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Inductive reasoning model

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Abstract

We introduce the *Inductive Reasoning Model* (IRM) as a comprehensive platform for the study of several phenomena central to self- and social perception. Going beyond the traditional phenomenon-focused research strategy, the model shows how to generate point-specific hypotheses about the size of individual effects and how to predict the interrelations among phenomena of interest. The model points to additional psychological processes at play when outputs cannot be accounted for within the confines of the IRM alone. The IRM is parsimonious in its assumptions and generative in its predictions. Using two empirically-based inputs, namely, the positivity of a person's self-image and the strength of social projection, the model predicts the direction and extent of four higher-order phenomena: intergroup accentuation, self-enhancement, ingroup favoritism, and differential accuracy. The model affords precise predictions pertaining to the relationships among these phenomena. Critically, alternative conceptions of social perceptions are not rendered irrelevant. Researchers can ask if the IRM over- or underpredicts social-perceptual phenomena in contexts of interest, and if alternative models can explain the differences.

Keywords: inductive reasoning, social perception, model, theoretical

We introduce the *Inductive Reasoning Model* (IRM) as a tool for the joint study of several higher-order social perceptual phenomena. The IRM is an exploratory model, designed to help integrate the study of disparate phenomena of social perception. Our goal is to provide an alternative to the common practice of single-phenomenon research and tests of theoretically meek null hypotheses. By deriving precise and substantive predictions, the IRM sets the stage for strong (i.e., non-nil) hypothesis testing (Meehl, 1967; 1978). To situate the model in the prevailing theoretical landscape, we first provide a brief overview of three intellectual traditions in social psychology. We then argue and show that the IRM aligns with one of these traditions, and that it can predict phenomena hitherto addressed by different theories. The model's utility rests on its parsimony, integrative potential, and ability to generate novel and testable hypotheses.

Historical and Theoretical Background

In their classic text on social cognition, Fiske and Taylor (1984) observed that social perception is difficult, but concluded that researchers need not be deterred from building and testing theoretical models. Today – in spite of progress in finding answers to numerous specific research questions – critical issues remain. One issue comprises questions of judgmental biases and accuracy. Some researchers believe that the issue of accuracy is intractable in the social world, and bias is inevitable because of irreducible complexity, inference-dependence, and strategic deception (Fiske, 1998; Jones 1985). This view limits the focus of research to the psychological mechanisms underlying perception irrespective of bias and accuracy. Others believe that accuracy is empirically low, and in some areas (e.g., stereotyping) by definition so (Bargh & Chartrand, 1999; Miller & Turnbull, 1986). This view locates inaccuracies in flawed

reasoning (i.e., biases) and cognitive illusions. Yet, many of those who take this view advocate *meliorism*, or the idea that education and practice can make social perception more accurate (Stanovich, 2011). Still others believe that accuracy can be assessed and attained, and that the evidence is encouraging (Funder, 1995; Jussim, 2012).

In light of such disagreements, it is not surprising that the field lacks a unifying paradigm. Instead, we can distinguish three major theoretical approaches whose assumptions and implications address the question of perceptual accuracy as well as well-known cognitive biases. Occasionally, advocates of these perspectives clash over disagreements, but by and large, their research programs have come to co-exist. Competitive hypothesis testing is rare, and often inconclusive when it occurs (Greenwald, 2012). Each of these paradigms has a long history. Their intellectual foundations were laid in the 1950s, but more distant forerunners dot the prehistory of the field. We now briefly consider these three perspectives.

The first perspective is interpersonal in its approach and its prototype is social comparison theory (Festinger, 1954; Gerber et al., 2018; Suls & Wheeler, 2000). Festinger was careful to note that not all social perception is comparative, although much of what is interesting is (see also Krueger, 2008; Krueger et al., 2012). In large part, the theory claims, self-perception arises from social comparison, an idea that can be extended to the perception of groups (Tajfel, 1969). The footprint of comparison is bias, either in the form of assimilation or in the form of contrast (Mussweiler, 2003). The roots of this approach lie in frame-of-reference theories in psychophysics (Parducci & Marshall, 1962). Research inspired by these theories demonstrated the relativity of stimulus judgment. The magnitude of strength of a stimulus, such as a tone or a weight, may be assimilated to or contrasted away from the properties of

referent stimuli or anchors (Beck, 1966; Müller & Schumann, 1889). When human beings are the stimuli, the task of the perceptual system is rather similar (though perhaps harder overall, as noted above). The theoretician's task is to predict when assimilation and when contrast will occur (Mussweiler, 2003; Sherif & Hovland, 1961). The idea that one of these two effects will occur is a theoretical precommitment to the view that social perception is biased and thus prone to predictable inaccuracies.

The second perspective emphasizes group and intergroup dynamics, with social identity theory being a prototypical variant (Tajfel & Turner, 1979; for a review, see Ellemers & Haslam, 2012). This theory was originally proposed to challenge individualist approaches dominant at the time, and social comparison theory as well. Its central idea is that psychological identity is both personal and social. Individuals have a sense of who they are as unique human beings, and they also have a sense of how they fit into the web of social categories. The concept of the *group* is critical to social identity theory; it captures memberships in all those social categories that are significant to the individual. With her influential theory of optimal distinctiveness, Brewer (1991) elaborated these ideas to explain how a person balances the unique or personal aspects with the shared or social aspects of identity.

Self-categorization theory (Turner et al., 1987) has been the most ambitious elaboration of social identity theory. Although this theory seeks to account for individuals' motivational and cognitive processes, its core assumptions place it squarely at the collectivist end of the spectrum. The individual is seen as a creation of group processes, and information processing is their epiphenomenon. With their most pointed claims, theories inspired by the concept of

social identity raise social groups to the status of quasi-organisms, while seeking to avoid the discredited concept of the group mind (Elwood, 1920). Granting prominence to the social group as a level of analysis, the social identity perspective echoes the aversion to psychological reductionism typical of the work of early sociologists (Durkheim, 1895/1966; Gumplowicz, 1899/2019).

The collectivist perspective insists that social perception, which includes self-perception, is comprehensible only with reference to group-level phenomena. Proponents of this paradigm tend to assume that definitions and perceptions of groups change over time and with the social context. There is, in other words, no stable stimulus – be it the self or the group – to be perceived, and hence the question of accuracy is moot (Oakes et al., 1994). Some contemporary theories, such as the identity fusion model (Swann et al., 2012), favor a contingent view of collectivism, retaining the notion of an individualist ego, while arguing that this ego may be lost in prevalent group contexts. This sort of contingent collectivism continues the tradition of the early psychology of the crowd (Le Bon, 1895).

The third, social cognitive, perspective comprises a family of theories that take methodological individualism as their point of departure (Allport, 1924; Alicke et al., 2005; Alicke & Sedikides, 2009; Hamilton & Sherman, 1996). Here, the individual person is the primary unit of analysis (Fiedler, 2000; Funder, 1995; Krueger et al., 2006). This individualist perspective may be construed as a social-realist paradigm; it does not deny the difficulties of social perception noted above, and it does not suggest that perception is mostly or necessarily accurate. It does assume, however, that the accuracy of social perception is an empirical question, and that the study of accuracy and inaccuracy provides a foundation for a better

understanding of cognitive biases, errors, and illusions. Indeed, the notions of error or illusion would be meaningless were it not for the corresponding notion of accuracy (Krueger & Funder, 2004). Likewise, the individualist perspective does not consider group processes or interpersonal comparisons irrelevant. Instead, this perspective presumes the sovereignty of individual-based perception of social reality, which can be modified by higher-level processes, such as social comparisons.

In sum, the three prevailing traditions of social psychological theory reviewed here are distinguished by the processes they deem essential for the explanation of social psychological phenomena such as attitudes, stereotypes, self-esteem, and self-concept. Most cognitive approaches assume – implicitly or explicitly – that the individual person is the appropriate units of analysis for psychological research. At the same time, the person is the fundamental building block of interacting systems from small groups to societies. Other approaches emphasize interpersonal or intergroup processes, although they too end up with predictions about and effects found in individual minds. In contrast, the IRM, without claiming to the exhaustive, has the advantage of being individualist at all levels of theory and analysis; it presumes to account for basic interpersonal and intergroup perceptions without having to consider the impact of other individuals or groups on the perceiver.

Building on the basic propositions of the social-reality perspective, the IRM allows us to develop a person-based model of inductive reasoning that generates predictions for several phenomena familiar to students of social perception. The model is progressive in several aspects. The IRM creates an opportunity to revive the study of perceptual accuracy and bias, while providing a social-cognitive alternative to the social identity and social comparison

perspectives. Note that while the IRM is rooted in methodological individualism (Krueger & Grüning, 2024), it is able to intersect with more collectivistic theories. In this regard, the IRM is parsimonious. We propose, for example, that there is no need to explain ingroup favoritism with complex intergroup dynamics when a few assumptions about individual-level mechanisms suffice. Two further properties of the model are noteworthy. The IRM is both generative and precise. Proceeding from a few simple assumptions and theoretical constraints (Fiedler, 2018), the model yields novel and sometimes surprising predictions (generativity). At the same time, the model can identify or rule out hypotheses that are impossible *a priori* (precision). In other words, the model can serve as both a hypothesis generator and a hypothesis eliminator.

The IRM is inclusive in that it sheds light on the interrelations among different social-cognitive phenomena and integrates them theoretically. Integrative models are essential to unite previously disparate or conflicting streams of theory and research. Kuhn (1962; 1977) proposed that scientific knowledge progresses in a series of paradigm shifts. Phases of "normal science," which are characterized by research respecting a set of common background assumptions, are followed by revolutions, which are characterized by the advent of a new set of assumptions and new ways of seeing things (θεορειν = to view in a particular way) and new ways of thinking (an idea that was anticipated by Ludvik Fleck, 1935, and anarchically deconstructed by Feyerabend, 1975). A paradigm shift is successful if it integrates previously disparate findings and anomalies, and if it generates new predictions (see also Hacking, 2012).

