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Abstract

Comparison asymmetries are most often explained in terms of underlying asymmetries in the perceived similarity of the comparison items, which in turn are seen as arising from the differential weighting of distinctive features of the target and base representations. In two experiments, we fail to confirm the predictions of the standard account. Rather, comparison-asymmetry effects seem to follow from two general principles. First, certain items act as cognitive reference points that other, less prominent category members are located in terms of or assimilated to. And second, the target and base terms of a comparison play different semantic roles, with the target acting as the figure and the base acting as the ground.

Introduction

The notion that similarity is a symmetric relation is highly intuitive. After all, if one claims that limes are similar to lemons, this would seem to entail that lemons are also similar to limes. This notion is further supported by the observation that many connotations can be stated either directionally, as in ‘Limes are similar to lemons’, or non-directionally and reciprocally, as in ‘Lemons and limes are similar to each other’. Nevertheless, comparison asymmetries often behave asymmetrically. For example, Tversky (1977) showed that people frequently prefer one direction of comparison (e.g., North Korea is similar to China) over the other (e.g., China is similar to North Korea). Such asymmetries are even more pronounced in metaphors and similes, for which only one direction of comparison may be meaningful. For example, whereas ‘time is like a river’ is an informative statement, ‘a river is like time’ is nonsensical. The general observation is that, whenever two items differ in prominence due to such factors as familiarity, salience, or concreteness, the less prominent item is compared to the more prominent item.

What is the source of these connotation asymmetries? That is, given that two items are recognized as being similar, why should one direction of comparison be more natural and meaningful than the other? Clearly, the answer to this question is in part to any psychologically plausible model of comparison. Indeed, the existence of connotation asymmetries has been used to argue for and against different theories of similarity (e.g., Tversky, 1977) and metaphor comprehension (e.g., Glucksberg & Keysar, 1990; Ortony, 1979). In this paper we evaluate two different accounts of the cognitive factors underlying comparison asymmetries.

The Standard Account

Comparison asymmetries are most commonly explained in terms of Tversky’s (1977) contrast model of similarity which predicts that, under certain circumstances, the similarity of item a to item b will actually seem greater than that of item b to item a. According to the contrast model, the perceived similarity of item a to item b, \( s(a, b) \), is given by

\[
s(a, b) = qf(A \cap B) - af(A - B) - bf(B - A)
\]

where \( A \) and \( B \) are the features of \( a \) and \( b \), \( f \) is a measure of salience, and \( q, a, \) and \( b \) are weights assigned to the feature sets. The basic idea is that the similarity of two items increases as a function of their common features and decreases as a function of their distinctive features. Symmetries in the similarity of two items are predicated in terms of the focusing hypothesis: Because the target (first term) of a directional comparison is the subject of the statement, it will receive more attention than the base (second term). This means that the distinctive features of the target are weighted more heavily than those of the base – that is, \( a > b \). Thus, the similarity of \( a \) to \( b \) will seem greater than that of \( b \) to \( a \) whenever \( b \) possesses the larger or more salient set of distinctive features.

Consistent with the contrast model, asymmetric similarity ratings have been obtained in a wide range of stimulus domains, such that less prominent items are seen as being more similar to more prominent items (e.g., Bartlett & Dowling, 1988; Holyoak & Gordon, 1983; Ortony, Vondruska, Foss, & Jones, 1985; Tversky, 1977). But how does this explain the fact that people typically prefer one direction of comparison between two items over the other? The standard answer is that, when interpreting a similarity comparison, the hearer seeks to maximize the similarity of the item s. In other words, people prefer North Korea is similar to
China over the reverse direction of comparison precisely because North Korea is judged as being more similar to China than the reverse – presumably reflecting differences in the situational complexity of the two items. In support of this position, both Tversky (1977) and O'rtuory et al. (1985) found that items in the preferred comparison order typically received higher similarity ratings than the same items in the non-preferred order.

