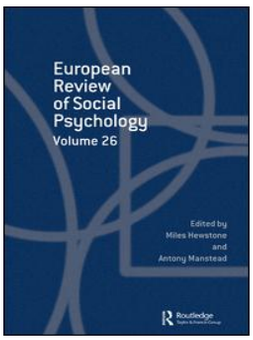

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Relativity in Social Cognition: Basic processes and novel applications of social comparisons

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ABSTRACT

A key challenge for social psychology is to identify unifying principles that account for the complex dynamics of social behaviour. We propose psychological relativity and its core mechanism of comparison as one such unifying principle. To support our proposal, we review recent evidence investigating basic processes underlying and novel applications of social comparisons. Specifically, we clarify determinants of assimilation and contrast, evaluative consequences of comparing similarities vs. differences, attitudinal effects of spatial relativity, and how spatial arrangements determine perceived similarity, one of the antecedents of social comparisons. We then move to behavioural relativity effects on motivation and self-regulation, as well as imitation behaviour. Finally, we address relativity within the more applied areas of morality and political psychology. The reviewed research thereby illustrates how unifying principles of social cognition may be instrumental in answering old questions and discovering new phenomena and explanations.

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KEYWORDS Social comparison; evaluative judgements; self-regulation; motivation; imitation

Introduction

Social cognition is relative in nature. Whenever people process information, judge or evaluate a given target, or make a decision, they do so relatively; they rely on comparisons in one way or another (Kahneman & Miller, 1986). Relativity is equally relevant to the physical and the social world. Just as the

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perceived size of a circle depends on the size of comparison circles in the Ebbinghaus Illusion (e.g., Coren & Enns, 1993), the perceived intelligence of a person depends on the intelligence of others (Dunning & Hayes, 1996; Gilbert et al., 1995). If someone states that a circle is small, it implies that it is small relative to relevant other circles; if someone states that someone is intelligent, it implies that the person is intelligent relative to relevant other persons.

Research to date has shown how such social comparisons pervade human thinking. Social comparisons play a role in critical areas of social psychological research such as stereotyping (Biernat, 2003), attitudes (Sherif & Hovland, 1961), person perception (Herr, 1986; Higgins & Lurie, 1983; Smith & Zárate, 1992), decision making (Choplin & Hummel, 2002; Kahneman & Miller, 1986; Sherman et al., 1999; Tversky & Kahneman, 1974), affect (Higgins, 1987), and the self (Festinger, 1954; Higgins et al., 1986; Miller & Prentice, 1996).

The present review aims to present the principle of relativity and its core mechanism of comparison as an overarching principle in social cognition and social behaviour. As Festinger (1980) believed, social behaviour is driven by "the operation of universal underlying dynamics", but to reveal these unifying principles, it is crucial to find the appropriate "theoretical apparatus" (p. 246). By presenting eight examples of relativity effects in social cognition, ranging from fundamental processes (e.g., when does assimilation or contrast relative to a standard occur) to novel applications (e.g., the relativity principle in moral and political psychology), we aim to support our claim that social cognition is essentially relative in nature in that it is shaped by comparative thinking. To do so, we first present an overview of comparison research up to date in the tradition of Mussweiler's (2003) selective accessibility model (SAM).

Then we review our original research in eight sections. We will first address basic processes, such as the determinants of assimilation and contrast (e.g., when do targets become more similar or less similar to a standard due to the comparison process), the evaluative consequences of looking for similarities and consequences (e.g., looking for similarities makes targets more positive, looking for differences makes targets more negative), the attitudinal effects of relativity in spatial locations (e.g., comparison objects are liked more or less depending on their relative position), and the effects of spatial relativity on categorisation and choice, (e.g., close objects are categorised differently compared to distant objects, and choices become easier or more difficult). Second, we transfer the more basic cognitive processes to the domain of motivation and self-regulation (e.g., what are the motivational consequences of comparisons) and apply the relativity principle in the areas of social imitation (e.g., what determines if people imitate others more or less), morality (e.g., is morality also relative, and how do moral comparison

differ from other comparisons), and finally, political psychology (e.g., are people's evaluations of politicians also relative). By addressing this wide range of topics, we illustrate the importance of relativity and its central process of comparative thinking. However, before we review the respective empirical evidence, we start with a brief overview of the principles of comparative thinking.

Principles of comparative thinking

Classic and current empirical research and theorising provided many insights into the psychology of comparative thinking. Specifically, researchers generated knowledge about the principles that guide the selection of comparison standards, the cognitive mechanisms that underlie comparison, and the immediate judgemental effects these mechanisms produce.

Standard selection

Standard selection has long been the focus of comparison research (Festinger, 1954; Goethals & Darley, 1977; Kahneman & Miller, 1986; Miller & Prentice, 1996). Three primary standard selection mechanisms have been identified. First, a standard may be selected due to conversational inferences (Grice, 1975; Schwarz, 1994), which leads judges to assume that a provided standard is particularly informative. Second, a standard may be selected because it is particularly accessible in memory (Higgins, 1996). Third, the selection process is guided by normative concerns to select a diagnostic standard in which case judges are particularly drawn to standards similar to the target (e.g., Festinger, 1954; Goethals & Darley, 1977; Wheeler et al., 1997). Thus, standard-target similarity is a potent force that drives standard selection in social (Smith & Zárate, 1992) and non-social judgement (Kahneman & Miller, 1986).

While Festinger (1954) indeed referred to similarity on the comparison dimension, other researchers defined similarity with regard to related attributes that are associated with outcomes on the focal dimension of comparison (Goethals & Darley, 1977; Wheeler et al., 1997, for a review, see Crusius et al., 2022). For example, when evaluating or predicting performance in a novel task, a comparison standard with similar previous training would be more diagnostic than an expert in the task. To re-use our example from the introduction, if someone states that a person is intelligent, it implies that the person is intelligent relative to relevant other persons. The similarity function determines the relevance. For a pre-schooler, other pre-schoolers are the relevant standard. For researchers, other researchers are the relevant standard. The comparison standard should be informative and accessible, and the similarity function fulfils these requirements in most cases.

Comparison processes

The actual comparison process relates the features of a selected standard to the target. This comparison is driven by the cognitive mechanisms of structural alignment (Gentner & Markman, 1994; Medin et al., 1993; Ritov, 2000) and selective accessibility (Mussweiler, 2003). Structural alignment – the process of determining a general relational structure among individual attributes – determines which attributes are considered during comparison. Specifically, judges first establish a relational structure shared by the target and the standard and then primarily compare those attributes related to the structure (Gentner & Markman, 1994; Markman & Gentner, 1996). Selective accessibility then determines how these critical attributes are compared and what the judgemental consequences of this comparison are. According to the selective accessibility model (SAM, Mussweiler, 2003), this comparison involves testing one of two alternative hypotheses. Judges either test the possibility of target-standard *similarity* or the alternative of target-standard *dissimilarity* (Mussweiler, 2003). The SAM posits that the direction of comparison is determined by an initial, holistic assessment of similarity. In this quick screening, judges consider a limited number of features such as extremity, category membership, or other salient characteristics. By themselves, these broad features are insufficient to evaluate the target on the focal dimension, as they can be independent of the focal comparison dimensions. However, such features that are salient and easy to process may guide whether more effortful subsequent comparative hypothesis testing focuses on similarities or differences.

Judgemental consequences

No matter which hypothesis guides the comparison process, judges selectively focus on and consequently render accessible knowledge consistent with the similarity or dissimilarity hypothesis. Using these respective knowledge bases has clear judgemental consequences: Similarity-focused comparisons lead to *assimilation* of the target towards the standard, whereas dissimilarity-focused comparisons lead to *contrast* of the target away from the standard. A rich body of empirical evidence has demonstrated such assimilative and contrastive comparison consequences. The judgemental effects of assimilation and contrast have been the focus of research for many years (e.g., Bless & Schwarz, 2010), and Gerber et al. (2018) summarised the respective findings in a quantitative meta-analysis.

In summary, research to date has provided insights into the psychology of comparative thinking. At the same time, however, this research has largely limited itself to studying comparative thinking as an independent topic. Again, we hypothesise that relativity and the process of comparative thinking

Table 1. Overview of the eight sections, the sources, and three open science principles of preregistration, open data, and open materials.

	Open Science Principles		
Section and Source	Preregistered	Open Data	Open Materials
1) Determinants of assimilation and contrast Barker and Imhoff (2021)	yes	yes	yes
2) Evaluative consequences of (dis-)similarity testing Alves et al. (2017a)	no	no	no
3) Attitudes from spatial relativity Gerten and Topolinski (2020)	yes	yes	yes
4) Spatial distance, similarity, and comparisons Schneider & Mattes (2022)	yes	yes	yes
5) Motivational effects of comparisons Diel and Grelle et al. (2021)	yes	yes	yes
6) Comparisons and automatic imitation Genschow, Groß-Bölting (2021)	Exp. 6	yes	yes
7) Comparisons and moral psychology Fleischmann et al. (2021)	Exp. 2b/4b	yes	yes
8) Comparisons and political psychology Baldwin and Lammers (2016)	no	no	No

is a unifying principle in social cognition and social behaviour. If this is the case, then comparative thinking should be influenced by, and influence itself, a wide variety of phenomena. The following sections address basic processes influencing comparative thinking (i.e., Sections 1 to 4) and present novel topic areas that are influenced by comparative thinking (i.e., Sections 5 to 8).

Open science

Unless stated otherwise, any effect we mention is statistically significant at $p < .05$. If there are statistical ambiguities, we explicitly mention these. In addition, as the review will show, we also include evidence not in line with predictions. The reviewed research builds on principles of open science; however, due to shifting publication standards over time, not all reviewed research implemented these principles formally. Table 1 provides an overview of the sections and which sources formally have preregistrations, open data, and open materials.

Section 1: Determinants of assimilation and contrast

As delineated above, humans navigate their social environment and respond to situational affordances relatively. Most of the time, the relativity of social cognition leads to contrast effects (Gerber et al., 2018). The same runner who looks fast in a pedestrian zone seems slow in an athletic competition. A mountain lodge with a 15°C room temperature seems cosy when one enters from the outside but chilly when one gets out of the warm sheets in the morning. However, such contrast effects are complemented by assimilation

effects. People not only contrast a given judgement away from a standard but also assimilate judgements towards a standard (Simmons et al., 2010; Strack & Mussweiler, 1997). Whether relative judgements and the underlying comparison lead to assimilation or contrast is not random. The outcome critically depends on explicable variables like standard extremity (e.g., Herr et al., 1983; Herr, 1986) or categorical inclusion of standard and target (Brewer & Weber, 1994; Mussweiler & Bodenhausen, 2002). These mechanisms have been summarised in the SAM (Mussweiler, 2003) and other models (e.g., Bless & Schwarz, 2010).

What are extreme and moderate standards?

A central variable is the relative position of the comparison standard on the judgement dimension (i.e., up vs. down; moderate vs. extreme). In most theoretical frameworks, the two aspects of relative standing produce either a judgement increase (i.e., assimilation to moderate upwards or contrast away from extreme downwards standard) or a decrease (i.e., assimilation to moderate downwards or contrast away from extreme upwards standard). For example, according to the SAM (Mussweiler, 2003), an initial holistic assessment of target-standard similarity, prompts either testing of the hypothesis that the target and standard are alike (similarity testing) or that they are different (dissimilarity testing). This confirmatory hypothesis testing makes hypothesis-congruent knowledge selectively accessible, creating assimilation or contrast.

The inclusion-exclusion model comes to similar predictions based on different mechanisms. Here, assimilation occurs when information about the standard is included in the target representation, while contrast occurs when standard information is excluded from the target representation (Bless & Schwarz, 2010). Standards similar (i.e., only moderately dissimilar) to the target have more overlapping features with the target and hence are seen as representative of the target, leading to assimilation effects (and vice versa for dissimilar standards).

Despite the consensus regarding these assumptions, the available evidence is less compelling. A meta-analysis of social comparison effects reports contrast effects as the pre-dominant response with little evidence for assimilation (Gerber et al., 2018); however, the analysis ignored the relative extremity of the comparison standard as a theoretically decisive moderator. The main problem might be that it is unclear what constitutes an extreme or moderate standard. Without a way to operationalise the standard as moderate or extreme, divergent results may follow because a chosen standard was neither extreme enough to prompt contrast nor moderate enough to prompt assimilation. This situation prevents consequential tests of theoretical assumptions; inconsistent results may follow from unsuccessful standard

manipulation and may thus be seen as informative only at the level of auxiliary hypotheses regarding the operationalisation, but not the theory itself (Meehl, 1990).

