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DISCOUNTING AND AUGMENTATION OF DISPOSITIONAL AND CAUSAL ATTRIBUTIONS

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This article investigates whether and how discounting and augmentation of dispositional and causal attributions differ between each other. In three experiments, the strength of a causal or dispositional attribution to a target actor (or object) was varied by manipulating the number of observations (i.e., sample size) of an alternative actor (or object). The results of Experiments 1 and 2 indicated that a greater sample size of the alternative actor (or object) resulted in greater discounting or augmentation of the target, and that this effect was alike for causal and dispositional attributions. This effect of sample size on discounting and augmentation cannot be explained by current algebraic attribution models, but is consistent with predictions from a connectionist framework. In Experiment 3, the extraction of information was made more difficult, and the effect of sample size on discounting and augmentation remained robust for causal attributions, whereas it disappeared for dispositional attributions. This failure for dispositional attributions was not predicted by any theoretical model. The discussion focuses on some potential explanations for this unexpected finding.

Introduction

For several years, the promising young Belgian tennis players, Kim Clijsters and Justine Henin, have been rising in the world top ranking. Now imagine that you just learn that they have teamed up in a doubles tournament and won the finals. You also learn that in the preceding months, Justine Henin won a series of important singles tournaments. Probably, you would tend to infer that Justine Henin is growing into a great tennis player. But what about Kim Clijsters? Lacking information about her past performance and knowing only that she just won the doubles with Justine Henin, would you believe that she is the lesser or better player? Questions like this – in which our dispositional judgments are influenced by comparisons with friends, heroes or similar others – are ubiquitous not only in sports, but in many aspects of social life, be it school, work or close relationships. If such com-

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parisons lead to lower dispositional attributions it is termed *discounting*, whereas if it leads to higher dispositional attributions it is termed *augmentation* (Kelley, 1971).

According to Kelley (1971) who introduced these terms, the discounting principle specifies that if there is a good explanation for an effect, perceivers will disregard other possible factors as irrelevant. Thus, if Justine's talent and past performances are sufficient to explain success on a doubles tournament with Kim, we tend to derogate the contribution of Kim in the win. The opposite tendency is described in the augmentation principle. It specifies that if there is a good explanation for failure, then to explain success, we need an especially strong facilitatory factor to compensate the failure. Thus, if Kim plays a doubles tournament with another amateur player who never won a tournament on her own, we tend to augment the contribution of Kim in explaining the win, as she presumably had to make up for the many flaws and mistakes of the amateur. Thus, unlike attributions to single causes, discounting and augmentation involve the *competition* between multiple causal factors, so that the stronger explanation wins over the weaker one. Numerous investigations have shown that these two competitive principles operate when possessing only minimal information (see Read & Montoya, 1999) as well as while taking in novel information (e.g., Hansen & Hall, 1985; Kruglanski, Schwartz, Maides, & Hamel, 1978; Van Overwalle & Van Rooy, 1998; Wells & Ronis, 1982).

The Role of Sample Size

A factor that strongly determines discounting and augmentation of Kim and Justine's talents is how often each individual player is capable of repeating her successful output, or the *sample size* of the performance (Anderson, 1967; Van Overwalle, 2003; Van Overwalle & Van Rooy, 2001a). If success is temporary, we attribute it to a lucky fluke, but if success repeats, then we tend to attribute it more to someone's dispositions. The idea that we make more robust and extreme dispositional attributions when we possess more supportive evidence is captured by the *law of large numbers* or *sample size effect*, which says that our judgments "should be more confident when they are based on a larger number of instances" (Nisbett, Krantz, Jepson, & Kunda, 1983, p. 339). Sample size effects have been documented in many areas of social cognition. For instance, when receiving more supportive information, people make more extreme judgments not only on causal attributions (Van Overwalle & Van Rooy, 2001a), but also on person impressions (Anderson, 1967), hypotheses and predictions (Fiedler, Walther, & Nickel, 1999; Manis, Dovalina, Avis, & Cardoze, 1980) and attitudes (Ebbesen &

Bowers, 1974; Petty & Cacioppo, 1984).

The present paper explores how sample size determines discounting and augmentation of dispositional attributions about other persons. My goal is not to compare discounting and augmentation effects; but rather to test the hypothesis that compared to a small sample size, a large sample size increases the effects of augmentation and discounting in dispositional attributions. To illustrate, when there is growing evidence indicating that one player of a tennis team is very strong (e.g., Justine), then given that there is no other information available, the talent of the target player (e.g., Kim) should be more discounted. Conversely, the greater the evidence that the team player is weak (e.g., an amateur), the more Kim's talent should be augmented. Although these sample size predictions may appear similar to Kelley's (1967) covariation notion of consistency, this is not the case. Consistency refers to the manipulation of a single factor, while here sample size refers to a manipulation of a competing disposition (e.g., Henin) to measure its effect on a different target disposition (e.g., Kim).

The sample size hypothesis is important, because it cuts through various computational models of discounting and augmentation and allows comparing their predictive power. Specifically, the principle of sample size follows naturally from novel connectionist network models introduced in social psychology (Read & Montoya, 1999; Van Overwalle, 1998; Van Overwalle & Van Rooy, 1998), whereas prominent algebraic models have difficulties with it (Anderson & Sheu, 1995; Cheng & Novick, 1990; Fales & Wasserman, 1992; Försterling, 1989) including algebraic models based on an anchoring and adjustment analogy (Busemeyer, 1991; Hogarth & Einhorn, 1992). Thus, the comparison between a small and large sample size has critical implications on how we view the process of making attributions. Briefly put, connectionist models of attributions are based on the idea that these judgments are made by associations of cause and effect and that the more one is exposed to a given association, the stronger this association becomes. Hence, repeating the information on the cause-effect association of a competing factor (in order to increase its sample size) increases this association, and consequently leads to competition with the association of another target factor. This results in stronger discounting and augmentation of that target factor (for a mathematical proof, see Van Overwalle & Van Rooy, 2001b, pp. 1623-1624). This is different from algebraic models because they are based on relative proportions of frequencies. Repeating these proportions does not change anything in their computations, and so they do not predict a change in discounting and augmentation. Anchoring and adjustment models are also unable to make a sample size prediction because they only take into account a single cause, not the competition between two or more causes.

