determined their sample size, all data exclusions, all manipulations, and all measures in the study, and they follow Journal Article Reporting Standards (Kazak, 2018). Data were analyzed using R, Version 4.2.1 (R Core Team, 2021). Findings from Studies 1, 2, and 4 included in this article have been previously presented as a poster at the Society for Personality and Social Psychology Conference.

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Simulation Changes the Self

The more individuals interact with people in person, the more they think about other people (Mildner & Tamir, 2021). On a typical day, someone may consider how their child is doing at school, if their parents are feeling lonely, or if their favorite celebrity is a kind person. When people daydream, approximately 70% of these momentary thoughts are about other people (Song & Wang, 2012; Sugiura & Sugiura, 2020). In thinking about others, people make inferences about what that person may think or feel or how they may behave (Dennett, 1990). The current studies focus on understanding the impact of this process of spontaneously or intentionally considering mental states—or mentalizing—on how people represent the self.

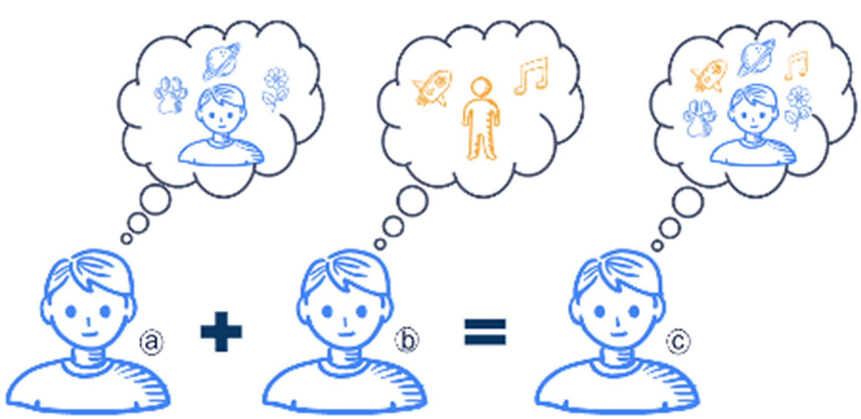
The contents of others' minds are all but invisible to perceivers. How do people make inferences about this invisible content? Philosophers and psychologists have proposed that people may solve this challenge by drawing upon their knowledge of a very well-known mind: their own (Cooley, 1902; Goldman, 2006; Mitchell et al., 2005; Tamir & Mitchell, 2010). When people use their own thoughts and feelings as a starting point for trying to understand how others think or feel, this process of mentalizing is called simulation. While the goal of simulation is often to understand *another* person, the simulator draws on self-knowledge to do so (Gallese & Goldman, 1998; Gilead et al., 2016; Goldman, 2006; Shanton & Goldman, 2010). The term simulation can refer to a range of specific processes, including imitating, copying, or reexperiencing the mental states of others (Shanton & Goldman, 2010). In the current studies, simulation is defined as the subcategory of mentalizing—the ability to understand the mental states of oneself and others—that uses an egocentric default. We propose that one of the key consequences of simulation—changes to the self—stems from using the self as the starting point to access others' minds. The aim is to understand how thinking of another individual and their traits or experiences may change the way an individual thinks about themselves. The current paradigms all elicit mentalizing by asking individuals to imagine a target and rate them on traits or imagine their experience in different scenarios.

Considering others' minds can change both a person's perceptions of *other* individuals (Benoit et al., 2010a; Bergström et al., 2015) and the *self* (Meyer et al., 2019; Rubin-McGregor et al., 2022). Prior work has proposed that mentalizing changes the self through a process called simulation-induced malleability (SIM; Meyer et al., 2019). SIM occurs when simulating other individuals results in a person's self-concept shifting closer to their representation of the other individual. For example, when thinking about a friend acing a math test, a person considers the mental state and abilities of that friend. After this simulation, they may estimate that they themselves feel more competent in math. SIM can shape a broad range of components of the self-concept, from semantic traits to episodic memories, and is effective with different targets of simulation (Meyer et al., 2019). SIM effects are also durable: Changes to one's memories can last for up to 48 hr. Finally, SIM effects can spread across semantically related concepts to influence a particular cluster of traits (Rubin-McGregor et al., 2022). The effect occurs regardless of whether simulation is induced and measured using rating or writing prompts. The findings occur when simulating both similar targets (e.g., "my friend Claire") and dissimilar targets (e.g., an average American or Walter Cronkite). However, the effects are generally strongest when simulating similar targets (Meyer et al., 2019).

Simulation is a potent force that can change the self-concept in myriad ways. However, little is known about the mechanisms behind SIM. It has been established that simulation can change the way individuals perceive themselves (Meyer et al., 2019) and that this effect endures over time and across paradigms (Rubin-McGregor et al., 2022), but it is unclear what mechanisms drive these effects. How do such simple flights of thought shape one's self-concept? In naming this phenomenon SIM, researchers have assumed that simulation is central to its effects. If simulation necessarily entails activation of self-knowledge, we must then ask: To what extent does SIM truly hinge on activation of self-knowledge? To answer this question, we must interrogate the components underlying the proposed simulation process.

We propose that simulation may change self-concept through the following process (Figure 1): First, self-knowledge is activated.

Figure 1
Mechanism Underlying Simulation-Induced Malleability



Note. Simulation impacts self-knowledge when a person (a) activates self-knowledge alongside (b) relevant target knowledge to (c) alter self-perceptions in a related domain. See the online article for the color version of this figure.

This can occur explicitly, by considering before simulation, or spontaneously, during simulation itself, without prompting. Importantly, activation of self-knowledge makes it malleable and subject to alteration (Meevissen et al., 2011; Libby et al., 2011; Di Bella & Crisp, 2015). In the context of these studies, malleability of self-knowledge is defined in a similar way to that of memory research (Klein et al., 1989, 1992; Klein & Loftus, 1988, 1993; Loftus, 2005; Loftus et al., 1978; Markus & Kunda, 1986). Malleability is when an existing memory, belief, or judgment (in this case self-judgment) can be changed or manipulated to integrate new information. The more something can be changed, the more malleable it is (Loftus, 2005; Loftus et al., 1978; Markus & Kunda, 1986). Second, this labile self-knowledge is activated *alongside* knowledge relevant to the target of the simulation (Moore et al., 2014; Welborn & Lieberman, 2015). When this labile self-knowledge is coactivated with target knowledge, target knowledge can then become integrated into self-knowledge during reconsolidation, resulting in lasting changes to memories and the self-concept (Hupbach et al., 2007, 2009; Nader, 2003; Rubin-McGregor et al., 2022). During this restabilization period, memories can be influenced and are reconsolidated into long-term memory in an altered form (J. L. C. Lee et al., 2017).

Across four studies, we examine the part of this process that defines simulation: the impact of self-knowledge activation. We propose that self-knowledge activation is one key element of simulation that can strengthen or attenuate its effects on self-concept change. We manipulate self-knowledge activation with several indirect, and theory-driven, manipulations and measure the impact on the magnitude of self-concept change.

Activation of Self-Knowledge

When simulating other individuals, people draw upon the knowledge of themselves (Goldman, 2006; Shanton & Goldman, 2010). That is, individuals pull from their own real or imagined experiences, mental states, and emotions and project them onto another person to better understand that person's experience (A. Moran, Campbell, et al., 2012; Shanton & Goldman, 2010). For example, to imagine how a friend would react to a breakup, a person may first consider how they themselves would react to a breakup. Evidence from both behavioral and neuroimaging research indicates that activation of self-knowledge during simulation occurs spontaneously (Epley et al., 2004; Mussweiler & Bodenhausen, 2002; Nickerson, 1999; Smith et al., 1999; Tamir & Mitchell, 2013). People can answer questions about themselves faster if they have recently simulated a close other (Mussweiler & Bodenhausen, 2002), suggesting that social inferences about close targets coactivate self-knowledge. Simulating others engages regions of the brain associated with self-referential thought, like the medial prefrontal cortex (Amodio & Frith, 2006; Harris & Fiske, 2006; Mitchell, 2009; Mitchell et al., 2005, 2006). These findings suggest that people automatically activate their own experiences when mentalizing about how others might think, feel, or act (Gordon, 1986; Hoch, 1987; Wegner & Vallacher, 1977). This self-knowledge serves as the anchor point for social inferences (Epley et al., 2004; Molnar-Szakacs & Arzy, 2009; Tamir & Mitchell, 2010). People never fully escape the pull of this starting point and, as a result, assume that others hold similar opinions (Fabrigar & Krosnick, 1995; Krueger & Clement, 1994; Mullen et al., 1985; Ross et al., 1977), possess similar factual knowledge (Epley et al., 2004), and participate in similar activities (Allport, 1924) as themselves.

Together, this wealth of evidence establishes self-knowledge activation as a central component of simulation. We propose that, in turn, self-knowledge activation when simulating another mind is essential for eliciting self-concept change. If so, the more self-knowledge is coactivated during simulation along with target knowledge, the greater the potential for the binding of self and target knowledge, which may lend itself to self-concept change. We investigate this hypothesis by examining several factors known to impact the magnitude of self-knowledge activation in simulation, including (i) the social proximity between the target and participant, (ii) the anchor stimuli used, and (iii) the age of the person simulating. Though our paradigms cannot measure the activation of self-knowledge directly, each manipulation is designed to create conditions that, based on existing literature, inherently activate more self-knowledge.

Social Proximity

The degree to which self-knowledge is spontaneously activated during simulation depends, in part, on one's perceived social proximity to the target, including similarity (Jenkins et al., 2008; Tamir & Mitchell, 2010), interpersonal closeness (Hughes & Beer, 2012; Krienen et al., 2010; Savitsky et al., 2011), familiarity (Beckes et al., 2013), liking (Higgins & Rholes, 1978), and positivity (Davis, 2017; Machunsky et al., 2014; Machunsky & Walther, 2015). As each of these social proximity metrics increases, people activate self-knowledge to a greater extent during simulation. For example, a person will activate more self-knowledge when thinking about their good friend Claire than when thinking about their long-forgotten second-grade teacher. This distinction arises in neuroimaging studies, where regions responsible for thinking about the self are automatically activated when considering proximal, but not distal, others (Hughes & Beer, 2012; Jenkins et al., 2008; Krienen et al., 2010; Mitchell et al., 2005, 2006; Ochsner et al., 2005). In fact, people may not use self-knowledge at all when considering dissimilar others unless they are instructed to actively take their perspective (Todd et al., 2016). If SIM depends on self-knowledge activation, then we would expect to see greater self-concept change after simulating similar, close, and liked targets because these activate more self-knowledge. Thus, one way to indirectly increase self-knowledge activation may be to manipulate the similarity of the target (Ames, 2004a, 2004b; Beckes et al., 2013; Jenkins et al., 2008; Tamir & Mitchell, 2010). We investigate the effects of self-knowledge activation by measuring and manipulating the similarity of the target and examining the impact on self-concept.

Context Effects

We can also indirectly increase self-knowledge activation by changing the anchor point from which people make comparisons. Our predictions build upon existing literature examining how properties of anchor stimuli (such as primes, tuning sets, and other frameworks) influence later judgments (Cohen, 1961; Herr, 1986, 1989; Higgins & Rholes, 1978; Innes, 1981; Mazis, 1973; Northoff, 2014; Zajonc, 1960). In particular, the work on context effects suggests that considering a target before the self creates greater perceived similarity to the said target (Mussweiler, 2001a, 2001b). That is, we see evidence of assimilation when individuals consider a target first and relate themselves to that person. For example, if a person is asked "how similar is Claire's opinion to yours?" they match features of Claire with features of themselves (Tversky, 1977; Tversky & Gati, 1978). If assimilation effects bolster similarity, and similarity drives self-knowledge activation, then it is possible that inducing assimilation effects will increase self-knowledge activation. Thus, using a target as an anchor for comparison is another method by which we can indirectly manipulate self-knowledge activation. Here, we predict that using the target as an anchor will lead to a greater change in self-concept than using the self.

In contrast, when individuals consider their own characteristics first, and subsequently relate a target to themselves, people are more likely to focus on differences between themselves and the other (Fabrigar & Krosnick, 1995; Karniol, 2003; Mullen et al., 1985; Mullen & Smith, 1990). For example, if a person is asked "how similar is your opinion to Claire's?" individuals draw on their elaborate and specific self-knowledge, making it difficult to match features, thereby decreasing perceived similarity (Tversky, 1977; Tversky & Gati, 1978). Thus, we expect stronger SIM effects when considering a similar target before the self.

Age

In addition to paradigms that manipulate self-knowledge by changing the target or context of the inference, some populations are less likely to activate self-knowledge across all contexts. Specifically, older adults are less likely to activate self-knowledge to the same extent as younger adults when mentalizing about social targets (Henry et al., 2013; J. M. Moran, Jolly, & Mitchell, 2012; J. M. Moran, 2013). Older adults show weaker activity in the medial prefrontal cortex, an area associated with self-referential cognition, when forming (Cassidy et al., 2013) and updating (Suzuki et al., 2019) impressions about social cues (Cassidy et al., 2021). If older adults activate less self-knowledge during simulation, then we would expect less self-knowledge to be made malleable than their younger counterparts. With reduced activation of self-knowledge during simulation, we would expect less self-concept change for older adults.

In sum, if self-knowledge activation is necessary for SIM to occur, we would expect to see the following. First, SIM effects should be greater when simulating similar targets compared with dissimilar targets. Second, effects should be weaker for older adults than for young adults.

Activation of Target Knowledge

Another essential component of simulation is the activation of target knowledge. People often engage in simulation when making inferences about another person's mind. That is, people may recruit self-knowledge when reasoning about others (Van Overwalle, 2009; Wu et al., 2020), but they do so in parallel with thinking about that person's mind, emotions (Decety & Jackson, 2004), personality traits (Funder, 1995), or other components of who they are. Indeed, people may activate multiple stores of knowledge about another person to make inferences about them.