A curve-fitting approach

Thus, we aimed to formalise predictions independent of ad hoc assumptions about what constitutes moderate or extreme standards. We relied on two premises: First, more extreme comparison standards increase the likelihood of contrastive judgements. Second, extremity (i.e., high vs. moderate) will not result in a discontinuous function where assimilation switches into contrast at one point of the standard continuum. This premise follows from imperfect construct validity at standard manipulation and measurement (Campbell, 1957; Cronbach & Meehl, 1955). Imperfect manipulation and imperfect measurement will smoothen the function, even if the underlying theoretical prediction is discontinuous (see Barker & Imhoff, 2021, for simulations).

For models that rely on dual forces (i.e., the outcome of judgement results from simultaneous antagonistic assimilative and contrastive tendencies; Bless & Schwarz, 2010), the same prediction follows, even without conceding imperfect construct validity. What follows then is a function as described in Figure 1.

Going up or down from the neutral zero, there will be a corresponding movement in judgements, indicative of assimilation of the judgement to the standard. Assimilation will be stronger with growing distance, but only to a certain point. At some point, contrastive tendencies will attenuate this assimilative pattern until manifest contrast is realised in lower judgements in the presence of (extreme) upwards comparison standards and vice versa for downward comparisons.

Mathematically, Figure 1 shows a combination of a positive linear function responsible for the assimilative tendency in the moderate region and a negative cubic function responsible for the contrastive turn. Notably, the theoretical outline predicts this function (i.e., a positive linear and a negative cubic effect) without the necessity of binding assumptions about where exactly contrastive tendencies take over. Although this may sound like a weakening of predictions, it is a strength. It allows falsification of the theoretical core rather than the auxiliaries. The theoretical predictions are falsified if the data do not comply with the function, independent of the exact parameters. The critical test of assimilation and contrast effects in social cognition is thus a curve-fitting approach for judgements relative to a standard that varies in extremity on the given judgement dimension (e.g., standards from low to high in extraversion).

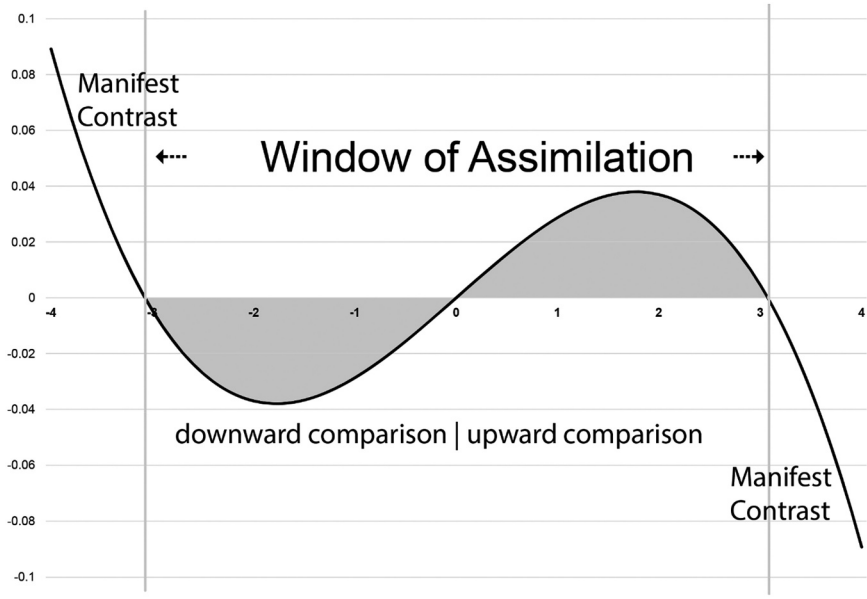

Figure 1. Predicted (standardized) judgments as a function of standard position on the given judgment dimension. Grey shaded area indicates assimilation effects.

Empirical evidence

Barker and Imhoff (2021) used the Comparative Judgement Task developed by Barker et al. (2020) to test these predictions. Participants judged a neutral target face on the dimensions "extraversion" (Study 1a), "trustworthiness" (Study 1b), and "dominance" (Study 1c). Using computer-generated faces based on Todorov et al. (2013), the neutral face appeared together with a standard that varied from −4 *SD* to + 4 *SD* in steps of 0.1 *SD* on the respective dimensions (e.g., dominance), resulting in 81 pairs. Each participant judged each pair 4 times on the respective dimension, resulting in 324 judgement trials.

In Study 1a, 85 German speakers from the campus of the University of Cologne participated (52 female, 33 male; $M_{age} = 25.41$, $SD_{age} = 4.41$). The judgement data showed the predicted pattern of assimilation between −1SD and 1SD (Figure 2, solid line); statistically, the study showed a significant positive linear effect and a negative cubic effect. Study 1b replicated Study 1a with trustworthiness as the dimension (see Figure 2, dashed line), with 159 participants from the same population (99 female, 60 male; $M_{age} = 24.09$, $SD_{age} = 6.05$). However, even extreme standards did not lead to manifest contrast effects, although both the positive linear effect together with a negative cubic effect were highly significant.

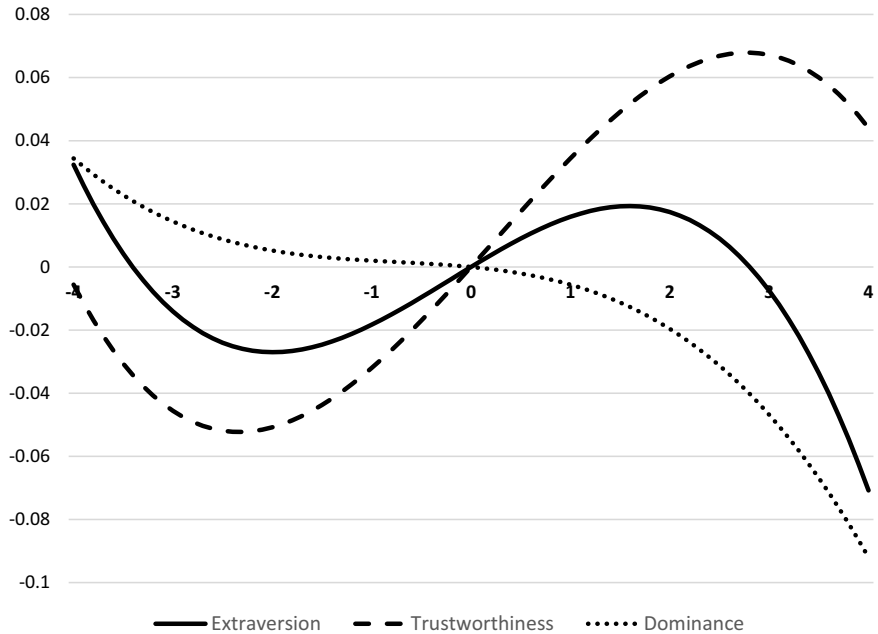

Figure 2. Estimated intercept adjusted standardised judgements of neutral faces as a function of position on judgement dimension of faces serving as comparison standards for three judgement dimensions (Studie 1a to 1c; Barker & Imhoff, 2021).

Different from Study 1a and 1b, Study 1c did not find the predicted pattern for dominance (see Figure 2, dotted line). The study employed 158 participants (61 female, 97 male; $M_{age} = 22.52$, $SD_{age} = 4.14$) from the same population as Studies 1a and 1b. The data showed no significant linear trend but only a negative cubic effect, indicating an increasing tendency to contrast at more extreme standing of the comparison standards. Thus, there was considerable heterogeneity in the exact point on the underlying dimension where assimilation turns into contrast that was only possible to detect – and tell it apart from mere null effects – through curve fitting. Importantly, this heterogeneity could be an aspect of the respective judgement dimension (dominance judgements prompting contrastive evaluations of one over the other; trustworthiness judgements prompting assimilative judgements), or it could be an effect of the exact item wording (e.g., "How often does this person enforce his opinion?").

Further studies used randomly sampled items from a more extensive list and hence showed that the heterogeneity was an effect of the item, not the dimension. Thus, accounting for random effects of the item resulted in exactly hypothesised function (virtually identical to the one for extraversion in Study 1a) and dominance and trustworthiness (Barker & Imhoff, 2021,

Studies 2a and 2b, respectively). Later studies then showed that this curve-fitting approach is a powerful tool to differentiate effects on the comparison direction (more assimilative when instructed to focus on similarities; Study 3) from effects on whether people compare at all or not (same vs. different racial category; Study 4).

Summary of the determinants of assimilation and contrast

In summary, the curve-fitting approach allows a better understanding of the dynamics of assimilation and contrast. The relative standing of a comparison standard had a consequential and theoretically predicted influence on the judgement of neutral targets. Thus, any comparison research ignoring the exact relative standing of the standard will lose information in aggregation. This is less problematic if standards are selected in a representative fashion from the population of possible standards (Brunswik, 1955), but more problematic if the standard selection is biased or a single standard is used. If, for instance, researchers habitually employ relatively starkly differing standards (as their relative position on upward vs. downward dimension is less ambiguous), they will drastically overestimate contrastive tendencies (e.g., Gerber et al., 2018). Likewise, an experimental approach to manipulating judgemental outcomes that ignores standard position runs the risk of harvesting phantom non-replications if the standard does not reside in the sweet spot where one condition will create contrast and the other assimilation effects. This introduces flexibility to legitimately attribute null findings or non-replications to operationalisation rather than theory and thus prevents strong tests of theories. The present curve-fitting approach avoids this flexibility, and thereby allows strong tests of social comparison theories themselves.

The following section will move to evaluative consequences for the targets when social perceivers look for similarities or differences.

Section 2: Evaluative consequences of (dis-)similarity testing

As delineated above, comparative thinking is a fundamental part of social cognition (e.g., Festinger, 1954; Möller & Marsh, 2013; Mussweiler, 2003). In this section, we address the evaluative consequences of comparisons. However, we are not concerned with the straightforward evaluative implications of comparisons involving the self (e.g., "How high is my h-index compared to my colleagues?" "How many push-ups can I do compared to my colleagues?"). These effects are typically studied for up- and down-ward comparisons (see Buunk et al., 1990), and we will address the evaluative and motivational consequences for the self later. Here, we will address the evaluative consequences of similarity and dissimilarity testing, as outlined

in the SAM (Mussweiler, 2003). In interaction with the structural properties of the evaluative ecology (see Unkelbach et al., 2019, 2020, for overviews), we delineate a consequence of comparing with a focus on similarities or differences: Similarity-based comparisons lead to more positive evaluations than difference-based comparisons (Alves et al., 2017a). We will first delineate the theoretical rationale and then present empirical data to support the rationale.

The evaluative information ecology

The Evaluative Information Ecology (EvIE; Unkelbach et al., 2019, 2020) is formed by the structural properties of evaluative information in a given environment (Lewin, 1951; Unkelbach, 2012). In most environments, two structural properties are prominent: First, positive information is more frequent than negative information (e.g., Boucher & Osgood, 1969; Matlin & Stang, 1978; Peeters & Czapinski, 1990; Rozin & Royzman, 2001). Second, negative information is more diverse than positive information (e.g., Alves et al., 2016; Koch et al., 2016; Unkelbach et al., 2008).

The examples and explanations for these two differential properties are manifold and would go beyond the present review's scope. However, in short, differential frequency of positive information follows from evolutionary pressures (i.e., cooperation trumps competition; Axelrod & Hamilton, 1981), from reinforcement learning (i.e., friendliness is rewarded, hostility is punished; e.g., Lyubomirsky et al., 2006), and from hedonic sampling (i.e., people seek the good and avoid the bad; e.g., Denrell, 2005). Differential similarity follows because first, given higher frequency, positive information must co-occur more often with other positive information, and co-occurring information appears more similar (e.g., Cilibrasi & Vitanyi, 2007; Jones & Mewhort, 2007). Second, there are more ways to be bad than to be good (Alves et al., 2017b). Unkelbach et al. (2019) provide a more comprehensive overview of these explanations.