Causal and Dispositional Attribution

Previous investigations of sample size effects on discounting and augmentation focused predominantly on causal, or explanatory, attributions. For instance, Van Overwalle and Van Rooy (2001b) varied the number of observations of a competing cause (e.g., Justine) and measured the causal attribution to a target cause (e.g., Kim). Consistent with the connectionist prediction, compared to a smaller sample size, the target cause (e.g., Kim) was more discounted or augmented given a larger sample size (see also Hansen & Hall, 1985; Wells & Ronis, 1982). Other research investigated sample size effects on dispositional attributions, but did not address its role in discounting or augmentation (Van Overwalle, 2003).

Can we extend Van Overwalle and Van Rooy's (2001b) sample size findings on discounting and augmentation for causal attributions to dispositional attributions? To begin with, we have to ask whether and in what ways dispositional attributions are different from causal attributions. Although one could conceive dispositional attributions as a specific type of attribution, they are definitely not causal attributions. Both judgments are related, but are not identical. Whereas in *causal* attribution, people seek the cause of a behaviour without further specifying what that cause might be (e.g., *something special about Kim Clijsters* that caused her to win), in *dispositional* attribution, people make a specific trait inference about an actor (e.g., Kim Clijsters is a *talented tennis player;* Hilton, Smith, & Kim, 1995; Van Overwalle, 1997). Thus, dispositional attributions do not point to the explanatory power of the actor's disposition, but rather reflect what kind of disposition it is (e.g., talent) and how strong that disposition is. For instance, in attributing causality, people may believe that a given disposition has good explanatory power (e.g., winning a local tournament because of the player's talent), but nevertheless believe that the disposition itself is not particularly strong (e.g., it is still a local amateur).

Consistent with this distinction, research has revealed that while people rely more on *differences* for making causal attributions, they rely more on *generalisations* for making dispositional attributions (see Hilton et al., 1995; Van Overwalle, 1997; 2003). For instance, when making a causal inference on Kim Clijsters' contribution in winning a tournament, we tend to rely mainly on low consensus information (indicating that Kim's actions *differentiate* her from lower-ranked players; Kelley, 1967). However, in making a dispositional inference on her talent, we rely also heavily on low distinctiveness information (indicating that Kim's success *generalises* across different opponents and tournaments; see also Van Overwalle, 1997; 2003).

In addition, it is possible that discounting and augmentation are less strong or less likely in the dispositional domain. Take the phenomenon of the *fun-*

damental attribution bias which dominates dispositional attributions. This bias suggests that when people make dispositional attributions, they tend to focus mainly on the actor, and are less likely to take into account the discounting or augmenting influence of external factors. For example, when Kim Clijsters wins a tournament, we may neglect the fact that some fierce opponents were absent, and we do not adjust our estimates accordingly. This bias might be particularly strong for dispositional as compared to causal attributions, because external factors are typically short-lived and situation specific and therefore potentially more relevant for causal attributions that seek to explain a recent event, but less so for making long-term and general dispositions inferences.

In spite of these differences, I hypothesise that the predicted sample size effect on discounting and augmentation operates in both types of attributions, not only for causal attributions as shown by Van Overwalle and Van Rooy (2001b), but also for dispositional attributions. This follows from the connectionist perspective that makes similar predictions for causal and dispositional attributions. Essentially, this prediction is driven by the fact noted earlier, that both types of attributions rely on *differences* between comparison cases. Previous research also showed sample size effects (without involving discounting and augmentation) that were equivalent for causes (Van Overwalle & Van Rooy, 2001a) and dispositions (Van Overwalle, 2003).

Design and Hypotheses

The basic design of the experiments reported here was modelled after previous research on causal attributions by Van Overwalle and Van Rooy (2001b) and the tennis example above. I induced competition between two persons or between two objects (both referred to as *entity* hereafter). I used persons and objects with the goal to generalise across social and innate objects. Discounting was induced by providing scenarios in which two entities reached a joint outcome, while one of the entities reached this effect on its own. Conversely, augmentation was induced by having two entities reaching opposite positive and negative outcome, while one of them reached this effect on its own. The crucial question is whether increasing the dispositional strength of the competing entity will further decrease (discount) or increase (augment) the dispositional strength of the target entity, as predicted by the connectionist approach. The strength of the competing disposition was manipulated by varying how often this entity alone obtained a positive or negative outcome: either one time (small sample size) or five times (large sample size). Thus, for instance, if we learn that Kim's tennis partner, Justine, won five single tournaments instead of only one tournament, would we discount Kim's tennis talents more after a joint win? In contrast, if we learn that an amateur tennis partner lost five instead of only one tournament, would we augment Kim's talents more after a joint win? To preclude participants' using their world knowledge in making attributions as much as possible, unlike this example, the scenarios in the experiments were situated out of context and involved unknown actors.

It is important to note that this scenario controls for Kelley's (1967) covariation variables. It controls for consensus (comparisons between different players) and distinctiveness (comparisons between different situational contexts) because the manipulation of sample size does not affect the number of the target and competition entities (players). Perhaps more importantly, it controls for consistency because the manipulation of sample size occurs for the *competing* player, not for the target player as required in Kelley's (1967) covariation model.

This basic design was first tested in Experiment 1 for dispositional attributions. In Experiments 2 and 3, a direct comparison was made between dispositional and causal attributions, either within the same participants or between groups. In addition, in Experiment 3, this comparison was examined under more difficult learning conditions.

Experiment 1: Dispositional Attributions

Method

Participants

Participants were 68 male and female students from the Vrije Universiteit Brussel, who participated for a partial course requirement. They were tested individually.