First, individuals may use general models of how people react to the world, which can then be used to make inferences about other people's mental states, personalities, and behaviors (Van Overwalle, 2009; Wimmer & Perner, 1983). Second, individuals may activate stereotype-specific knowledge when making social inferences and fill in gaps in knowledge, particularly when they possess minimal knowledge about a target or perceive them as dissimilar (Ames, 2004b; Kunda et al., 2002; Kunda & Spencer, 2003). Finally, people may also activate person-specific theories of mind (Welborn & Lieberman, 2015). That is, people may activate knowledge about the idiosyncratic characteristics of specific, well-known others to make inferences about them.

People always activate *some* amount of target knowledge—whether from generalized social models or person-specific theories—to make an inference about them. While simulation entails activating knowledge about the self, knowledge about the target is what can shift people's self-concept in a particular direction. This new target information alters the self-concept by integrating with the concurrently active and malleable self-knowledge. In line with prior work, we anticipate that the self-concept should change to be more similar to this activated target knowledge (Meyer et al., 2019). That is, we propose that self-knowledge activation impacts the magnitude of self-concept change and shifts it toward the target of simulation. While target knowledge is a central part of simulation, we refrain from testing the effects of target knowledge activation on self-concept change to focus the scope of the studies on examining the role of self-knowledge activation.

The Present Studies

During simulation, individuals activate self-knowledge alongside target knowledge. Does SIM of self-concept depend on self-knowledge activation? Across four studies, we manipulate self-knowledge activation indirectly to test its role in self-concept change. First, we examine if similarity to the simulated target is associated with increases in the magnitude of self-knowledge change after simulation (Study 1). Second, we test anchor effects (Studies 2 and 3). Third, we test the generalizability of these effects by measuring the impact of self-knowledge activation for novel, semantically related traits (Study 3). Finally, we test if the magnitude of SIM is greater for younger than older adults (Study 4). Across all studies, we expect that SIM effects will be strongest for similar targets and when the target is used as the anchor for comparison (vs. self-anchoring). Finally, effects will be stronger for younger (vs. older) adults.

These studies extend upon previous work on priming (when the self is the prime) and the self-reference effects that both use the self as the *independent* variable (Klein et al., 1989, 1992; Klein & Loftus, 1988, 1993; Rogers et al., 1977). Here, our key insight is that when self-knowledge is measured as the *dependent* variable, we see that it is impacted by simulation. There are indeed other prior studies looking at self-change as a dependent variable (Di Bella & Crisp, 2015; Libby et al., 2011; Meevissen et al., 2011). However, very little of that work uses simulation of another person as the catalyst for that change (Meyer et al., 2019; Rubin-McGregor et al., 2022). In showing that self-knowledge *does* change, these studies speak to a boundary condition of the work on the self as a powerful memory structure (Greenwald & Banaji, 1989).

Study 1: The Effect of Social Proximity on SIM

Method

Study 1 tested whether self-concept change after simulation is associated with self-knowledge activation. We did so by leveraging the finding that people activate more self-knowledge when simulating similar targets than dissimilar targets (Ames, 2004a, 2004b; Beckes et al., 2013; Tamir & Mitchell, 2010) and that closeness to a target moderates self-knowledge activation (Krienen et al., 2010). If SIM depends on self-knowledge activation, then simulating more socially proximal targets should produce greater SIM effects, operationalized by greater similarity between ratings for the self and the target. To test this possibility, Study 1 drew on data from 15 prior studies of SIM, all of which included both measures of the magnitude of SIM for each participant and measures of perceived similarity and closeness between each participant and target (Meyer et al., 2019; Rubin-McGregor et al., 2022).

Participants

A final sample size of $N = 5{,}235$ was determined by the number of total participants who had previously completed studies on SIM online between 2018 and 2022 and responded to all prompts used in the current analyses. Some study designs were within-participants, leading to two target ratings per participant, for a total of $N = 8{,}807$ individual responses (see Supplemental Material for demographic breakdown). For all studies, participants were asked to answer the following questions for demographic reporting: “What is your gender?” “What is your race?” This sample afforded us over 99% power to detect the main effects of condition and similarity, along with an interaction between condition and social proximity, based on a post hoc power analysis ($N = 5{,}235$, two-sided $\alpha = .05$, $f = 0.3$). A sensitivity analysis was also used to determine the minimal detectable effect size ($f = 0.07$). All power analyses were conducted using G*Power Version 3.1. We included all participants who were used for data analysis in the original studies. Exclusion criteria across these studies included overall time on task being too short, self-reporting poor English comprehension, providing too few unique answers (at least 10% of responses differ from any other participant), or not responding to the dependent variables of interest.

Procedure

Across these studies, we coded existing conditions into three umbrella conditions: (a) In *Control* conditions (N = 955), no simulation was performed, or the condition was designed to elicit no effect on the dependent variable (similarity or competence). (b) *Active* conditions (N = 4,416) were designed to elicit greater change in the dependent variable, relative to a Control or *Intermediate* condition (i.e., simulating a highly similar, competent target). (c) *Intermediate* conditions (N = 3,436) were ones in which the condition was designed as a less effective version of the Active condition (i.e., simulating a dissimilar target; simulation with a temporal delay). In all studies, participants rated their perceived similarity and closeness to the target and completed at least one Inclusion of the Other in the Self measure (Aron et al., 1992). We collapsed these social proximity items into a single measure, as all three have been shown to be individually associated with an increase in self-knowledge activation during social inferences (Davis, 2017; Jenkins et al., 2008; Krienen et al., 2010; Machunsky et al., 2014; Machunsky & Walther, 2015; Savitsky et al., 2011).

There were two study designs used in this analysis. In the first study design, participants first completed a simulation block (or control, depending on experimental condition), followed by a self-rating block. During the simulation block, participants rated a target on eight competence traits; during the control block, participants rated a target on eight irrelevant traits, such as those related to warmth or physical appearance, or completed a visual control. During the self-rating block, participants rated themselves on the same eight competence traits. Participants were asked to generate someone they knew who was highly competent (defined in the study) and rate them on competence traits. Thus, the expected SIM effect, where participants report greater self-target alignment following simulation, was operationalized by increased self-competence ratings.

In the second study design, participants first completed a self-block, followed by a simulation (or control) block, followed by a second self-block. Thus, all of these studies utilized a pretest–posttest design. During the first self-block, participants were asked to either (a) recall a set of scenarios (i.e., remember a time you received good news) and rate the valence of this event for themselves or (b) rate themselves on a broad range of personality traits (i.e., charming, reliable) using a continuous 0–100 slider scale anchored on *not-at-all* to *extremely*. During the simulation block, participants simulated a target using the same traits. They then completed the second self-block where they rerated their own traits or memories from the first self-block. In this study design, the SIM effect was calculated as the difference between two difference scores: the difference between target and self-ratings presimulation and the difference between target and self-ratings postsimulation. We compared presimulation and postsimulation difference scores to measure how much people shifted their self-ratings toward the target. Specifically, we subtracted the difference scores from presimulation to postsimulation to create one change score, showing how much closer the self-ratings came to target ratings following simulation.

We converted the change score for the similarity designs and the competence score for the competence designs into z scores to compare across designs. All findings were similar within each study design and across change and competence scores (see Supplemental Material). Thus, for each participant we had a z score, where higher ratings indicate a greater SIM effect on similarity or competence score.

To examine the relationship between social proximity and the magnitude of the SIM effect, we created a linear mixed-effects model. We included condition (Active, Intermediate, or Control) and social proximity as fixed effects and examined the main effects and an interaction effect for these terms. Social proximity was measured globally across four measures: perceived similarity, emotional closeness, and two versions of the Inclusion of Others in Self scale (see Supplemental Material for parallel results from each measure individually). We converted the scores of these four measures into z scores and averaged across them to create a global proximity score between each participant and target. The dependent variable was the z scored competence ratings or change in self-target similarity after simulation, depending on the study design. The model included a random grouping factor for individual studies and study design (similarity vs. competence). Analyses were conducted using the *lme4* package in R, Version 4.0.2. We expected that if the amount of activated self-knowledge is associated with SIM, then closer proximity would predict greater SIM. That is, we expected to observe an interaction between condition and proximity in which as similarity increases, so does the difference between Active and Control conditions. We conducted a parallel model to test if the Active condition showed a stronger effect than the Intermediate simulation condition; the only difference from our primary model was that the Intermediate condition, and not the Control condition, was set as the reference level.

Results

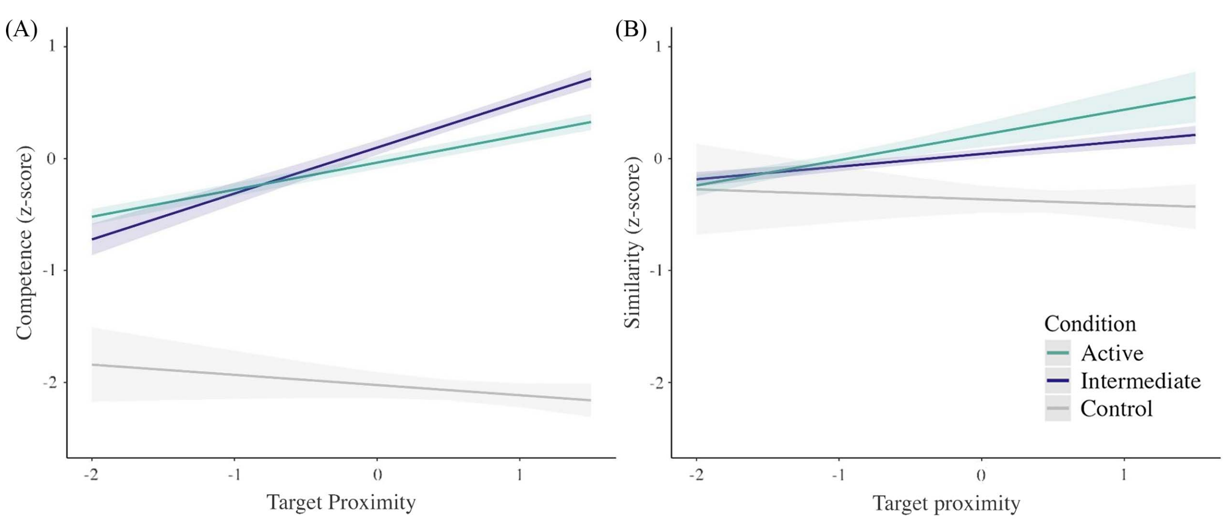
We first tested for a main effect of condition (Active, Intermediate, Control) across all studies. A mixed-effects model regressing the SIM measure onto condition identified a significant main effect for the Active, $\beta = 1.49$, $SE = 0.062$, $t(4508.37) = 23.72$ $p < .001$, $R^2 = 0.12$, and Intermediate, $\beta = 1.33$, $SE = 0.07$, $t(2814.54) = 18.89$, $p < .001$, $R^2 = 0.10$, conditions compared with the Control condition. People exhibited greater self-target alignment after simulating a target on the same traits. These results replicated prior findings that simulation leads to self-concept change. Second, we tested for a main effect of proximity. Using the same model, we found no evidence of a main effect of proximity on self-ratings, $\beta = 0.18$, $SE = 0.08$, $t(1.01) = 2.24$, $p = .27$, $R^2 = 0.03$, providing insufficient support for a link between proximity and SIM. While this effect was contrary to the expected direction, this main effect was qualified by the hypothesized interaction effect (Figure 2).

To assess our primary hypothesis that people who feel most proximal to the target would show the greatest SIM effects, we tested for an interaction effect between condition and proximity using a second model. We expected that there would be a stronger positive relationship between proximity and SIM in the Active and Intermediate than the Control condition, using Control as the reference condition. As expected, we observed significant differences in the effect of proximity for the Active condition, $\beta = 0.44$, $SE = 0.11$, $t(352.63) = 4.15$, $p < .001$, $R^2 = 0.003$, and the Intermediate condition, $\beta = 0.29$, $SE = 0.11$, $t(277.12) = 2.70$, $p < .01$, $R^2 = 0.001$, relative to the Control condition. This interaction accounted for the null effect found for proximity, with a negative trend in the Control condition and positive trends in the Active and Intermediate conditions.

Discussion

These findings suggest that as social proximity to a target increases, the effectiveness of simulation in changing self-perceptions also increases. These results build upon both a robust literature, which posits that proximal targets activate more self-knowledge, and our framework, which posits that greater activation of self-knowledge during simulation is related to greater SIM effects (Aron & Fraley, 1999; Benoit et al., 2010; Bergström et al., 2015; Mashek et al., 2003). This study directly connected the established literature and our framework by showing that the strength of SIM and proximity are positively related. With this in mind, Studies 2–4 manipulated target proximity directly to further probe the effects of activation of self-knowledge on changes in self-perception.

Figure 2
Target Proximity Predicts Simulation-Induced Malleability



Note. Results of Study 1. Study 1 found an interaction between similarity and the amount of simulation-induced malleability. As participants' social proximity to a target increased, the difference between the Active and Control conditions increased, suggesting that simulating similar others changes self-concept more than simulating dissimilar others. The simulation-induced malleability effect is measured in two experimental paradigms, either as (A) increasing competence (*z* scored) or (B) increasing similarity (*z* scored) in the simulation conditions compared with the control condition. Values are relative to the sample mean. Target proximity is calculated as a composite of multiple similarity and closeness measures (*z* scored). The shaded regions reflect the standard error. See the online article for the color version of this figure.