Combining (dis-)similarity testing with the evaluative information ecology

The structural properties of frequency and diversity predict evaluative consequences of similarity and dissimilarity testing (Mussweiler, 2003). Figure 3 illustrates the predictions. Let us assume that a target (i.e., an attitude object, a person, a group) is represented by a vector of attributes. These attributes might be traits, behaviours, or any information that makes targets "good" or "bad". A filled box indicates the presence of the attribute. The higher number of available boxes for negative attributes represents negative information's greater diversity (i.e., more ways to be bad; Alves et al., 2017b). The higher number of filled boxes for positive attributes indicates positive information's

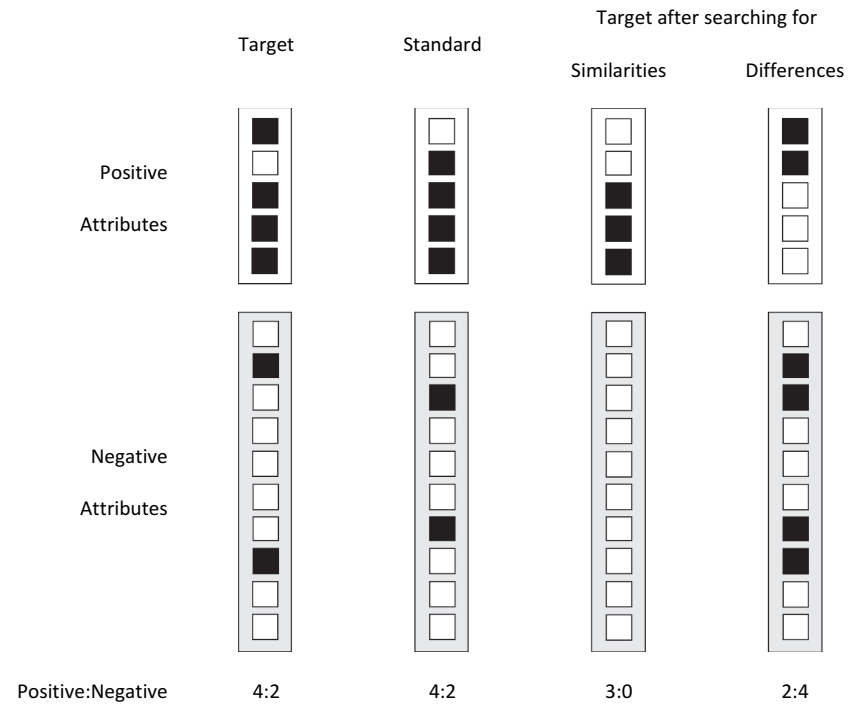

Figure 3. Illustrating the evaluative consequences of searching for similarities vs. differences, given the ecological properties of positive information's relatively higher frequency (i.e., more filled boxes) and lower diversity (fewer boxes overall). White boxes represent potential attributes; filled boxes represent present attributes. The evaluative outcome depends on the cognitive comparison process applied to these two valence vectors. The bottom row shows the positive:negative ratio.

higher frequency. Figure 3 represents a target and a standard with twice as many positive attributes being present (i.e., higher frequency of positive information) and twice as many negative attributes being possible (i.e., higher diversity of negative information).

If a social perceiver searches for similarities, the target becomes more positive due to the mathematical necessity that there are more shared positive attributes than shared negative attributes. If the perceiver searches for differences, the target becomes more negative because there are more unshared negative attributes than unshared positive attributes. The strength of the evaluative effects depends on the number of attributes and the differential ratios. In the presented approach, we assume that frequency and diversity are independent ecologically. However, the proximal causal factor is the *differential probability* of shared vs. unshared attributes of a given valence, which is jointly influenced by both ecological variables. In

the following, we will present empirical evidence for the prediction illustrated in Figure 3: Searching for similarities makes people appear more positive than searching for differences.

Searching for similarities makes people look good

Alves et al. (2017a) provided several direct tests of this model; we describe two experiments in more detail here. The presented effects follow from the frequency of positive information alone; however, differential diversity amplifies the evaluative consequences. In one experiment (Experiment 4a with 176 students from the University of Cologne; 123 female, 53 male; no age data collected), participants first provided the names of two people they knew. Then they provided up to six traits (i.e., the filled attribute boxes in Figure 3) about these people.

Participants were randomly assigned to one of three conditions. In the "shared" condition, participants provided traits that both persons possessed. In the "unshared" condition, participants provided traits that differed between the persons. Finally, in a "natural" condition, participants provided traits of these two persons without further instructions. After generating the traits, participants rated the traits' valence. Based on these ratings, we classified traits as positive or negative.

Figure 4's left panel provides the probability of generating a positive trait (relative to the maximum number of 6 traits) in the three between-conditions. As Figure 4 shows, looking for similarities increased the probability of positive traits relative to the natural condition. Conversely, looking for differences significantly decreased the probability of generating positive traits.

Figure 4's left panel provides the probability of generating a positive trait (relative to the maximum number of 6 traits) in the three between-conditions. As Figure 4 shows, looking for similarities increased the probability of positive traits relative to the natural condition. Conversely, looking for differences significantly decreased the probability of generating positive traits.

Next, another group of participants (Experiment 4b; with 70 students from the University of Cologne; 50 female, 20 male; no age data collected) evaluated the persons' overall likeability based on the trait profiles (i.e., the representation of these persons generated as a result of searching for similarities or differences). As Figure 4's right panel shows, looking for similarities made people more likeable, and looking for differences made them less likeable, with the natural condition being in the middle.

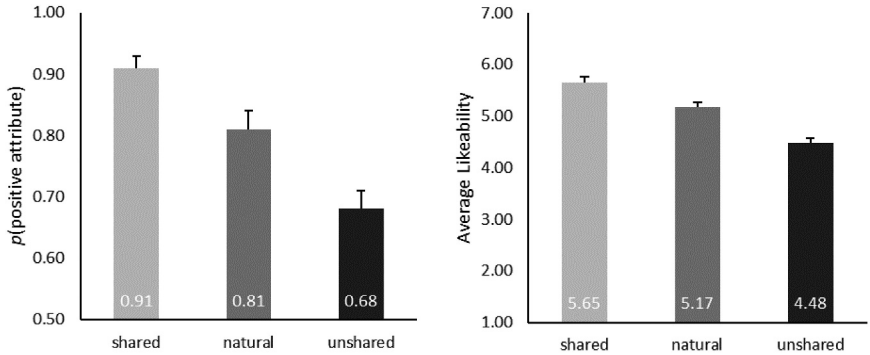

Figure 4. Searching for similarities (shared attributes) makes targets more positive. The left panel shows the probability of generating a positive attribute when participants searched for similarities (i.e., shared attributes), differences (i.e., unshared attributes), and the probability without instructions (i.e., natural search). The right panel shows the average rated likeability based on the attributes generated in the shared, natural, and unshared conditions (ratings on a 7-point scale). The error bars show the standard error of the means.

Searching for similarities and differences in varying ecologies

The central element for the observed evaluative consequences of searching for similarities or differences is the respective ecology (here, the attributes of people one knows). Given the abovementioned reasons, we assumed that the ecology of people one knows is marked by positive information's higher frequency and lower diversity. The overall high probability of generating positive attributes (see Figure 4's left panel) supports this notion. However, there are ecologies in which negative information should be more frequent. Such ecologies afford a critical test of the EvIE's interaction with comparison processes. The overall pattern should reverse if negative information is more frequent (and less diverse) than positive information.

To test this prediction, we took advantage of the US's bipartisan political structure; there are only two large political factions: Republicans and Democrats. We thus asked a sample of US online participants (n = 310; 106 female, 204 male; no age data collected) to generate shared or unshared attributes of two political figures. We selected Mitt Romney and George W. Bush as two political figures typically liked by Republicans but disliked by Democrats, and Bill Clinton and Barack Obama, as two figures liked by democrats but disliked by Republicans. Thus, the two pairs represented the manipulation of the ecology from which participants should sample their attributes, and the condition again asked people to search for similarities or differences. After the attribute generation task, we asked participants to rate the target persons' likeability.

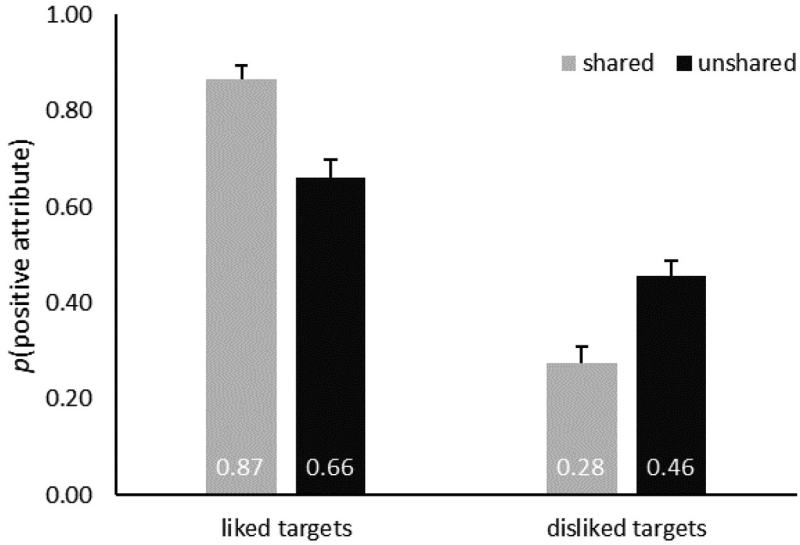

Figure 5. Probability to generate a positive attribute when participants searched for similarities (i.e., shared attributes) or differences (i.e., unshared attributes) in a positive ecology (i.e., liked targets/politicians) or in a negative ecology (i.e., disliked targets/politicians). The error bars show the standard error of the means.

Figure 5 plots the probability of generating a positive attribute in the resulting two ecologies (i.e., liked or disliked politicians) as a function of searching for similarities or differences. As Figure 5 shows, there is a strong main effect of ecology; for liked politicians, the possibility of generating a positive attribute was substantially higher than for disliked politicians. The relevant point is the interaction: When comparing liked politicians, participants had almost the same probability of generating a positive trait when searching for shared or unshared attributes as in the previous experiment: searching for similarities made the politicians look better. When comparing disliked politicians, though, the pattern flipped as predicted: when participants searched for similarities, they were *less* likely to generate a positive attribute but *more* likely when they searched for differences.

Summary of evaluative consequences of (dis-)similarity testing

The experiments summarised in this section show the evaluative consequences of searching for similarities and differences and the central role of the evaluative information ecology. In standard ecologies, looking for similarities will make targets appear more positively. Looking for dissimilarities or differences will make targets appear more negatively.

This evaluative effect of comparison modes also has substantial implications. For example, stimuli that people see as different (e.g., outgroup members relative to ingroup members) will be devalued (see Alves et al., 2018, 2020). Notably, the predicted devaluation of an outgroup, for example, follows from purely cognitive processes interacting with an ecology marked by positive information's higher frequency and lower diversity.

In the next section, we will address a different kind of evaluative consequence, namely the relative position of stimuli as a source of evaluation.

Section 3: Attitudes from spatial relativity

So far, our review has addressed psychological aspects of relativity (e.g., judgements of personality traits and evaluations). However, as anticipated in our introduction, relativity extends from the social to the physical dimension. Accordingly, given our assumption that relativity is a general principle in psychology, we postulated that locations in the physical dimensions of time and space are not absolute but relative to each other.

In time, one thing happens after the other. In space, physical objects are related to each other. Similar to psychological concepts such as intelligence, one cannot identify the location of any object without referring to other objects or ourselves, such as with "above", "in front of", or "to the left of". The detection of spatial relations runs fast, automatically, and outside of awareness (e.g., Dehaene et al., 1993). Spatial relations precede consciousness because they create people's perceptions in the form of so-called spatial codes assigned to everything people experience (e.g., Fischer, 2006). These spatial codes and their relations create spontaneous attitudes – a process we were the first to explore in the research reviewed here.

Stimuli's spatial codes interact with the semantic meaning of these stimuli. The best-known implication is the so-called *spatial-numerical association of response codes* (SNARC; Dehaene et al., 1993). Numerous studies showed that participants respond to large numbers faster with a right than a left response and to small numbers faster with a left than a right response (for a review, see Wood et al., 2008). Building on the reasoning for the SNARC effect, it also follows that the directional effect depends on the reading direction in a given culture; for example, Shaki and Fischer (2008) showed that the effect can be modulated by letting bi-lingual participants read either a Cyrillic script (from left-to-right) or a Hebrew script (from right-to-left) before assessing the effect.

The association between spatial codes and numerical quantity brings about a processing advantage for SNARC-compatible (e.g., higher number on the right) compared to SNARC-incompatible (e.g., higher number on the left) stimulus arrangements (see reviews by Fischer, 2012). Applying the notion of *processing fluency* (Reber et al., 2004), that is, the ease and efficiency

of mental operations, to this phenomenon, we developed a straightforward prediction: Because high processing fluency triggers positive feelings (Topolinski et al., 2009), SNARC compatibility (i.e., leading to fluent processing) feels good. In other words, the relative location of stimuli in space (i.e., left and right) should predict evaluative changes, underlining the inherent relativity of accidental stimulus arrangements that influence spontaneous attitudes.