Although Kuhn's narrative was focused on the grand historical stages of physics and astronomy, small-scale shifts in the prevailing theoretical thinking can be observed in areas of

research known to be in a pre-paradigmatic stage, a stage Kuhn famously ascribed to the social sciences. The IRM is an attempt to follow in the footsteps of other small- to medium-scale integrative frameworks (e.g., Greenwald et al., 2002) a point to which we will return. It bears mentioning that theoretical integration is consistent with the Open Science push toward collaborative research practices and the attainment of replicable and generalizable findings (Munafò et al., 2016; Robson et al., 2021). In short, the IRM attempts to respond to fundamental concerns in the philosophy of science and specifically to contemporary concerns about the fragmentation of social psychological research. To illustrate the model's properties and capabilities, we now describe its assumptions, data inputs, and result outputs, and apply it to a selection of issues that are of interest to the three conventional social perception frameworks sketched above.

The Inductive Reasoning Model

Several building blocks of the IRM have been introduced and tested elsewhere (DiDonato et al., 2011; Krueger, 2007; Krueger et al., 2006; Krueger & DiDonato, 2008; Krueger et al., 2013; Robbins & Krueger, 2005), but to date there exists no fully integrated and elaborated presentation. In this article, we focus on unfolding the interrelations of the phenomena of interest and present IRM's predictions for more complex second-order phenomena (e.g., self-enhancement and in-group favoritism).

Assumption 1: Social Projection

The concept of social projection (Allport, 1924; Krueger, 1998) lies at the core of the model. Social projection can be defined as a judgmental heuristic that allows individuals to predict the extent to which other individuals share their preferences or attributes. As a process

of inductive reasoning, social projection uses available information, such as a person's own preferences or attributes, to infer the preferences or attributes of other people. Like other judgmental heuristics, the heuristic of social projection is most useful when uncertainty is high (Hertwig et al., 2013). When specific information about others becomes available, the projection heuristic becomes less relevant (Krueger & Clement, 1994; Krueger & Stanke, 2001). As such, the projection heuristic can be viewed a special case of Bayesian learning (Dawes, 1998; Krueger et al., 2012; Tenenbaum & Griffiths, 2001). As information accumulates, evidence (observed facts about others) crowds out *a priori* expectations (self-based hypotheses).

Induction by projection has two important properties, one analytic and one empirical. The analytic property is that projection increases the accuracy of perception over random guessing. Assuming that others are similar to the self, yields a higher-than-average hit rate because others *are* similar to the self (Christakis, 2020; Humphrey, 1978). The understanding of this basic fact, which may now seem obvious, was hard won by Hoch (1987) and Dawes (1989) against the then-prevalent but false consensus that social projection amounts to false consensus (Ross et al., 1977). The false-consensus view now represents a historic case of scientists being illuded when studying a presumed cognitive illusion (Dawes & Mulford, 1996). Hoch (1987) and Dawes (1989) realized that, by definition, most people's preferences and attributes are the preferences and attributes of the majority. This insight implies that if a person only knows his or her own preferences or attributes, the best prediction strategy is to assume that others share these preferences or attributes. In contrast, the presumed uniqueness of these preferences or attributes is a hypothesis that requires strong evidence.

The strength of social projection declines with the social distance between the perceiver and the target of perception (Evans et al., 2021; Krueger, et al., 2016). This decline can be justified by noting that with increasing social distance, people become less similar to one another and they know that they do. Individuals, in general, share more preferences and attributes with their neighbors than with the inhabitants of their city, country, continent, and so on. Compelling as this principle is, it is difficult to quantify (Krueger & DiDonato, 2008). In social psychological research practice, the simple distinction between ingroups and outgroups serves as a convenient proxy for social distance.

A conceptually clean variant of social categorization is the minimal-group paradigm (Rabbie & Horwitz, 1969; Tajfel, 1970; Diehl, 1990; Otten, 2016). Work in this paradigm shows that social projection drops sharply as the social category boundary between ingroup and outgroup is crossed. Projection to outgroups is generally weak (Robbins & Krueger, 2005). The minimal group paradigm outflanks the ecological fact of decreasing self-other similarity with increasing social distance because "in truth," there are no differences between minimal ingroups and minimal outgroups. The lack of social projection to minimal outgroups may be seen as an overgeneralization of the ecological principle that one need not project (as strongly) to groups to which one does not belong. The IRM, as we shall see, derives most of its specific predictions from the stylized empirical fact of "differential projection," that is, from the finding that people project strongly to groups to which they belong (ingroups), while barely projecting to groups to which they do not belong (outgroups). More generally, the IRM assumes that social projection decreases over social distance. The study of judgments about ingroups and outgroups is but one specific – and highly prominent – variant of this more general principle.

Assumption 2: Self-Positivity

The other foundational assumption of the IRM is that most individuals have positive self-images (Alicke & Sedikides, 2011). Much theorizing and research work has gone into trying to understand why this is so. Whereas most theorists are willing to assume the existence of a drive or need to have a positive self-view (Crocker & Park, 2004; Maslow, 1943), others have argued (and shown) that inductive reasoning alone can result in positive, as opposed to neutral or negative, self-concepts inasmuch as self-observation and sampling of relevant behavioral episodes (Fiedler, 2000; Fiedler & Kutzner, 2015).

The utility of a positive self-concept is uncontroversial. A positive self-image is healthy, desirable, and worthy of being maintained (Baumeister et al., 2003; Krueger et al., 2017; Taylor & Brown, 1988). The IRM does not take a normative position on this issue. Rather, its goal is to show how, given a positive self-image, social projection produces higher-order effects associated with questions of bias and accuracy. Specifically, the model offers a new perspective on self-enhancement and on ingroup favoritism, that is, the ideas that oneself (Heck & Krueger, 2015; Heck, Simons, & Chabris, 2018) and one's own group are better than most others (Dasgupta, 2004; Hewstone et al., 2002). These familiar phenomena are commonly understood as desirability-based biases; the former is a prominent focus of social comparison theory as the latter is of social identity theory. Both theories assume that it is psychological acts of comparison (self with other; ingroup with outgroup) that produce the result. The IRM offers a simpler explanation.

To address the question of perceptual accuracy, the IRM uses the concept of cue validity (Brunswik, 1943; Gigerenzer & Gaissmaier, 2011; Goldstein & Gigerenzer, 2002). As

noted above, most people are – by necessity – similar to the prototype of the groups to which they belong. Their own preferences and attributes are therefore valid predictors of group-level preferences and attributes. Yet, the predictive power of their own preferences and attributes diminishes as the target group becomes more socially remote. The IRM treats the validity of a person's own information as a structural variable, which in conjunction with the psychological mechanism of social projection produces lawful patterns of accuracy. Specifically, the IRM predicts that differential projection yields an accuracy differential: Perceptions of ingroups are, *ceteris paribus*, more accurate than perceptions of outgroups, independent from the perceived desirability of each.

Input

The IRM explores a set of individual-level correlations over preferences or attributes (hereafter: traits). Imagine a population in which each individual judges each trait with respect to the self, S (How well does the trait describe me?), with respect to its desirability, D (How desirable is it, in general, to possess this trait?), with respect to an ingroup, I (How well does the trait describe the average person in my group?), and with respect to an outgroup, O (How well does the trait describe the average person of the other group?). This set of input judgments yields the following correlations as shown in the top row of Table 1:

[i] The desirability of the self-image, or self-positivity, $r_{S,D}$.

[ii] The strength of projection to the ingroup, $r_{S,I}$.

[iii] The strength of projection to the outgroup, $r_{S,O}$.

The averages of the S judgments made by individual members of the ingroup are the criterion values perceivers try to predict. We label this variable $\langle I \rangle$. Likewise, the outgroup is described

by the averages of the S judgments made by members of that group, $\langle O \rangle$. The correlations between a perceiver's own S judgments and these group averages of the S judgments are validity correlations. Hence, the IRM also yields the following correlations.

[iv] The validity of a person's self-judgments for the ingroup, $r_{S,\langle I \rangle}$.

[v] The validity of a person's self-judgments for the outgroup, $r_{S,\langle O \rangle}$.

The two validity correlations are not purely intra-psychological because they each involve one variable arising from data aggregated over group members. For example, a high $r_{S,\langle I \rangle}$ and a low $r_{S,\langle O \rangle}$ indicate that the person is a typical member of his or her own group but not of the other group. Self-judgments have respectively high and low inductive power when the person attempts to predict the traits of the ingroup and the outgroup.

Table 1

Correlations Among Input Variables

	D	**I**	**O**	**<I>**	**<O>**
S	$r_{S,D}$	$r_{S,I}$	$r_{S,O}$	$r_{S,<I>}$	$r_{S,<O>}$
D	—	$r_{D,I}$	$r_{D,O}$	$r_{D,<I>}$	$r_{D,<O>}$
I		—	$r_{I,O}$	$r_{I,<I>}$	$r_{I,<O>}$
O			—	$r_{O,<I>}$	$r_{O,<O>}$
<I>				—	$r_{<I>,<O>}$
<O>					—

Note. S = self-judgments, D = desirability judgments, I = judgments of ingroup, O = judgments of outgroup, $\langle I \rangle$= mean S judgments in ingroup, $\langle O \rangle$ = mean S judgments in outgroup. The items in bold (top row) are the five basic

input correlations from which the rest of the matrix derives. The items in black are derived measures of theoretical interest in this paper; the smaller items in gray are derived measures that we do not use in this article.

The IRM is macroscopic in the sense that it is concerned with a set of correlations, where each correlation – or set of correlations – represents an individual person. Each input correlation is treated as a one-case sample taken from a population distribution characterized by a central tendency ρ and a dispersion given by the number of traits N. While any combination of parameter settings for the input correlations can be explored, the model's psychological plausibility rests on settings that are empirically sound or analytically plausible. To illustrate the model, we begin – as noted above – with the empirically well-supported assumption that, on average, people have positive self-images. We assume a distribution of self-positivity correlations, $r_{S,D}$, centered around ρ = .5. Likewise, we assume that people project their self-images strongly onto the ingroup (Robbins & Krueger, 2005), that is, we assume that $r_{S,I}$, is distributed with ρ = .5.

For projection to the outgroup, $r_{S,O}$, we assume that the distribution is centered on ρ = 0. This assumption is an idealization (the meta-analytical mean lies closer to .1; Robbins & Krueger, 2005). By assuming a *distribution* around ρ = 0, we allow for instances where outgroup projection is positive (or negative) and weak-to-moderate. That is, we use this idealized setting to illustrate, as comprehensively as possible, how the model behaves. The IRM can be used to simulate judgments for any set of groups and differing values of similarity; ingroups and outgroups are merely the most convenient starting point.