Study 2: The Effect of Self-Anchoring on SIM

Method

Study 2 aimed to expand upon the foundation of Study 1 by indirectly manipulating self-knowledge activation. Specifically, Study 2 looked at whether prompting participants to self-anchor before simulation led to weaker SIM effects compared with simulation with no self-anchoring. In this paradigm, participants either rated themselves on competence traits both before and after simulation (Self-other-self), only after simulation (Other-self), or after a control task (Control). During simulation, participants considered the competence of a self-generated, highly competent, and similar target, or a neutral target. We used higher self-ratings of competence postsimulation as a measure of SIM.

We predicted first that participants who simulated competent targets would show higher self-ratings on competence traits following simulation than participants who simulated neutral control targets on control traits; this would replicate the expected SIM effect. Second, to answer our primary question, we manipulated the order of self-knowledge activation. We predicted that competence scores would differ between Self-other-self (self-anchoring) and Other-self (target-anchoring) conditions. Our initial hypothesis was that self-anchoring would increase the effect of simulation, making more self-knowledge available to change. However, the results of this study as well as the two replications (see Supplemental Material) reshaped our understanding of the phenomenon and the relevant theoretical framework. Hypotheses and materials for this study were preregistered on the Open Science Framework at https://osf.io/juwq9?view_only=aa3286d668104c03b88db00509083b8a.

Participants

Participants (N = 799) were recruited from Prolific Academic. This sample size provided 95% power at an α = .05 to detect the difference between the Self-other-self and Other-self conditions, based on results from a pilot study (see Supplemental Material). Participants were excluded prior to analysis based on three a priori criteria: if they provided too few unique answers (N = 0), if they completed the study in an unreasonably short time (N = 2), and if they reported poor English proficiency (N = 4). The final sample size following these exclusions was 793 (33.4% men, 65.7% women, 0.6% nonbinary/agender, 0.3% prefer not to answer; M_{age} = 35.7, SD_{age} = 12.91; 87% White, 2.5% Black or African American, 5% Asian, 5.5% mixed race or other). Participants in this and each other study provided informed consent in compliance with the institutional review board.

Procedure

Participants completed either two or three blocks in this experiment, depending on their condition (Control, Self-other-self, or Other-self). Participants in the Control (N = 264) and Self-other-self (N = 268) conditions first completed baseline self-ratings on eight traits related to competence (see Supplemental Figure 3). These participants rated how well each trait applied to them on a scale of *not at all* to *extremely well*, corresponding to an unmarked 0–100 scale. Participants in the Other-self condition (N = 261) did not complete this block of baseline self-ratings.

In the simulation block, participants in the Other-self and Self-other-self conditions provided the name of an individual who was both similar to them and highly competent. Participants then considered how well the same eight competence traits applied to the target and rated them on the same unmarked 0–100 scale. Participants in the Control condition were asked to provide the name of an individual who was similar to them, but the instructions did not mention competence. Control participants then considered how well a series of physical traits applied to this target.

In the final postsimulation self-block, all participants rated how well the eight competence traits applied to them on the same scale (Figure 3). Traits were presented in a randomized order in all blocks. Our analyses used participants' ratings on competent traits during the postsimulation block as our primary dependent variable of interest.

Results

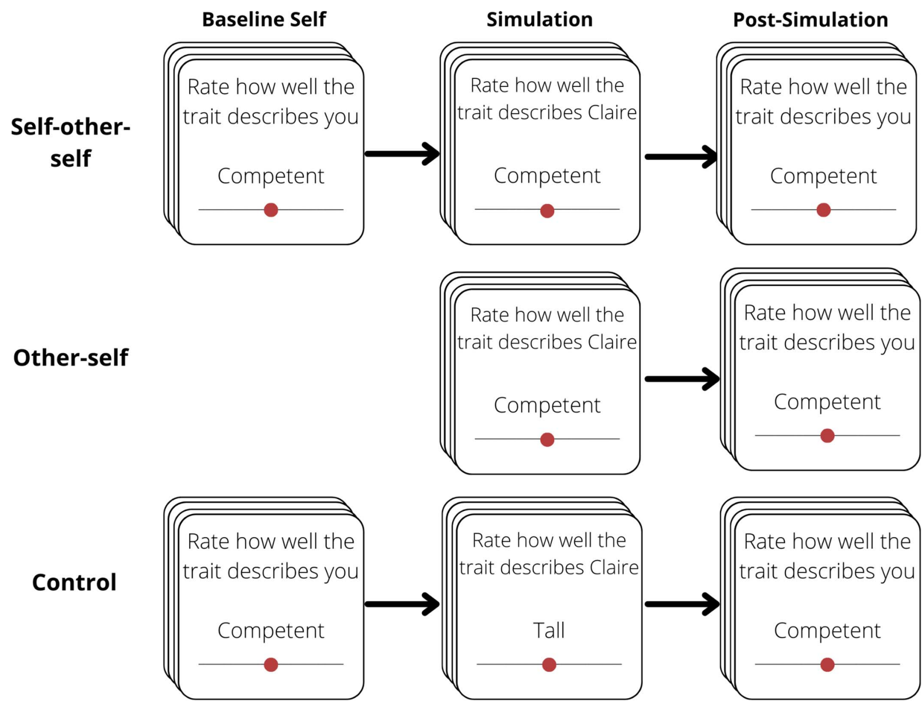
To test our first hypothesis that participants who simulated competent targets would show higher self-ratings on competent traits than participants who simulated controls, a t test examined the differences between self-ratings on competence for the Control condition, and the two simulation conditions (Self-other-self and Other-self) collapsed. As expected, results showed higher competence ratings in the simulation conditions, M = 67.27, SD = 13.90, $t(444.5)$ = 4.57, p < .001, d = 0.37, than in the Control condition (M = 61.77, SD = 16.93), replicating prior work that simulation induces self-concept change. Additional Bonferroni-corrected t tests were conducted to determine whether the postsimulation self-ratings were significantly different across all conditions (Figure 4). Replicating the findings above, the Control condition was significantly different from both the Self-other-self, M = 65.31, SD = 13.66, $t(504.15)$ = 2.66, p = .01, d = 0.23, and Other-self conditions, M = 69.28, SD = 13.88, $t(505.67)$ = 5.56, p < .001, d = 0.49.

Next, we tested the effect of anchor on SIM. We found a significant difference between the two simulation conditions: A two-sample t test comparing Self-other-self with Other-self revealed a significant main effect, $t(526)$ = 3.31, p < .001, d = 0.29, such that the participants' postsimulation self-ratings were higher in the Other-self than the Self-other-self condition. That is, we found greater SIM effects when the target was simulated before considering the self than when the self was considered prior to simulation.

Discussion

Study 2 offered two main findings. First, we observed a greater SIM effect for both the Other-self and Self-other-self conditions compared with the Control condition, suggesting that simulating a similar target moves self-concept toward that target. This replicates prior work on the SIM effect with a new paradigm for increasing competence (Meyer et al., 2019; Rubin-McGregor et al., 2022). Second, we found that activating self-knowledge before simulation (Self-other-self condition) was associated with less self-concept change than the Other-self condition. Participants who engaged in self-knowledge activation prior to simulation showed higher self-ratings on competence traits following simulation. When simulating similar targets, the Other-self order may strengthen SIM relative to Self-other-self.

Figure 3
Study 2 Design



Note. Task schematic for Study 2. Two thirds of participants completed a baseline block, in which they rated how well a series of eight traits related to competence (baseline self). All participants then completed a simulation block, in which they rated a similar target on either eight competence traits or eight control traits (simulation) before rating themselves on the eight competence traits (postsimulation). See the online article for the color version of this figure.

We initially preregistered a prediction that the Self-other-self condition would lead to greater self-concept change than the Other-self condition. That hypothesis was based on the intuition that explicitly activating self-knowledge would facilitate SIM. That said, these current findings do not align with that intuition. Instead, these findings align with the literature on context effects, which shows that considering the self before a target highlights differences between the two, whereas considering a target before the self highlights similarities (Biernat et al., 1997; Mussweiler, 2001b). We expect that highlighting similarities should increase self-knowledge activation, which, in turn, may increase SIM.

That said, a drive for self-consistency offers a clear alternative explanation to these effects. If this is the case, then people would show a smaller increase in self-rated competence in the Self-other-self condition to remain consistent with their baseline self-ratings (J. Elder et al., 2022; J. Elder, Cheung, et al., 2023; J. J. Elder, Davis, & Hughes, 2023; Markus & Kunda, 1986; Scheller & Sui 2022). That is, participants may lock in their baseline self-judgments, making them less subject to change. Indeed, this explanation is consistent with not only the findings in Study 2 but also two additional studies (see Supplemental Material). The design of Study 3 isolates the unique contribution of anchoring with relevant similar target knowledge compared with anchoring with self-knowledge directly using a design that does not require repeated self-ratings. While it is fully possible that self-consistency may be at play in all instances of simulation, we can at least examine the unique effects of anchoring with the knowledge of others.

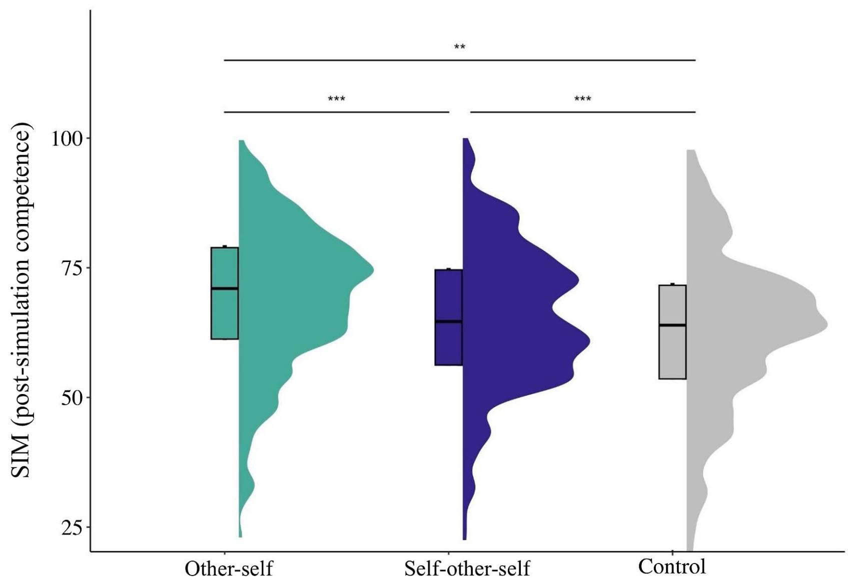
Study 3: Anchoring With the Self Versus the Other

Method

Studies 1 and 2 provide consistent evidence that when people recruit more self-knowledge, they also show greater SIM effects. Here, we aim to replicate these findings while also testing the reaches of simulation-induced change to self-concept more broadly. People maintain complex self-concepts with components that relate to each other in different ways (J. Elder, Cheung, et al., 2023; Markus & Wurf, 1987). If simulation changes the self-concept more broadly, the effects of simulation should generalize to other, related aspects of the self-concept.

The design of Study 3 also allows us to partially address the potential limitations of the previous design. First, participants in the previous Self-other-self conditions rate themselves on traits twice—both before and after rating the target. This might induce a drive to remain self-consistent unrelated to self-knowledge activation (Unkelbach & Rom, 2017). In Study 3, participants complete only two blocks. Participants either rate themselves and then a target or a target and then the self. In the second block, participants rate traits that are shared across the two blocks. Participants also rate traits that

Figure 4
Activation Order Impacts SIM



Note. Study 2 found a significant main effect of self-knowledge activation, such that participants in the Other-self condition reported higher competence than those in the Self-other-self or Control conditions. SIM = simulation-induced malleability. See the online article for the color version of this figure.

are novel and were never previously evaluated in the first block, removing the possibility of seeking consistent ratings.

This new design allows us to test two effects of self-knowledge activation: First, do SIM effects extend to novel traits? If so, this would suggest that SIM is not reducible to repetition effects. Instead, it would show that SIM effects generalize beyond simulated traits to impact semantically related aspects of self-concept. To test this, this new design operationalizes SIM in a new way: as the extent to which initial target ratings predict subsequent self-ratings. This is compared with a condition where self-ratings predict subsequent target ratings. To capture generalizability, the initial ratings are weighed by both the extent to which they apply to the target/self and the similarity between the traits being rated in each block. Second, we can replicate the context effects from Study 2 showing that the Other-self condition leads to more SIM than the Self-other condition. We do so without the confounded condition where participants in the Self-other-self condition (Study 2) make self-ratings twice. Despite this change in design, we cannot rule out the effects of self-consistency completely, but we can examine the unique effect of using a similar target as an anchor and compare this with the self.

This study was collected as part of a separate research project. As such, the preregistration includes hypotheses unrelated to, though largely aligning with, the current project. The preregistration and all materials for this study are available on the Open Science Framework at https://osf.io/c8rx9/?view_only=529d3e3b1d194033b00e2e39251fd31c.

Participants

Amazon Mechanical Turk participants (N = 231) were native English-speaking university students (62.16% cisgender women, 33.59% cisgender men, 00.90% nonbinary, 1.35% transgender men; M_{age} = 18.59, SD_{age} = 1.29, range$_{\text{age}}$ = [19, 69]) were recruited with consent and in compliance with the University of California, Riverside, institutional review board practices. Participants were randomly assigned to one of two conditions: Self-other (N = 115) or Other-self (N = 116). Participants were 68.83% White/Caucasian, 10.82% Black/African American, 6.93% mixed/other, 5.63% Asian, 4.76% Hispanic/Latino, 1.73% Native American, 4.33% Indian/South Asian, 4.33% Middle Eastern/North African, and 0.43% Pacific Islander. An a priori power analysis using G*Power 3.1 suggested that 200 ≥ N is required to detect an effect size of at least d = .28 at α = .05 and 80% power for a two-tailed independent-samples t test. However, we note that this is a repeated measures design with nested data. Participants were excluded prior to analyses if the target names provided were nonsensical (N = 3; e.g., "[A, B, C, D, E]") or if they did not provide enough targets.