Numbers on the right side – attitudinal consequences of SNARC

Four experiments tested the attitudinal consequences of spatial arrangements for numerical size (Gerten & Topolinski, 2020). To do so, we presented pairs of digits ranging from 1 to 9 on the computer screen, one digit on the left, and one digit on the right side, and asked participants how much they liked the given arrangement on a Likert scale from 1 to 10. Because the numbers were randomly sampled for a given trial, half of the resulting trials were SNARC-compatible (e.g., 2–7; 1–8), and half were SNARC-incompatible (e.g., 6–4; 9–3). In all experiments, participants provided 25 likeability judgements.

We conducted Experiment 1 laboratory-based with 131 participants from the University of Cologne's campus (99 female, 30 male, 1 diverse; $M_{age} = 23$, $SD_{age} = 5$). Experiment 2 was done online via the platform *Clickworker* with 237 participants (91 female, 145 male, 1diverse; $M_{age} = 35$, $SD_{age} = 13$). Experiment 3 was again laboratory-based with 229 participants (173 female, 71 male, 5 diverse; $M_{age} = 24$, $SD_{age} = 5$). Experiment 3 also varied the distance between the digits, which had no effect. Finally, Experiment 4 was again done online via *Clickworker* with 189 participants (71 female, 116 male, 1 diverse; $M_{age} = 36$, $SD_{age} = 12$). Experiment 4 balanced the likeability scale orientation to control for spatial alignment effects of the response scale.

Figure 6 shows the results. Participants reported higher liking ratings for SNARC-compatible than incompatible trials in Experiments 1, 3, and 4. Experiment 2 showed no effect; Gerten and Topolinski (2020) discuss reasons for this null effect beyond a potentially false negative result. Interestingly, manipulating the horizontal distance between the two digits, that is, whether they appeared far apart on the outer left and right side of the screen or closer together, did not make a difference (Experiment 3). This pattern implies that the effect only depends on the relative position of the digits (one is right/left to the other), not on their position in absolute space. Also, whether the response scale featured its numbers 1–9 or 9–1 did not change the effect (Experiment 4), ruling out the alternative explanation that SNARC-compatible compared to incompatible trials simply matched better with the horizontal arrangement of the scale.

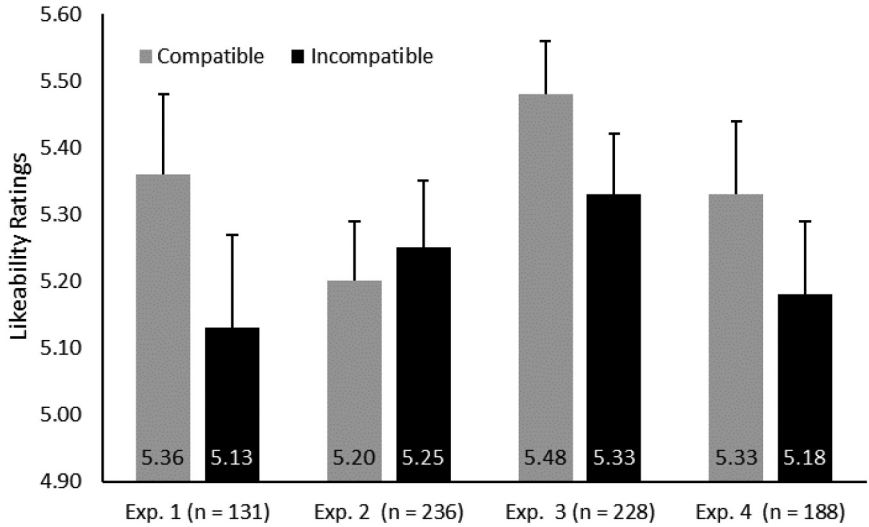

Figure 6. Average likeability rating for compatible and incompatible stimulus displays in Gerten and Topolinski's (2020) Experiments 1 to 4. Participants performed ratings on a 10-point rating scale. The error bars show the standard errors of the means. The difference is significant in Experiments 1, 2, and 4 (Cohen's effect size measure for within-subjects designs $d_z = 0.19$, 0.15, and 0.16, respectively).

Summary and implications when spatial position create attitudes

The experiments reviewed here illustrate how stimuli's relative position in space has attitudinal consequences. The experiments used highly controlled and decontextualised instantiations. Participants had no task to perform on the presented digits but simply passively watched them. Still, they developed immediate attitudes, spontaneously liking some arrangements more than others due to their relative location in space. Beyond the presented experiments, Löffler et al. (2022, total $N = 521$) conceptually replicated the effect with the spatial arrangement of different brightness levels (i.e., luminance); that is, when luminance increases from left to right (i.e., compatible) rather than from right to left (i.e., incompatible).

Although the observed effects were small, the recommendations from spatial code compatibility for social contexts are substantial. For example, in product ads involving several items, put the big ones to the right, and the smaller ones to the left. However, there are also less apparent implications that might be tested in the future.

Many socially relevant dimensions are represented as quantities, such as age, wealth, expertise, intelligence, or popularity. One interesting case is the concept of power (De Cremer et al., 2011), where powerful implies a large, and powerless a small quantity. Although the concept of power has usually

been associated with the vertical axis (power is on the top; e.g., Schubert, 2005), horizontal spatial compatibility might also trigger spontaneous attitudes.

On the surface, the presented effect thereby contradicts the spatial agency bias (Suitner & Maass, 2016). According to this bias, people perceive higher agency for people on the left rather than on the right in cultures that read from left to right and have a typical "subject"-"object" grammar. However, the contradiction is more apparent than real. The present effect relates to liking and thus warmth or communion, which is conceptually orthogonal to agency (see Koch et al., 2020). In addition, both effects build on different explanations and paradigms; it would be difficult to assign agency to numbers or non-living entities in spatial comparison setups.

Thus, we believe the present experiments illustrate potentially fascinating implications of social stimuli's relative location in space, going beyond the inherent relativity of comparative judgements we have considered so far. In the next section, we address another set of effects of relative spatial locations, namely spatial distances and their effects on categorisations and choice.

Section 4: Spatial distance, similarity, and comparisons

As we have delineated above, standard selection is a crucial factor for the comparison processes that implement the relativity principle, and we argued that similarity is a crucial determinant of how people select relevant standards. As such, similarity, the conceptual distance between the standard and the target, matters for comparison processes (Mussweiler, 2003; Mussweiler & Gentner, 2007). However, spatial distance between standard and target has received less attention as a factor in comparison processes. Investigating this role of spatial distance in comparison processes is relevant for at least two reasons. First, comparisons rely on understanding how two stimuli relate to each other (e.g., better, stronger, faster, similar to). As we will argue, spatial distance holds information about relationships between stimuli, particularly their conceptual distance from each other. Second, in experiments and the real world, stimuli are often spatially displayed and processed, for instance, when people compare options on screens, in supermarkets, or brochures, making spatial distance a factor in many comparison situations.

In the environment, spatial distance is a strong cue for what "*goes together*". On the perceptual level, this is described by the law of proximity, which states that "*that form of grouping is most natural and involves the smallest interval*" (Wagemans et al., 2012; Wertheimer, 1938). This law implies that people tend to group things in the environment together with things that are conceptually close rather than far. For instance, most people see the following dots ● ● ● ● as two *pairs* of dots instead of four individual dots (Wagemans et al., 2012; Wertheimer, 1938). Here, the two dots on either

end immediately seem to "go together" instead of all dots being seen as a group. Readers may experience that it takes effort not to *see* the dots as pairs, illustrating the importance of spatial closeness in visual grouping: *close together goes together*.

The assumption that *close together goes together* is supported in many situations. For instance, in natural environments, flowers and plants of the same kind bloom close to each other, and members of the same species often live in close proximity. Human-made environments show the same pattern. In libraries, poetry books and science books are arranged together/apart; in kitchens, plates and silverware are arranged together/apart; and in supermarkets, meats and vegetables are placed together/apart, respectively. Thus, people learn a relationship between spatial closeness and shared category membership in most environments. This learned relationship between spatial closeness, shared category membership, and similarity is summarised in the *Clumpiness Principle* (Casasanto, 2008), which posits that stimuli are clumped together in the environment, not just perceptually but also conceptually. Specifically, the *Clumpiness Principle* posits that "*physical closeness encourages construing stimuli as members of the same category*".

In the following, we investigate the consequences of spatial distance on this central antecedent for social comparisons, namely whether people construe stimuli as members of the same category or different categories as a function of spatial distance.

Distance, categorisation, and comparisons

Categorisation is a fundamental way for people to understand the world around them (Rosch, 1975; Rosch et al., 1976). Whether stimuli are categorised together or apart determines whether they will be compared in the first place because to be comparable, stimuli must"have some commensurability" (James, 1890, p. 528) along which the comparison can be aligned (Gentner & Markman, 1994). Because spatial closeness (i.e., proximity) is associated with shared category membership, spatial and, thereby, conceptual closeness becomes a predictor for what will be selected as a comparison standard.

We thus predict that when stimuli are presented close together, as compared to far apart, people will prefer to categorise the stimuli as belonging to a shared superordinate category (e.g., fruit) over belonging to separate basic categories (e.g., apple and orange). In the following, we present the respective evidence from Schneider and Mattes (2022).

In Experiment 1A, Schneider and Mattes (2022) first tested the likelihood of construing two stimuli as part of the same category between participants in a distal and proximal condition, with 182 participants from Amazon Mechanical Turk (104 males, 77 females, one unreported; *M*age = 37.57,

*SD*age = 11.57) in an online survey. Participants saw ten stimulus pairs (e.g., orange/apple; gun/knife; pea/carrot; see Figure 7 for an example) and responded to the question: "Please label these images". We counted the construal as a shared category when the same label described both objects (i.e., "Fruit") and as separate when participants used different labels ("Orange" and "Apple"). As Figure 8's left panel shows, participants were more likely to categorise the stimuli into a common category when they were close.

This influence of spatial closeness on categorisation seems moderated by the degree of prototypicality of the stimuli or the degree to which a stimulus is considered typical for a category (Rosch, 1975). This qualification was shown by Experiment 1B. Experiment 1B used the same setup but with less prototypical stimuli (e.g., lemon an mango as fruit stimuli). Despite an increased power ($N = 802$, recruited from Amazon Mechanical Turk, 388 males, 412 females, two other; *M*age = 38.21, *SD*age = 11.95), participants hardly ever used shared categories to describe the pairs of stimuli, and the difference between close and far stimulus pairs was not statistically significant (see Figure 8, centre panel). Although speculative, this finding suggests that when the relation of the stimuli to an overarching category is weak, spatial closeness might not be enough to make them "go together".

Experiment 2 in Schneider and Mattes (2022) then used a different approach; rather than asking for free response, participants rated how likely they would prefer to categorise the stimuli into a shared category (e.g., from "apple & orange" = 1 to "fruits" = 10). The experiment realised the proximal and distal conditions within-participants and recruited 344 participants from Amazon Mechanical Turk (174 females, 170 males; *M*age = 38.59, *SD*age =

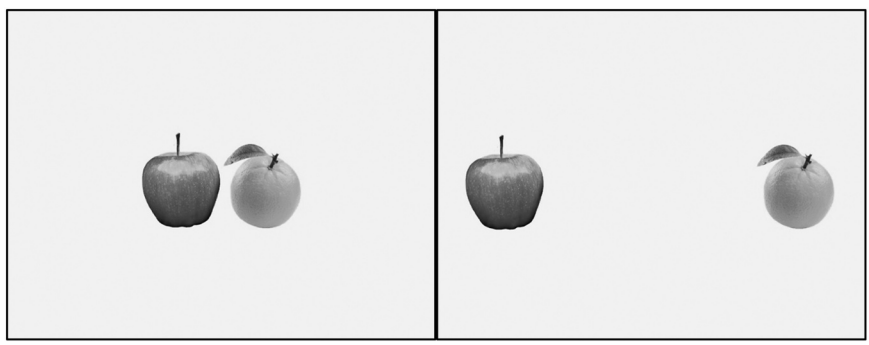

Figure 7. Example stimuli from Schneider and Mattes (2022). The left picture depicts a stimulus pair in the close (proximal) condition. The right picture shows the same stimulus pair in the far (distant) condition. Figure adapted from Schneider and Mattes (2022).