For ingroup validity, $r_{S,\langle I\rangle}$, we expect a positive mean. To appreciate the analytical claim that people within a group are similar to one another, imagine a matrix containing the judgments of a group of individuals with regard to a set of traits. If the numbers in one column of the matrix (one person) are correlated with the numbers in a column representing the averages computed over all the other columns, the result is very likely positive. How large the mean of these correlations is and how variable the correlations are, depends on how similar individual trait profiles are to one another within the group. The assumption that $\rho = .5$ is a reasonable starting point.

The assumption that $\rho = 0$ for outgroup validity is a further reasonable idealization. Perhaps some individuals' traits are uncorrelated with the average trait values in some outgroup (if social distance is high). One should expect these correlations to be positive because all (in- and out-) groups are subsumed under the superordinate category of the human species. Any outgroup member becomes an ingroup member once the social category is made broad enough (Krueger & DiDonato, 2008). By assuming a *distribution* around $\rho = 0$, we allow for instances where outgroup projection is positive (or negative) and weak-to-moderate. We use these idealized settings to illustrate how the model behaves. Again, we note that the IRM can be used to simulate judgments for any set of groups and differing values of similarity; ingroups and outgroups are merely the most convenient starting point.

Output

Using the distributions of the five input correlations, the model enables the study of the implications for complex phenomena of interest. The model asks what we can learn if only two

psychological facts, self-positivity and differential projection, and one social-structural effect, differential group validity, are available. Doing so, we accept – for the moment – the *ceteris paribus* clause that "nothing else is going on." We set aside the possibility that phenomenon-specific motives or capacities affect the output measures, but we will return to the question of how deviations from these derived measures can advance our understanding of individual phenomena. Combining the quantitative input in theoretically meaningful ways, the IRM yields a suite of predictable outcomes as derived measures. We focus on the following four measures: intergroup accentuation, self-enhancement, ingroup-favoritism, and differential accuracy.

Intergroup accentuation. The first derived measure addresses the idea that people perceive groups as different. This idea is foundational in social psychology (Tajfel, 1969). Crucially, social categorization affords perceptions of intergroup differences, even when no actual differences exist. More broadly, the term "accentuation" suggests that people perceive group differences as greater than they are (Krueger, 1992). Most empirical work in this tradition has followed the lead of Tajfel and Wilkes (1963), and studied the difference between ratings on a single variable (Corneille et al., 2002; Krueger & Clement, 1994; Rothbart et al., 1997). In a multi-trait environment, however, mean-level differences do not reveal all that is of interest. Here, profile-similarity correlations show degrees of similarity vs. dissimilarity over traits (Cronbach & Gleser, 1953). In the IRM, the correlation between judgments of the ingroup and judgments of the outgroup, $r_{I,O}$, is a measure of intergroup accentuation. The differences between two groups are accentuated inasmuch as the correlation, over traits, between the two is small or negative. Although the correlational metric and the simple difference-score metric are conceptually independent, there are constraints. For example, a

negative correlation implies accentuation on most individual traits, whereas the reverse is not true (Krueger, 2009).

The basic mathematical device used to derive variables is the *multiplication rule* (Alwin & Hauser, 1975; Edwards & Berry, 2010). If two correlations that have one variable in common are known, the best prediction for the correlation between the two unique variables is the product of the two known correlations. The result shows the correlation one would find if there is no unique and direct path linking the two variables. In the case of intergroup accentuation, we assume that on average, projection to the ingroup is .5 and that projection to the outgroup is 0. Hence, we predict the mean correlation representing intergroup accentuation ($r_{I,O}$) as $r_{S,I} \times r_{S,O} = 0.5 \times 0$ (see Table 1). The trait judgments of two groups are predicted to be independent if there is no projection to one of the groups (typically the outgroup). Increasing or decreasing projection to the other group does not change this result. A lack of projection to the outgroup is sufficient to yield the phenomenon of intergroup accentuation.

The critical psychological point is that this result is obtained without assuming that people *want* to perceive intergroup differences or that they fall prey to a perceptual illusion of difference. An issue to be addressed later is how low the accentuation correlation needs be before it may be regarded as evidence of accentuation *bias*. For the moment, we accept a correlation of 0 or lower as evidence of accentuation because, like pairs of individuals, pairs of social groups may be expected to share more similarities than be distinguished by differences.

For the phenomenon of intergroup accentuation – and the phenomena discussed below – the IRM generates point-specific predictions from quantitative input. These predictions can serve as null hypotheses in empirical work. If the data are significantly different from the

model predictions, the hypothesis that "nothing else is going on" is rejected, and attention can turn to the causes of these differences. Alternative models may be built that allow precise predictions that differ from those of the IRM, and research can turn to the task of model comparison instead of finding just any effect.

Self-enhancement. The second derived measure addresses the common finding of self-enhancement. Although there are numerous conceptualizations of self-enhancement and many measurement approaches (Krueger et al., 2017; Krueger & Wright, 2011), the most common idea comes from the social-comparison framework, which says that self-enhancers are those who think they are better (i.e., have more positive and fewer negative traits) than the average person (see Zell et al., 2020 for a meta-analysis). Although cognitive accounts of self-enhancement exist (Denrell & March, 2001; Heck & Krueger, 2015; Fiedler, 2000; Moore & Small, 2007), the dominant view is that people actively seek to create a positive differential between themselves and others (Brown, 2012; Zell & Alicke, 2010). Like intergroup accentuation, self-enhancement is typically studied with respect to individual traits. This approach reflects the view that enhancement bias is the result of a perceptual or motivational force that pulls self-judgments up and away from other-judgments, or a force that pushes other-judgments down, making them more negative.

The IRM assumes that most people have positive self-images, which they project to members of their ingroup (i.e., $r_{S,D}$ and $r_{I,D} > 0$). As a result, a straightforward difference-score measure of self-enhancement can be computed by subtracting ingroup positivity from self-positivity, $r_{S,D} - r_{I,D}$. Ingroup positivity is computed as the product of self-positivity and projection to the ingroup, $r_{S,D} \times r_{S,I}$. Self-enhancement is therefore described as

$r_{S,D} - r_{S,D} \times r_{S,I}$, or $r_{S,D}(1 - r_{S,I})$. The default values we have proposed yield an estimate of .25. Note that this self-enhancement score is not bound by 1 or -1,[1] and negative values, indicating self-effacement, may occur. Once obtained, the IRM estimate can be compared with the conventional measure of self-enhancement. If $r_{S,D} - r_{I,D} > r_{S,D}(1 - r_{S,I})$, the IRM only partially accounts for self-enhancement. Other cognitive or motivational processes may inflate self-enhancement beyond the estimate the model provides, resulting in differences between the model's prediction and the observed value. From these differences, researchers are able to detect additional psychological processes when at play and can design studies to test them.

Ingroup favoritism. The third derived measure brings together the study of self- and group-perception. The finding of ingroup favoritism, that is, the tendency to describe one's own groups in more favorable terms than other groups is so pervasive that it has attained the status of an organizing principle for much theory and research (Tajfel & Turner, 1979; Yzerbyt & Demoulin, 2010). The IRM treats ingroup favoritism as the difference between two correlations, namely ingroup positivity, $r_{I,D}$, and outgroup positivity, $r_{O,D}$. The IRM predicts both correlations from the inputs of self-positivity and differential projection. Using the multiplication rule, ingroup positivity is estimated as the product of self-positivity and projection to the ingroup, $r_{I,D} = r_{S,D} \times r_{S,I}$. If we assume the values of $r_{S,D}$ and $r_{S,I}$ to be both .5, ingroup positivity is predicted to be .25 (on average). Likewise, the IRM predicts outgroup positivity as $r_{S,D} = r_{S,D} \times r_{S,O} = 0.5 \times 0 = 0$. Hence, the predicted value for ingroup favoritism is $r_{S,D} \times r_{S,I} - r_{S,D} \times r_{S,O}$ or $r_{S,D} \times (r_{S,I} - r_{S,O})$ = .25. As in the case of intergroup

[1] If $r_{S,D}$ is negative, and $r_{S,I}$ is negative, the result can be < -1.

accentuation and self-enhancement, the IRM estimates the effect without reference to motives, needs, or limited cognitive capacity, but as a result of inductive inference. The model suggests that most reasonable people will show evidence of these effects. The question of whether their perceptions are biased can be addressed by comparing empirically obtained difference-score measures between ingroup- and outgroup-positivity with the benchmarks provided by the IRM.

Differential accuracy. The fourth derived measure is intended to address the idea that ingroup stereotypes tend to be more accurate than outgroup stereotypes. The presumed falsity of outgroup stereotypes has been a core assumption of much social psychological theorizing since the dawn of the field (LaPiere, 1936; Lippmann, 1922; but see Zawadski, 1948; or Jussim, 2012, for critical reviews). Given the input to the IRM, the correlation between judgments of the ingroup and the average self-judgments in the ingroup is a measure of ingroup accuracy. Likewise, the correlation between judgments of the outgroup and the average self-judgments in the outgroup indexes outgroup accuracy. Subtracting the latter from the former yields a measure of differential accuracy, that is, a measure that expresses the degree to which judgments of the ingroup are more (or less) accurate than judgments of the outgroup.

The IRM predicts ingroup accuracy as the product of projection to the ingroup and self-ingroup validity, and it predicts outgroup accuracy as the product of projection to the outgroup and self-outgroup validity. Using the default values as input, $r_{S,I} \times r_{S,\langle I \rangle} - r_{S,O} \times r_{S,\langle O \rangle} = .5 \times .5 - 0 \times 0 = .25$. The widespread assumption that outgroup stereotypes are less accurate than ingroup stereotypes has some empirical support (Ryan, 1996), but the database is thin. One reason for this thinness is that perceptions of an

ingroup are rarely considered stereotypes. Self-categorization theory is an exception in this regard, because it considers self-stereotyping to be a process of paramount importance (Leach et al., 2008). Yet, this theory is not concerned with questions of accuracy.

The IRM shows that differential projection can yield differential accuracy. In particular, weak projection to the outgroup is sufficient to give the impression that outgroup perceptions are comparatively inaccurate. Low or zero levels of outgroup validity (i.e., the perceiver's traits have little or no predictive value for judgments of outgroups) further contribute to differential accuracy. It is therefore difficult to interpret evidence of differential accuracy *per se* as a form of blameworthy prejudice. Suppose, for example, that perceivers project strongly to the ingroup (.7) and moderately to the outgroup (.4). Also suppose that the strength of projection matches the validity of the person's self-judgments for the aggregated group judgments. Now, a substantial degree of differential accuracy is expected ($.7 \times .7 - .4 \times .4 = .33$). Again, the IRM provides benchmark predictions against which perceivers' empirical data can be tested.