Procedure

Participants nominated five other people who freely came to mind, given the following prompt: "Please list the first five people you know and are familiar with that come to mind: They can be family members, friends, co-workers, acquaintances." Participants then rated themselves and the nominated targets across two blocks and were randomly assigned to one of two block order conditions. Participants in the Other-self condition first engaged in simulation by evaluating each of the targets that they had just nominated on 18 traits (per target), from 1 (*not at all descriptive*) to 7 (*extremely descriptive*), leading to a total of 90 target trait evaluations (Block 1). Participants then rated themselves on the full set of 148 traits. At least 58 traits were "novel" or never evaluated on targets (Block 2). However, different targets could be rated on some of the same traits, leading to possible overlap between target ratings. In the Self-other condition, participants first rated themselves on a subset of 90 traits (Block 1). Participants then evaluated each of five targets on 30 traits each, for a total of 150 traits (Block 2). Some of the traits presented to targets may be repeated; at least 58 out of 148 traits were "novel" or never evaluated for the self. In this study the self-other condition was not a true simulation condition, as the self was not rated again after others; however, the design was important for addressing a central limitation of Study 2. Here, the self-other condition acts as an active control condition to which we compare our SIM intervention.

Materials

Study 3 used a different set of traits than in the previous studies. Specifically, traits were drawn from a semantic dependency network of traits used in prior research (J. Elder, Cheung, et al., 2023), allowing for an efficient estimation of pairwise relational similarity among traits. To construct the network, prior participants identified traits they believed depended on a target trait for semantic meaning (i.e., "What trait does sociable depend on?"). When over 25% of participants agreed upon a given dependency relationship, it was included as a binary, directed relationship between the traits (i.e., friendly → sociable). This was conducted for all traits, leading to a directed network that reflects all dependency relationships. From this network, prior work derived the similarity between all the traits, where similarity measures represent the proportion of overlap between two traits based on their number of shared features (i.e., neighbors), consistent with feature-based models of semantics (Martin, 2007; Tyler & Moss, 2001) and similarity (Tversky, 1977).

The traits used in the semantic dependency network and their network metrics have been validated in terms of their predictive validity and reliability (J. Elder, Cheung, et al., 2023) and were further extended in subsequent work (J. J. Elder, Davis, & Hughes, 2023; J. Elder et al., 2022). Study 3 used the pairwise relational similarity estimates generated from this directed network to test whether simulation induces generalized changes to the self.

Measures

Anchor Weight. In previous studies, we measured SIM as either an increase in competence ratings toward a competently perceived target or as the actual change in self-ratings toward a target from pre- to postsimulation. In the present study, we operationalize SIM in a new way. This new SIM measure depends on whether a trait being evaluated for the self is similar to all previous traits evaluated for the target—not just the exact same trait. In this study, if SIM occurs, then the extent to which prior target ratings influence a later self-rating is a function of both how the target is rated as on each prior trait *and* the relevance of all prior target-rated traits to the trait in which the self is being rated. Here, we calculate this expected influence as the rating-weighted average of a trait's similarities to the self-rated trait—its *anchor weight*. We then measure SIM as the extent the anchor weight predicts a subsequent self-rating.

The anchor weight (AW) for the Other-self condition is calculated for each self-rated trait by its network-based similarity to all prior traits and their target descriptiveness as follows:

$$\mathrm{AW}_i = \frac{\sum_{t=1}^{T=90}(R_t \times S_{ti})}{\sum_{t=1}^{T=90} R_t}. \quad (1)$$

This is a weighted average where S_{ti} is the similarity of self-rated trait i during the self-rating block (Block 2) to previously rated trait t during the simulation block and R_t is the target descriptiveness of trait t from the target simulation block (Block 1). For example, when "outgoing" is self-rated during the second block, we know that it has high relevance to social traits, such as sociable and fun, and low relevance to analytic traits, such as mathematical and disciplined. If the target is rated high on the similar social traits and low on the dissimilar analytic traits, then the anchor weight would be higher. That is, we would predict the self should be rated as highly outgoing. If the target is rated low on the similar social traits and high on the dissimilar analytic traits, then the anchor weight would be lower. That is, we would predict the self should be rated as not outgoing. This measure is estimated across all targets. If SIM occurs, then this anchor weight should predict subsequent self-ratings.

This anchor weight measure can be calculated for the Self-other condition in which self-ratings occurred before target ratings. In this condition, anchor weight is computed with R now reflecting self-ratings in the first block rather than target ratings.

Results

Linear mixed-effects models were implemented in R Programming Environment 4.2.1 using *lme4* version (Bates et al., 2015), and Satterthwaite approximated degrees of freedom were used for determining p values in *lmerTest* (Kuznetsova et al., 2017). Maximal random effects were tested and were removed as needed if unsupported by the data or if the model failed to converge (Barr et al., 2013). To account for variability in intercepts and slopes across both subjects and traits, we modeled crossed random factors for both (Baayen et al., 2008). We report all zero-order effects without covariates in the Supplemental Material.

SIM Effect Replication

We first investigated the hypothesis that the ratings for self and other should be significantly associated with each other. Specifically, we tested whether people rate Block 1 traits in a manner that is similar to Block 2 traits, regardless of condition order. To do so, we predicted Block 2 ratings from anchor weight using a linear mixed-effects model. This model controlled for the novelty of the trait (i.e., whether it was rated during Block 1 ratings), as well as the normative desirability (i.e., measured via an independent set of raters) of the traits, as people tend to evaluate more socially desirable traits as more self-descriptive. Anchor weight and trait novelty were estimated with varying slopes across subjects, while both subjects and traits were estimated with varying intercepts. Results showed that anchor weight positively predicted Block 2 ratings across both conditions, $\beta = 0.085$, CI = [.052, .117], $t(495) = 5.100$, $p < .001$, $sr^2 = .007$. This suggests that the extent to which a trait is similar to prior anchor ratings predicts people's later ratings. That is, there is an alignment between self and target perceptions following simulation. We next tested whether this SIM effect was impacted by the order of simulation.

Order Effects of Knowledge Activation

We next tested the hypothesis that SIM should be stronger in the Other-self condition than the Self-than-other condition. To do so, we estimated an interaction between anchor weight and condition (Self-other vs. Other-self) to test whether the effect of anchor weight was stronger in the Other-self condition. The effect of condition was allowed to vary across traits. As expected, results showed that the effect of anchor weight is significantly stronger in the Other-self condition than the Self-other condition, $\beta = -0.054$, CI = [−.095, −.013], $t(307) = 2.583$, $p = .01$, $sr^2 = .001$. This suggests that SIM is stronger when targets are simulated first than when the self is simulated first. That is, self-ratings (Block 2) reflect target ratings (Block 1) in the Other-self condition, $\beta = .114$, CI = [.073, .155], $t(502) = 5.445$, $p < .001$, $sr^2 = .013$, more strongly than target ratings (Block 2) reflect self-ratings (Block 1) in the Self-other condition, $\beta = .047$, CI = [.009, .085], $t(235) = 2.438$, $p = .0155$, $sr^2 = .002$. We next sought to test whether the act of simulating and incorporating target-beliefs into self-knowledge requires generalizing across related, but different, self-beliefs (Figure 5).

Generalization for Novel Traits

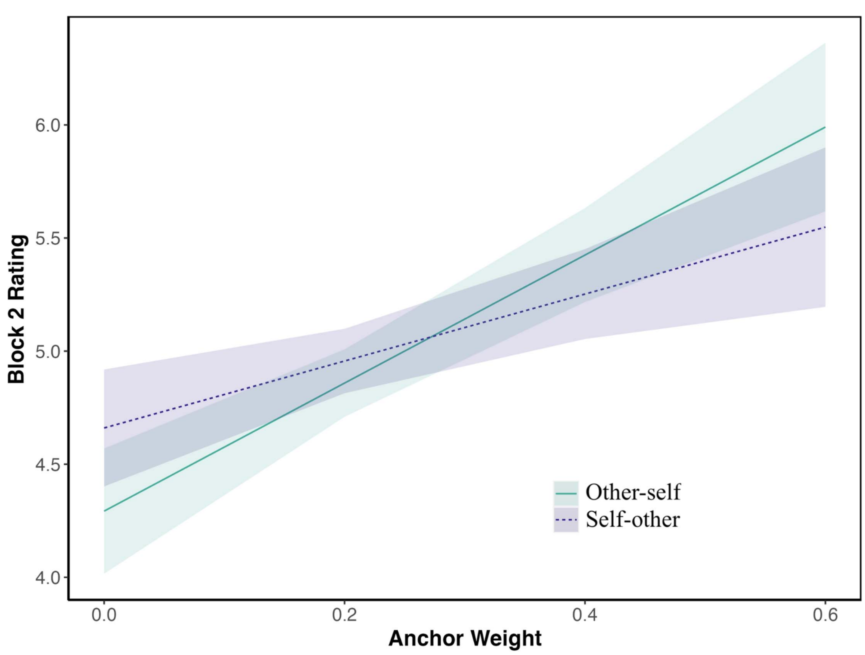
We predicted that anchor weight would have as strong of an effect on novel Block 2 ratings as repeated traits (Figure 6). If so, this would demonstrate that SIM effects generalize from rated traits to related aspects of self-concept, more broadly. It would also show that the established effects of SIM are not reducible to repetition effects. We tested the extent to which the anchor weight impacted ratings for both novel and repeated traits and how this effect differs depending on whether the target knowledge or self-knowledge was activated first. To test this, we implemented a three-way interaction between novelty (which is a dummy-coded factor with repeated traits set as the reference group), condition (Self-other vs. Other-self), and anchor weight. We allow the effect of novelty and anchor weight to vary among subjects, for the effect of condition to vary across traits, and for the intercepts to vary among intercepts and subjects.

We identify a marginal three-way interaction, $\beta = -0.034$, CI = [−.069, .001], $t(307) = -1.887$, $p = .057$, $sr^2 = .00008$, such that the effect of anchor weight is marginally weaker for novel traits than repeated traits in the Self-other condition, $\beta = -0.024$, CI = [−.051, .002], $t(16700) = -1.786$, $p = .074$, $sr^2 = .00003$, whereas novel and repeated traits show similar effects in the Other-self condition, $\beta = 0.009$, CI = [−.014, .032], $t(19000) = .765$, $p = .444$ (see Figure 6). These results suggest that people show SIM for both novel and repeated traits. Further, while people show SIM for novel and repeated traits in both order conditions, people may generalize marginally more to novel traits in the Other-self condition.

Discussion

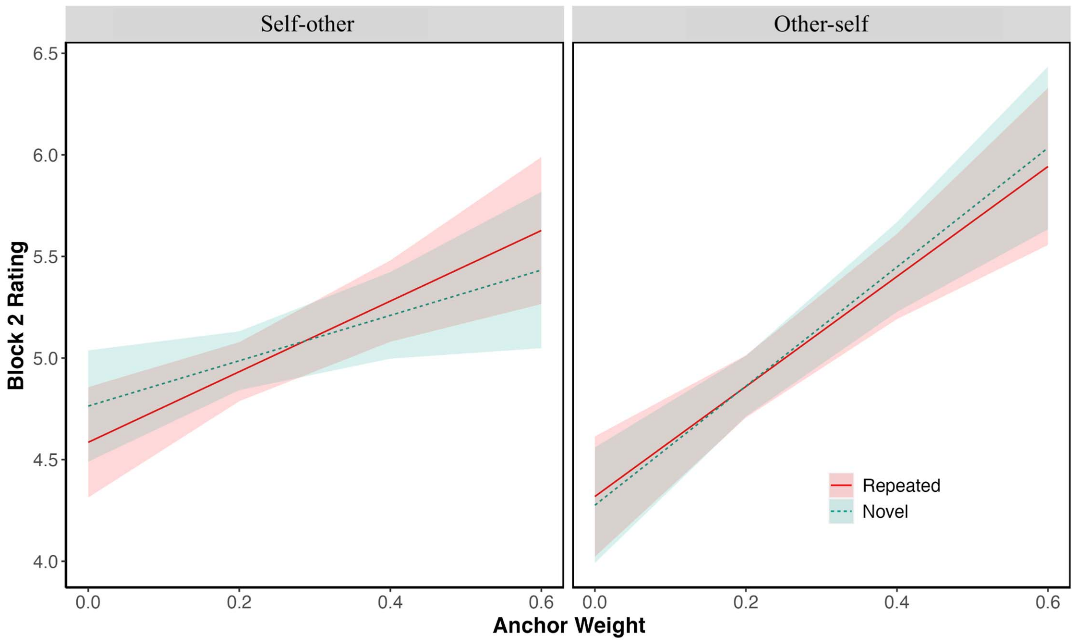
Study 3 replicates findings that simulation induces self-concept change using a design that better isolates the effect of interest. First, we show that anchor weight predicts Block 2 ratings, reflecting alignment between self and target perceptions. Second, we show that the order in which participants think about the self versus the

Figure 5
Activation Order Impacts Simulation-Induced Malleability



Note. Study 3 found that the effect of anchor weights on later ratings was stronger when target knowledge was activated first than when self-knowledge was activated first. Marginal effects from linear mixed-effects models, with 1.96 ± standard error confidence intervals. See the online article for the color version of this figure.