To sum up, the standard account of comparison asymmetries makes two claims. First, comparison asymmetries reflect underlying asymmetries in the perceived similarity of the items. And second, these underlying asymmetries are due to attentional factors, such that the distinctive features of the target are weighted more heavily than the distinctive features or spatial density of the base.

Cognitive Reference Points

Although the contrast model has been widely adopted, there is an alternative explanation of comparison asymmetries – namely, that such asymmetries follow from principles of reference point reasoning (e.g., Gleim et al., 1997; Roesch, Shem et al., & Hur, 1998; Rosch, 1975; Shen, 1989). One of the central claims of this position is that certain highly prominent items act as cognitive reference points that other items are seen in relation to. Somewhat known examples of cognitive reference points are prototypes and ideals, which may be used to understand less prominent category members (Rosch, 1975), and the self-concept, which serves as a habitual landmark with respect to which the figure's site or path is defined. Thus, whichever item makes a better cognitive reference point will be the preferred ground of the sentence. In directional comparisons, this predicts that deviant items should be placed in the target position, and reference items in the base position.

Perhaps the most notable distinction between the standard account of comparison asymmetries and the reference point account is that the latter does not rely on the notion of underlying asymmetries in the perceived similarity of the comparison items. That is, one does not have to judge whether item a seems more similar to item b or item b seems more similar to item a in order to determine the preferred ordering. Rather, comparison asymmetries reflect the fact that deviant items are more congruent with the semantic constraints of the target position, and reference items with the semantic constraints of the base position. Simply put, using a cognitive reference point as the base of a directional comparison results in a more natural and informative statement.

Comparison of the Positions

Both the standard account and the reference point account are able to explain many of the comparison
asymmetries that have been observed in the literature, although sometimes using different mechanisms. In the present study, we sought to address an important limitation of existing research in this area. Specifically, the available evidence all exclusively involves asymmetrical comparisons for similarity, for which the two accounts make essentially the same predictions concerning which direction of comparison should be preferred. If one turns to consider the relationship between similarity and difference comparisons, however, then the two accounts can be shown to make distinct predictions.

According to the standard account, people prefer the direction of a similarity comparison that makes the perceived similarity of the target to the base. By analogy, then, people should also prefer the direction of a difference comparison that makes the perceived difference of the target from the base. This suggests that comparison asymmetries should go in opposite directions for similarity and difference statements, as asymmetrical comparisons in similarity and difference statements tend to be inversely related (Tversky, 1977). For example, if North Korea is seen as more similar to China than the reverse, then China will be seen as more different from North Korea than the reverse. Therefore, people should not only prefer North Korea is similar to China over China is similar to North Korea, they should also prefer China is different from North Korea over North Korea is different from China. In both cases, the preferred direction of comparison makes the value of the dimension specified by the comparison predicate.

In contrast to the standard account, the reference point account states that people simply prefer the direction of comparison that uses the better cognitive reference point as the ground, because this ordering makes the information in the statement easier. Given that the position of figure and ground in a statement should not be affected by the particular comparison predicate, the preferred direction of comparison between two items should place reference items in the base position for both similarity and difference statements. Thus, if people prefer North Korea is similar to China over the reverse, then they should also prefer North Korea is different from China over the reverse.

In addition to making different predictions about the direction of comparison asymmetries for similarity and difference statements, the standard and reference point accounts also make different predictions about the relative magnitude of such asymmetries. A comparison of Tversky's (1977) difference comparison will tend to place more weight on the distinctive feature sets than will similarity comparison. Because the standard account derives asymmetries from distinctive features, this means that difference comparisons should be more asymmetrical than similarity comparisons. In contrast, the reference point account suggests precisely the opposite - similarity comparisons should be more asymmetric than difference comparisons. Although the use of reference items to specify the location of deviant items is presumably equally important in both manners of comparison, conceptual assimilation of deviant items to reference items should be more likely to occur in similarity statements. As noted by a number of theorists, informal similarity comparison does not explain obvious commonalities; rather, they highlight nonobvious commonalities, and promote the creation of new ones through processes such as inference projection (e.g., Bowdle & Gentner, 1997; Medin et al., 1993). While less work has been done concerning the communicative functions of difference comparisons, it is reasonable to assume that difference comparisons are less likely to invoke such modes of conceptual assimilation. This is because difference comparisons serve more to suggest differences between items than to suggest commonalities. Thus, although there should be a general preference for comparing deviant item s to reference item s, the utility of doing so should be greater for similarity statements than for difference statements.