IRM as modeling engine

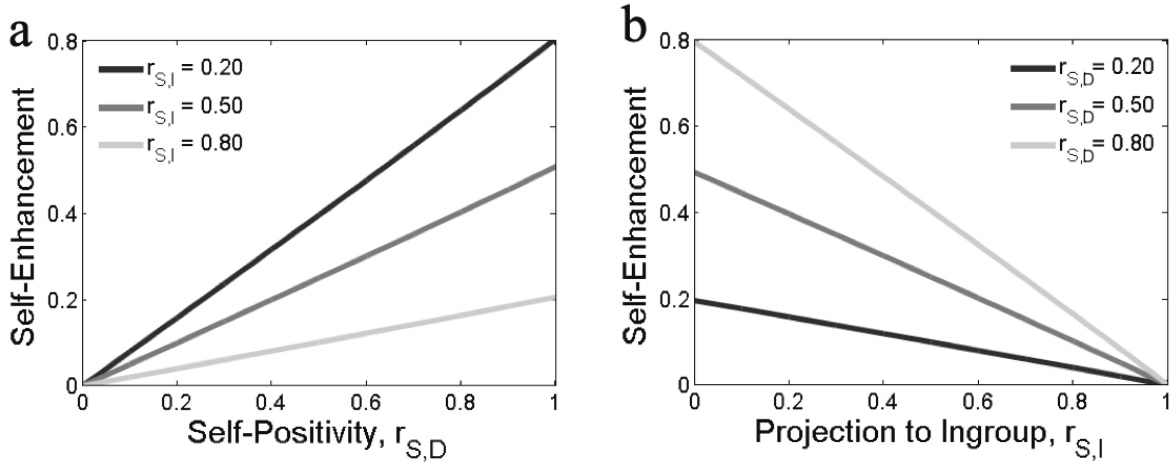
One attractive property of the IRM is that it can serve as a hypothesis generator. The estimates it derives from simple and empirically-based inputs can be evaluated both ideographically and nomothetically. Investigators can study patterns of accuracy and bias within individual respondents (assuming that group data are available for the evaluation of the respondent's level of accuracy), and they can also study these patterns at the group level. The hypotheses generated by the IRM need not be hypotheses of no difference (or *nil* hypotheses). Indeed, the model assumes that unbiased respondents will view themselves more positively

than they view the average person, and that they view ingroups more favorably than outgroups. The IRM therefore provides stricter and more informative tests of irrational bias than the conventional approaches do. The results of the IRM vary precisely with the input. Researchers working in specific social *milieus* may use quantitative input that is different from the default settings we have used. We now explore the consequences of varying the input settings on IRM's predictions.

Varying the input. Having shown that the phenomena of intergroup accentuation, self-enhancement, ingroup favoritism, and differential accuracy can emerge from theoretically and empirically plausible input levels for self-positivity, differential projection, and self-validity, we now ask how changes in the input affect these derived measures. To illustrate the general idea, we turn to one of the predictable outcomes, namely, self-enhancement, as represented by the product of self-positivity and the complement of projection to the ingroup, $r_{S,D} \times (1 - r_{S,I})$. It is clear that self-enhancement increases with self-positivity and that it decreases with projection to the ingroup (Heck & Krueger, 2020). Over all settings of $\rho > 0$, the effects of self-positivity and projection to the ingroup on self-enhancement are of the same magnitude. Figure 1 shows the trade-off between the two input variables. Panel a shows that self-enhancement increases steeply with self-positivity inasmuch as projection to the ingroup is weak. Panel b shows that self-enhancement decreases as steeply as with projection to the ingroup inasmuch as self-positivity is strong. Other variations are examined with little effort. It is clear, for example, that ingroup favoritism increases with differential projection, and more so as self-positivity is strong.

Figure 1

Self-enhancement at varying levels of self-positivity and projection to ingroup



Interrelations. Once we have examined the effects of changes in the input on individual derived measures, we can ask how these changes affect the relationships among the derived measures. Such questions are vital for theories designed to go beyond one-phenomenon accounts. Asking how various social-perceptual phenomena are related to one another is also of practical concern. We may ask, for example, whether knowing a person's tendency to self-enhance tells us anything about their inclination to favor an ingroup. The IRM provides an answer. It offers an integrated view of several phenomena by showing how they are related to one another given specific changes in the input parameters.

As an illustration, suppose projection to the ingroup increases from a correlation of .5 to .8, while the other parameters remain at their default settings. We observe the following consequences: *Intergroup accentuation* remains 0 because one multiplier, projection to the outgroup, remains 0. Hence, $r_{S,I} \times r_{S,O} = .8 \times 0$. *Self-enhancement* decreases because members of the ingroup are now perceived to be more similar to the self;

$r_{S,D} - \left(r_{S,D} \times r_{S,I}\right) = .5 - .5 \times .8 = .1$. Conversely, *ingroup favoritism* increases because the perceived ingroup positivity increases;

$r_{S,D} \times r_{S,I} - r_{S,D} \times r_{S,O} = .5 \times .8 - .5 \times 0 = .4$. Finally, *differential accuracy* increases because with greater projection to the ingroup, perceivers make increased use of their own traits' validity; $r_{S,I} \times r_{S,<I>} - r_{S,O} \times r_{S,<O>} = .8 \times .5 - 0 \times 0 = .4$.

These lawful patterns of change yield correlations among the four derived variables over an array of values for projection to the ingroup (or any input variable). Because varying projection to the ingroup does not create variation in intergroup accentuation, any correlation between intergroup accentuation and another derived phenomenon remains undefined (in the following, we will treat undefined correlations as zero by assuming the presence of some random error). As projection to the ingroup increases, both ingroup favoritism and differential accuracy increase. Hence, these two phenomena will be positively correlated with each other. Conversely, an increase in projection to the ingroup reduces self-enhancement, leading to negative correlations between this phenomenon on the one hand and ingroup favoritism or differential accuracy on the other hand (Table 2, panel a).

Table 2

Correlations Between Derived Measures While Varying Three Primary Inputs

(a) Projection to Ingroup

	SE	**IF**	**DA**
IA	-1	1	1
SE	-	-1	-1
IF	-	-	1

(b) Self-Positivity

	SE	IF	DA
IA	0	0	0
SE	-	1	0
IF	-	-	0

(c) Projection to Outgroup

	SE	IF	DA
IA	0	-1	-1
SE	-	0	0
IF	-	-	1

Note. IA = Intergroup Accentuation, SE = Self-enhancement, IF = Ingroup Favoritism, DA= Differential Accuracy

The significance of these results goes beyond the provision of theoretically and empirically justified benchmark predictions. These results inform and constrain theory development beyond the basic IRM. A comprehensive theory of social perception must articulate how and why various phenomena of interest are related to one another. For example, ingroup favoritism requires intergroup accentuation, but not *vice versa*. If the ingroup is perceived more favorably than the outgroup, the two groups are not perceived in the same way, and intergroup accentuation is implied. Ingroup favoritism (assuming that the self-image is positive) and intergroup accentuation increase as projection to the ingroup increases or as projection to the outgroup decreases. Conversely, accentuation can occur in the absence of ingroup favoritism. If projection to the outgroup were the same as projection to the ingroup, there would be no ingroup favoritism, whereas the correlation for intergroup accentuation could be quite low. Its value would only depend on the overall strength of projection.

To take another example, consider the relationship between self-enhancement and ingroup favoritism. The finding that increases in projection to the ingroup create a negative relation between these two phenomena must be considered in light of the fact that an increase in self-positivity will create a positive relationship (Table 2, panel b). The IRM shows that compared with individuals with a negative self-image, individuals with a positive self-image are more likely to think they are better than others *and* that their group is better than other groups.

Finally, the positive relation between ingroup favoritism and differential accuracy (Table 2, panel c) may seem unremarkable. A rarely questioned assumption is that ingroup favoritism is a type of comparative inaccuracy. If it were the case that all groups are essentially equally positive, and are to be perceived as such, then it would follow that any evidence of ingroup favoritism is also evidence of differential inaccuracy. The IRM predicts a positive correlation between these two phenomena regardless of whether projection to the ingroup or projection to the outgroup is varied. Self-positivity plays no role because it is only relevant for ingroup favoritism. Yet, the positive relation between ingroup favoritism and differential accuracy itself does not compel the conclusion that ingroup favoritism implies differential inaccuracy. Ingroup favoritism can occur in the absence of differential accuracy (e.g., if the self is not a valid predictor of ingroup traits) and *vice versa* (e.g., if the self-image is neutral).

The interrelations among the four derived measures that we have considered are relations over changes in one of the input variables. The obtained patterns are deterministic; they do not require simulations. If, for example, ingroup favoritism is plotted against projection to the ingroup, the result is a straight line. Ingroup favoritism, it may be recalled, is computed

as $r_{S,D} \times r_{S,I} - r_{S,D} \times r_{S,O}$. The IRM estimates the derived measures, and the relationships among them, over a sample of individuals. In other words, the defaults and other input settings discussed so far can be understood as either the values describing a single individual or as the averages describing groups.

Extensions

The IRM provides benchmark estimates for social perceptual phenomena that can inform the interpretation of empirical observations. For intergroup accentuation, for example, the model prediction, $r_{S,I} \times r_{S,O}$, may turn out to be larger and more positive than the empirical correlations between judgments of the ingroup and judgments of the outgroup, $r_{I,O}$. If so, one may conclude that the perceiver accentuates intergroup differences by means other than differential projection. Note, however, that this analysis uses data sampled from the same perceiver, and is therefore mute on the question of how the observed degree of accentuation measures up to the perceiver's actual social context. The IRM offers opportunities to include this important social dimension into theory and assessment. For each of the four derived measures, we now introduce criteria for rational judgment and bias under the assumption of comprehensive sampling of individuals.