Figure 6
Simulation-Induced Malleability Effect for Novel Traits



Note. The effect of anchor weights on later ratings is weaker for novel traits than repeated traits if the self was rated first, whereas the effect of anchor weights on ratings is similar if simulating targets first. This may reflect that generalization to novel traits using semantic similarity is stronger when simulating targets first. Marginal effects from linear mixed-effects models, with 1.96 ± standard error confidence intervals. See the online article for the color version of this figure.

target matters: Anchor weight predicts Block 2 ratings more in the Other-self condition, conceptually replicating findings from Study 2. These effects of anchor weight on later ratings were robust across both novel and repeated traits. In fact, generalization to novel traits was slightly stronger for the Other-self condition (vs. Self-other). This may reflect a potential mechanism through which simulation contributes to the malleability of self-beliefs: For traits that people previously evaluated for the target, beliefs may be more instantiated and less susceptible to change, whereas for traits that are related but were not evaluated, people can infer and generalize on how this simulated knowledge may also apply to themselves. Importantly, this design did not have participants rate themselves twice, which may have reduced the drive to remain self-consistent across multiple ratings. The Self-other condition in this study was not a true example of SIM, where simulating other individuals results in a person's self-concept shifting closer to their representation of the other individual. This condition acted more as an active control, allowing us to examine how different methods of self-knowledge activation have unique effects.

Study 4: Age Effects Across SIM Studies

Method

Studies 1–3 support the hypothesis that self-knowledge activation is essential for simulation to change self-concept. In Study 4, we examined the role of self-knowledge activation by studying individuals who naturally activate less self-knowledge when mentalizing. Specifically, we compared SIM effects across older adults, as they may not activate self-knowledge when mentalizing about social targets to the same degree as younger adults (J. M. Moran, Jolly, & Mitchell, 2012). We drew on data from 17 previously conducted studies, all of which included measures of both the magnitude of SIM and the age of each participant. If the amount of activated self-knowledge is associated with SIM, then we would expect younger adults to show stronger SIM effects than older adults. These hypotheses and all materials for this study were preregistered on the Open Science Framework at https://osf.io/x2j5d/?view_only=8abb2a933c71426f8ab1d7cd2c0ad53d.

Participants

A final sample size of $N = 6{,}719$ was calculated as the number of total participants who had previously completed studies on SIM online and responded to all prompts used in the current analyses. Some study designs were within-participants, leading to multiple data points per participant, for a total of 9,528 individual responses (see Supplemental Material for a full breakdown). This sample size afforded us over 99% power to detect the main effects of condition and age, along with an interaction between condition and age, based on a post hoc power analysis. A post hoc sensitivity analysis was also used to determine the minimal detectable effect size ($f^2 = 0.05$). All analyses were conducted using G*Power Version 3.1. We included all participants who were in the original studies, based on exclusion criteria predetermined for each study. Participants were previously excluded based on criteria established for each study. Exclusion criteria included overall time on task being too short, self-reporting poor English comprehension, and providing too few unique answers.

Procedure

Across these studies, we coded three types of conditions as in Study 1: (a) Control conditions included no simulation ($N = 1{,}308$); (b) Active conditions ($N = 4{,}649$) were designed to elicit greater SIM effects, relative to a Control or Intermediate condition; and (c) Intermediate conditions ($N = 3{,}571$) were designed as a less effective version of the Active condition (e.g., simulating a distal target, recall following a delay).

Two study designs were present in this analysis as in Study 1. The first study design used SIM to increase competence scores. Successful SIM in these studies was evidenced by higher ratings of competence in the simulation versus control condition. The second study design used SIM to increase the similarity between the participant and the simulated targets. Successful SIM in these studies was evidenced by greater similarity between the self and target ratings after simulation, relative to before simulation. We converted the SIM scores from both study designs into z scores to collapse across designs (see Supplemental Material for further analyses).

To examine the relationship between age and the magnitude of the SIM effect, we utilized a mixed-effects model. We examined age, condition (Active, Intermediate, or Control), and an interaction between the two as predictor variables. Age was measured continuously. The dependent variable was a z-scored SIM measurement (i.e., competence ratings or change in self-target similarity after simulation, depending on the study design). The model included a random effect variable for individual studies and for study design. We expected this difference in mentalizing between younger and older adults to be expressed as an interaction between age and condition (Active, Intermediate, Control), such that as the age of participants went up, the difference in SIM scores between the Active and Control conditions would decrease. That is, we expected that younger adults would show the traditional significant differences in SIM between the simulation and Control conditions, whereas older adults should show smaller differences between simulation and Control conditions. This would suggest that simulation is not as effective in changing self-knowledge in older adults.

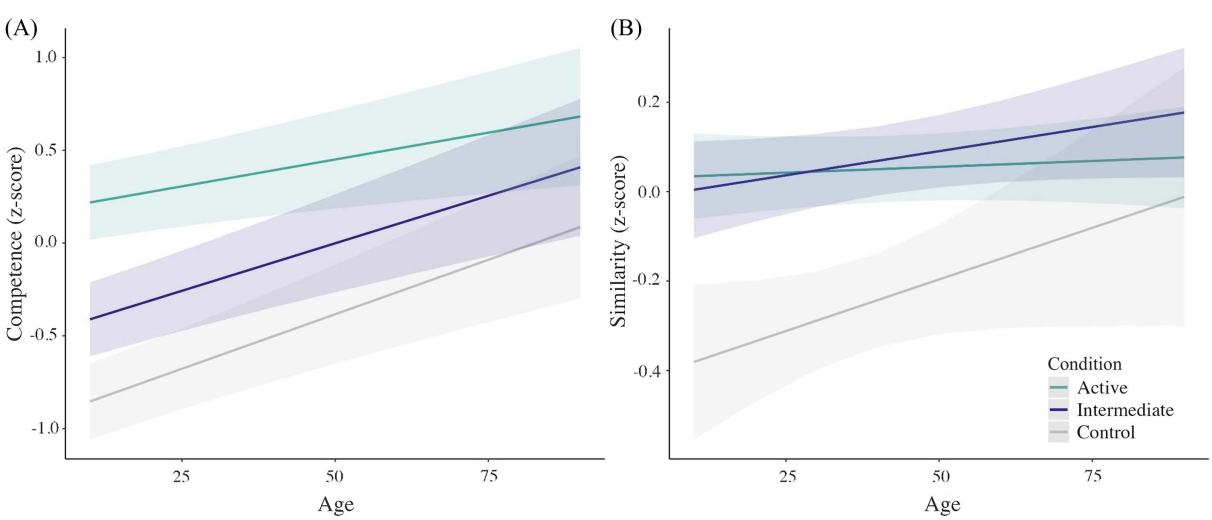
Results

We first tested for an association between individual conditions (Active, Intermediate, Control) on our outcome measures of similarity and competence across all studies. We implemented a mixed-effects regression model and found a significant association between condition and similarity/competence for the Active, $\beta = 0.91$, $SE = 0.10$, $t(556.5) = 9.20$, $p < .001$, and Intermediate, $\beta = 0.48$, $SE = 0.10$, $t(520.9) = 4.75$, $p < .001$, conditions with the Control condition set as the reference level. This suggests that Self-other similarity and competence ratings were higher on average in the Active and Intermediate conditions, relative to the Control condition. Second, we tested for an association between age and the outcome measures. We found a significant main effect of age, $\beta = 0.008$, $SE = 0.003$, $t(93.9) = 3.07$, $p = .002$, such that self-other similarity and competence ratings increased with age across conditions. These main effects were qualified by the hypothesized interaction effect.

To test our primary hypothesis that older adults would show a smaller SIM effect, we examined the interaction effect from the same regression (Figure 7). In this study, a larger SIM effect was evidenced by a larger difference between the simulation conditions and the Control condition. That is, a smaller difference between

Figure 7

Age Predicts Simulation-Induced Malleability



Note. Results of Study 4. Study 4 found an interaction between age and the amount of simulation-induced malleability. As participant age increased, the difference between the Active versus Control conditions decreased, suggesting that simulation did not shift self-concept for older adults as much as it did for younger adults. Simulation-induced malleability is measured in two experimental paradigms, either as (A) increasing competence or (B) increasing self-other similarity in the simulation condition compared with the control condition. Values are relative to the sample mean. The shaded regions reflect the standard error. See the online article for the color version of this figure.

these conditions implied a smaller SIM effect. As expected, results showed a significant interaction between the Active and Control conditions, such that the difference between conditions decreased with age, $\beta = -0.007$, $SE = 0.002$, $t(554.6) = -2.45$, $p = .01$. This suggests that as participants aged, there was a weaker effect of simulation. This effect aligns with prior work suggesting that older adults may activate less self-knowledge when mentalizing about social targets (Henry et al., 2013; J. M. Moran, 2013; J. M. Moran, Jolly, & Mitchell, 2012).

Discussion

These findings suggest that as the age of participants increased, simulation became less effective at changing self-concept. This effect was specific to the Active simulation condition designed to generate the strongest changes to similarity and competence scores. These findings support the idea that older adults may mentalize about social targets differently than younger adults (J. M. Moran, 2013; J. M. Moran, Jolly, & Mitchell, 2012). In particular, older adults may activate less self-knowledge when simulating targets, making this self-knowledge less malleable during simulation compared with younger adults.

Transparency and Openness

All open data, and open code are publicly available on the Open Science Framework at https://osf.io/etq7u/?view_only=cc6be3b73ed343d9a7bb98b35cc7b491. Preregistrations are also included for Studies 2–3. We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study, and we follow JARS (Kazak, 2018). Data were analyzed using R, Version 4.2.1 (R Core Team, 2020).

General Discussion

Just like fingerprints on photographs, memories too can change when we pull them out of storage. Semantic and episodic knowledge about the self is no exception. Here, four studies demonstrate that the magnitude of self-knowledge activation is associated with the magnitude of self-concept change. Specifically, we find that SIM effects are strongest for socially proximal targets, when similar targets are considered before the self, and for younger (vs. older) adults. Together, these findings offer robust knowledge to inform the mechanism underlying SIM and contribute to broader theoretical knowledge on the stability and malleability of self-concept.

We find that simulating socially proximal others induced self-concept change, more so than simulating socially distal others. People activate more self-knowledge for socially proximal targets than socially distal ones (Ames, 2004a, 2004b; Beckes et al., 2013; Tamir & Mitchell, 2010). As a result, people are more likely to entwine information about the self and the proximal target after simulation. Importantly, social proximity was operationalized in several different ways in Study 1. This included multiple continuous measures of closeness, inclusion of other in self, and similarity averaged into one composite measure. This suggests that self-knowledge activation depends not just on similarity but perhaps on social distance more generally. This global similarity measure impacted both the Active and Intermediate conditions to a similar extent. The Intermediate conditions often consisted of simulating a dissimilar other, self-anchoring, temporal delays, or neutral targets. Even in this intermediate simulation condition, our key factor—social proximity—played a significant role in determining the magnitude of SIM.

This article implemented several indirect manipulations of self-knowledge accessibility in addition to social proximity. Manipulations of age, anchor effects, and trait similarity all produce similar effects. Each manipulation has been shown to interact with self-knowledge activation. First, socially proximal targets activate neural regions associated with self-thought. As you increase similarity, simulating a target activates increasingly more self-knowledge. Second, altering the order of anchor stimuli manipulates perceived similarity to a target, influencing self-knowledge. And finally, older adults, who activate less self-knowledge automatically, are less impacted by simulation in changing their self-concept. Any of these methods alone would not be sufficient to support the conclusion that self-knowledge activation is necessary for self-change. However, together, they offer a compelling set of findings that converge on this conclusion. This convergent evidence allays several concerns about potential limitations of any one method.

In Study 4, we find that populations who activate self-knowledge less when simulating other minds, specifically older adults, are less impacted by simulation. These effects held across two types of designs—one in which participants rated their competence after simulation and one in which they rated themselves on a variety of traits before and after simulation. Older adults showed both higher competence scores and greater similarity to the simulated target on average. However, older adults show no difference in the key comparison between the active simulation and control conditions, suggesting that simulation had no detectable impact on their self-knowledge. That is, the competence and similarity scores did not differ between older adults who simulated and those who did not, whereas there were significant amplifications of competence and similarity in younger adults who simulated. High competence ratings at baseline could have imposed a ceiling effect in the competence paradigm, reducing the possible impact of simulation. However, this cannot explain why older adults would likewise show smaller increases in similarity in the similarity paradigms (see Supplemental Material). This convergence across distinct paradigms strengthens our conclusion that older adults are less impacted by simulation. While these results were in line with our hypotheses, there are several alternative mechanisms that may be driving this effect. First, it is possible that older adults simply have highly stable self-concepts (Ji et al., 2022; Löckenhoff & Rutt, 2017). If their self-knowledge is more tightly encoded or fossilized, then it would be more difficult to shift it. That is unlikely to explain our results here. Analyses of Study 4 show that older adults changed their self-ratings from presimulation to postsimulation as much as younger and middle-aged adults (see Supplemental Material). Older adults simply changed their self-ratings in all directions, whereas younger ones shifted them consistently toward the target. Second, it may be the case that older adults activate less target knowledge overall. If older adults do not activate knowledge that can be intermixed with their self-knowledge, then their self-knowledge is less likely to change in that direction. We know of little work investigating the extent to which older adults differentially activate target knowledge. We look forward to future work that can help pinpoint why older adults are less likely to adjust their self-knowledge after considering a target.

Self-knowledge activation is not the only component of simulation. During simulation, people also activate knowledge about the target. To what extent might SIM be dependent on this latter process as well? We hypothesized that this necessary component of simulation impacts the direction of self-concept change, but not the magnitude of self-concept change. In a separate line of work, we tested this hypothesis and found convincingly null effects of this second factor—target knowledge activation—on SIM. These findings suggest that self-knowledge activation plays a key role in eliciting SIM; not just any moderator will show these effects. Future work should examine how target knowledge manipulations impact the observed effects.