**Experiment 1**

In Experiment 1, we tested the central predictions of the standard and reference point accounts concerning comparison asymmetries. Subjects were given directional similarity or difference comparisons, each of which contained a less prominent (deviant) item and a more prominent (reference) item. All comparison were presented in both possible orders - with the reference item in the base position (e.g., A zebra is similar to/different from a horse) or in the target position (e.g., A horse is similar to/different from a zebra). For convenience, we will refer to statements with the first ordering of items as forward comparisons, and statements with the second ordering of items as reverse comparisons. For each comparison, subjects were asked to indicate the strength of their preference for one direction of comparison over the other. Again, the standard account predicts that comparison asymmetries should go in opposite directions for similarity and difference statements, and should be stronger for similarity statements. In contrast, the reference point account predicts that comparison asymmetries should go in the same direction for similarity and difference statements, and should be stronger for similarity statements.

**Method**

**Subjects.** Forty Northwestern University undergraduates participated in partial fulfillment of a course requirement.

**Materials and Design.** Each subject received 32 directional comparison between a less prominent (deviant) item and a more prominent (reference) item. The relative prominence of each item was initially determined by the authors and then confirmed by two judges. To ensure generality, the 32 comparisons involved eight categories of item: animals (e.g., zebra - horse), artifacts (e.g., motel - hotel), colors (e.g., tan - brown), countries (e.g., North Korea - China), emotions
effects should be stronger in similarity statements. Assimilation than difference statements, reference points are likely to elicit a greater degree of conceptual the reference point account: Because similarity statements, the directional preference \((M = 4.77, SD = 0.39)\) was significantly above the scale midpoint \((3.5)\), \(t_{(19)} = 14.66, p < .001\) and comparisons over reverse comparisons. For similarity statements, the directional preference \((M = 4.03, SD = 0.57)\) was also significantly above the scale midpoint, \(t_{(19)} = 4.14, p < .001\). For difference statements, the directional preference \((M = 4.03, SD = 0.57)\) was also significantly above the scale midpoint, \(t_{(19)} = 4.14, p < .001\) and \(t_{(31)} = 6.41, p < .001\). Thus, subjects consistently preferred comparison deviant item \(s\) to reference item \(s\) in both similarity and difference statements. This is consistent with the reference point account of comparison asymmetry effects: People prefer the direction of comparison that places the better cognitive reference point in the base position, regardless of the particular comparison predicate used.

Turning to the relative magnitudes of the comparison asymmetry effects, the preference for the flow and direction of comparison was higher for similarity statements than for difference statements, \(t_{(38)} = 4.83, p < .001\) and \(t_{(31)} = 10.31, p < .001\). A gain, this is as predicted by the reference point account: Because similarity statements are likely to elicit a greater degree of conceptual assimilation than difference statements, reference point effects should be stronger in similarity statements.

A symmetric in similarity and difference ratings

Contrary to the claim \(s\) of the standard account, the results of Experiment 1 suggest that comparison asymmetric effects are not due to underlying asymmetric effects in the perceived similarity or difference of the comparison item \(s\). If this were the case, then – assuming that humans seek to map maximize the value of the dimension specified by the comparison predicate – comparison asymmetric effects should have gone in opposite directions for similarity and difference statements. But how, then, does one explain the fact that comparison asymmetric effects are typically associated with asymmetric effects in similarity and difference ratings (e.g., Ortony et al., 1985; Tversky, 1977)? We suggest that such asymmetric effects might also be due to reference point reasoning.