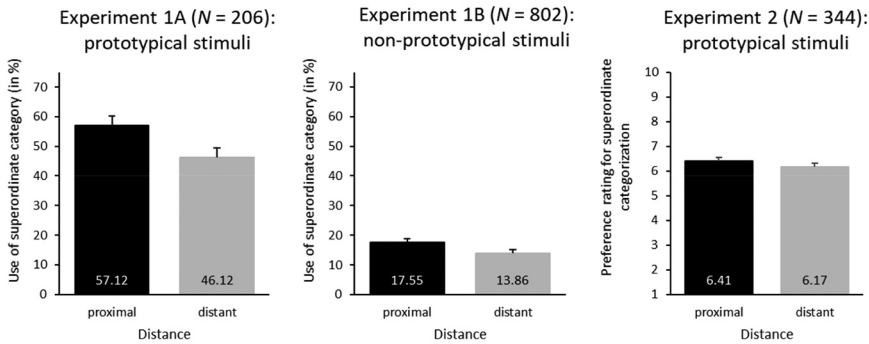

Figure 8. Results of Experiments 1A (left), 1B (centre), and 2 (right) from Schneider and Mattes (2022) illustrating the relation between spatial distance and object categorisation. Spatially close stimuli are more likely to be categorised in a common superordinate group than spatially far stimuli, but only if they are sufficiently prototypical. Experiments 1A and 1B display the use of superordinate categories (in percentages) for close (proximal) and far (distant) stimulus pairs. Experiment 2 displays the mean rating for distant and proximal stimulus pairs, with higher rating scores indicating the tendency towards the superordinate category and lower rating scores indicating the tendency towards the basic category. Error bars represent the standard errors of the means.

11.88). As Figure 8's right panel shows, participants preferred shared category labels when stimuli were close than when they were far apart.

Together, these experiments show that spatial distance influences categorisation processes. For stimuli with strong associations with an overarching category, such as *apple* and *orange*, to the category FRUIT, proximity makes it more likely that stimuli are categorised in superordinate categories. Such shared category membership makes it more likely that people will engage in similarity search, which means that categorisation fundamentally influences comparison processes (Mussweiler, 2003).

Summary of spatial closeness and relativity

Spatial closeness is an important cue for the relationship between stimuli. Spatial closeness often indicates shared category membership and conceptual similarity in the environment. Thus, spatial closeness as a low-level, bottom-up cue may influence the type of comparison in which people engage. The *Selective Accessibility Model* (Mussweiler, 2003; Mussweiler & Gentner, 2007) posits that before comparing, people make a quick first judgement about the similarity of the stimuli at hand. Spatial closeness might influence whether this first judgement lands on "similar", making subsequent similarity-testing more likely, or if it falls on "dissimilar", making dissimilarity-testing more likely.

This section provided indirect evidence from our work suggesting that spatial distance indeed influences the relativity of stimuli. First, by making shared category memberships cognitively accessible, closeness makes stimuli more comparable (Gentner & Markman, 1994). The superordinate grouping, encompassing properties of different stimuli, makes shared properties salient. Thus, the effect of closeness on categorisation might make comparison possible in the first place. Secondly, because spatial closeness provokes superordinate categorisation, it may not only facilitate the occurrence of comparison but also shape the comparison process itself. For instance, shared social group membership induces different mechanisms for comparisons than non-shared group membership: Specifically, targets are more likely to be assimilated to a standard when both of them share the same category or group membership compared to when they do not belong to the same category (Bless & Schwarz, 1998). Understanding the when's and how's of the influence of spatial distance on relativity is thus a fruitful avenue for future research.

Section 5: Motivational effects of comparisons

So far, in exploring relativity in various areas, we have remained on the cognitive level of relativity (e.g., when does one observe assimilation and when contrast), with evaluative consequences (e.g., similarities are usually good, differences are bad; relative positions in space may be good or bad due to compatibility effects), and how spatial locations influence the construal of stimuli (e.g., same or different categories). However, if our bold claim that relativity is one of social cognition's general principles is to be substantiated, we should also find consequences of relativity and the underlying social comparison effects on motivation. Indeed, Leon Festinger himself used motivational concepts such as the notion that humans have a *drive* to evaluate their abilities and opinions accurately (*self-evaluation*), but also hypothesised a "unidirectional drive upward", a want to continually improve one's ability upwards (*self-improvement*). However, even though Festinger's view of self-evaluation is consistent with a dominant theme of accuracy motivation and his early notion of self-improvement accords well with the areas of achievement motivation and observational learning (Atkinson & Feather, 1966; Bandura, 1986), social comparison research also revealed a third motive, *self-enhancement*, reflecting the notion that people often aim to protect and enhance their self-esteem, often at the sacrifice of accuracy (Suls et al., 2002; Trope, 1986; Wood, 1989); for example, by comparing downwards to boost one's self-esteem.

Social comparison research has thus recognised at least three motives, *self-evaluation*, *self-improvement*, and *self-enhancement*. These motives are partially incompatible "background goals" of social comparison effects that may

vary from individual to individual and become temporarily activated by the situation, such as when a salient self-threat activates the motive for self-enhancement (Wills, 1981). However, these social comparison motives have not been integrated tightly with frameworks of human goal pursuit and action. This section aims to provide a framework that connects the concept of relativity with its core process of social comparisons with actual motivated, goal-directed behaviour and self-regulation.

A framework for linking social comparisons and self-regulation

Self-regulation, or the pursuit of nontrivial goals (Carver & Scheier, 1981, 1982), is a feedback loop whereby individuals compare their current standing or actual state with a salient reference standard. The outcome of this comparison process is a discrepancy assessment. Notably, the sign and extent of the ensuing discrepancy have quite divergent motivational and emotional implications. Our proposed new look interlinking social comparison with the self-regulation process rests on two main propositions.

The first proposition is that the salient reference standard stems from observing other people in one's environment. (Festinger, 1954; Wood, 1989). The second proposition is that the motives generally considered within social comparison research (i.e., self-evaluation, self-improvement, and self-enhancement) are conceptually linked to different phases and comparison outcomes of the self-regulation feedback loop. Table 2 summarises the relation of the three motives with the comparison goal, the comparison direction, and the motivational effects.

The *self-evaluation motive* most closely corresponds to the *comparator* or discrepancy-assessment stage of the self-regulation process. The key function of self-evaluation is to gather information about one's standing on a given comparison dimension. To do so, available information from all sorts of available social comparison standards is attended to (lateral direction of comparison), and this information needs to be processed and integrated as accurately as possible. Please note that this lateral comparison implies comparisons with similar and relevant others, as outlined in the introduction (i.e., scientists rarely compare themselves with pre-schoolers to assess their mental abilities).

Self-improvement corresponds to the likely motivational consequences ensuing from a *negative* discrepancy assessment. Specifically, we propose that self-improvement best characterises the motivational state in which people are engaged in pursuing their goals and investing effort and time. This goal-pursuit is also called *pushing*, following Fulford et al. (2010). Thus, the discrepancy is negative if the actual standing starts to undershoot the standard. In this case, the person is likely to invest additional effort to progress towards the standard, that is, to reduce the discrepancy. In affective

Table 2. Mapping of key motives from social comparison literature to motivational states in self-regulation research.

Motive	Goal of Social Comparison	Direction of Comparison	Motivational Effects for Goal Pursuit
Self-Evaluation	Gathering information about oneself (e.g., abilities)	↔ lateral	Self-assessment: Detection of discrepancies between actual standing and salient comparison standard
Self-Improvement	Aiming to achieve something worthwhile	↑ upward	Investing effort aimed at discrepancy reduction (*pushing*) But: Possibility of disengagement if discrepancy is too large (*disengagement*)
Self-Enhancement	Improving self-esteem	↓ downward	Effort reduction (*coasting*)

terms, this motivational state can be described as *ambivalent*: on the one hand, people may feel inspired and hopeful, but since success is uncertain, it can also take on a more pessimistic note (Carver & Scheier, 1981, 1990).

However, self-regulation theory and various related frameworks also predict a *nonlinear* pattern of effort investment or engagement (Brehm & Self, 1989; Carver & Scheier, 1981; Carver, 2004; Klinger, 1975), such that if the actual standing is *too far* below the comparison standard, the standard is perceived to be out of reach. Hence, the person tends to disengage from further effort investment. In affective terms, this motivational state can be described as *negative*. It can be threatening to one's self-concept and self-esteem (e.g., finding out that one's partner receives a far better biological age test score) and has been linked to sadness and even depression (Carver, 2004; Carver & Scheier, 1990).

Hence, self-regulation theory predicts that there is an optimum of motivational potential – which we term the *maximally effective standard* (MES) – within the possible distribution of available comparison standards in the social environment. Up to that point, increasing discrepancies between own standing and the standard increase the effort people are willing to invest for self-improvement/change; beyond that turning point, larger discrepancies reduce invested effort.

Self-enhancement, in contrast, characterises a situation in which the actual standing overshoots the standard such that the discrepancy is positive. The predicted motivational response is a *"coasting"* pattern, characterised by a reduction in effort investment and a shifting/reorientation towards other priorities. In affective terms, this motivational state can be described as *positive* (i.e., happy, content, delighted) and beneficial for one's self-concept of abilities and self-esteem (Carver, 2004; Carver & Scheier, 1990). Thus, whereas the former focus of social comparison research has been chiefly on the self-enhancing nature of downward comparisons (Wills, 1981), a self-regulation lens would allow one to recast a boost in state self-

esteem associated with downward comparisons during goal pursuit as the emotional readout of a "coasting" response signalling that enough progress has been made, rather than a mere "boasting" response.

Putting the framework to the test: Social comparisons in everyday life

To test the predictions derived from this framework and several additional research questions, we sampled social comparisons as they happen in people's natural environments, thus adding a high degree of ecological validity to the test (Diel, Broeker, et al., 2021). In a preregistered experience sampling study, we collected detailed self-reports from a heterogeneous 454 German participants (318 female, 136 male; *M*age = 29.32, *SD*age = 8.81), recruited via panels and research data-bases, social media platforms, and flyers at the University of Cologne. We collected data on more than 5,500 social comparison situations from their everyday lives over five days.

The data showed that social comparisons were quite frequent, as participants reported that they engaged in a social comparison since the last signal (i.e., a time window of about 2hrs) on about 30% of the measurement occasions. These social comparisons were spread over a large number of life domains, with the most prevalent domains of comparisons being academic- and work-related (23.7%), sport- and fitness-related (11.1%), as well as appearance/looks-related (8.3%). Social comparisons of upward (41.1%) and downward (42.2%) occurred at comparable frequencies. The remaining 16.4% were lateral comparisons. Most importantly, multilevel analysis, including non-linear terms (i.e., quadratic, cubic, quartic), accounted for significant portions of variance and showed that social comparison direction and motivational states were linked in mostly nonlinear ways (see Figure 9).

Pushing

As predicted, there was a tendency for increasing levels of upward comparison to boost motivation, but only up to a certain point, after which the strength of the pushing tendency declined again (Figure 9, solid line). As pushing declined at high levels of upward social comparison, there was a relatively steep acceleration of people's tendency to disengage from the implied goal (Figure 9, dotted line; disengagement). Together, the pattern for these two tendencies shows that there is an optimum level of upward social comparison beyond which motivation to invest further effort declines.

Coasting

In contrast, increasing levels of downward comparison were associated with an increased tendency to coast, and this relationship could best be described as linear (see Figure 9, dashed line). Additional analyses revealed that state

self-esteem was closely associated with the motivational coasting response, as indicated by their substantial multilevel correlation of $r = .48$.

Additional analyses showed that the above pushing response was more pronounced when people considered the goal domain in question as highly important to themselves, as well as when they perceived a high degree of control over behaviour in this domain (Diel, Broeker, et al., 2021). These moderator findings underscore the notion that the pushing-function captures how social comparisons affect people's agentic attempts to progress in these goal domains.