Similarly, it was beyond the scope of this work to examine potential different effects of semantic and episodic information, though past work, and work included in the Supplemental Material, begin to examine these differences. In the Supplemental Material, we examine SIM effects in trait simulations and episodic simulations and find similar effects across both kinds. Thus, in terms of effects, episodic and semantic tasks seem to show similar malleability. In terms of structure, semantic knowledge has been suggested to be superordinate to episodic knowledge and, thus as it relates to perceptions of self and others, is likely dependent on episodic memory (Hupbach et al., 2007, 2009). Prior work has shown that episodic knowledge can shift and indeed can remain changed for extended periods, while semantic malleability remains less explored (Marsh et al., 1983; Rubin-McGregor et al., 2022; Tulving, 1985).

In Study 3, we tested if simulating other minds leads to localized changes in self-beliefs or more widespread changes across the self-concept. When simulating other people on specific attributes, people retrieve and modify those specific self-beliefs as well as related aspects of the self-concept. Generalizing simulation-induced changes to related aspects of the self-concept would help people maintain a locally consistent and globally coherent self-concept from moment to moment across social encounters. In fact, Study 3 demonstrates that simulation-induced changes to self-beliefs may be *even stronger* for novel traits relative to the specific traits retrieved during simulation. This suggests that people use semantic relations among attributes to infer and generalize across related traits, particularly for nonrepeated inferences (Unkelbach & Rom, 2017).

People are constantly making self-judgments and comparisons to others (Clement & Krueger, 2000; Heck & Krueger, 2015, 2020; Krueger, 1998) and still maintain a coherent self-view. It is possible that people have a motive to remain consistent in their self-assessments (Greenwald & Banaji, 1989; J. L. C. Lee et al., 2017; Rogers et al., 1977; Sedikides & Strube, 1995; Sui & Humphreys, 2015; W. B. Swann et al., 1987). Our findings in Study 2 are consistent with past work demonstrating that people try to maintain a coherent self-concept (J. Elder et al., 2022; J. J. Elder, Davis, & Hughes, 2023; Markus & Kunda, 1986; Scheller & Sui, 2022). In this design people rate themselves twice in the control and Self-other condition but only once in the Other-self. Because order is confounded with rerating, this design limits our interpretation of our results. In this study, the drive to remain self-consistent works in opposition to SIM effects, even though we attempted to minimize the impact of this anchoring, for example, by hiding the number associated from participants' responses. The design of Study 3 further addresses order and rerating by manipulating anchor order with no repeating self-ratings. In this study, we find that order still has a strong effect on SIM. Specifically, SIM effects were greater when a target was used as an anchor. However, it is beyond the scope of these studies to fully explain and account for the effects of self-consistency, an important question to be addressed in future work.

Our studies are consistent with prior work on priming (Herr, 1986, 1989). However, our findings cannot be fully explained by priming. For example, prior work manipulated different dimensions of anchor stimuli and found that priming with moderate and/or ambiguous stimuli leads to judgments more aligned with the priming stimuli. Here we find that manipulating the similarity of the anchor leads to more aligned judgments. Other works that specifically manipulated the similarity between a prime and a target likewise showed that similarity increases the priming effect (Gonnerman et al., 2007; Johnston & Barry, 2001; McRae & Boisvert, 1998; Rueckl, 1990; Schreuder et al., 1984). In these studies, the priming effect was measured in terms of reaction time to the target, such that a more similar prime speeds up one's ability to process a target—often a word or visual stimulus. Our studies bring together these two lines of work. First, like prior work on inferences, we find that features of the prime impact the extent to which it will anchor subsequent inferences. Like the work on semantic, phonological, and visual priming, we find that the effect is strongest with more similar primes. In both cases, the prime (here the simulated other) partially activates the target (here self-knowledge). The difference is in the outcome: In the current studies, this is associated with self-knowledge becoming malleable and subject to change. Thus, in our view, it is the accessibility (i.e., activation potential; Higgins, 1996) of self-information that is important here, and there are multiple routes (including priming) by which self-information may come to be more accessible.

While all of our effects of simulation on self-concept are reliable, the absolute magnitude of change to self-concept was relatively small. The average difference in competence after simulation (vs. nonsimulation) was 13.57 points on a 100-point scale in paradigms designed to increase competence scores; the average shift in self-ratings toward a target from before to after simulation was 1.34 points in paradigms designed to increase self-other similarity. Simulation does not challenge the existence of a stable self over time (J. Elder et al., 2022; J. L. C. Lee et al., 2017; Markus & Wurf, 1987; Oyserman et al., 2012; Rogers et al., 1977; Sui & Humphreys, 2015). That is, a single episode of simulation may not dramatically shift fundamental components of personality, traits, or memories. However, we do not know how the effects of simulation accumulate over time; given the frequency of time people spend spontaneously considering others (Mar et al., 2012; Mildner & Tamir, 2021; Song & Wang, 2012), it is possible that simulation slowly and steadily shifts the self over time, and perhaps some of our self-conceptions are dependent on our social contexts. We look forward to future work that helps determine when simulation in naturalistic contexts results in self-concept change, how these shifts are shaped by the social input surrounding a person, and what the long-term impacts of simulation may be.

If simulation can cause lasting change in the self, this presents an opportunity to leverage simulation for social good. For example, can we implement interventions that apply simulation in contexts that directly benefit disadvantaged individuals? Women in science, technology, engineering, and mathematics (STEM) fields are highly underrepresented. While women acquire more than half of undergraduate degrees in some STEM fields, such as biology, chemistry, and mathematics, they earn less than 20% of STEM degrees in other realms such as computer science, engineering, and physics (Hamrick, 2021). Direct interventions have found that exposure to other women in STEM as role models have numerous transferrable benefits (Stout et al., 2011) including increased sense of belonging (González-Pérez et al., 2020), higher retention rates in STEM courses (Herrmann et al., 2016), and lower gender–STEM stereotypes (Van Camp et al., 2019). The findings that simulation can increase self-perceived competence suggest that simulation may offer an opportunity to replicate these effects through a brief and highly accessible intervention that people already engage with in their daily lives.

Here we present evidence that self-concept can be altered, much like memory. If self-concept functions similarly to memory, it is possible that self-knowledge can be altered long after encoding (Hupbach et al., 2007, 2009; Nader, 2003) and be reconsolidated into long-term memory in an altered form (J. L. C. Lee et al., 2017). That said, while we assume that simulation induces self-knowledge change, per se, throughout the article, each study measures self-knowledge change indirectly. We operationalize changes to self-concept as the changes in self-ratings, higher competence, and alignment between self and target. Future work could implement a more direct measurement of self-representations to assess the impact of SIM, for example, by measuring changes in neural representations of the self. In doing so, it could test if self-knowledge changes through the same mechanisms of memory reconsolidation.

These studies stand on the shoulders of a large body of work concerning the self, simulation, and much more. The primary contribution to a larger literature is in adding to an understanding of the mechanism underlying SIM—a phenomenon first identified by Meyer and colleagues (Meyer et al., 2019). In particular, we focus on identifying the association between a particular component of simulation—self-knowledge activation—and the magnitude of self-knowledge change, in a unique and robust way. We conducted multiple well-powered studies and used multiple convergent proxies for manipulating self-knowledge activation in a way that had not been examined before. The result is insight into the mechanism by which simulation and social inferences hold the power to change self-knowledge.

Constraints on Generality

Though we found evidence that the effects of SIM may generalize within an individual's mind, this work is potentially limited in its generalizability across diverse populations (Simons et al., 2017). Our target population included U.S. and U.K. adults. Additionally, our sample was derived primarily from Prolific Academic, where the demographics do not necessarily reflect the demographics of the countries we recruited from. Much of our sample was composed of White, heterosexual women. Future research will need to investigate these effects in a larger, more diverse samples to examine the generalizability of our results before drawing any conclusions about the replicability of these results across different cultures and contexts. One strength of these studies was the large sample sizes obtained for Studies 1 and 4, which allowed us to examine these SIM effects within a well-powered data set, including a wide range of ages.

Conclusion

These results demonstrate that one's self-knowledge can be updated and shifted. While knowledge about the self is uniquely remembered (Klein et al., 1989, 1992; Klein & Loftus, 1988, 1993), encoded, and stored tightly in memory (J. L. C. Lee et al., 2017, 2021; Rogers et al., 1977; Sui & Humphreys, 2015), it is not static or unchanging. People can expand their self-concepts to include new information (Markus & Kunda, 1986; Markus & Nurius, 1986; Markus & Wurf, 1987). By simply thinking about another person—who they are, how they think, and how they interact with the world—individuals can alter their self-concept to align with that person. This presents theoretical implications for our understanding of self-concept malleability and also has real meaning for people's day-to-day lives. These findings suggest that the ways individuals perceive those closest to them inform not only their impressions of others but who they believe themselves to be.

References

Allport, F. H. (1924). *Social psychology*. Houghton Mifflin.

Ames, D. R. (2004a). Strategies for social inference: A similarity contingency model of projection and stereotyping in attribute prevalence estimates. *Journal of Personality and Social Psychology*, *87*(5), 573–585. https://doi.org/10.1037/0022-3514.87.5.573

Ames, D. R. (2004b). Inside the mind reader's tool kit: Projection and stereotyping in mental state inference. *Journal of Personality and Social Psychology*, *87*(3), 340–353. https://doi.org/10.1037/0022-3514.87.3.340

Amodio, D. M., & Frith, C. D. (2006). Meeting of minds: The medial frontal cortex and social cognition. *Nature Reviews Neuroscience*, *7*(4), 268–277. https://doi.org/10.1038/nrn1884

Aron, A., Aron, E. N., & Smollan, D. (1992). Inclusion of other in the self scale and the structure of interpersonal closeness. *Journal of Personality and Social Psychology*, *63*(4), 596–612. https://doi.org/10.1037/0022-3514.63.4.596

Aron, A., & Fraley, B. (1999). Relationship closeness as including other in the self: Cognitive underpinnings and measures. *Social Cognition*, *17*(2), 140–160. https://doi.org/10.1521/soco.1999.17.2.140

Baayen, R. H., Davidson, D. J., & Bates, D. M. (2008). Mixed-Effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language*, *59*(4), 390–412. https://doi.org/10.1016/j.jml.2007.12.005

Barr, D. J., Levy, R., Scheepers, C., & Tily, H. J. (2013). Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory and Language*, *68*(3), 255–278. https://doi.org/10.1016/j.jml.2012.11.001

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, *67*(1), 1–48. https://doi.org/10.18637/jss.v067.i01

Beckes, L., Coan, J. A., & Hasselmo, K. (2013). Familiarity promotes the blurring of self and other in the neural representation of threat. *Social Cognitive and Affective Neuroscience*, *8*(6), 670–677. https://doi.org/10.1093/scan/nss046

Benoit, R. G., Gilbert, S. J., Volle, E., & Burgess, P. W. (2010). When I think about me and simulate you: Medial rostral prefrontal cortex and self-referential processes. *NeuroImage*, *50*(3), 1340–1349. https://doi.org/10.1016/j.neuroimage.2009.12.091

Bergström, Z. M., Vogelsang, D. A., Benoit, R. G., & Simons, J. S. (2015). Reflections of oneself: Neurocognitive evidence for dissociable forms of self-referential recollection. *Cerebral Cortex*, *25*(9), 2648–2657. https://doi.org/10.1093/cercor/bhu063

Biernat, M., Manis, M., & Kobrynowicz, D. (1997). Simultaneous assimilation and contrast effects in judgments of self and others.

Journal of Personality and Social Psychology, *73*(2), 254–269. https://doi.org/10.1037/0022-3514.73.2.254

Cassidy, B. S., Hughes, C., & Krendl, A. C. (2021). Age differences in neural activity related to mentalizing during person perception. *Aging, Neuropsychology, and Cognition*, *28*(1), 143–160. https://doi.org/10.1080/13825585.2020.1718060

Cassidy, B. S., Leshikar, E. D., Shih, J. Y., Aizenman, A., & Gutchess, A. H. (2013). Valence-based age differences in medial prefrontal activity during impression formation. *Social Neuroscience*, *8*(5), 462–473. https://doi.org/10.1080/17470919.2013.832373

Chartrand, T. L., & Bargh, J. A. (1999). The chameleon effect: The perception-behavior link and social interaction. *Journal of Personality and Social Psychology*, *76*(6), 893–910. https://doi.org/10.1037/0022-3514.76.6.893

Clement, R. W., & Krueger, J. (2000). The primacy of self-referent information in perceptions of social consensus. *British Journal of Social Psychology*, *39*(2), 279–299. https://doi.org/10.1348/014466600164471

Cohen, A. R. (1961). Cognitive tuning as a factor affecting impression formation. *Journal of Personality*, *29*, 235–245. https://doi.org/10.1111/j.1467-6494.1961.tb01658.x

Cooley, C. H. (1902). *Human nature and the social order*. Scribner's.