According to the reference point account, the target and base item \(s\) of a directional comparison play different semantic roles, with the target acting as the figure and the base acting as the ground. Thus, information flows directionally from the base to the target, as when the base is used to generate new inferences about the target. A seeming that deviant item \(s\) are more easily assimilated to reference item \(s\) than the reverse, this means that assigning the reference item to the base position (flow and comparison) should result in a greater degree of conceptual assimilation than assigning it to the target position (reverse comparison). Therefore, forward and comparison should elicit higher similarity ratings – and lower difference ratings – than reverse comparison.

This explanation of ratings asymmetric effects is radically different from that offered by Tversky’s (1977) contrast model. In this model, the representations of the comparison item \(s\) are assumed to be in a static, and asymmetric effects are simply due to attentional factors. On the reference point view, however, the representations of deviant item \(s\) may shift towards those of reference item \(s\), thereby making the item \(s\) more similar. This view is, in fact, consistent with a fair amount of evidence. Indeed, asymmetric effects in conceptual assimilation are often associated with asymmetric effects in similarity ratings. For example, people not only make asymmetric inferences and predictions about others based on the self than vice versa (e.g., Kunda & Nisbett, 1988; McFarland & Miller, 1990), they also rate others as being more similar to the self than vice versa (e.g., Catrambone, Beike, & Niedenthal, 1996; Holyoak & Gordon, 1983, Stull & Gaelick, 1983). We propose that the latter effect may be largely due to the flow from the self to others, which makes others seem more similar to the self.

In sum, the reference point account can explain asymmetric effects in similarity and difference judgments, and in fact predicts the same directionality as the standard account. As was the case for comparison asymmetric effects, however, these approaches make different predictions about the relative magnitude of asymmetric effects in similarity and difference ratings. A according to the standard account, difference comparisons will tend to place more weight on the comparison item \(s\)’ distinctive feature sets than will similar comparison. Because the standard account derives asymmetric effects from precisely these stimulus properties, this predicts that directional difference ratings should be more asymmetric than directional similarity ratings. A according to the reference point account, however, this pattern of results
should not hold. This is because conceptual assimilation is more likely to occur in similarity comparisons. A seeming that conceptual assimilation is in fact a primary source of ratings asymmetries, then, directional similarity ratings should be more asymmetric than directional difference ratings.

**Experiment 2**

In Experiment 2, subjects were given the same directional comparison pairs used in Experiment 1, and rated either the similarity or the difference of both the deviant item to the reference item (e.g., How similar is a zebra to a horse?) and the reference item to the deviant item (e.g., How similar is a horse to a zebra?). A gain, the standard account predicts that difference judgments should be more asymmetric, whereas the reference point account predicts that similarity judgments should be more asymmetric. We also gave a second group of subjects nondirectional versions of these comparison questions (e.g., How similar is a zebra and a horse? or How similar is a horse and a zebra?). That is, these subjects were asked to rate either the similarity of or the difference between the two items without any specification of which item was the target and which was the base.

The inclusion of the nondirectional ratings condition was inspired by Catrambone et al. (1996), who argued that the most prominent item serves as a cognitive reference point for understanding the other item, then it should act as the implicit base of a nondirectional comparison. That is, nondirectional comparison judgments should be mentally translated into forward and backward comparisons, in which the target item serves as the reference item. Supporting this claim, Catrambone et al. found that nondirectional similarity judgments were rated as expressing the same degree of similarity as forward and backward similarity comparisons, and a higher degree of similarity than reverse similarity comparisons. In the present experiment, we sought to replicate this finding for similarity comparisons, and extend it to difference comparisons. If both nondirectional similarity and difference ratings are closer to forward than reverse ratings, then this would further support the claim that asymmetric ratings are due to reference point reasoning.

**Method**

*Subjects.* Eighty Northwestern University undergraduates served as paid subjects.