Intergroup accentuation. How low does the correlation between ingroup judgments and outgroup judgments need to be before intergroup accentuation can be said to be biased? To answer this question, we can compute the correlation of the mean self-judgments in the ingroup with the mean self-judgments in the outgroup and subtract the difference from the model's prediction. If $r_{S,I} \times r_{S,O} - r_{\langle I \rangle,\langle O \rangle} < 0$, the model's prediction amounts to an accentuation

bias. That is, the model yields a perceiver-based estimate of intergroup similarity that is lower than the estimate of intergroup similarity obtained from the entire sample. Next, both the model prediction $r_{S,I} \times r_{S,O}$ and the social benchmark estimate $r_{\langle I \rangle,\langle O \rangle}$ may serve as competing hypotheses to describe the perceivers' empirical index of accentuation, $r_{S,I}$. In other words, one can ask whether differential projection (as expressed by the IRM estimate) or social reality (as expressed by the correlation of means) provides a better account of the perceiver's expressed degree of accentuation. Having two specific and substantive hypotheses in play, the investigator can compute Bayes Factors (Lee & Wagenmakers, 2014) or Frequentist equivalence tests (Lakens, 2017) to evaluate the relative support for the two hypotheses. The extensions proposed for the three remaining phenomena follow the same general logic.

Self-enhancement. The IRM predicts self-enhancement as the product of self-positivity and the complement of projection to the ingroup. An estimate based on social reality is given by the difference between self-positivity and the positivity of the average ingroup member. Hence, the model predicts a self-enhancement bias if $r_{S,D} \times (1 - r_{S,I}) - \left(r_{S,D} - r_{\langle I \rangle,D} \right) > 0$. A perceiver's simple difference between self-positivity and other positivity, $r_{S,D} - r_{I,D}$, can then be evaluated for its relative fit with the theoretical predictions.

Ingroup favoritism. The question here is whether the model predicts that people see a greater difference in the positivity of the ingroup and the positivity of the outgroup than is warranted by the aggregated group data. A group-based criterion measure is computed by subtracting the correlation between desirability judgments and average self-judgments in the

outgroup from the correlation between desirability judgments and average self-judgments in the ingroup. According to the IRM, there is ingroup favoring bias if $r_{S,D} \times (r_{S,I} - r_{S,O})$ $-\left(r_{D,\langle I\rangle} - r_{D,\langle O\rangle}\right) > 0$. Again, the model prediction and the group-based criterion offer competing explanations for the perceivers' direct measures of ingroup favoritism, $r_{I,D} - r_{O,D}$.

Differential accuracy. Making judgments that are more accurate for the ingroup than for the outgroup is not necessarily evidence of bias. To provide a measure of bias, we can ask how much accuracy would be attained if individuals' projections were equal to the validity of their responses for the group. For the ingroup, predicted accuracy would be $r_{S,\langle I\rangle}{}^2$, and for the outgroup, predicted accuracy would be $r_{S,\langle O\rangle}{}^2$. When the difference between the two is subtracted from the IRM measure of differential accuracy, the result is a measure of biased differential accuracy. There is a bias if $(r_{S,I} \times r_{S,\langle I\rangle} - r_{S,O} \times r_{S,\langle O\rangle}) - (r_{S,\langle I\rangle}{}^2 - r_{S,\langle O\rangle}{}^2) > 0$.

Now that we have derived an index of bias for each of the four derived measures so that the task of model comparison can be addressed within the IRM itself. An investigator can ask whether the original IRM index (e.g., of self-enhancement) or whether its amended version, which is designed to capture bias, is the better fit for the empirical data.

Discussion

Theory and evidence stand in a reciprocal relationship (Campbell, 1974; Greenwald, 2012; Popper, 1963). Theory informs what types of data to look for and data stimulate adjustments in theory (Felin et al., 2021). If there is a chicken-and-egg conundrum, it need not

be resolved here.[2] In our presentation of the IRM, we have accepted the evidence for positive self-images and differential projection as input to the IRM. The question of why most people have positive self-images is a concern for other theoretical work (Leary, 2007). Likewise, the question of why people project to ingroups and (barely) to outgroups is a matter that has been discussed elsewhere (Ames, 2004a; 2004b; Robbins & Krueger, 2005). Accepting the stylized empirical facts of self-positivity and ingroup projection, the IRM proceeds to set them in relation to one another and to explore the consequences. Doing so, the model can guide the construction of testable hypotheses. If, for example, an experimental treatment raises the positivity of the self-image, it should also, *ceteris paribus*, increase self-enhancement, while leaving intergroup accentuation unchanged. Conversely – revealing the asymmetry of forward and reverse inference – there are no necessary implications for the constituent variables of self-enhancement if an experimental intervention increases the effect (e.g., by presenting a threat to the ego). Empirical analysis is required to explore whether self-enhancement increases because of an increase in self-positivity, a decrease in social projection, or both.

The IRM is psychologically parsimonious. Knowing the value of self-positivity and projection to the ingroup, for example, the model generates a precise prediction for self-enhancement without introducing a new force, such as a motive to self-enhance. The IRM explains self-enhancement in terms of simple building blocks and processes. The model does not *reify* these phenomena (Billig, 2013; Krueger et al., 2013).[3] Instead, the model uses

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[2] Karl Popper, Don Campbell, and the Reverend Bayes, felt that the egg (hypothesis) comes before the chicken (data).

[3] Many intriguing psychological phenomena can be modeled as regression effects without dismissing them as artifacts (Fiedler & Krueger, 2012; Fiedler & Unkelbach, 2014; Moore & Healy, 2008).

mathematical deduction to predict precise patterns of results from limited input information. These patterns can be examined empirically for their sufficiency and compared to other theoretical predictions. The model can be expanded. It remains to be seen, for example, whether the correlational patterns used by IRM to generate predictions can be used to differentiate perceiver effects from target effects or their interactions (see e.g., the dependence of perceiver evaluations on general positivity tendencies and trait contexts; Rau et al., 2021).

Hypothesis evaluation

An important consequence of the IRM approach is a change in the role of statistical testing. The traditional approach is to look for positive evidence for a phenomenon of interest. Null hypothesis significance testing (NHST) evaluates the evidence against a hypothesis that has little theoretical interest (Cohen, 1994; Krueger, 2001; Krueger & Heck, 2017; Lambdin, 2012). Sometimes the hypothesis of no effect is called the *nil* hypothesis, which assumes that the measurement of an effect in the given data is noisy. When observations are gathered that are improbable under the nil hypothesis, investigators infer that there is "not nothing" (Dawes, 1991). When, for example, the null hypothesis of no difference between the evaluation of the self and the evaluation of others is rejected, researchers infer that self-enhancement (or self-effacement) is not absent. Precise *a priori* predictions regarding substantive alternatives are rare, and substantive hypotheses are merely stated in a directional manner. Students of social perception predict that there is self-enhancement or self-effacement, or that there is ingroup favoritism or outgroup favoritism. A theory that offers only directional predictions is weak (Meehl, 1967); it has little inductive power because it fails to predict how much of not nothing there shall be.

The IRM makes NHST stronger. Meehl (1978) proposed that the tool of significance testing be wielded in Sir Karl Popper's critical rationalist spirit (see also Campbell, 1974). When theories provide non-trivial, non-noise, point-predictions, the rejection of these hypotheses affords the inference that a specific something is not there, which is more definitive than saying that there is not nothing (Popper, 1963). If, for example, self-enhancement is predicted to be .49 because self-positivity is .7 and projection to the ingroup is .3, an observed value of self-enhancement that is significantly higher than .49 indicates that the IRM prediction is insufficient. Something else is going on, and exploring its nature becomes the task for theory and research.

A move away from testing nil hypotheses does not eliminate theories postulating the presence of phenomenon-specific processes. Instead, such a move creates opportunities for making a *stronger* case for such theories. Consider again the case of self-enhancement. The null hypothesis of $r_{S,D} - r_{I,D} = 0$ is not only arbitrary, it is misleading. Since the IRM predicts $r_{S,D} - r_{I,D} > 0$ simply because judgments of the ingroup are regressive with respect to self-judgments, the traditional nil test, which treats *any* individual with a positive difference between $r_{S,D}$ and $r_{I,D}$ as a genuine self-enhancer, overestimates the prevalence of motivated self-enhancement or truly biased self-enhancement. By using IRM predictions as conservative baselines, theories concerned with the detection of unique processes contributing to bias will become more credible as they become less prone to declaring false positives.

Even the strong use of NHST has limitations. Researchers interested in the retention of particular non-null research hypotheses might be tempted to perform underpowered studies. Conversely, researchers motivated to support claims that go beyond the model's baseline

predictions may be tempted to maximize statistical power. These problems are familiar from the decades-long debate over NHST (Krueger, 2001; Lykken, 1968; Simmons et al., 2011). As Bayesian approaches to hypothesis evaluation and comparative model testing gain acceptance, and as social psychological theory gains experience in specifying alternative hypotheses with precision, Bayes factors can be used to estimate the relative support the evidence provides for the IRM predictions and specific alternatives (Kruschke, 2013; Rouder et al., 2012). Alternatively, such comparisons between hypotheses can be computed within the Frequentist statistical framework. By defining the IRM's prediction as the smallest effect size of interest, researchers can test for statistically meaningful deviations from it via equivalence testing (Lakens, 2017; for a practical guide, Lakens et al., 2018). They can then compare this result with the data's similarity to effects which are predicted by competing theories.

Further considerations

The IRM is a broad theoretical model designed to challenge and unify existing perspectives on social and self-perception by providing structure and predictability to a theoretically and empirically fragmented area of research. Naturally, such a broad model meets several challenges, two of which we reflect on below.

Nothing but entailments. One question is whether the IRM merely reveals the implications of initial conditions. According to this view, nothing new is learned because the input determines the output. If some of that output seems surprising in its patterning or complexity, the sentiment of surprise may only reflect the reader's limited analytical capacity and foresight. A careful reading of this article will have revealed our answer to this concern. We chose the initial input settings after a careful review of relevant theory and research. We

went beyond prior work by exploring the model's predictions for input settings that, although possible, are not probable in the social world.

Lest one think that derivations and simulations only reveal that which is entailed by initial settings, it must be understood that experiments are open to the same concern. If nature (and thus the social mind) is deterministic (perhaps with room for some irreducible randomness), then experiments can only reveal that which is entailed by initial settings (Krueger & Grüning, in press). Experiments with observational data only *seem* to be less deterministic than simulations and derivations because they allow less precision when setting initial conditions, and because we use probabilistic statistics to model the data. An important difference that remains is that simulations and derivations reveal what could be or should be the case, whereas observational data reveal what actually is the case. The IRM recognizes this difference by treating its results as hypotheses or best guesses given the model's inputs and assumptions. Simple in conceptualization and precise in its outputs, the IRM is at its core a modeling engine, and it should be used as such.