The motivational framework presented could be further validated in a field study following a sample of first-year students from an elite sports university over one semester with weekly assessments of their social comparison experiences (Diel, Broeker, et al., 2021). Again, the general pattern of the three motivational tendencies was highly similar to the findings from the experience sampling study reported above, adding further generalisability from a highly applied domain of social comparisons. Furthermore, the results are consistent with a set of earlier experiments reported in Diel and Hofmann (2019), in which we found across three studies that a comparison to a moderate upward standard consistently boosted motivation relative to

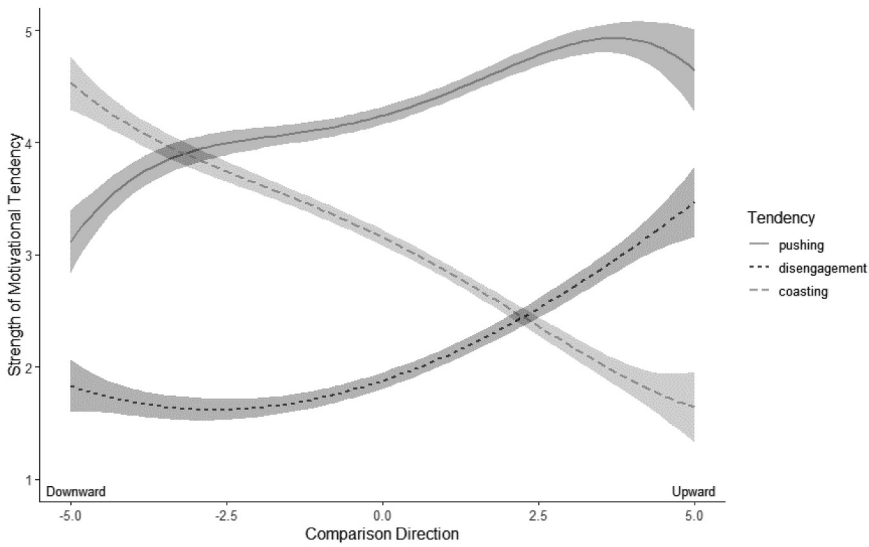

Figure 9. Multilevel regression predictions of the three motivational tendencies of pushing, disengagement, and coasting, measured on a scale from 1 to 5, as a function of comparison direction (x-axis), measured on a scale from extremely downward (−5) to extremely upward (+5). Ribbons around regression lines indicate the standard error of prediction.

an extreme upward standard and especially so in relation to downward social comparison standards.

Summary and implications of comparison's motivational effects

The reviewed empirical work shows the connections between relativity and comparative thinking to people's motivation and their everyday goal pursuits. For social comparison research, in particular, the neglect of motivational principles, or their treatment as contextual background factors, obstructs a deeper understanding of the connection between social comparison processes and actual *behaviour*. Despite decades of research into social comparison processes and many important insights, what remained largely unclear is how the postulated motives and the resulting comparisons may interlock in producing self-regulated behaviour. Here, we argued that the role of these motives might be better understood by rethinking them as functional (i.e., adaptive) states that support and channel goal pursuit and self-regulation.

Let us provide three brief illustrations of why such a new motivational look at social comparison matters. First, the social comparison literature focuses on *comparative judgements* rather than the *behavioural implications* of social comparison. This largely experimental literature has produced much evidence for assimilation vs. contrast in judgement as a function of standard extremity (Gerber et al., 2018; Mussweiler, 2003). However, the present findings show that what is known from comparative judgements does not transfer one-on-one onto the motivational dimension. Specifically, in none of our studies was there any indication of a motivational boost at rather extreme downward comparisons, as might be expected from a transfer of this literature. Instead, we believe that assimilation and contrast may be best seen as shaping people's subjective perception of self-other discrepancies at the *self-evaluation/self-assessment stage*. However, how such discrepancies translate into tangible motivational effects such as effort investment or emotional consequences seems an entirely different story that may best be told through a motivational narrative.

Second, the neglect of motivation may have led to a problematic focus on the self-esteem implications of downward social comparison. This body of literature claims that downward social comparison serves self-enhancement (Wills, 1981). Whereas we do not seek to challenge the evidence for self-enhancement as a universal motive in social psychology, we believe this effect might just as well be viewed as the emotional readout of a "coasting" response signalling that enough progress has been made. Future research is needed to disentangle whether and when downward comparisons may reflect "coasting" or "boasting," respectively.

Third, a motivational focus in combination with a more fine-grained, non-linear methodological approach may facilitate the search for the

maximally effective standard of upward social comparison. Where is the optimum across settings? Does it differ by domain, person, and further context? —Arguably, this is an empirical, big-data question, but we hope that the present approach presents a good starting point for thinking about novel research designs that may help address this big and thorny issue (i.e., beyond the classic 2×2 design).

Finally, for the present review, it highlights the importance of relativity in understanding self-regulatory processes, motivation, and goal pursuit.

Section 6: Comparisons and automatic imitation

The previous section showed the influence of comparative thinking on self-regulation and behaviour; in this section, we move to automatic imitation behaviour. Almost by definition, automatic imitation does not rely on motivation and self-regulation. Thereby, we aimed to test if even behaviours that seem, by and large, context-independent may be influenced by comparative thinking. To do so, we first provide a brief overview to illustrate the relevance and importance of this ubiquitous aspect of social interactions and then present empirical data to show comparison processes' role in automatic imitation behaviour.

Automatic imitation

In social cognition research, automaticity has several features. A process is considered automatic when it is unintentional, unaware, efficient, and uncontrollable (Bargh, 1994). However, all four features are rarely present. Research on automatic imitation showed that imitation is an unintentional and, to a certain degree, uncontrollable process (Heyes, 2011). For efficiency, past research has demonstrated that automatic imitation takes place very fast and even under conditions of reduced attention and high cognitive load (for a review, see Cracco, Bardi, et al., 2018) and can thus be considered efficient. However, the degree to which people are aware of automatic imitation is still a matter of investigation.

Individuals automatically imitate a wide range of behaviours, including facial expressions (Dimberg, 1982), characteristics of language (Cappella & Planalp, 1981), emotions (Hess & Fischer, 2016), postures (LaFrance, 1982), gestures (Cracco, Genschow, et al., 2018), or even simple movements (Genschow & Florack, 2014; Genschow & Schindler, 2016; Genschow et al., 2013).

Several theories argue that automatic imitation is based on a shared mental representation of observed and executed actions. For example, ideomotor theory (e.g., Greenwald, 1970; Prinz, 1990, 1997) proposes that the perceptual representation of an action is part of its motor representation. As a result, the observation or anticipation of an action (Genschow & Brass,

2015; Genschow, Groß-Bölting, 2021; Genschow et al., 2018) evokes the same representation as the execution of this action. This shared representation then increases the likelihood of executing the observed action.

Moderators of imitative behaviour

While the idea of a shared representation suggests that individuals constantly map their actions onto others automatically, other research suggests this is not always the case. For instance, research found a decrease in imitative behaviour when individuals are faced with out-group members (e.g., Genschow & Schindler, 2016), interact with non-human agents (e.g., Bird et al., 2007; Liepelt & Brass, 2010; Longo & Bertenthal, 2009; Press et al., 2005), are in a competitive mode as compared to a cooperative mode (e.g., Weyers et al., 2009), or when they observe actions from a third-person perspective rather than a first-person perspective (Bortoletto et al., 2013; Genschow et al., 2013; Lamm et al., 2007; Vogt et al., 2003)

Typically, such moderating influences are explained with a motivational account (Chartrand & Dalton, 2009; Wang & Hamilton, 2012), suggesting that individuals imitate others because they expect social benefits from this behaviour. As a result, individuals should imitate others more strongly when they have an affiliation goal (Lakin & Chartrand, 2003). However, these accounts remain silent about the basic cognitive processes underlying the social modulation of imitative behaviour.

Social comparisons as an explanation for moderating influences on imitative behaviour

We believe that the present relativity principle and the underlying comparison processes (Mussweiler, 2003) offer a framework that integrates different social moderators of imitative behaviour. As argued above, people engage in spontaneous and automatic hypothesis testing assessing their similarity or dissimilarity from social comparison standards. Testing for similarities leads to the activation of self-related knowledge in line with this similarity hypothesis and, in turn, to self-evaluative and behavioural assimilation. Testing for dissimilarities leads to the activation of standard-inconsistent knowledge and, in turn, to contrast.

Initial support that social comparisons, and focusing on similarities versus differences in particular, may account for social modulation of automatic imitation comes from self-other overlap theories (e.g., Brass & Heyes, 2005; Heyes, 2010). These theories suggest that imitative tendencies are learned responses that develop due to self-observation and interaction with others, often similar (Efferson et al., 2008), individuals (Brass & Heyes, 2005; Cook et al., 2014; Heyes, 2010; Ray & Heyes, 2011). Consequently, people should

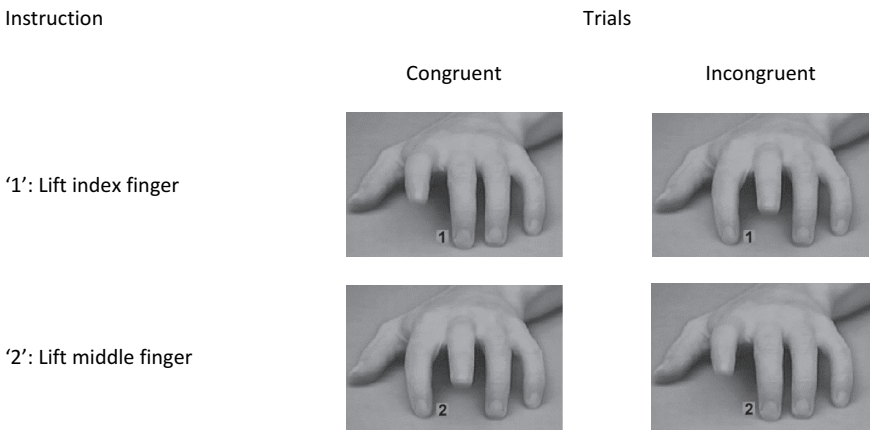

Figure 10. Trial structure of the imitation-inhibition task (Brass et al., 2000). In the congruent trials, the required response matches the observed response. In the incongruent trials, the required response does not match the observed response, and participants must suppress the automatic imitation behaviour.

imitate others more who are perceived as similar than those who are perceived as dissimilar (Cracco, Bardi, et al., 2018).

Recently, we (Genschow, Cracco, et al., 2021) tested this prediction using the imitation-inhibition task (Brass et al., 2000; see Figure 10 for an illustration)—a standard measure to assess automatic imitation tendencies. In this task, participants respond to two different cues by either lifting the index or the middle finger (i.e., depending on the cue). At the same time, participants see another person's hand in a mirrored position, either executing a congruent (i.e., same finger) or incongruent (i.e., different finger) movement. The typical finding in such a task is that participants respond faster and with fewer errors for congruent than incongruent movements (for a meta-analysis, see Cracco, Bardi, et al., 2018). This congruency effect is evidence that individuals automatically imitate other persons' actions (Heyes, 2011). In three experiments, we (Genschow, Cracco, et al., 2021; Exp. 2–4) tested whether focusing on similarities versus dissimilarities influences the outcome of the imitation-inhibition task. The results across all three experiments showed that focusing on similarities increased participants' congruency effect compared to focusing on differences. Based on this finding and the assumptions put forward by the SAM (Mussweiler, 2003), one could predict that different forms of similarity between interaction partners should automatically lead individuals to focus on similarities and therefore increase their tendency to imitate the other person.

However, more recent findings questioned the idea that in-group members are imitated more strongly than out-group members (De Souter et al., 2021). Specifically, we (Genschow, Westfal, et al., 2021) let participants run

through the imitation-inhibition task in an online task. Depending on the experimental block, participants saw hands belonging to the in-group or the out-group. In Experiments 1 to 4, US participants responded to hands from other persons belonging either to their in-group (i.e., USA) or to different out-groups (i.e., Germany or China). The hand was shown with a glove and a flag above the hand (Exp. 1–3), or the country flag in the background and a face above the hand that matched the country (i.e., European features for Germany, Asian features for China). In Experiments 5 and 6, black and white participants responded to black and white hands; different from Experiments 1–4, the hands were computer-generated. At the end of each experiment, participants indicated how similar they perceived the other persons' hands.

Across all experiments, we found that although participants perceived in-group members as more similar than out-group members, they imitated in-group members not more (see Figure 11 for an overview of the results). Recently similar results (De Souter et al., 2021; Genschow et al., 2022) were obtained when studying the influence of group membership in a slightly different imitation task, indicating that group membership does not influence imitation behaviour. However, it produces differences in the perceived similarity between interaction partners.

Summary of relativity, comparisons, and imitation

Genschow, Cracco, et al. (2021) found evidence that focusing on similarities, as compared with dissimilarities, increases individuals' automatic tendency to imitate others. This finding explains several moderating influences on automatic imitation previously documented in the literature. However, our research on group membership also indicates that not all variables that influence perceived similarity modulate automatic imitation. Although similarity between interaction partners – and a focus on similarities in particular – influences automatic imitation, other factors may counteract the influence of similarity on imitative behaviour. Future research should test these inhibitory factors in more detail to shed further light on the relation between comparison processes and imitation. For our larger picture, this section also illustrates a failure to find a relativity influence in all instances, despite imitation being a social behaviour.

In the remainder, our following two sections move away from the more basic research areas and show the relativity principle within two more applied areas: moral and political psychology.