*Materials and Design.* Half of the subjects were assigned to the directional ratings condition, and half to the nondirectional ratings condition. In the directional condition, subjects rated all 32 comparison statements in a random order. Subjects gave ratings for both the forward and the reverse direction. The order of presentation of the two directions was counterbalanced within and between subjects.

In the nondirectional ratings condition, subjects received nondirectional versions of the 32 comparison statements. As in the directional condition, half of the subjects were asked to rate the similarity of the comparison item, and half the difference between the comparison item and the reference item. The order of presentation of the deviant and reference item was in a comparison (e.g., How similar are a zebra and a horse? versus How similar are a horse and a zebra?) was counterbalanced within and between subjects.

*Procedure.* Each subject was given a booklet containing the 32 comparison statements in a random order. Subjects gave similarity or difference ratings by circling a number on a 20-point scale below each comparison. For similarity ratings, the low end of the scale was labeled “not at all similar” and the high end “very similar.” For difference ratings, the low end was labeled “not at all different” and the high end “very different.”

*Results and Discussion.* Focusing first on the directional ratings, subjects gave higher similarity ratings to forward comparisons (M = 11.02, SD = 2.44) than to reverse comparisons (M = 9.84, SD = 2.69), t(19) = 3.93, p < .001 and t(31) = 6.57, p < .001. Likewise, subjects gave higher difference ratings to reverse comparisons (M = 13.12, SD = 2.26) than to forward comparisons (M = 12.44, SD = 2.35), t(19) = 3.29, p < .005 and t(31) = 3.42, p < .005. These results are consistent with both the standard account and the reference point account. More critically, however, the directional similarity ratings were more asymmetric than the directional difference ratings: The absolute mean difference in ratings between the forward and reverse comparison was nearly twice as large for similarity comparisons (M = 1.18, SD = 1.34) as it was for difference comparisons (M = 0.68, SD = 0.92). This is only consistent with the reference point account, according to which conceptual assimilation will result in asymmetric similarity and difference ratings but is more likely to occur in similarity comparisons. However, this difference in the magnitude of the ratings asymmetries was only marginally significant by items, t(31) = 1.91, p < .10, and not by subjects, t(38) = 1.38, p < .20.

Turning now to consider the entire pattern of ratings, the nondirectional similarity ratings (M = 11.42, SD = 2.71) did not differ from forward and/or similarity ratings, but were significantly larger than reverse similarity ratings, t(38) = 2.23, p < .05 and t(31) = 6.41, p < .001. This replicates the findings of Catrambone et al. (1996). Likewise, the nondirectional difference ratings (M = 12.10, SD = 3.12) did not differ from forward and/or difference ratings, but were significantly smaller than reverse difference ratings by items, t(31) = 4.25, p < .001, but...
not by subjects, t(38) = 1.58, p < .20. Thus, subjects seemed to interpret nondirectional similarity and difference com parisons as forward com parisons, in which the reference item played the implicit role of ground. This result cannot be explained by Tversky’s (1977) contrast model, and further illustrates the centrality of reference point reasoning in com parisons.

Conclusions

Our findings suggest that asym meta ses in sim ilarity and difference com parisons cannot be explained in terms of the differential weighting of static representations. Rather, they seem to follow from two general principles. First, certain items act as cognitive reference points that other items are understood in terms of via conceptual location or conceptual assimilation. And second, the target and base terms of a com parison play different sem antic roles – the base, acts as the ground, is used to understand the target, which acts as the figure. Thus, com parison asym meta ses reflect the fact that deviant items are more congruent with the linguistic constraints of the target position, and reference items with the linguistic constraints of the base position. D irectional com parisons are most informative when a cognitive reference point is used as the base. Further, this direction of com parison is most likely to result in higher sim ilarity ratings – and lower difference ratings – due to the increased potential for conceptual assimilation. In sum , the com parison process would appear to be far more dynamic than is commonly assumed, with reference-point reasoning playing a prominent role in both sim ilarity and difference.

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