Inherent causal assumptions. Using correlations as inputs, the IRM imports some causal assumptions. The model assumes that correlations between self-judgments and group judgments represent a unidirectional process of social projection. In other words, the IRM assumes that self-referent information is mentally more accessible and more readily – even automatically – utilized as a judgmental cue than is group-referent information (Krueger, 2003). While evidence for this assumption is plentiful (Gawronski et al., 2007; Gramzow & Gaertner; 2005; Gramzow et al., 2001; Otten & Epstude, 2006; Otten & Moskowitz, 2000; Otten & Wentura, 2001; Roth & Steffens, 2014; Vanhoomissen & van Overwalle, 2010), it is

also clear that, under certain conditions, such correlations reflect processes of self-stereotyping (Cadinu & Galdi, 2012; Latrofa et al., 2010). Since the IRM uses the correlation between self-judgments and group judgments as one of its inputs, its quantitative modeling remains instructive regardless of the primary directionality of the inductive inference.

Our presentation of the IRM from the perspective of social projection surely is an idealization. The model's most immediate area of application is the context of relatively novel groups (DiDonato et al., 2011). As groups become more familiar, group-related beliefs or information will affect social judgments in ways that may gradually reduce the model's fit. It should be remembered, however, that the IRM is designed to be a starting point for the modeling of inductive social inferences. Further theoretical consideration and empirical observations may lead the way to refinements.

Alternative frameworks. The IRM, while unique in its particular architecture, is but one of several componential and integrative models available today (e.g., Funder, 1995; Kenny, 1984; Krueger, 2009). Of particular interest is the "Unified Theory" (UT) proposed by Greenwald et al.'s (2002), an effort to accommodate various self-related and social constructs in a common framework. Greenwald and colleagues noted – and bemoaned – the fact that conflicts among major social psychological theories are rarely resolved and that some very successful theories fade away not because they are false, but because they are displaced by theories that more faithfully capture the spirit of the day, or *Zeitgeist*.

The UT draws on balance theories, especially Heider's (1958) variant, and on Hebb's (1949) neural network theory of associative learning. The main computational property that makes the UT similar to the IRM, is its use of the trivariate space provided by self-judgments,

S, group judgments, G, and trait desirability judgments, D. The UT refers to the association between S and G as "identity," the association between S and D as "self-esteem," and the association between G and D as "stereotype." Like the IRM, the UT predicts any one of these associations from the cross-product of the other two. Unlike the IRM, however, the UT does not isolate some associations as theoretic—empirical primitives, although it credits Kurt Koffka (1935) and early *Gestalt* psychology with the insight that the self-concept filters much of social perception (cf., Alicke et al., 2005). Yet, the UT does not provide for with-person, ideographic, modeling, and it does not produce estimates for the strength of derivative concepts, such as self-enhancement, accentuation, or accuracy. In short, the IRM provides a fresh and innovative look at a subset of social-perceptual phenomena.

Conclusion

We began our investigation by noting the existence of three broad paradigms in the area of self and social perception. We noted that , advocates of the Neo-Festingerian school of social comparison favor the equation of psychological process with judgmental bias (in the form of contrast or assimilation effects) without providing direct indices or accuracy, and that adherents of the Neo-Durkheimian school of social identity theory and its offshoots have moved away from the study of judgmental accuracy. We developed the IRM as a quantitative social-cognitive model to provide a common platform for the study of error, bias, and accuracy, where no characteristic of social judgment is favored or dismissed *a priori*. The IRM allows to test point-predictions and to compare competing theoretically-derived hypotheses. IRM's theoretical base of assumed cognitive processes is parsimonious. The model is one among a family of quantitative and integrative approaches. It does not replace other models, but neither

can it be subsumed under any of them. By providing this platform and by enabling researchers to study selected phenomena within a shared context, we hope to contribute to Henri Tajfel's (1969) vision of a psychological theory that is cognitively sufficient and socially relevant.

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Conflicts of interest

There are no conflicts of interest to disclose. The views expressed here are those of the authors and do not necessarily represent the views of the Consumer Financial Protection Bureau or the United States.

References

Alicke, M. D., Dunning, D. A., & Krueger, J. I. (2005*). The self in social judgment*. Psychology Press.

Alicke, M. D., & Sedikides, C. (2009). Self-enhancement and self-protection: What they are and what they do. *European Review of Social Psychology, 20*(1), 1-48. https://doi.org/10.1080/10463280802613866

Alicke, M. D., & Sedikides, C. (2011). *Handbook of self-enhancement and self-protection*. Guilford.

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

Alwin, D. F., & Hauser, R. M. (1975). The decomposition of effects in path analysis. *American Sociological Review, 40*, 37-47. https://doi.org/10.2307/2094445

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

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

Bargh, J. A., & Chartrand, T. L. (1999). The unbearable automaticity of being. *American Psychologist, 54*, 462-479. https://doi.org/10.1037/0003-066X.54.7.462

Baumeister, R. F., Campbell, J., Krueger, J. I., & Vohs, K. (2003). Does high self-esteem cause better performance, interpersonal success, happiness, or healthier lifestyles? *Psychological Science in the Public Interest, 4*(whole No. 1).

Beck, J. (1966). Contrast and assimilation in lightness judgments. *Attention, Perception, &*

Billig, M. (2013). *Learn to write badly: How to succeed in the social sciences*. Cambridge University Press.

Brewer, M. B. (1991). The social self: On being the same and different at the same time. *Personality and Social Psychology Bulletin, 17*, 475-482. https://doi.org/10.1177/0146167291175001

Brown, J. D. (2012). Understanding the better than average effect: Motives still matter. Personality and Social Psychology Bulletin, 38, 209-219. https://doi.org/10.1177/0146167211432763

Brunswik, E. (1943). Organismic achievement and environmental probability. *Psychological Review, 50*, 255-272.

Cadinu, M., & Galdi, S. (2012). Gender differences in implicit gender self-categorization lead to stronger gender self-stereotyping by women than by men. *European Journal of Social Psychology, 42*, 546-551. https://doi.org/10.1002/ejsp.1881

Campbell, D.T. (1974), Evolutionary Epistemology. In P.A. Schilpp (ed.), The *Philosophy of Karl Popper* (pp. 413–463). Open Court.

Christakis, N. A. (2020). *Blueprint: The evolutionary origins of a good society*. Little, Brown Spark.

Cohen, J. (1994). The earth is round ($p < .05$). *American Psychologist, 49*, 997-1003. https://doi.org/10.1037/0003-066X.49.12.997

Corneille, O., Klein, O., Lambert, S., & Judd, C. C. (2002). The role of familiarity with units of measurement in categorical accentuation: Tajfel and Wilkes (1963) revisited and

replicated. *Psychological Science, 13*, 380-383. doi: 10.1111/1467-9280.00468

Crocker, J., & Park, L. E. (2004). The costly pursuit of self-Esteem. *Psychological Bulletin, 130*(3), 392–414. https://doi.org/10.1037/0033-2909.130.3.392

Cronbach, L. J., & Gleser, G. C. (1953). Assessing similarity between profiles. *Psychological Bulletin, 50*, 456-473. https://doi.org/10.1037/h0057173

Dasgupta, N. (2004). Implicit ingroup favoritism, outgroup favoritism, and their behavioral manifestations. *Social Justice Research, 17*, 143-169. https://doi.org/10.1023/B:SORE.0000027407.70241.15

Dawes, R. M. (1989). Statistical criteria for establishing a truly false consensus effect. *Journal of Experimental Social Psychology, 25*, 1–17. https://doi.org/10.1016/0022-1031(89)90036-X

Dawes, R. M. (1991). Probabilistic versus causal thinking. In D. Cicchetti & W. M. Grove (Eds.), Thinking clearly about psychology: Vol. 1. *Matters of public interest: Essays in honor of Paul Everett Meehl* (pp. 235—264). Minneapolis: University of Minnesota Press.

Dawes, R. M. (1998). Behavioral decision making and judgment. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *The Handbook of Social Psychology* (4th ed., pp. 497–548). McGraw-Hill.

Dawes, R. M., & Mulford, M. (1996). The false consensus effect and overconfidence: Flaws in judgment or flaws in how we study judgment? *Organizational Behavior and Human Decision Processes, 65*, 201-211. https://doi.org/10.1006/obhd.1996.0020

Denrell, J., & March, J. G. (2001). Adaptation as information restriction: The hot stove effect. *Organization Science*, *12*(5), 523-538. https://doi.org/10.1287/orsc.12.5.523.10092

DiDonato, T. E., Ullrich, J., & Krueger, J. I. (2011). Social perception as induction and inference: An integrative model of intergroup differentiation, ingroup favoritism, and differential accuracy. *Journal of Personality and Social Psychology, 100,* 66-83. https://doi.org/10.1037/a0021051

Diehl, M. (1990). The minimal group paradigm: Theoretical explanations and empirical findings. *European review of social psychology*, *1*(1), 263-292. https://doi.org/10.1080/14792779108401864

Durkheim, E. (1895/1966). *Les Règles de la méthode sociologique*. [*The rules of sociological method*]. Free Press.

Edwards, J. R., & Berry, J. W. (2010). The presence of something or the absence of nothing: Increasing theoretical precision in management research. *Organizational Research Methods, 13*, 668-689. https://doi.org/10.1177/1094428110380467

Ellemers, N., & Haslam, S. A. (2012). Social identity theory. In P. A. M. Van Lange, A. W. Kruglanski, & E. T. Higgins (Eds.), *Handbook of theories of social psychology* (pp. 379–398). Sage Publications Ltd. https://doi.org/10.4135/9781446249222.n45

Elwood, C. A. (1920). *An introduction to social psychology*. New York, NY: Appleton and Co.

Evans, A. M., Ong, H. H., & Krueger, J. I. (2021). Social proximity and respect for norms in trust dilemmas. *Journal of Behavioral Decision Making, 35,* 657-668. https://doi.org/10.1002/bdm.2238

Felin, T., Koenderink, J., Krueger, J. I., Noble, D., & Ellis, G. (2021a). The data-hypothesis relationship. *Genome Biology*, *22*:57. https://doi.org/10.1186/s13059-021-02276-4

Festinger, L. (1954). A theory of social comparison processes. *Human Relations, 7*, 117-140. https://doi.org/10.1177/001872675400700202

Feyerabend, P. (1975). *Against method – outline of an anarchistic theory of knowledge*. London: NLB.