Davis, M. H. (2017). Social projection to liked and disliked targets: The role of perceived similarity. *Journal of Experimental Social Psychology*, *70*, 286–293. https://doi.org/10.1016/j.jesp.2016.11.012

Decety, J., & Jackson, P. L. (2004). The functional architecture of human empathy. *Behavioral and Cognitive Neuroscience Reviews*, *3*(2), 71–100. https://doi.org/10.1177/1534582304267187

Denissen, J. J. A., Penke, L., Schmitt, D. P., & van Aken, M. A. G. (2008). Self-esteem reactions to social interactions: Evidence for sociometer mechanisms across days, people, and nations. *Journal of Personality and Social Psychology*, *95*(1), 181–196. https://doi.org/10.1037/0022-3514.95.1.181

Dennett, D. C. (1990). The interpretation of texts, people and other artifacts. *Philosophy and Phenomenological Research*, *50*, 177–194. https://doi.org/10.2307/2108038

Di Bella, L., & Crisp, R. J. (2015). Imagining oneself in a stereotyped role may stifle generalized tendencies to support social change. *Social Influence*, *10*(3), 157–167. https://doi.org/10.1080/15534510.2015.1030446

Elder, J., Cheung, B., Davis, T., & Hughes, B. (2023). Mapping the self: A network approach for understanding psychological and neural representations of self-concept structure. *Journal of Personality and Social Psychology*, *124*(2), 237–263. https://doi.org/10.1037/pspa0000315

Elder, J., Davis, T., & Hughes, B. L. (2022). Learning about the self: Motives for coherence and positivity constrain learning from self-relevant social feedback. *Psychological Science*, *33*(4), 629–647. https://doi.org/10.1177/09567976211045934

Elder, J. J., Davis, T. H., & Hughes, B. L. (2023). A fluid self-concept: How the brain maintains coherence and positivity across an interconnected self-concept while incorporating social feedback. *The Journal of Neuroscience*, *43*(22), 4110–4128. https://doi.org/10.1523/JNEUROSCI.1951-22.2023

Epley, N., Keysar, B., Van Boven, L., & Gilovich, T. (2004). Perspective taking as egocentric anchoring and adjustment. *Journal of Personality and Social Psychology*, *87*(3), 327–339. https://doi.org/10.1037/0022-3514.87.3.327

Fabrigar, L. R., & Krosnick, J. A. (1995). Attitude importance and the false consensus effect. *Personality and Social Psychology Bulletin*, *21*(5), 468–479. https://doi.org/10.1177/0146167295215005

Fazio, R. H., Effrein, E. A., & Falender, V. J. (1981). Self-perceptions following social interaction. *Journal of Personality and Social Psychology*, *41*(2), 232–242. https://doi.org/10.1037/0022-3514.41.2.232

Funder, D. C. (1995). On the accuracy of personality judgment: A realistic approach. *Psychological Review*, *102*(4), 652–670. https://doi.org/10.1037/0033-295X.102.4.652

Gallese, V., & Goldman, A. (1998). Mirror neurons and the simulation theory of mind-reading. *Trends in Cognitive Sciences*, *2*(12), 493–501. https://doi.org/10.1016/S1364-6613(98)01262-5

Gilead, M., Boccagno, C., Silverman, M., Hassin, R. R., Weber, J., & Ochsner, K. N. (2016). Self-regulation via neural simulation. *Proceedings of the National Academy of Sciences of the United States of America*, *113*(36), 10037–10042. https://doi.org/10.1073/pnas.1600159113

Goldman, A. I. (2006). *Simulating minds: The philosophy, psychology, and neuroscience of mindreading*. Oxford University Press. https://doi.org/10.1093/0195138929.001.0001

Gonnerman, L. M., Seidenberg, M. S., & Andersen, E. S. (2007). Graded semantic and phonological similarity effects in priming: Evidence for a distributed connectionist approach to morphology. *Journal of Experimental Psychology: General*, *136*(2), 323–345. https://doi.org/10.1037/0096-3445.136.2.323

González-Pérez, S., Mateos de Cabo, R., & Sáinz, M. (2020). Girls in STEM: Is it a female role-model thing? *Frontiers in Psychology*, *11*, Article 2204. https://doi.org/10.3389/fpsyg.2020.02204

Gordon, R. M. (1986). Folk psychology as simulation. *Mind & Language*, *1*(2), 158–171. https://doi.org/10.1111/j.1468-0017.1986.tb00324.x

Greenwald, A. G., & Banaji, M. R. (1989). The self as a memory system: Powerful, but ordinary. *Journal of Personality and Social Psychology*, *57*(1), 41–54. https://doi.org/10.1037/0022-3514.57.1.41

Hamrick, K. (2021). *Women, minorities, and persons with disabilities in science and engineering*. National Science Foundation. https://ncses.nsf.gov/pubs/nsf21321/report

Harris, L. T., & Fiske, S. T. (2006). Dehumanizing the lowest of the low: Neuroimaging responses to extreme out-groups. *Psychological Science*, *17*(10), 847–853. https://doi.org/10.1111/j.1467-9280.2006.01793.x

Heck, P. R., & Krueger, J. I. (2015). Self-enhancement diminished. *Journal of Experimental Psychology: General*, *144*(5), 1003–1020. https://doi.org/10.1037/xge0000105

Heck, P. R., & Krueger, J. I. (2020). Self-enhancement error motivates social projection. *Social Cognition*, *38*(5), 489–522. https://doi.org/10.1521/soco.2020.38.5.489

Henry, J. D., Phillips, L. H., Ruffman, T., & Bailey, P. E. (2013). A meta-analytic review of age differences in theory of mind. *Psychology and Aging*, *28*(3), 826–839. https://doi.org/10.1037/a0030677

Herr, P. M. (1986). Consequences of priming: Judgment and behavior. *Journal of Personality and Social Psychology*, *51*(6), 1106–1115. https://doi.org/10.1037/0022-3514.51.6.1106

Herr, P. M. (1989). Priming price: Prior knowledge and context effects, *Journal of Consumer Research*, *16*(1), 67–75. https://doi.org/10.1086/209194

Herrmann, S. D., Adelman, R. M., Bodford, J. E., Graudejus, O., Okun, M. A., & Kwan, V. S. Y. (2016). The effects of a female role model on academic performance and persistence of women in STEM courses. *Basic and Applied Social Psychology*, *38*(5), 258–268. https://doi.org/10.1080/01973533.2016.1209757

Higgins, E. T. (1996). The "self digest": Self-Knowledge serving self-regulatory functions. *Journal of Personality and Social Psychology*, *71*(6), 1062–1083. https://doi.org/10.1037/0022-3514.71.6.1062

Higgins, E. T., & Rholes, W. S. (1978). "Saying is believing": Effects of message modification on memory and liking for the person described. *Journal of Experimental Social Psychology*, *14*(4), 363–378. https://doi.org/10.1016/0022-1031(78)90032-X

Hoch, S. J. (1987). Perceived consensus and predictive accuracy: The pros and cons of projection. *Journal of Personality and Social Psychology*, *53*(2), 221–234. https://doi.org/10.1037/0022-3514.53.2.221

Hughes, B. L., & Beer, J. S. (2012). Orbitofrontal cortex and anterior cingulate cortex are modulated by motivated social cognition. *Cerebral Cortex*, *22*(6), 1372–1381. https://doi.org/10.1093/cercor/bhr213

Hupbach, A., Gomez, R., Hardt, O., & Nadel, L. (2007). Reconsolidation of episodic memories: A subtle reminder triggers integration of new information. *Learning & Memory*, *14*(1–2), 47–53. https://doi.org/10.1101/lm.365707

Hupbach, A., Gomez, R., & Nadel, L. (2009). Episodic memory reconsolidation: Updating or source confusion? *Memory*, *17*(5), 502–510. https://doi.org/10.1080/09658210902882399

Innes, J. M. (1981). Polarization of response as a function of cognitive tuning set and individual differences. *Social Behavior and Personality*, *9*, 213–218. https://doi.org/10.1007/BF02686752

Jenkins, A. C., Macrae, C. N., & Mitchell, J. P. (2008). Repetition suppression of ventromedial prefrontal activity during judgments of self and others. *Proceedings of the National Academy of Sciences of the United States of America*, *105*(11), 4507–4512. https://doi.org/10.1073/pnas.0708785105

Ji, L. J., Imtiaz, F., Su, Y., Zhang, Z., Bowie, A. C., & Chang, B. (2022). Culture, aging, self-continuity, and life satisfaction. *Journal of Happiness Studies*, *23*(8), 3843–3864. https://doi.org/10.1007/s10902-022-00568-5

Johnston, R. A., & Barry, C. (2001). Best face forward: Similarity effects in repetition priming of face recognition. *The Quarterly Journal of Experimental Psychology A: Human Experimental Psychology*, *54*(2), 383–396. https://doi.org/10.1080/713755976

Karniol, R. (2003). Egocentrism versus protocentrism: The status of self in social prediction. *Psychological Review*, *110*(3), 564–580. https://doi.org/10.1037/0033-295X.110.3.564

Kazak, A. E. (2018). Editorial: Journal article reporting standards. *American Psychologist*, *73*(1), 1–2. https://doi.org/10.1037/amp0000263

Klein, S. B., & Loftus, J. (1988). The nature of self-referent encoding: The contributions of elaborative and organizational processes. *Journal of Personality and Social Psychology*, *55*(1), 5–11. https://doi.org/10.1037/0022-3514.55.1.5

Klein, S. B., & Loftus, J. (1993). The mental representation of trait and autobiographical knowledge about the self. In T. K. Srull & R. S. Wyer (Eds.), *Advances in social cognition* (Vol. 5, pp. 1–49). Erlbaum.

Klein, S. B., Loftus, J., & Burton, H. A. (1989). Two self reference effects: The importance of distinguishing between self descriptiveness judgments and autobiographical retrieval in self referent encoding. *Journal of Personality and Social Psychology*, *56*(6), 853–865. https://doi.org/10.1037/0022-3514.56.6.853

Klein, S. B., Loftus, J., Trafton, R. G., & Fuhrman, R. W. (1992). The use of exemplars and abstractions in trait judgments: A model of trait knowledge about the self and others. *Journal of Personality and Social Psychology*, *63*(5), 739–753. https://doi.org/10.1037/0022-3514.63.5.739

Koop, A. (2021). *Who Americans spend their time with, by age*. Visual Capitalist. https://www.visualcapitalist.com/who-americans-spend-the-most-time-with-by-age/

Krienen, F. M., Tu, P.-C., & Buckner, R. L. (2010). Clan mentality: Evidence that the medial prefrontal cortex responds to close others. *The Journal of Neuroscience*, *30*(41), 13906–13915. https://doi.org/10.1523/JNEUROSCI.2180-10.2010

Krueger, J. (1998). Enhancement bias in the description of self and others. *Personality and Social Psychology Bulletin*, *24*(5), 505–516. https://doi.org/10.1177/0146167298245006

Krueger, J., & Clement, R. W. (1994). The truly false consensus effect: An ineradicable and egocentric bias in social perception. *Journal of Personality and Social Psychology*, *67*(4), 596–610. https://doi.org/10.1037/0022-3514.67.4.596

Kunda, Z., Davies, P. G., Adams, B. D., & Spencer, S. J. (2002). The dynamic time course of stereotype activation: Activation, dissipation, and resurrection. *Journal of Personality and Social Psychology*, *82*(3), 283–299. https://doi.org/10.1037/0022-3514.82.3.283

Kunda, Z., & Spencer, S. J. (2003). When do stereotypes come to mind and when do they color judgment? A goal-based theoretical framework for stereotype activation and application. *Psychological Bulletin*, *129*(4), 522–544. https://doi.org/10.1037/0033-2909.129.4.522

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest package: Tests in linear mixed effects models. *Journal of Statistical Software*, *82*(13), 1–26. https://doi.org/10.18637/jss.v082.i13

Lee, J. L. C., Nader, K., & Schiller, D. (2017). An update on memory reconsolidation updating. *Trends in Cognitive Sciences*, *21*(7), 531–545. https://doi.org/10.1016/j.tics.2017.04.006

Lee, N. A., Martin, D., & Sui, J. (2021). A pre-existing self-referential anchor is not necessary for self-prioritisation. *Acta Psychologica*, *219*, Article 103362. https://doi.org/10.1016/j.actpsy.2021.103362

Libby, L. K., Valenti, G., Pfent, A., & Eibach, R. P. (2011). Seeing failure in your life: Imagery perspective determines whether self-esteem shapes reactions to recalled and imagined failure. *Journal of Personality and Social Psychology*, *101*(6), 1157–1173. https://doi.org/10.1037/a0026105

Löckenhoff, C. E., & Rutt, J. L. (2017). Age differences in self-continuity: Converging evidence and directions for future research. *The Gerontologist*, *57*(3), 396–408. https://doi.org/10.1093/geront/gnx010

Loftus, E. F. (2005). Planting misinformation in the human mind: A 30-year investigation of the malleability of memory. *Learning & Memory*, *12*, 361–366. https://doi.org/10.1101/lm.94705

Loftus, E. F., Miller, D. G., & Burns, H. J. (1978). Semantic integration of verbal information into a visual memory. *Journal of Experimental Psychology: Human Learning and Memory*, *4*, 19–31. https://doi.org/10.1037/0278-7393.4.1.19

Machunsky, M., Toma, C., Yzerbyt, V., & Corneille, O. (2014). Social projection increases for positive targets: Ascertaining the effect and exploring its antecedents. *Personality and Social Psychology Bulletin*, *40*(10), 1373–1388. https://doi.org/10.1177/0146167214545039

Machunsky, M., & Walther, E. (2015). Of Caucasians, Asians, and Giraffes: The influence of categorization and target valence on social projection. *Personality and Social Psychology Bulletin*, *41*(9), 1236–1246. https://doi.org/10.1177/0146167215592842

Mar, R. A., Mason, M. F., & Litvack, A. (2012). How daydreaming relates to life satisfaction, loneliness, and social support: The importance of gender and daydream content. *Consciousness and Cognition*, *21*(1), 401–407. https://doi.org/10.1016/j.concog.2011.08.001

Markus, H., & Kunda, Z. (1986). Stability and malleability of the self-concept. *Journal of Personality and Social Psychology*, *51*(4), 858–866. https://doi.org/10.1037/0022-3514.51.4.858

Markus, H., & Nurius, P. (1986). Possible selves. *American Psychologist*, *41*(9), 954–969. https://doi.org/10.1037/0003-066X.41.9.954

Markus, H., & Wurf, E. (1987). The dynamic self-concept: A social psychological perspective. *Annual Review of Psychology*, *38*(1), 299–337. https://doi.org/10.1146/annurev.ps.38.020187.001503

Marsh, H. W., Smith, I. D., Barnes, J., & Butler, S. (1983). Self-concept: Reliability, stability, dimensionality, validity, and the measurement of change. *Journal of Educational Psychology*, *75*(5), 772–790. https://doi.org/10.1037/0022-0663.75.5.772

Martin, R. C. (2007). Semantic short-term memory, language processing, and inhibition. In A. S. Meyer, L. R. Wheeldon, & A. Krott (Eds.), *Automaticity and control in language processing* (pp. 161–191). Psychology Press.