Material

The materials and procedure largely replicated those by Van Overwalle and Van Rooy (2001b), with the exception that now dispositional attributions were measured rather than causal attributions. The overall design of the experiment involved three within-participant factors including Sample Size (small or large), Type (discounting or augmentation) and Order (forward or backward; see below). Eight discounting stories and eight augmentation stories, or sixteen stories overall with an equal amount of positive and negative outcomes were adapted from Van Overwalle and Van Rooy (2001b, see also Appendix). They were randomly distributed for each participant between the Sample Size and Order factors, resulting in two stories per cell. The target and competing entities involved either two *actors* (persons) or two *stimuli* (objects or persons). To make sure that the target and competing entity would be seen as causally related to the effect (which is necessary for discounting and augmentation to occur, see McClure, 1998), the stories involving actors used *action* verbs (which tend to imply the actor as the cause) and the stories involving stimuli used *state* verbs (which tend to imply the stimulus as the cause, see Rudolph & Försterling, 1997). To control for the order in which the competing and target entities were presented, this factor was counterbalanced. The competing entity was either presented before the target (*forward* order) or after the target (*backward* order).

Sample Size. Each story consisted of five trials (large sample size) or one trial (small sample size) in which a competing entity was present alone. In addition and regardless of sample size, there were another five compound trials in which both the target and competing entity were present together.

Type. To induce discounting, both target and competing trials were followed by the same outcome. In contrast, to induce augmentation, the outcome of the competing entity alone was *opposite* to the focal outcome when also the target entity was present. To make sure that the participants would encode this opposite information correctly, the semantic negation of an outcome was always indicated in capitals.

The manipulation of these within-participants factors is illustrated in the next example with *An* as the discounted target actor and *Elena* as the discounting competing actor. The example illustrates ten consecutive trials between slashes (except those omitted for the small sample size as indicated between straight brackets) in a forward order (i.e., competing-only trials first):

- Elena passed the first [/ second / third / fourth / fifth] selection round in single scull
- An and Elena passed the first / second / third / fourth / fifth selection round in double scull

Similarly, the augmentation manipulation of a stimulus is illustrated below in a backward order (i.e., competing-only trials last), with the *red pill* as the augmented target stimulus and the *white pill* as the augmenting competing stimulus:

- Joeri / Edwin / Alfred / Luk / Bert coughed LESS after taking the white and red pills
- Daniel [/ Wilfried / Mark / Johannes / Dirk] did not stop coughing after taking the white pill

Procedure

Participants were seated in front of an IBM-compatible PC and the experiment was monitored by MEL software. Instructions appeared on the screen and the use of the rating scale was practiced. The computer randomized for each participant the order in which the stories appeared, as well as the order in which specific persons or stimuli appeared in a story, with the provision that forward and backward order was not affected.

After reading each story, participants rated the disposition of the target and competing entity on an 11-point scale. The dispositions were phrased in the same (facilitatory) direction as the target outcome, except in two stories (as it sounded more natural in Dutch to use the other direction) and these ratings were reversed before analysis. Following earlier research (Hilton et al., 1995; Van Overwalle, 1997; 2003), the particular questions and anchors were specifically fitted to each story. For instance, in the first (actor) example, participants had to judge "to what extent is Elena [An] a competent rower" (0 = *not at all competent* to 10 = *very much competent*); in the second (stimulus) example, participants rated "To what extent is the white [red] pill effective against a cough" (0 = *not at all effective* to 10 = *very much effective*). Participants indicated their answer by moving through the scale points in steps of 1, using the left and right arrow keys. The order in which the dispositions were rated was randomized for each participant and each story.

Results

Because I made the same predictions for actor and stimulus dispositions, these ratings were collapsed and analysed together. This was justified, as a preliminary analysis of variance (ANOVA) with Measure (actor or stimulus), Type (discounting or augmentation), Sample Size (small or large) and Order (forward or backward), revealed that Measure did not interact with the primary Sample Size factor nor with any higher order interaction including Sample Size.

Figure 1 depicts the mean ratings for the competing and target dispositions. As can be seen in both panels, in line with my predictions, a larger sample size produced a polarisation of the competing and target ratings. The means were subjected to an ANOVA with Type (discounting or augmentation), Sample Size (small or large) and Order (forward or backward), as within-participant factors. There was a significant main effect of Type for competing dispositions, $F(1, 67) = 384.54$, $p < .001$, indicating that the participants clearly differentiated between competing entities with the same (given discounting) or the opposite (given augmentation) outcome; and for target dispositions, $F(1, 67) = 47.82$, $p < .001$, indicating that they also clearly differentiated between target entities that were either discounted or augmented.

More importantly, these tendencies were further polarised by sample size, as revealed by a significant interaction between Type and Sample Size for competing dispositions, $F(1, 67) = 56.15$, $p < .001$, and for target dispositions, $F(1, 67) = 9.95$, $p < .01$. Planned comparisons confirmed that, as

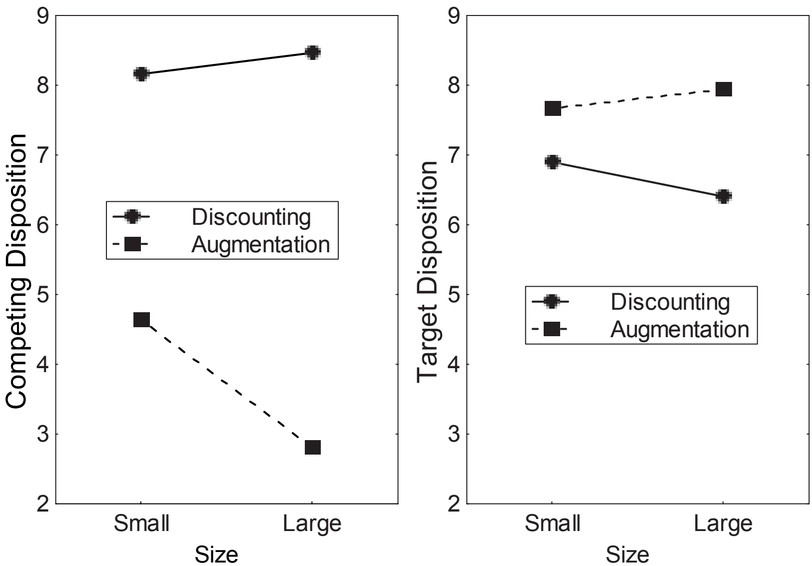

Figure 1.
Experiment 1: Dispositional Attributions as a function of Size and Type (full data points denote a significant Size effect, $p < .06$, one-tailed).