Fiedler, K. (2000). Beware of samples! A cognitive-ecological sampling approach to judgment biases. *Psychological Review, 107*(4), 659–676. https://doi.org/ 10.1037/0033-295X.107.4.659

Fiedler, K., & Krueger, J. I. (2012). More than an artifact: Regression as a theoretical construct. In J. I. Krueger (Ed.). *Social judgment and decision-making* (pp. 171-189). Psychology Press.

Fiedler, K., & Kutzner, F. (2015). Information sampling and reasoning biases: Implications for research in judgment and decision making. *The Wiley Blackwell handbook of judgment and decision making*, *2*, 380-403.

Fiedler K. (2018). The creative cycle and the growth of psychological science. *Perspectives on Psychological Science*, 13, 433–438. https://doi.org/10.1177/1745691617745651

Fiedler, K., & Unkelbach, C. (2014). Regressive judgment: Implications of a universal property of the empirical world. *Current Directions in Psychological Science, 23*, 361-367. https://doi.org/10.1177/0963721414546330

Fiske, S. T. (1998). Stereotyping, prejudice, and discrimination. In D. Gilbert, S. T. Fiske, & G. Lindzey (eds). *The handbook of social psychology*, Vol. 2 (4th ed.) (pp. 357411). McGraw-Hill.

Fiske, S. T., & Taylor, S. E. (1984). *Social cognition*. Random House.

Fleck, L. (1935). *Entstehung und Entwicklung einer wissenschaftlichen Tatsache. Einführung in die Lehre vom Denkstil und Denkkollektiv*, Basel: Benno Schwabe und Co.

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

Gawronski, B., Bodenhausen, G. V., & Becker, A. P. (2007). I like it, because I like myself: Associative self-anchoring and post-decisional change in implicit evaluations. *Journal of Experimental Social Psychology, 43*, 221-232. https://doi.org/10.1016/jesp.2006.04.001

Gerber, J. P., Wheeler, L., & Suls, J. (2018). A social comparison theory meta-analysis 60+ years on. *Psychological Bulletin, 144*(2), 177–197. https://doi.org/10.1037/bul0000127

Gigerenzer, G., & Gaissmaier, W. (2011). Heuristic decision making. *Annual Review of Psychology, 62*, 451–482. https://doi.org/10.1146/annurev-psych-120709-145346

Goldstein, D. G., & Gigerenzer, G. (2002). Models of ecological rationality: The recognition heuristic. *Psychological Review, 109*(1), 75–90. https://doi.org/10.1037/0033-295X.109.1.75

Gramzow, R. H., & Gaertner, L. (2005). Self-esteem and favoritism toward novel in-groups: The self as evaluative base. *Journal of Personality and Social Psychology, 88*, 801-815. https://doi.org/10.1037/0022-3514.88.5.801

Gramzow, R. H., Gaertner, L., & Sedikides, C. (2001). Memory of in-group and out-group information in a minimal group context: The self as informational base. *Journal of Personality and Social Psychology, 80*, 188-205. https://doi.org/10.1037/0022.3514.80.2.188

Greenwald, A. G., Banaji, M. R., Rudman, L. A., Farnham, S. D., Nosek, B. A., & Mellott, D. S. (2002). A unified theory of implicit attitudes, stereotypes, self-esteem, and self-concept. *Psychological Review, 109*(1), 3–25. https://doi.org/10.1037/0033-295X.109.1.3

Greenwald, A. G. (2012). There is nothing so theoretical as a good method. *Perspectives on Psychological Science, 7*, 99-108. https://doi.org/10.1177/1745691611434210

Gumplowicz, L. (1899/2019). *Grundriss der Soziologie* [The Outlines of Sociology]. Routledge.

Hamilton, D. L., & Sherman, S. J. (1996). Perceiving persons and groups. *Psychological Review, 103*, 336 –355.

Hebb, D. O. (1949). *Organization of behavior*. Wiley.

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

Heck, P. R., & Krueger, J. I. (2020). Self-enhancement error motivates social projection. *Social Cognition, 38,* 489-522.

Heck, P. R., Simons, D. J., & Chabris, C. F. (2018). 65% of Americans believe they are above average in intelligence. *PLoS ONE 13*: e0200103.

Heider, F. (1958). *The psychology of interpersonal relations*. Wiley.

Hertwig, R., Hoffrage, U. and the ABC Research Group (2013). *Simple heuristics in a social world*. Oxford University Press.

Hewstone, M., Rubin, M., & Willis, H. (2002). Intergroup bias. *Annual Review of Psychology, 53*, 575-604. https://doi.org/10.1146/annurev.psych.53.100901.135109

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

Humphrey, N. (1978). Nature's psychologists. *New Scientist, 29*, 900-904.

Jones, E. E. (1985). Major developments in social psychology during the past five decades. In G. Lindzey & E. Aronson (Eds), *The handbook of social psychology* (Third edition, Vol 1., pp. 47-107). Random House.

Jussim, L. (2012). *Social perception and social reality*. *Why accuracy dominates bias and self-fulfilling prophecy*. Oxford University Press.

Kenny, D. A., & La Voie, L. (1984). The social relations model. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 18, pp. 141-182). Academic Press.

Koffka, K. (1935). *Principles of gestalt psychology*. Harcourt, Brace, & World.

Krueger, J. (1992). On the overestimation of between-group differences. *European Review of Social Psychology*, *3*, 31-56. https://doi.org/10.1080/14792779243000014

Krueger, J. (2001). Null hypothesis significance testing: On the survival of a flawed method. *American Psychologist, 56,* 16-26. https://doi.org/10.1037/0003-066X.56.1.16

Krueger, J. I. (2003). Return of the ego—self-referent information as a filter for social prediction: Comment on Karniol (2003). *Psychological Review, 110*, 585-590. https://doi.org/10.1037/0033-295X.110.3.585

Krueger, J. I. (2007). From social projection to social behaviour. *European Review of Social Psychology, 18,* 1-35. https://doi.org/10.1080/10463280701284645

Krueger, J. I. (2008). The robust beauty of simple associations. In J. I. Krueger (Ed.), *Rationality and social responsibility: Essays in honor of Robyn M. Dawes* (pp. 111-140). Psychology Press.

Krueger, J. I. (2009). A componential model of situation effects, person effects and situation-by-person interaction effects on social behavior. *Journal of Research in Personality, 43*, 127-136. https://doi.org/10.1016/j.jrp.2008.12.042

Krueger, J. I., Acevedo, M., & Robbins, J. M. (2006). Self as sample. In K. Fiedler & P. Juslin (Eds.), *Information sampling and adaptive cognition* (pp. 353-377). Cambridge University Press.

Krueger, J., & Clement, R. W. (1994). Memory-based judgments about multiple categories: A revision and extension of Tajfel's accentuation theory. *Journal of Personality and Social Psychology, 67,* 35-47. https://doi.org/10.1037/0022-3514.67.1.35

Krueger, J. I., & DiDonato, T. E. (2008). Social categorization and the perception of groups and group differences. *Social and Personality Psychology Compass: Group Processes, 2*, 733-750. https://doi.org/10.1111/j.1751-9004.2008.00083.x

Krueger, J. I., DiDonato, T. E., & Freestone, D. (2012). Social projection can solve social dilemmas. *Psychological Inquiry, 23,* 1-27. https://doi.org/

10.1080/1047840X.2012.641167

Krueger, J. I., Freestone, D., & MacInnis, M. L. (2013). Comparisons in research and reasoning: Toward an integrative theory of social induction. *New Ideas in Psychology, 31,* 73-86. http://dx.doi.org/10.1016/j.newideapsych.2012.11.002

Krueger, J. I., & Funder, D. C. (2004). Towards a balanced social psychology: Causes, consequences and cures for the problem-seeking approach to social behavior and cognition. *Behavioral and Brain Sciences, 27,* 313-376.

Krueger, J. I., & Grüning, D. G. (2024). Inductive reasoning can facilitate tribalism. In J. P. Forgas (ed.), *The tribal mind: The psychology of collective delusions. The Sidney Symposium of Social Psychology, 25*.

Krueger, J. I., & Grüning, D. J. (in press). The unceremonious death of free will. Review of 'Determined: A science of life without free will' by Robert M. Sapolsky. *American Journal of Psychology*.

Krueger, J. I., & Heck, P. R. (2017). The heuristic value of *p* in inductive statistical inference. *Frontiers in Psychology: Educational Psychology*. https://doi.org/10.3389/fpsyg.2017.00908

Krueger, J. I., Heck, P. R., & Asendorpf, J. B. (2017). Self-enhancement: Conceptualization and assessment. *Collabra: Psychology, 3*(1), 28. https://www.collabra.org/article/10.1525/collabra.91/

Krueger, J. I., Heck, P. R., & Athenstaedt, U. (2017). The search for the self. In T. Nelson (Ed.). *Getting grounded in social psychology: The essential literature for beginning researchers* (pp. 15-36). Routledge.

Krueger, J., & Stanke, D. (2001). The role of self-referent and other-referent knowledge in perceptions of group characteristics. *Personality and Social Psychology Bulletin, 27*(7), 878–888. https://doi.org/10.1177/0146167201277010

Krueger, J. I., Ullrich, J., & Chen, L. J. (2016). Expectations and decisions in the volunteer's dilemma: effects of social distance and social projection. *Frontiers in Psychology: Cognition, 7,* article 1909. https://doi.org/10.3389/fpsyg.2016.01909

Krueger, J. I., & Wright, J. C. (2011). Measurement of self-enhancement (and self-protection). In M. D. Alicke & C. Sedikides (Eds.), *Handbook of self-enhancement and self-protection* (pp. 472-494). Guilford.

Kruschke, J. K. (2013). Bayesian estimation supersedes the *t* test. *Journal of Experimental Psychology: General, 142*, 573-603. https://doi.org/10.1037/a0029146

Kuhn, T. S. (1962). *The structure of scientific revolutions.* University of Chicago Press.

Kuhn, T. S. (1977). *The essential tension: Selected studies in scientific tradition and change.* University of Chicago Press.