Section 7: Comparisons and moral psychology

After discussing the importance of relativity for basic cognitive processes, motivation, and imitation behaviour, we now turn to a more applied content

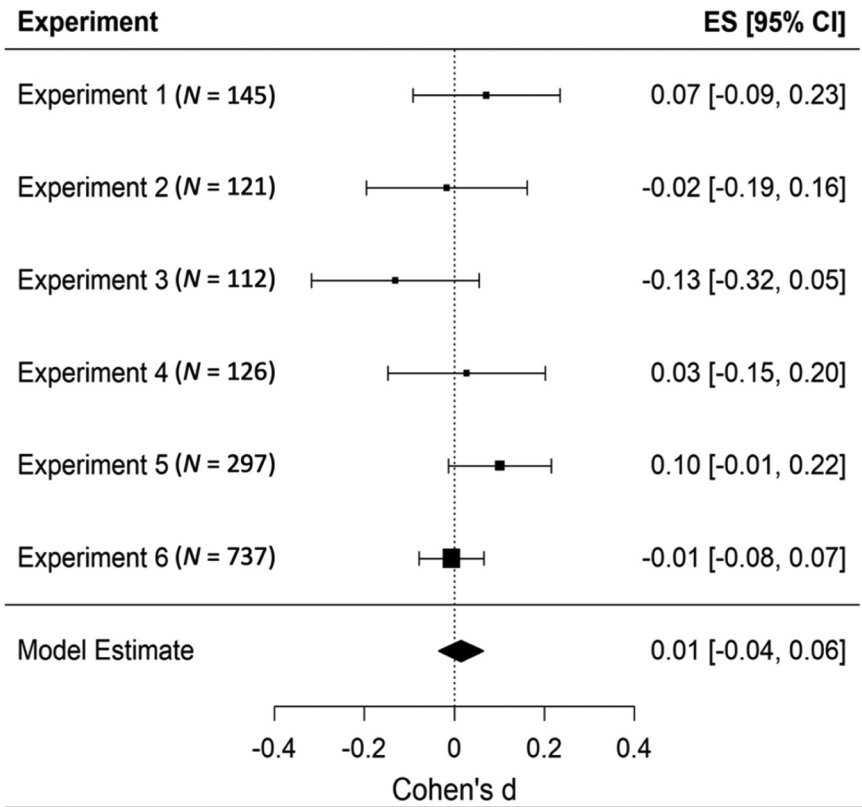

Figure 11. Internal meta-analysis for the difference in automatic imitation between in- and out-group members of Genschow, Cracco, et al. (2021)'s experiments. Sample demographics after exclusions were Exp. 1 (43.4% female; M_{age} = 37.54; SD_{age} = 11.98), Exp. 2 (38.8% female; M_{age} = 35.19; SD_{age} = 11.25), Exp. 3 (41.1% female; M_{age} = 39.52; SD_{age} = 11.22), Exp. 4 (33.3% female; M_{age} = 35.13; SD_{age} = 9.37), Exp. 5 (37.66% female, M_{age} = 37.66; SD_{age} = 11.25, and Exp. 6 (46.1% female; M_{age} = 28.03; SD_{age} = 9.49). We conducted all experiments online.

area that should be detached from relativity or comparative reasoning: Morality. Despite the philosophical school of moral relativism (e.g., "who am I to judge?"), morality is often considered absolute, not relative. Studying morality within a relativity framework represents thus an interesting approach and a strong test of the relativity principle. People quickly realise that the same person may be seen as small in Kenya but tall in Japan or that standards of taste and beauty differ across the globe. However, accepting the relativity of moral standards seems more difficult (Spinoza, 1994). For example, a common cultural symbol of morality, the Ten Commandments, expresses rules as absolute and inalterable – written in stone by a divine and

infallible hand. Moral judgements seem to differ from other judgements – in particular, they should not be relative.

Nonetheless, principles of relativity may also apply to moral judgements. Various findings show that the effects of comparisons with moral standards (once activated) follow general principles of relativity. For example, Nelson and Norton (2005) found that exposure to the category superheroes increases commitment to act morally, but exposure to Superman has the opposite effect (i.e., the typical exemplar vs. category effect in comparisons). This point fits with the comparison principle discussed in the introduction: categorical standards lead to similarity testing and therefore to assimilation effects, while comparisons with exemplars lead to dissimilarity testing and therefore contrast effects (Dijksterhuis et al., 1998; Mussweiler, 2003). As another example, if people witness someone who behaves dishonestly, they are more likely to behave dishonestly themselves, but only if they feel socially connected to him or her. If the immoral person is an outgroup member, they behave more honestly (Gino & Galinsky, 2012; Gino et al., 2009). This finding fits the principle that similarity testing and thus assimilation effects occur when the target and the standard belong to the same category, whereas dissimilarity testing and thus contrast effects occur when they belong to different categories (Mussweiler & Bodenhausen, 2002). However, although consistent, these findings on morality have not been discussed regarding relativity and comparisons.

Moral standard selection principles

Inspired by the examples above, we (Fleischmann et al., 2021) investigated whether the general principles of relativity and comparisons also apply to the process of moral standard selection. This question follows from the notion that before people compare themselves with a comparison standard, they first need to select the standard from the possible comparison standards (Mussweiler, 2003). When it comes to morality, one could compare oneself with a great number of upward standards (e.g., heroes, philanthropists, saints) or downward standards (e.g., villains, criminals). To investigate standard selection, we compared morality to various other commonly studied areas of comparison regarding three principles of standard selection: direction (i.e., upward vs. downward comparisons), threat (i.e., after a threat to the self, people compare downwards), and diagnosticity (i.e., only similar standards are relevant).

Direction

Again, a recent meta-analysis found that people generally prefer to compare upward (Gerber et al., 2018). However, regarding moral comparisons, we hypothesised that people *predominantly compare downward* (Fleischmann

et al., 2021). Morality is central to people's identity, and people aim to see themselves as moral (e.g., Monin, 2007). We tested this hypothesis using an experience-sampling methodology (Fleischmann et al., 2021; Study 1), with the same data described in Section 5 on motivation and comparison (i.e., Diel, Broeker, et al., 2021). We measured the direction (i.e., upward versus downward) and domain of the everyday social comparisons (e.g., academic, sports/fitness, or finances) of 454 Germans over five days. The specifics of the sample are described above.

Multilevel analysis regression showed that people compare more downward on the moral domain than they do on average on all other domains combined. We found that people only make downward comparisons more frequently regarding smoking cigarettes and alcohol consumption (although the latter effect was not significantly different). This pattern suggests that morality differs from other domains regarding the predominant comparison direction.

Threat

This principle holds that people tend to avoid upward and instead prefer downward comparisons after an aspect of the self on that same dimension is threatened (Hakmiller, 1966; Pyszczynski et al., 1985; Taylor & Lobel, 1989; Wills, 1981; for a meta-analysis see Gerber et al., 2018). Again, as morality is central to people's identity, we hypothesised that the *threat principle* is amplified because violating one's identity as a moral person is particularly threatening.

To test this hypothesis, we (Fleischmann et al., 2021; Experiment 4a) compared this tendency to avoid upward moral comparisons with a similar tendency in other domains. For example, participants (online; $N = 759$; 426 female, 331 male, 2 other; $M_{age} = 35$) were randomly assigned to recall personal anecdotes that made them feel good (low threat) or bad (high threat) about their morality or athletic abilities (both manipulated between participants). Next, they indicated their interest in reading upward vs. downward stories (within-participants). Focusing first on those who made moral comparisons, we found that although all participants expressed higher interest in upward stories, this effect was reduced by 89% among participants who felt threatened after they recalled a negative moral episode, resulting in a significant interaction. Although we found the same interaction pattern for the athletic domain, the overall interaction pattern was 79% smaller than in the case of moral comparisons. A similar interaction was found when comparing morality with economic success (i.e., good financial decision making; Fleischmann et al., 2021, Experiment 4b).

Diagnosticity

This principle holds that upward comparisons are only relevant when the comparison standard is close to or similar to the comparison dimension as the target (Tesser, 1988). Therefore, the effect of comparisons depends on the closeness and similarity of the comparison target (Corcoran et al., 2011; Festinger, 1954; Lockwood & Kunda, 1997; Major et al., 1991). However, we argued that moral comparisons violate this central principle because people treat their moral norms and values objectively correct, ignoring interpersonal, intergroup, or intercultural differences (Haidt, 2007; Shweder et al., 1987; Tetlock, 2003).

To test this hypothesis, we (Fleischmann et al., 2021; Experiment 6b) used a similar design, where we measured the preference for upward versus downward comparisons, when participants were threatened or not, on either their moral standing or their athletic abilities. This time, we used extreme comparison standards (online; N = 752; 387 female, 357 male, 8 other; *M*age = 36). In the case of moral comparisons, we used fictional descriptions of people who acted extremely positively (gave away all their possessions to the poor) or negatively (practiced medicine without a licence). Similarly, we used extreme comparisons in the athletic domain, such as people who won Olympic medals (positive) or could not do even the simplest sports (negative). We also used a pre-test (N = 200) to match these materials across conditions. Focusing on the main results, we found no interaction across the athletic comparison conditions, reflecting the lack of diagnosticity of stimuli. In contrast, across the moral threat we found a significant interaction, despite the same lack of diagnosticity. A similar pattern was found when comparing moral with economic success (i.e., good financial decision making; Fleischmann et al., 2021, Experiment 6b). Together, these results suggest that the diagnosticity principle is weaker for moral than for other comparisons.

Summary and implications of comparisons and moral psychology

Our findings show that morality, compared to other domains, shows overlap but also differences in the social comparisons that people make. Table 3 summarises our key findings between social comparisons and moral comparisons regarding standard selections.

As proposed in the introduction, our research illustrates that the same principles that guide perceptual judgements, such as the Ebbinghaus illusion, and more meaningful judgements, such as perceived academic abilities, also apply to the most consequential judgements, such as those on the moral domain. However, there are noticeable differences in the direction of comparison and the strength of central principles. In addition, recent developments in that field have focused on identifying the role of intuition and

Table 3. Key differences between moral comparisons and comparisons in other domains.

	Compared to most other domains, moral comparisons are:
Direction	Predominantly downward: people compare most with "sinners".
Threat principle	Stronger: those who feel threatened strongly avoid upward.
Diagnosticity principle	Weaker: even very distant comparisons are considered relevant.

emotion (Greene & Haidt, 2002; Haidt, 2007). This new focus is often presented as a reaction to older models of morality, which focused mainly on cognitive processes associated with moral thinking (e.g., Kohlberg, 1969). Although this trend advanced moral psychology, the focus on intuition should – we argue – not come at the cost of ignoring cognitive processes. Indeed, our findings show that cognitive processes, such as those involving comparison and relativity, may powerfully shape moral judgements.

Section 8: Comparisons and political psychology

Our final section aims to illustrate another applied area with even more real-world implications of the relativity principle. Specifically, we test notions of relativity and comparison in political psychology. This path follows an old tradition in political psychology, where basic research is used to uncover processes of political cognition. Ranging from research on prospect theory in political decision-making (McDermott, 2004; Quattrone & Tversky, 1988) to research on anchoring effects on judgements of the likelihood of international conflict (Plous, 1989), researchers have found that basic cognitive models offer surprising and original insights into political thoughts and behaviour at both the mass level (citizens, voters) and elite level (politicians and other decision-makers). At the same time, applying these theories to the field also informs theories – if only because it often shows that theories and principles cannot be applied one-on-one.

Temporal comparisons and political ideology

We sought to test the role that comparisons play in influencing political ideologies. In particular, we focused on temporal comparisons, meaning comparisons with earlier times in the past. We observed that in contrast to liberals, who focus only on the future implications of their political plans, conservatives often present their ideas as a way to return to the past (e.g., Kirk, 1953; Scruton, 1980). We found direct support for this link by comparing the tendency to enter in the Google search engine phrases focused on the past ("in the past", "the past", "past", and "used to be") with phrases focused on the future ("in the future" "the future", "future", and "will be") with the degree of political support for Republicans vs. Democrats in the 2016 and

2020 elections (http://www.cookpolitical.com/). This comparison yielded a positive correlation (meaning that people in states who support Democrats appear more interested in the future, while people in states who support Republicans appear more interested in the past. Figure 12 shows the comparison.