expected, the competing dispositions were significantly increased when the same outcome was repeated (given discounting), $t(67) = 2.04$, $p < .05$, and decreased when the opposite outcome was repeated (given augmentation), $t(67) = 6.93$, $p < .001$. In line with my prediction, as a consequence, the target disposition was more discounted, $t(67) = 2.55$, $p < .05$, and also tended to be more augmented, $t(67) = 1.60$, $p < .06$ (one-tailed). This latter effect only approached significance presumably because of a ceiling effect. As can be seen in the right panel of Figure 1, the target ratings for augmentation were very high (e.g., they remained above a mean of 7.5 even for a small sample size), and this may have limited the range left for further augmenting the disposition given a large sample size.

There was no main effect of Order, in line with recent associative learning findings and theorizing (see Van Hamme & Wasserman, 1994), and this lack of an Order effect was observed throughout subsequent experiments. However, there was an unexpected interaction between Type and Order on the target and competing dispositions, $F(1, 67) = 7.48\text{-}22.75$, $p < .01$, which showed somewhat stronger competition effects given a backward order. This contradicts earlier research, which typically showed weaker competition effects for backward than forward discounting. However, this result does not qualify the main result, that is, the predicted interaction between Type and Sample Size on the target dispositions.

Discussion

The results of this experiment generally confirm the predictions. There was a clear effect of sample size. The larger the size of the observations, the more polarised (stronger or weaker) the competing dispositions became, and the more the target dispositions tended to be discounted or augmented. The combined effect of sample size and competition is consistent with a connectionist perspective, but contradicts an algebraic approach. However, on the whole, the predicted sample size effect was not very strong. As can be seen from the right panel of Figure 1, regardless of whether the target was discounted or augmented and regardless of sample size, all target dispositions remained quite high. Thus, the effect of the competing information was relative minor, and participants provided high dispositional ratings to all target entities in line with the fundamental attribution bias.

Experiment 2: Dispositional and Causal Attributions

Although the effects of competition and sample size on dispositional inferences were (marginally) significant, they were relatively weak in comparison to Van Overwalle and Van Rooy's (2001b) very robust effects of these manipulations for causality judgments. In other words, although people may be aware that a competing factor caused an actor's behaviour, they seem somewhat less inclined to change their correspondent dispositions about this actor. To pursue my main question on the potential differences and similarities between dispositional and causal judgments with respect to discounting and augmentation, in the next experiment, I requested besides dispositional ratings, also causal ratings for the same events, using a format that is typically used in earlier research, including by Van Overwalle and Van Rooy (2001a; 2001b). For instance, dispositional ratings ask to what extent the actor "is a competent" or "effective" tennis player and the like, while causal ratings ask to what extent the outcome "is due something special about" the actor. This allows comparing both types of attributions directly.

Method

Participants

Participants 60 were male and female students from the Vrije Universiteit Brussel, who participated for a partial course requirement. They were tested individually.

Material

The materials and procedure were identical to the first experiment, except that the participants were informed from the start that they had to make dispositional as well as causal ratings, and they learned how to respond to each of these ratings. Then, at the end of each story, after dispositional ratings had been given like in the first experiment, the participants were requested to make causal ratings in the same manner as in the causal judgment study by Van Overwalle and Van Rooy (2001b). Specifically, they rated the causal influence of the target factor and the competing factor (*something special about [actor or stimulus]*) on an 11–point rating scale ranging from 0 (*absolutely no influence*) to 10 (*very strong influence*), with midpoint 5 (*partial influence*). For example, in the story with An and Elena as actors, participants rated the causal influence of *something special about An* and *something special about Elena*. Similarly, in the story with the white and red pills, participants rated the causal influence of *something special about the white [red] pill*.

Results

The ratings for the actor and stimulus dispositions were again collapsed, as an ANOVA with Measure (actor or stimulus), Type (discounting or augmentation), Sample Size (small or large) and Order (forward or backward), revealed that Measure did not interact with the primary Sample Size factor nor with any higher order interaction including Sample Size, for both dispositional and causal target judgments.

Figure 2 depicts the mean ratings for dispositions (left panel) and causes (right panel). As predicted, a larger sample size produced a polarisation of the target and competing ratings for both dispositional and causal judgments. I conducted the same ANOVA as in the first experiment, and generally found the same results. There were significant main effects of Type for target dispositions and causes, and for competing dispositions and causes, Fs(1, 59) = 53.99-422.61, ps < .001, indicating that the participants clearly differentiated between competing entities with the same (given discounting) or the opposite (given augmentation) outcome, and between target entities that were either discounted or augmented.