Mashek, D. J., Aron, A., & Boncimino, M. (2003). Confusions of self with close others. *Personality and Social Psychology Bulletin*, *29*(3), 382–392. https://doi.org/10.1177/0146167202250220

Mazis, M. B. (1973). Cognitive tuning and receptivity to novel information. *Journal of Experimental and Social Psychology*, *9*, 307–319. https://doi.org/10.1016/0022-1031(73)90068-1

McRae, K., & Boisvert, S. (1998). Automatic semantic similarity priming. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *24*(3), 558–572. https://doi.org/10.1037/0278-7393.24.3.558

Meevissen, Y. M. C., Peters, M. L., & Alberts, H. J. (2011). Become more optimistic by imagining a best possible self: Effects of a two week intervention. *Journal of Behavior Therapy and Experimental Psychiatry*, *42*(3), 371–378. https://doi.org/10.1016/j.jbtep.2011.02.012

Meyer, M. L., Zhao, Z., & Tamir, D. I. (2019). Simulating other people changes the self. *Journal of Experimental Psychology: General*, *148*(11), 1898–1913. https://doi.org/10.1037/xge0000565

Mildner, J. N., & Tamir, D. I. (2021). The people around you are inside your head: Social context shapes spontaneous thought. *Journal of Experimental Psychology: General*, *150*(11), 2375–2386. https://doi.org/10.1037/xge0001057

Mitchell, J. P. (2009). Social psychology as a natural kind. *Trends in Cognitive Sciences*, *13*(6), 246–251. https://doi.org/10.1016/j.tics.2009.03.008

Mitchell, J. P., Banaji, M. R., & Macrae, C. N. (2005). The link between social cognition and self-referential thought in the medial prefrontal cortex. *Journal of Cognitive Neuroscience*, *17*(8), 1306–1315. https://doi.org/10.1162/0898929055002418

Mitchell, J. P., Macrae, C. N., & Banaji, M. R. (2006). Dissociable medial prefrontal contributions to judgments of similar and dissimilar others. *Neuron*, *50*(4), 655–663. https://doi.org/10.1016/j.neuron.2006.03.040

Molnar-Szakacs, I., & Arzy, S. (2009). Searching for an integrated self-representation. *Communicative & Integrative Biology*, *2*(4), 365–367. https://doi.org/10.4161/cib.2.4.8290

Moore, W. E., III, Merchant, J. S., Kahn, L. E., & Pfeifer, J. H. (2014). 'Like me?': Ventromedial prefrontal cortex is sensitive to both personal relevance and self-similarity during social comparisons. *Social Cognitive and Affective Neuroscience*, *9*(4), 421–426. https://doi.org/10.1093/scan/nst007

Moran, A., Campbell, M., Holmes, P., & Macintyre, T. (2012). *Mental imagery, action observation and skill learning*. Routledge.

Moran, J. M. (2013). Lifespan development: The effects of typical aging on theory of mind. *Behavioural Brain Research*, *237*, 32–40. https://doi.org/10.1016/j.bbr.2012.09.020

Moran, J. M., Jolly, E., & Mitchell, J. P. (2012). Social-cognitive deficits in normal aging. *The Journal of Neuroscience*, *32*(16), 5553–5561. https://doi.org/10.1523/JNEUROSCI.5511-11.2012

Mullen, B., Atkins, J. L., Champion, D. S., Edwards, C., Hardy, D., Story, J. E., & Vanderklok, M. (1985). The false consensus effect: A meta-analysis of 115 hypothesis tests. *Journal of Experimental Social Psychology*, *21*(3), 262–283. https://doi.org/10.1016/0022-1031(85)90020-4

Mullen, B., & Smith, C. (1990). Social projection as a function of actual consensus. *The Journal of Social Psychology*, *130*(4), 501–506. https://doi.org/10.1080/00224545.1990.9924612

Mussweiler, T. (2001a). "Seek and ye shall find": Antecedents of assimilation and contrast in social comparison. *European Journal of Social Psychology*, *31*(5), 499–509. https://doi.org/10.1002/ejsp.75

Mussweiler, T. (2001b). Focus of comparison as a determinant of assimilation versus contrast in social comparison. *Personality and Social Psychology Bulletin*, *27*(1), 38–47. https://doi.org/10.1177/0146167201271004

Mussweiler, T., & Bodenhausen, G. V. (2002). I know you are, but what am I? Self-evaluative consequences of judging in-group and out-group members. *Journal of Personality and Social Psychology*, *82*(1), 19–32. https://doi.org/10.1037/0022-3514.82.1.19

Nader, K. (2003). Memory traces unbound. *Trends in Neurosciences*, *26*(2), 65–72. https://doi.org/10.1016/S0166-2236(02)00042-5

Nickerson, R. (1999). How we know—And sometimes misjudge—What others know: Imputing one's own knowledge to others. *Psychological Bulletin*, *125*(6), 737–759. https://doi.org/10.1037/0033-2909.125.6.737

Northoff, G. (2014). How is our self altered in psychiatric disorders? A neurophenomenal approach to psychopathological symptoms. *Psychopathology*, *47*(6), 365–376. https://doi.org/10.1159/000363351

Ochsner, K. N., Beer, J. S., Robertson, E. R., Cooper, J. C., Gabrieli, J. D. E., Kihsltrom, J. F., & D'Esposito, M. (2005). The neural correlates of direct and reflected self-knowledge. *NeuroImage*, *28*(4), 797–814. https://doi.org/10.1016/j.neuroimage.2005.06.069

Oyserman, D., Elmore, K., & Smith, G. (2012). Self, self-concept, and identity. In M. R. Leary & J. P. Tangney (Eds.), *Handbook of self and identity* (2nd ed., pp. 69–104). Guilford Press.

Ploderer, B., Reitberger, W., Oinas-Kukkonen, H., & van Gemert-Pijnen, J. (2014). Social interaction and reflection for behavior change. *Personal and Ubiquitous Computing*, *18*(7), 1667–1676. https://doi.org/10.1007/s00779-014-0779-y

R Core Team. (2021). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. https://www.r-project.org/

Rogers, T. B., Kuiper, N. A., & Kirker, W. S. (1977). Self-reference and the encoding of personal information. *Journal of Personality and Social Psychology*, *35*(9), 677–688. https://doi.org/10.1037/0022-3514.35.9.677

Ross, L., Greene, D., & House, P. (1977). The "false consensus effect": An egocentric bias in social perception and attribution processes. *Journal of Experimental Social Psychology*, *13*(3), 279–301. https://doi.org/10.1016/0022-1031(77)90049-X

Rubin-McGregor, J., Zhao, Z., & Tamir, D. I. (2022). Simulation induces durable, extensive changes to self-knowledge. *Journal of Experimental Social Psychology*, *98*, Article 104229. https://doi.org/10.1016/j.jesp.2021.104229

Rueckl, J. G. (1990). Similarity effects in word and pseudoword repetition priming. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *16*(3), 374–391. https://doi.org/10.1037/0278-7393.16.3.374

Savitsky, K., Keysar, B., Epley, N., Carter, T., & Swanson, A. (2011). The closeness-communication bias: Increased egocentrism among friends versus strangers. *Journal of Experimental Social Psychology*, *47*(1), 269–273. https://doi.org/10.1016/j.jesp.2010.09.005

Scheller, M., & Sui, J. (2022). The power of the self: Anchoring information processing across contexts. *Journal of Experimental Psychology: Human Perception and Performance*, *48*(9), 1001–1021. https://doi.org/10.1037/xhp0001017

Schreuder, R., Flores d'Arcais, G. B., & Glazenborg, G. (1984). Effects of perceptual and conceptual similarity in semantic priming. *Psychological Research*, *45*(4), 339–354. https://doi.org/10.1007/BF00309710

Sedikides, C., & Strube, M. J. (1995). The multiply motivated self. *Personality and Social Psychology Bulletin*, *21*(12), 1330–1335. https://doi.org/10.1177/01461672952112010

Shanton, K., & Goldman, A. (2010). Simulation theory. *Wiley Interdisciplinary Reviews: Cognitive Science*, *1*(4), 527–538. https://doi.org/10.1002/wcs.33

Simons, D. J., Shoda, Y., & Lindsay, D. S. (2017). Constraints on generality (COG): A proposed addition to all empirical papers. *Perspectives on Psychological Science*, *12*(6), 1123–1128. https://doi.org/10.1177/1745691617708630

Smith, E. R., Coats, S., & Walling, D. (1999). Overlapping mental representations of self, in-group, and partner: Further response time evidence and a connectionist model. *Personality and Social Psychology Bulletin*, *25*(7), 873–882. https://doi.org/10.1177/0146167299025007009

Song, X., & Wang, X. (2012). Mind wandering in Chinese daily lives—An experience sampling study. *PLOS One*, *7*(9), Article e44423. https://doi.org/10.1371/journal.pone.0044423

Stout, J. G., Dasgupta, N., Hunsinger, M., & McManus, M. A. (2011). STEMing the tide: Using ingroup experts to inoculate women's self-concept in science, technology, engineering, and mathematics (STEM). *Journal of Personality and Social Psychology*, *100*(2), 255–270. https://doi.org/10.1037/a0021385

Sugiura, Y., & Sugiura, T. (2020). Relation between daydreaming and well-being: Moderating effects of otaku contents and mindfulness. *Journal of Happiness Studies*, *21*(4), 1199–1223. https://doi.org/10.1007/s10902-019-00123-9

Sui, J., & Humphreys, G. W. (2015). The integrative self: How self-reference integrates perception and memory. *Trends in Cognitive Sciences*, *19*(12), 719–728. https://doi.org/10.1016/j.tics.2015.08.015

Suzuki, A., Ueno, M., Ishikawa, K., Kobayashi, A., Okubo, M., & Nakai, T. (2019). Age-related differences in the activation of the mentalizing- and reward-related brain regions during the learning of others' true trustworthiness. *Neurobiology of Aging*, *73*, 1–8. https://doi.org/10.1016/j.neurobiolaging.2018.09.002

Swann, W. B., Jr., Griffin, J. J., Jr., Predmore, S. C., & Gaines, B. (1987). The cognitive–affective crossfire: When self-consistency confronts self-enhancement. *Journal of Personality and Social Psychology*, *52*(5), 881–889. https://doi.org/10.1037/0022-3514.52.5.881

Swann, W. B., & Hill, C. A. (1982). When our identities are mistaken: Reaffirming self-conceptions through social interaction. *Journal of Personality and Social Psychology*, *43*(1), 59–66. https://doi.org/10.1037/0022-3514.43.1.59

Tamir, D. I., & Mitchell, J. P. (2010). Neural correlates of anchoring-and-adjustment during mentalizing. *Proceedings of the National Academy of Sciences of the United States of America*, *107*(24), 10827–10832. https://doi.org/10.1073/pnas.1003242107

Tamir, D. I., & Mitchell, J. P. (2013). Anchoring and adjustment during social inferences. *Journal of Experimental Psychology: General*, *142*(1), 151–162. https://doi.org/10.1037/a0028232

Todd, A. R., Simpson, A. J., & Tamir, D. I. (2016). Active perspective taking induces flexible use of self-knowledge during social inference. *Journal of Experimental Psychology: General*, *145*(12), 1583–1588. https://doi.org/10.1037/xge0000237

Tulving, E. (1985). Memory and consciousness. *Canadian Psychology / Psychologie canadienne*, *26*(1), 1–12. https://doi.org/10.1037/h0080017

Tversky, A. (1977). Features of similarity. *Psychological Review*, *84*(4), 327–352. https://doi.org/10.1037/0033-295X.84.4.327

Tversky, A., & Gati, I. (1978). Studies in similarity. In E. Rosen & B. B. Lloyd (Eds.), *Cognition and categorization* (pp. 79–98). Lawrence Erlbaum.

Tyler, L. K., & Moss, H. E. (2001). Towards a distributed account of conceptual knowledge. *Trends in Cognitive Sciences*, *5*(6), 244–252. https://doi.org/10.1016/S1364-6613(00)01651-X

Unkelbach, C., & Rom, S. C. (2017). A referential theory of the repetition-induced truth effect. *Cognition*, *160*, 110–126. https://doi.org/10.1016/j.cognition.2016.12.016

Van Camp, A. R., Gilbert, P. N., & O'Brien, L. T. (2019). Testing the effects of a role model intervention on women's STEM outcomes. *Social Psychology of Education*, *22*(3), 649–671. https://doi.org/10.1007/s11218-019-09498-2

Van Overwalle, F. (2009). Social cognition and the brain: A meta-analysis. *Human Brain Mapping*, *30*(3), 829–858. https://doi.org/10.1002/hbm.20547

Wegner, D. M., & Vallacher, R. R. (1977). *Implicit psychology: An introduction to social cognition* (p. 326). Oxford University Press.

Welborn, B. L., & Lieberman, M. D. (2015). Person-specific theory of mind in medial pFC. *Journal of Cognitive Neuroscience*, *27*(1), 1–12. https://doi.org/10.1162/jocn_a_00700

Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition*, *13*(1), 103–128. https://doi.org/10.1016/0010-0277(83)90004-5

Wu, H., Liu, X., Hagan, C. C., & Mobbs, D. (2020). Mentalizing during social InterAction: A four component model. *Cortex*, *126*, 242–252. https://doi.org/10.1016/j.cortex.2019.12.031

Zajonc, R. B. (1960). The process of cognitive tuning in communication. *The Journal of Abnormal and Social Psychology*, *61*(2), 159–167. https://doi.org/10.1037/h0047987

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