Lakens, D. (2017). Equivalence tests: A practical primer for t tests, correlations, and meta-analyses. *Social psychological and personality science*, *8*(4), 355-362. https://doi.org/10.1177/1948550617697177

Lambdin, C. (2012). Significance tests as sorcery: Science is empirical – significance tests are not. *Theory & Psychology, 22*, 67-90. doi: 10.1177/0959354311429854

LaPiere, R. T. (1936). Type-rationalizations of group antipathy. *Social Forces, 15*, 232-237. https://doi.org/10.2307/2570963

Latrofa, M., Vaes, J., Cadinu, M., & Carnaghi, A. (2010). The cognitive representation of self-stereotyping. *Personality and Social Psychology Bulletin, 36*, 911-922. https://doi.org/10.1177/0146167210373907

Leach, C. W., van Zomeren, M., Zebel, S., Vliek, M. L. W., Pennekamp, S. F., Doosje, B., Ouwerkerk, J. W., & Spears, R. (2008). Group-level self-definition and self-investment: A hierarchical (multicomponent) model of in-group identification. *Journal of Personality and Social Psychology, 95*(1), 144–165. https://doi.org/10.1037/0022-3514.95.1.144

Le Bon, G. (1895). *Psychologie des foules*. Paris: Alcan.

Lee, M. D., & Wagenmakers, E.-J. (2014). *Bayesian cognitive modeling: A practical course*. Cambridge University Press. https://doi.org/10.1017/cbo9781139 087759

Lippmann, W. (1922). *Public opinion*. New York, NY: Harcourt, Brace and Co.

Leary, M. (2007). Motivational and emotional aspects of the self. *Annual Review of Psychology, 58*, 317-344. https://doi.org/10.1146/annurev.psych.58.110405.085658

Lykken, D. T. (1968). Statistical significance in psychological research. *Psychological Bulletin, 70*, 151-159. https://doi.org/10.1037/h0026141

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review, 50*(4), 370–396. https://doi.org/10.1037/h0054346

Meehl, P. E. (1967). Theory-testing in psychology and physics: A methodological paradox. *Philosophy of Science, 34*(2), 103–115. https://doi.org/10.1086/288135

Meehl, P. E. (1978). Theoretical risks and tabular asterisks: Sir Karl, Sir Ronald, and the slow progress of soft psychology. *Journal of Consulting and Clinical Psychology, 46*,

806-834.https://doi.org/10.1037/0022-006X.46.4.806

Miller, D. T., & Turnbull, W. (1986). Expectancies and interpersonal processes. *Annual Review of Psychology, 37*, 233-256. https://doi.org/10.1146/annurev.ps.37.020186.001313

Moore, D. A., & Healy, P J. (2008). The trouble with overconfidence. *Psychological Review, 115*, 102-117.

Moore, D., & Small, D. A. (2007). Error and bias in comparative judgment: On being both better and worse than we think we are. Journal of Personality and Social Psychology, 92, 972-989. https://doi.org/10.1037/0022-3514.92.6.972

Müller, G. E., & Schumann, F. (1889). Über die psychologischen Grundlagen der Vergleichung gehobener Gewichte [On the psychological foundations of comparisons between lifted weights]. *Pflügers Archiv der gesamten Physiologie, 45*, 37-112. Xxxx

Munafò, M. R., Nosek, B. A., Bishop, D. V., Button, K. S., Chambers, C. D., du Sert, N. P., Simonsohn, U., Wagenmakers, E. J., Ware, J. J., & Ioannidis, J. P. (2016). A manifesto for reproducible science. *Nature human behaviour, 1*(1), 0021. https://doi.org/10.1038/s41562-016-0021

Mussweiler, T. (2003). Comparison processes in social judgment: Mechanisms and consequences. *Psychological Review, 110*, 472-489. https://doi.org/10.1037/0033-295X.110.3.472

Oakes, P. J., Haslam, S. A., & Turner, J. C. (1994). *Stereotyping and social reality*. Blackwell.

Otten, S. (2016). The Minimal Group Paradigm and its maximal impact in research on social categorization. *Current Opinion in Psychology*, *11*, 85-89. https://doi.org/10.1016/j.copsyc.2016.06.010

Otten, S., & Epstude, K. (2006). Overlapping mental representations of self, ingroup, and outgroup: Unraveling self-stereotyping and self-anchoring. *Personality and Social Psychology Bulletin, 32*, 957-969. https://doi.org/10.1177/0146167206827254

Otten, S., & Moskowitz, G. B. (2000). Evidence for implicit evaluative in-group bias: Affect-based spontaneous trait inference in a minimal group paradigm. *Journal of Experimental Social Psychology, 36*, 77-89. https://doi.org/10.1006/jesp.1999.1399

Otten, S., & Wentura, D. (2001). Self-anchoring and in-group favoritism: An individual profiles analysis. *Journal of Experimental Social Psychology, 37*, 525-537. https://doi.org/10.1006/jesp.2001.1479

Parducci, A., & Marshall, L. M. (1962). Assimilation vs. contrast in the anchoring of perceptual judgments of weight. *Journal of Experimental Psychology, 63*(5), 426–437. https://doi.org/10.1037/h0048727

Popper, K. R. (1963). *Conjectures and refutations: The growth of scientific knowledge.* Routledge.

Rabbie, J. M., & Horwitz, M. (1969). Arousal of ingroup-outgroup bias by a chance win or loss. *Journal of Personality and Social Psychology, 13*, 269–277. https://doi.org/10.1037/h0028284

Rau, R., Carlson, E. N., Back, M. D., Barranti, M., Gebauer, J. E., Human, L. J., Leising, D., & Nestler, S. (2021). What is the structure of perceiver effects? On the importance of global positivity and trait-specificity across personality domains and judgment contexts. *Journal of Personality and Social Psychology, 120*(3), 745–764. https://doi.org/10.1037/pspp0000278

Robbins, J. M., & Krueger, J. I. (2005). Social projection to ingroups and outgroups: A review and meta-analysis. *Personality and Social Psychology Review, 9*, 32-47. https://doi.org/10.1207/s15327957pspr0901_3

Robson, S. G., Baum, M. A., Beaudry, J. L., Beitner, J., Brohmer, H., Chin, J. M., Jasko, K., Kouros, C. D., Laukkonen, R. E., Moreau, D., Searston, R. A., Slagter, H. A., Steffens, N. K., Tangen, J. M., & Thomas, A. (2021). Promoting open science: a holistic approach to changing behaviour. *Collabra: Psychology*, *7*(1), 30137. https://doi.org/10.1525/collabra.30137

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

Roth, J., & Steffens, M. C. (2014). When I becomes We: Self-anchoring drives implicit intergroup bias in minimal groups. *Social Psychology*, 45, 2014, 253-264. http://dx.doi.org/10.1027/1864-9335/a000169

Rothbart, M., Davis-Stitt, C., & Hill, J. (1997). Effects of arbitrarily placed category boundaries on similarity judgments. *Journal of Experimental Social Psychology, 33*, 122-145. https://doi.org/10.1006/jesp.1996.1315

Rouder, J. N., Morey, R. D., Speckman, P. L., & Province, J. M. (2012). Default Bayes factors for ANOVA designs. *Journal of Mathematical Psychology, 56*, 356-374. https://doi.org/10.1016/j.jmp.2012.08.001

Ryan, C. (1996). Accuracy of Black and White college students' in-group and out-group stereotypes. *Personality and Social Psychology Bulletin, 22*, 1114-1127. https://doi.org/10.1177/01461672962211003

Sherif, M., & Hovland, C. I. (1961). *Social judgment: Assimilation and contrast effects in communication and attitude change*. Yale University Press.

Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). False-positive psychology: Undisclosed flexibility in data collection and analysis allows presenting anything as significant. *Psychological Science*, *22*(11), 1359-1366. https://doi.org/10.1177/0956797611417632

Stanovich, K. E. (2011*). Rationality and the reflective mind*. Oxford University Press.

Suls, J., & Wheeler, L. (2000). *Handbook of social comparison: Theory and research*. Kluwer/Plenum.

Swann, W. B. Jr., Jetten, J., Gómez, Á., & Whitehouse, H. (2012). When group membership gets personal: A theory of identity fusion. *Psychological Review, 119*, 441-456. https://doi.org/10.1037/a0028589

Tajfel, H. (1969). Cognitive aspects of prejudice. *Journal of Social Issues, 25*, 79–97. https://doi.org/10.1111/j.1540-4560.1969.tb00620.x

Tajfel, H. (1970, November). Experiments in intergroup discrimination. *Scientific American, 223*, 96–102. https://doi.org/10.1038/scientificamerican1170–96

Tajfel, H., & Turner, J. C. (1979). An integrative theory of intergroup conflict. In W. G. Austin & S. Worchel (Eds.), *Psychology of intergroup relations* (pp. 33-47). Nelson-Hall.

Tajfel, H., & Wilkes, A. L. (1963). Classification and quantitative judgement. *British Journal*

of Psychology, 54, 101-114. https://doi.org/10.1111/j.2044-8295.1963.tb00865.x

Taylor, S. E., & Brown, J. D. (1988). Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin, 103*, 193-210. https://doi.org/10.1037/0033-2909.103.2.193

Turner, J. C., Hogg, M. A., Oakes, P. J., Reicher, S. D., & Wetherell, M. (1987). *Rediscovering the social group: A self-categorization theory*. Basil Blackwell.

Tenenbaum. J. B., & Griffiths, T. L. (2001). Generalization, similarity, and Bayesian inference. *Behavioral and Brain Sciences, 24*, 629-640. Xxxx

Vanhoomissen, T. & Van Overwalle, F. (2010). Me or not me as source of ingroup favoritism and outgroup derogation: A connectionist perspective. *Social Cognition, 28*, 84-109. https://doi.org/10.1521/soco.2010.28.1.84

Yzerbyt, V., & Demoulin, S. (2010). Intergroup relations. In S. T. Fiske, D. T. Gilbert, & Lindsey, G. (eds.), *Handbook of social psychology* (Fifth ed., Vol. 2, pp. 1024-1083). Wiley.

Zawadski, B. (1948). Limitations of the scapegoat theory of prejudice. *Journal of Abnormal and Social Psychology, 43*, 127-141. https://doi.org/10.1037/h0063279

Zell, E., & Alicke, M. D. (2010). The local dominance effect in self-evaluation: Evidence and explanations. *Personality and Social Psychology Review, 14*, 368-384. https://doi.org/10.1177/1088868310366144

Zell, E., Strickhouser, J. E., Sedikides, C., & Alicke, M. D. (2020). The better-than-average effect in comparative self-evaluation: A comprehensive review and meta-analysis. *Psychological Bulletin, 146*, 118-149. https://doi.org/10.1037/bul0000218