More importantly, these effects were further polarised by sample size, as revealed by a significant interaction between Type and Sample Size for competing and target dispositions and causes, Fs(1, 59) = 12.95-112.74, ps < .001. Planned comparisons showed that, as expected, the competing dispositions and causes were significantly increased when the same outcome was repeated (given discounting), and decreased when the opposite outcome was repeated (given augmentation), t(59) = 4.75-4.33, ps < .001, except that this

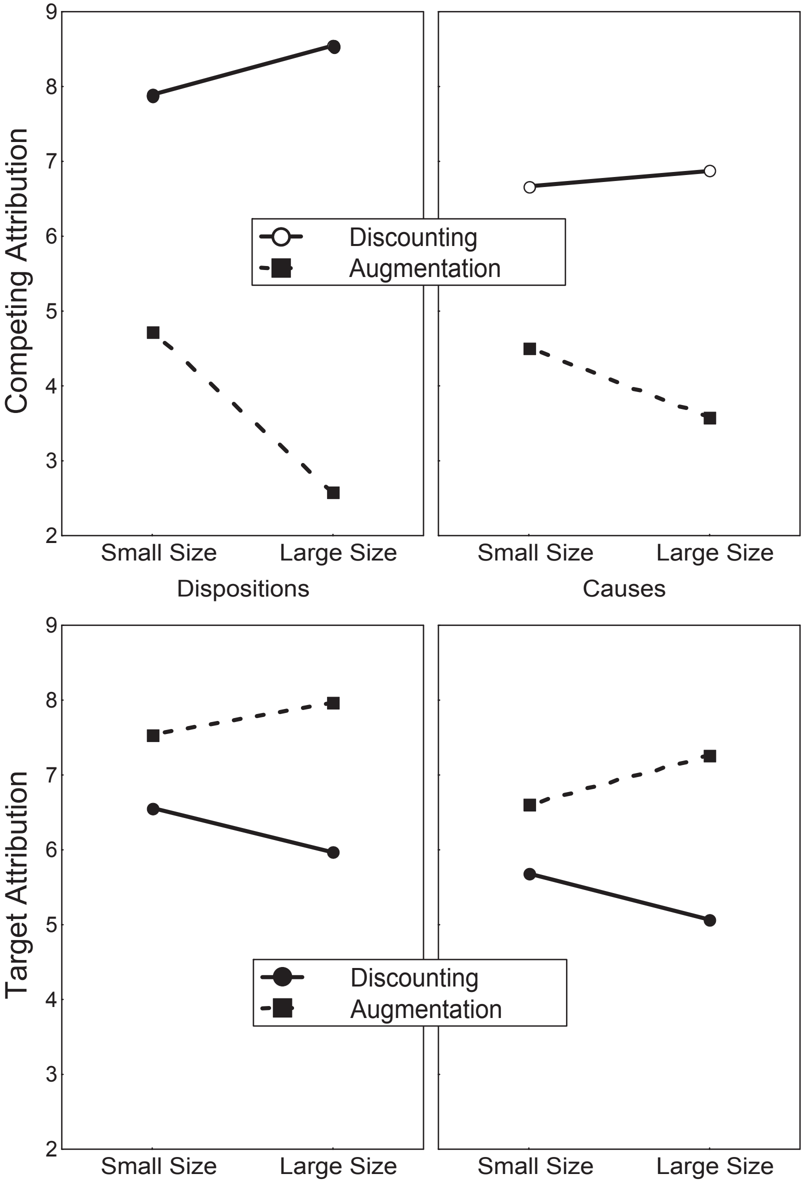

Figure 2.
Experiment 2: Dispositional and Causal Attributions as a function of Size and Type (full data points denote a significant Size effect, $p < .05$).

effect was not significant for competing causes given discounting, $t(59) = 1.17$, $p = .27$. Importantly, all the predicted effects of discounting and augmentation on the target dispositions and causes were significant, ts(59) = 2.72-3.76, ps < .01. There was also an unexpected interaction between Type and Order on all ratings, $F(1, 59) = 4.73$-31.50, ps < .05 (except for the competing causal rating), which revealed stronger competition effects given a backward order, in line with Experiment 1. As before, this result does not qualify the predicted interaction between Type and Sample Size on the target ratings.

Although discounting and augmentation took place for both dispositional and causal attributions, the ratings were not entirely equivalent. An ANOVA with Judgment Format (dispositional versus causal) as an additional factor revealed that there was a main effect of Judgment Format on the target and competing ratings, Fs(1, 59) = 11.01-32.31, ps < .001, indicating that dispositional ratings were generally higher. In addition, there was a significant triple interaction between Judgment Format, Type and Order on the target ratings, $F(1, 59) = 7.56$, $p < .01$, which was due to the fact that backward augmentation was somewhat weaker for dispositions than for causes. For the competing ratings, there was also an interaction between Format, Type and Sample Size, $F(1, 59) = 27.67$, ps < .001, which revealed a greater effect of sample size for augmentation than for discounting, especially given dispositional ratings.

Discussion

This experiment generally replicates and strengthens the findings of the first experiment. Again, the dispositional target ratings were more discounted and augmented given a greater sample size, and this was now reliable for both competition types. The analyses indicated that there were no substantial sample size differences between dispositional and causal judgments, although the means of the dispositional ratings were higher than the causal ratings. Moreover, a visual inspection of the target ratings in Figure 1 (Experiment 1) and Figure 2 (Experiment 2) confirms that the effect of sample size on dispositional and causal target ratings resulted in an almost identical discounting and augmentation pattern.

However, a potential limitation of the present experiment that may explain in part why the sample size effects on discounting and augmentation are more robust than before, is that the concurrent causal ratings may have primed the causal underpinnings of the dispositional judgments. Thus, although dispositional attributions were requested before causal attributions, the fact that these ratings were repeated for 16 stories may have primed the ratings mutually, so that more causality seeped in the dispositional ratings.

That is, it may have drawn attention to the multiple causes that may influence a given behaviour or outcome, leading to stronger discounting and augmentation. To verify this potential explanation, I conducted a statistical comparison between the dispositional ratings of both experiments, using the same ANOVA with Experiment (1 vs. 2) as additional between-participants factor. These analyses revealed no significant main nor interaction effect of Experiment, either in the target nor competing dispositions, all Fs(1, 126) < 2.07, ps > .150. This rules out causal priming as explanation for the more robust effects in this experiment.