Based on this insight, we explored whether conservatives' and liberals' support for political ideas depends on the *temporal comparisons* made in those ideas (Baldwin & Lammers, 2016). Any political plan can be framed as a return to the past. For example, environmental policies are often framed as moving away from the current, polluted environment towards a future propelled by clean, alternative energy. However, those same policies can also plausibly be framed as a return to the past – the time before the industrial revolution, for example. Thus, one may influence policy support by changing the implied comparison of the respective policy.

To test this, we conducted a series of six studies focusing on pro-environmentalism – a stereotypically liberal issue in the USA. For example, in one study, we (Baldwin & Lammers, 2016, Study 6) created descriptions of two fictional charities and asked participants to distribute money (i.e., 50 US cents) between those charities. We recruited 194 Americans online (82 female, 112 male; $M_{age} = 37.76$, $SD_{age} = 12.17$; 55% self-identified liberal, 45% self-identified conservative). One charity made a comparison with the past ("Restoring the planet to its original state") and the other charity with the future ("Creating a new earth for the future"). We tasked participants with allocating funds to these charities. Figure 13 shows the results. As expected, conservatives allocated more to the past-focused than the future-focused charity, while liberals did the opposite. We found similar results in

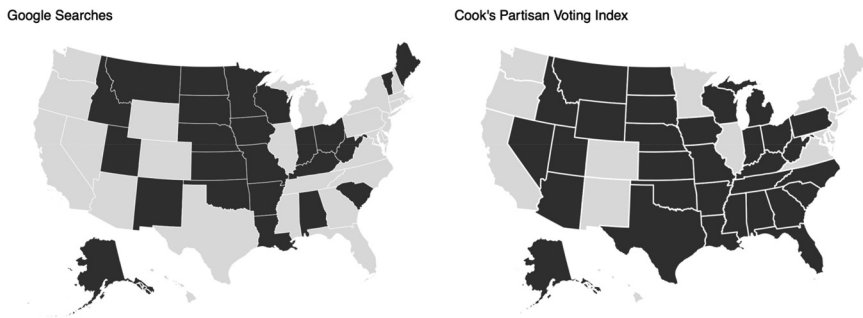

Figure 12. Citizens of conservative states focus more on the past than citizens of liberal states. Data are dichotomised for illustration. On the left, dark-coloured states have a stronger relative frequency of Google search terms focused on the past, while light states focus more on the future. On the right, dark-coloured states have a Republican majority and light states a Democrat majority. Voting and Google searches correlate positively across states, $r = .59$, $t(48) = 5.00$, $p < .001$, 95% CI [.37; .74].

five other studies (Baldwin & Lammers, 2016; but see Kim et al., 2021; for a failed replication, and Stanley et al., 2021 for inconsistent results).

The appeal of the past is not limited to American conservatives' opposition to climate change. Rather, in follow-up research, we found that conservatives in many parts of the world react more positively to a host of political plans if these are framed with a temporal focus on the past (Lammers & Baldwin, 2018). For example, a temporal focus on the past persuaded British conservatives to accept plans for a more lenient police force (Lammers & Baldwin, 2018, Study 2b) and German conservatives to accept Syrian refugees (Study 4). The appeal of the past can also undermine conservatives' attitudes. For example, American conservatives were less supportive of Donald Trump, when his typical blunt interpersonal style was framed as a deviation from the past etiquette, rather than a return to the past's lack of political correctness (Lammers & Baldwin, 2018).

Summary of comparisons and political psychology

Supporting our hypothesis of relativity as a general principle, we found that comparison processes strongly influence people's opinions about political ideas. Indeed, temporal comparisons with the past appear to be central to conservatives' political psychology. Appealing to it can lead conservatives to support policies that are fundamentally opposed to their ideological position,

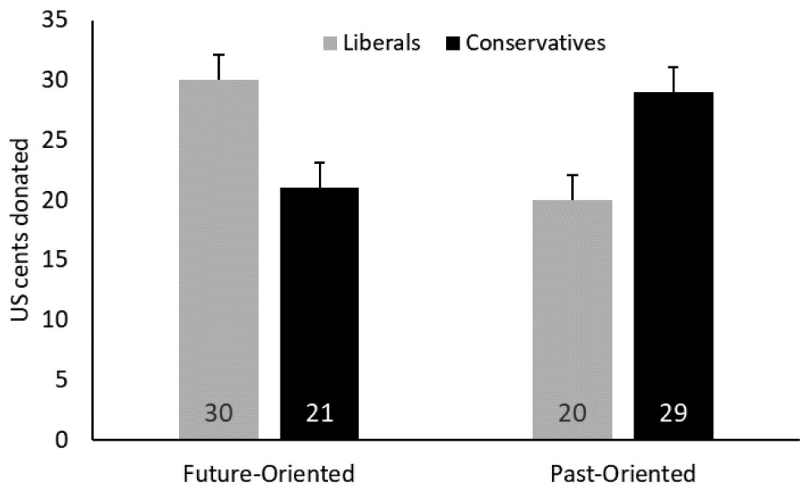

Figure 13. Participants' donation allocations as a function of the charities' temporal comparison (Future vs. Past) and participants' self-reported ideology. Error bars represent standard errors of the means. Due to the nature of the allocation measure, the means are not independent, as they must add up to 50c. The statistical analysis took this point into account.

as they prefer policy proposals or candidates that constitute returns to the past. This preference suggests that the past acts as a positive standard for conservatives, which they use to evaluate political stimuli as a comparison target. The more they focus on the similarities, the more positive their judgement of that policy or candidate. The more they focus on the dissimilarities, the more negative their judgement. This research shows that relativity is highly relevant in the political domain. After all, more than with almost any other domain, political ideas are not primarily the result of perceptions of society but instead of people's thoughts of how society *should be*. In other words, people's evaluation of society is strongly influenced by people's selection of standards and processes of comparison and thus resulting in perceived discrepancies. Hence, it is almost impossible to think about political issues without making comparisons. Therefore, we believe that future research that relies on notions of relativity can produce many novel and relevant insights.

General discussion

We proposed that social cognition is relative in nature. To substantiate this proposal, we illustrated the relativity's importance and the importance of comparative thinking in eight sections (cf. Table 1). The first four sections addressed basic processes influencing comparative thinking, while the latter four sections addressed influences of comparative thinking; on behaviours, both regulated and automatic, as well as the more applied aspects of moral and political psychology.

Our first section on the determinants of assimilation and contrast established a method and analysis that allows vigorous tests of comparison theories (Barker & Imhoff, 2021; Barker et al., 2020). The section also explains why Gerber et al. (2018)'s meta-analysis found little evidence for assimilation effects. For most people, Pope Francis is an extreme downward comparison standard on the athleticism dimension, while Serena Williams is an extreme upward standard, leading to contrast effects in judgements of athleticism. However, the "window of assimilation" (cf. Figure 1) might be much more difficult to hit and might vary from person to person. The first section thereby provides a strong methodological and theoretical advancement for research on classic social comparison phenomena.

The second section addressed a central assumption of the SAM (Mussweiler, 2003): People compare stimuli based on their similarities or differences. In combination with properties of the evaluative ecology (i.e., the frequency and diversity of positive and negative information; Unkelbach et al., 2019, 2020; cf. Figure 3), we predicted and found a novel effect, the "common good" phenomenon (Alves et al., 2017a). In a standard ecology, similarities are likely to be good, while differences are likely to be bad. This

insight has important implications if one again realises the ubiquity of comparisons and how often people look for differences (see Alves et al., 2018, 2020). The second section thereby also illustrates how comparative thinking may contribute to processes of stereotyping and, ultimately, prejudice.

The third section addressed another evaluative consequence of relativity, building on the relative location of stimuli in space (Gerten & Topolinski, 2020). Relativity is not only ubiquitous in the social but also in the physical domain. The third section showed the evaluative consequences of such relative location due to processing facilitations. While this might appear rather abstract and the effect rather subtle, the implications for real-world applications are straightforward (e.g., how to arrange quantities in texts and pictures). Our third section thereby illustrates novel relativity effects that have been so far overlooked in the literature.

Our fourth section returned to the question of which stimuli are considered as comparison standards and addressed spatial distance as a moderator. The section illustrated this point with an increased probability of jointly categorising two stimuli (Schneider & Mattes, 2022; cf. Figure 8). Thus, because close stimuli appear more similar, they should be more likely to be selected as a comparison standard. We have to concede, though, that the respective experimental evidence is currently lacking. In addition, we did not yet investigate the joint implication of section four's and section two, namely that close stimuli should also appear more positive compared to more distant stimuli (i.e., if they appear more similar, they should also appear more positive; Alves et al., 2017a).

Our fifth section then moved to a largely unexplored area of relativity and the corresponding comparative thinking, namely motivational effects (Diel and Grelle et al., 2021, Diel, Broeker, et al., 2021). The section shows how key motives postulated in social comparison research (i.e., self-evaluation, self-improvement, and self-enhancement) map onto comparison directions (i.e., lateral, upward, and downward), resulting in corresponding effects for goal pursuit from upward and downward comparisons (i.e., "pushing" or "disengagement" vs. "coasting", respectively). The theoretical framework and the data provide a step from the cognitive judgement effects (e.g., self-esteem) to actual behavioural effects of relativity and social comparisons.

The sixth section continued the path towards behavioural effects of comparison. However, instead of motivated behaviour, the section addressed automatic imitation, which occurs between interaction partners (Genschow, Cracco, et al., 2021). The straightforward hypothesis, derived from the similarity function between a target and a standard, was that more similar targets should lead to stronger imitation behaviours. We could confirm this prediction initially (Genschow, Cracco, et al., 2021): If participants focus on similarities between themselves and the other person, they show more

imitation behaviour. However, when we manipulated searching for similarities and differences not directly (as we did in the previous sections) but more indirectly via group membership (Genschow, Westfal, et al., 2021), the influence was no longer visible (cf. Figure 11). The similarity/difference perspective explains and unifies several documented moderators on imitation behaviour. However, the subtler effects of group membership failed to produce the predicted effects.

The seventh section advanced the relativity principle into the area of moral psychology. We found major differences between moral and social comparisons (cf. Table 3; Fleischmann et al., 2021). Despite these differences, the section highlights the usefulness of an over-arching empirical framework. While theories of emotion and intuition strongly influence moral psychology, the section provides relevant insights from a social-cognitive comparison perspective.

Our last section applied the relativity principle to political psychology, showing that Republicans (in the US) accept pro-environmental messages more when the message is framed as a comparison to the past ("Restoring the planet") rather than a comparison with a potential future ("Creating a new earth"; Baldwin & Lammers, 2016; Lammers & Baldwin, 2018).

Together, these eight sections lines show the usefulness of an overarching theoretical framework, here, what we termed the relativity principle, to generate new insights into novel areas (e.g., self-regulation, imitation, morality, and political psychology) and to understand existing (i.e., social comparison) phenomena better. Given both the breadth and depth of the reviewed results, we thus believe our review suggests that Festinger (1980, p. 246) was correct in his assumption that universal dynamics can be found in all of social psychology. At the very least, such universals provide a lens through which one can gain new perspectives on classic and contemporary research topics.

Limitations

Despite the overall success of applying the relativity principle and the processes of comparative thinking to different areas, we must concede that our approach is flawed. It amounts to what Karl Popper (1934) called a confirmatory research strategy: We postulated that swans are white and went on to search for white swans (i.e., confirmatory evidence). We agree that science advances best by searching for black swans, that is, by trying to falsify a hypothesis.

However, one may also construe our strategy more positively. First, to stay within the metaphor, we provided some conceptual and theoretical clarifications on how to test if a swan is white (e.g., when does assimilation and contrast occur), antecedents of why the swan is white (e.g., spatial distance),

and consequences of the swan being white (e.g., similarities are typically positive). Second, we discovered some unknown swan species (e.g., motivational effects) even in areas where one might assume that there are no swans (i.e., see Section 7 on moral psychology).

Our reviewed data might nevertheless represent only a small percentage of a larger psychological universe where relativity and comparative thinking play no role at all. This problem is not specific to the presented research program. It applies to every empirical investigation that does not rely on a representative sample (Brunswik, 1955) and inductively makes bottom-up inferences from a sample to a population (Becker et al., 2021). In our case, the sample is not participants and a population of people but a sample of research areas. Thus, our review is suggestive but cannot provide conclusive evidence for our claim.

Conclusion

Festinger (1980) searched for universal dynamics in social psychology. Just like physics relies on four fundamental forces – gravity, electromagnetism, weak and strong nuclear force – to explain relations among entities, social psychology needs a handful of principles to explain various social behaviours. Identifying and applying such overarching principles has enormous integrative potential. With this review, we believe we illustrate this point for the principle of relativity, in addition to solving old problems and discovering new, fascinating areas for further research.

Disclosure statement

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