Experiment 3: Attributions under Difficult Learning

The previous results demonstrate that discounting and augmentation of dispositions is strengthened by increasing the sample size of the competing entity in much the same way as causal attributions, consistent with a connectionist perspective. Another way to test the connectionist underpinnings of dispositional and causal attributions is by exploring how much they depend on people's awareness of the frequency of co-occurrences. If, as suggested by a connectionist approach, dispositions and causes are developed automatically online rather than by explicitly estimating frequencies and making calculations on them, then the effect of sample size and competition should also appear when it is much more difficult to extract these frequencies.

In social cognition research, reduced awareness during information uptake is often established by making the task more difficult, for instance, by adding a concurrent secondary task (e.g., remembering an 8-digit number). However, this may raise the possibility that participants were not attentive to the primary material, rather than unable to process it. To rule out this possibility, I increased the difficulty of learning by randomly shuffling all trial information on all stories of the previous experiment, and presenting all this information in a single block before ratings were made. Thus, all participants had sufficient time and opportunity to read and encode all material, but the shuffling makes it very difficult to memorise and retrieve all individual trial information and their frequencies (Fiedler et al., 1999). To allow an independent comparison between dispositional and causal attributions, one group of participants gave dispositional ratings and another group gave causal ratings.

According to algebraic approaches, estimating the frequencies of co-occurrences or their relative proportions is a prerequisite for making attributions. As Cheng and Novick (1990, p. 549) – who developed one of the most influential algebraic models of attribution – argued, making attributions "requires that people be able to estimate and compare proportions, a task that has been found to be performed reasonably well by naive subjects". Hence, decreasing the ease of estimating these proportions should have a disadvantageous effect on discounting and augmentation. In contrast, the connectionist assumption is that attributions are made automatically so that attributional ratings are influenced by the sample size of discounting and augmentation even under difficult processing. However, it is possible that contrary to causal attributions, dispositional attributions reveal less of these effects because they are susceptible to the fundamental attribution bias discussed earlier, that is, the tendency to ignore additional information (i.e., about a competing cause). This bias is particularly strong under difficult processing conditions when people have less capacity to execute the mental arithmetic needed to make discounting adjustments (Fiedler et al., 1999; Gilbert & Malone, 1995).

Method

Participants

Participants were 126 male and female students from the Vrije Universiteit Brussel, who participated for a partial course requirement. About half of them were randomly assigned to the dispositional format group, and the other half to the causal format group. They were tested individually.

Material and Procedure

The materials and procedure were identical to the second experiment, with the following modifications. First, the dispositional and causal formats were manipulated between participants instead of within. As in the earlier experiments, before reading the stories, instructions for the response format appeared on the screen and the use of the rating scale was practiced. Second, to avoid ceilings effects like in the first experiment and to make the task not unduly heavy, the number of compound trials where target and competing entities were jointly presented was reduced from five to one. By reducing the compound trials, the effect of the competing entity in comparison with the target entity is increased, leading to more discounting and augmentation and a greater effect of sample size. However, in connectionist simulations, these changes are minimal. Third, participants first read all trials of all sixteen stories shuffled in a random order for each participant, with the provision that forward and backward order was not affected. Thus, the same material was provided as in the previous experiments, but now the stories were randomly spread across the whole learning phase of the experiment, so that a trial of one story was nearly always followed by a trial of another story, which was again followed by a trial of still another story, and so on. (Because of this random order, some trials of the same story might occasionally follow each other immediately). Thus, estimating the frequencies within each of the sixteen stories was made very difficult. After having read all this information from all stories, the participants made their judgments of all entities, again in a random order.

Results

The ratings were again pooled across actor and stimulus, as preliminary ANOVAs again revealed no significant interaction of Measure (person or stimulus) with Sample Size or with any higher interaction including Sample Size for the causal or dispositional target ratings. In order to explore the effect of rating format, I conducted an ANOVA with an additional between-participants factor Format (dispositional or causal) and Type, Sample Size and Order as within-participants factors. The results revealed strong main and interaction effects of Format, so that I analysed the dispositional and causal ratings separately. Figure 3 depicts the mean ratings. As can be seen, consistent with my prediction, the causal ratings replicated the combined effect of sample size and competition obtained the previous experiment. In contrast, contrary to my expectations, the dispositional target ratings failed to show not only the effect of sample size, but also the effect of discounting and augmentation altogether.

Causal Ratings

The right panels of Figure 3 show the predicted polarisation of the target and competing causal ratings due to a larger sample size. An ANOVA revealed significant main effects of Type for target and competing causes, Fs(1, 67) = 43.13-78.35, ps < .001, indicating that the participants clearly differentiated between competing causes with the same (given discounting) or the opposite (given augmentation) outcome, and between target causes that were either discounted or augmented. More importantly, a significant interaction between Type and Sample Size for competing causes, Fs(1, 67) = 23.36, $p < .001$, and target causes, Fs(1, 67) = 27.65, $p < .001$, confirmed that these effects were further polarised by sample size. Planned comparisons showed that, as expected, the competing causes were significantly increased when the same outcome was repeated (given discounting), and decreased when the opposite outcome was repeated (given augmentation), $t(66)$ = 3.27-3.97, ps < .001. Crucially, the predicted sample size effects on discounting and augmentation of the target causes were significant, ts(66) = 2.85-4.07, ps < .01.

Dispositional Ratings

In contrast to the causal ratings, the sample size and competition manipulation revealed an effect only on the competing dispositions, but not on the target dispositions. For the competing dispositions, an ANOVA revealed the

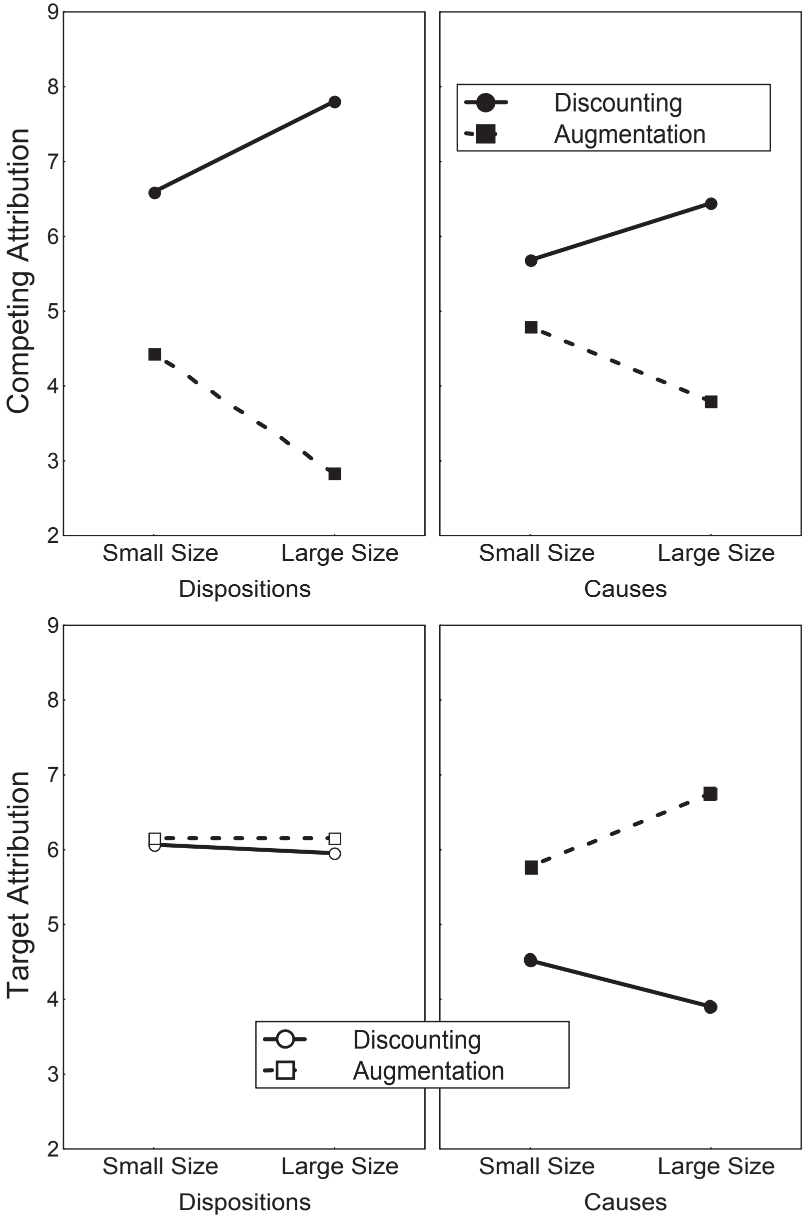

Figure 3.
Experiment 3: Dispositional and Causal Attributions as a function of Size and Type (full data points denote a significant Size effect, $p < .05$).

expected main effect of Type suggesting that participants discriminated between competing entities with the same (discounting) or the opposite (augmentation) outcome, $F(1, 58) = 229.17$, $p < .001$. The expected interaction between Type and Sample Size further indicated that they polarised their rating when sample size was large, $F(1, 58) = 43.48$, $p < .001$. Planned comparisons confirmed the significant effect of sample size on the competing ratings, ts(57) = 4.82-4.84, ps < .001. However, contrary to my main prediction, all these manipulations of the competing entities had no observable effect on the target entities, as neither the effect of Type nor the interaction of Type and Sample Size did have any effect on the target dispositions, Fs < 1. There was also an unexpected interaction between Type and Order on the competing dispositions, $F(1, 59) = 8.13$, $p < 01$, which showed stronger effects given a forward order. The direction of this effect was opposite to the one found in Experiment 1 and 2.

Discussion

The present results provided mixed evidence for the connectionist approach. The effect of sample size on discounting and augmentation was reliable for causal attributions even when estimating frequencies was made very difficult, but disappeared completely for dispositions. Although a greater sample size of the competing entities increased the competing dispositions, there was no noticeable influence on the target dispositions. Even the basic effect of discounting and augmentation (without the effect of sample size) that was reliable for dispositional attributions previously, now disappeared entirely. In sum, although making learning more difficult did not diminish the direct sample size effects on the competing causal ratings or competing dispositions consistent with an on-line connectionist perspective, it abolished the indirect effects of discounting and augmentation on dispositional attributions but not on causal attributions, in contradiction with my hypothesis.

To verify this observation, I statistically compared the present results with those of Experiment 2. I ran the same ANOVA with Experiment (2 vs. 3) as additional between-participants factor, and I focused on the most relevant interaction effects with Type and Sample Size on the target ratings. For the causal target ratings, the analysis confirmed that there were no differences between the two experiments, as none of the interactions of Type and Sample Size with Experiment were significant, all Fs(1, 125) < 3.86, ps > .05. In contrast, for the dispositional target ratings, there was a significant interaction between Experiment and Type, $F(1, 117) = 24.71$, $p < .001$, that was further qualified by a marginally significant Experiment x Type x Sample Size interaction, $F(1, 117) = 3.57$, $p < .06$. These latter two interactions confirm that whereas discounting and augmentation of dispositional attributions were effective under the normal learning conditions of Experiment 2, they disappeared under the difficult learning manipulation of Experiment 3.

General Discussion

The present findings demonstrate that there is greater discounting and augmentation of dispositional attributions given a greater sample size of a competing entity. Experiments 1 and 2 demonstrated that this pattern of competition and sample size is much like that revealed in earlier research on causal attributions (Van Overwalle & Van Rooy, 2001b), although the mean level of attributed dispositions was generally higher than that of attributed causes. In addition, although there were some minor effects of order of competition, overall, forward and backward discounting and augmentation were equally effective (see also Van Hamme & Wasserman, 1994). However, in Experiment 3, when the extraction of frequencies was made more difficult, surprisingly, only causal attributions were discounted or augmented, and no effect was found on dispositional attributions.

The finding that discounting and augmentation of dispositional and causal attributions are susceptible to sample size (at least under normal learning conditions of Experiments 1 and 2) is problematic for algebraic models (Anderson & Sheu, 1995; Cheng & Novick, 1990; Fales & Wasserman, 1992; Försterling, 1989). Perhaps, sample size does not so much affect dispositional and causal judgments, but rather the confidence with which these judgments are given. In line with this reasoning, one might suggest that consistent information increases confidence over trials whereas inconsistent information decreases confidence. However, this argument simply shifts the burden of proof from attributional judgments to confidence judgments. Moreover, it does not explain why the opposite confidence effects should occur for discounting and augmentation. Cheng (1997) provided an account of why perceivers become increasingly uncertain of the causal status of a discounted cause, but she did not provide an account for why they should become more certain in the case of augmentation. I see no way to solve these logical inconsistencies of the confidence notion within the boundaries of the existing algebraic theories.

In contrast, these sample size effects strongly supported the predictions of connectionist models (McClelland & Rumelhart, 1988; Van Overwalle & Van Rooy, 1998). Connectionist models provide a unifying framework incorporating many causal inference processes, as they incorporate Kelley's (1967) principles of covariation, competition (discounting and augmentation; Kelley, 1971) and the principle of sample size. Basically, connectionist models suggest that causal learning on the basis of novel information is an incremental, largely automatic process in which estimates of causality are continuously updated on-line. People do not need to make estimates of frequencies or proportions, but rather they infer causality even when they are not fully aware of it, much like young infants and children learn how to understand and predict their environment and how to control it. The results of the difficult learning conditions of Experiment 3 provided evidence that discounting and augmentation of attributions does not require explicit assessment of frequencies or proportions, at least not for causal attributions. However, for dispositional attributions, this prediction was not confirmed.

Differences between Dispositional and Causal Attributions

Although the pattern of results was generally in line with connectionist predictions, an unexpected exception was observed under more difficult processing conditions in Experiment 3. Discounting and augmentation were eliminated for dispositional attributions, while causal attributions did not suffer from this manipulation. This is consistent with ample research demonstrating that dispositional attributions are very susceptible to biases under complex processing circumstances, such as the fundamental attribution bias (Gilbert & Malone, 1995), indicating that they are quite immune to additional information (e.g., of competing factors). However, the finding seems to contradict prominent models of dispositional inferences (Gilbert & Malone, 1995; Trope & Gaunt, 2000), which suggest that *dispositions* are based on the *causal* attributions people make. None of these models can explain the present results.

One possible explanation is that correcting dispositional inferences in the light of alternative explanations consumes more cognitive effort than causal attributions, so that they are more vulnerable to manipulations that render the extraction of information more difficult. However, to date, there is little evidence for the idea that dispositional attributions would require more mental effort than causal attributions. To the contrary, there is an abundance of evidence that trait attributions are often made spontaneously with little cognitive effort, even in combination with novel covariation information (Van Overwalle; Drenth, & Marsman, 1999). Moreover, the number of compound trials was reduced to make sure that the task in Experiment 3 would not be too difficult. This reduction of compound trials may be a limitation, because it complicates a comparison with the earlier experiments. However, since this reduction happened for both causal and dispositional judgments, it cannot easily explain the differences between these judgments.

Another explanation is that in making dispositional attributions, people may prefer other information than in making causal attributions, with the result that they tend to ignore alternative information, especially when distracted or under difficult processing conditions. As noted earlier, some authors (Hilton et al., 1995; Van Overwalle, 1997) have argued that because dispositions refer to stable and enduring characteristics, people rely more on Kelley's (1967) covariation evidence that reflects generalisation across comparison cases than differences, the latter being used more exclusively for causal attributions. Thus, under difficult processing circumstances, the participants may have relied less on competing factors and more on the behaviour of the target itself, so that the sample size manipulation failed. A related explanation concerns the jointly produced outcome which was presented multiple times in Experiments 1 and 2, but only once in Experiment 3. Perhaps participants were reluctant to make dispositional attributions about the target when there is information only on a single jointly produced outcome because generalised information is unavailable. Other authors argued that dispositional inferences are strongly influenced by the perceived motives of the behaviour, which can lead to insufficient discounting (Reeder, Kumar, Hesson-McInnis, & Trafimow, 2002). The present results open an interesting debate on the immutability of dispositional attributions to alternative factors under difficult processing circumstances, but which account is correct in explaining the origin of this bias is still much an open question.

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Appendix: Stimulus Material for Experiment 1

Listed here are the stories, each with one pair of target and competing entities (actors or stimuli, as shown in italics). Stories 1-8 involve competing actors and use *action* verbs, while stories 9-16 involve competing stimuli and use *state* verbs. The assignment of the stories across conditions was counterbalanced between participants.

1. *Greet* and *Naomi* won their first tennis doubles game.
3. *Jaco* and *Pieter* together devised an AWFUL advertisement tune.
4. *Guus* and *Jos* attained a good time in the first round of kayaking.
5. *Florine* and *Anita* obtained LOW grades on the first team paper.
6. *An* and *Elena* passed the first selection round in double scull.
7. *Lucas* and *Pablo* obtained LOW grades for their first teamwork
8. *Walter* and *Kris* won their first game of table tennis.
9. *Martine* and *Helen* together designed a BAD plan for the kitchen.
10. Joeri coughed LESS after taking the *white* and *red pills*.
11. Ella felt sick after eating the *mackerel* and the *salmon*.
12. Rita lost extra kilos after a diet using products *Linea* and *Light*.
13. Arno got a rash after he applied the after shaves *Ax* and *Men*.
14. Tim felt better with the *heating on* and *a warm water jar*.
15. Nathalie got a rash after using *ointment B.* and *ointment A*.
16. Tania sweated LESS after drinking *product V.* and *product Z.*
16. Bert felt very tipsy after a beer of *brand P.* and *brand T.*

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