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The Power of a Co-witness: When More Power Leads to More Conformity

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Summary: The effect of the power dynamic between co-witnesses on memory conformity for images was investigated. Participant–confederate pairs were first presented with 50 images on a computer and then were randomly assigned to one of three social power role combinations analogous to those present in the workplace: manager and subordinate, subordinate and manager, or collaborators with equal power and status. After role assignment (but without ever engaging in the role-related tasks), pairs were tested on whether each of 100 images (50 old and 50 new) had or had not been shown previously. Confederates always responded before participants. Subordinates were significantly less likely to conform than managers. Findings are discussed in light of the work-related facet of social power and memory distortion. Copyright © 2013 John Wiley & Sons, Ltd.

Memory can be largely a social phenomenon. Both memory encoding and memory retrieval can be influenced by external factors, such as distractions during encoding and recalling the details of a crime with a co-witness during retrieval. Memory research has shown that what one person says can influence another person's recollections (e.g., Gabbert, Memon, & Wright, 2006; Meade & Roediger, 2006; Schwartz & Wright, 2012; Wright, Gabbert, Memon, & London, 2008). Thus, one's original memory of an event is not always what one reports subsequently during recall with another individual present. In general, if one eyewitness reports incorrect information in the presence of another witness, this second witness will be more likely to report the same incorrect information than someone who had been asked to recall the details of the crime alone. Factors such as co-witness status (e.g., actor vs. bystander) and perceived encoding duration have been shown to moderate the memory conformity effect (Carlucci, Kieckhaefer, Schwartz, Villalba, & Wright, 2011; Gabbert, Memon, & Wright, 2007). The present study examines how the manager–employee power dynamic between dyads moderates memory conformity.

The conformity literature posits two reasons why individuals conform: informational influence and normative influence (Campbell & Fairey, 1989). Informational influence is driven by a desire to be accurate, so an individual conforms because he or she believes that someone else's report is correct. For example, Gabbert et al. (2007) found that believing another witness had viewed an event for longer increased memory conformity to that witness' responses. Normative influence is based on the desire to maximize positive social outcomes; people may conform to avoid disagreement with others, even if they feel that the others are wrong (Asch, 1955; Baron, Vandello, & Brunsman, 1996; Deutsch & Gerard, 1955).

Another factor that may influence memory conformity is the nature of the power dynamic between reporting co-witnesses. Social science research and theory generally distinguish between two types of power: social and personal. Social power (i.e., power over other people) is characterized by interdependence and control over important resources, with the powerless person disproportionately depending on the more powerful person (e.g., Keltner, Gruenfeld, & Anderson, 2003). One example of social power is a manager's control over her or his employees through the administration of rewards and punishments (i.e., the manager–employee relationship commonly present in the workplace). Another example of social power is a teacher's influence over her or his students through evaluation, feedback, and critique. Personal power, on the other hand, is the ability to ignore the influence of others, to control one's own outcomes, and to be personally independent (e.g., Galinsky, Magee, Gruenfeld, Whitson, & Liljenquist, 2008). The present study focused on social power.

Most research on social power and conformity suggests that those in powerful positions should be more resistant to social influence than those in less powerful positions. Research on social power and persuasion, for example, has shown that power can validate an individual's existing views (Brinol, Petty, Valle, Rucker, & Becerra, 2007) and is associated with endorsing resoluteness and resisting attitude change (Eaton, Visser, Krosnick, & Anand, 2009). Power may be an impediment to experiencing empathy (Galinsky, Magee, Inesi, & Gruenfeld, 2006) and increases the psychological distance that one feels from others (Smith & Trope, 2006) while motivating one to act in accordance with one's own disposition or attitudes (e.g., Chen, Lee-Chai, & Bargh, 2001; Galinsky, Gruenfeld, & Magee, 2003; Galinsky et al., 2008). Finally, powerful individuals have been shown to perceive less need for input from others, even when advice could help them perform better (See, Morrison, Rothman, & Soll, 2011). For these reasons, one would expect powerful individuals to exhibit less memory conformity than less powerful individuals.

However, research on power, attention, and goal pursuit shows that rather than being uniformly and carelessly resistant to influence, powerholders can attend carefully and give credence to any stimulus that facilitates their own goal attainment. This research shows that powerholders have flexible attention that can vary on the basis of the expectations and responsibilities that are salient and important to them (e.g., Guinote, 2008; Overbeck & Park, 2001, 2006), and

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that power can bias impression processes through effortful attention to information (Goodwin, Gubin, Fiske, & Yzerbyt, 2000). Ultimately, powerholders should deliberately distribute their efforts and attention in accord with the responsibilities and the opportunities they perceive in the environment, whereas low-power individuals are more indiscriminant in allocating attention, setting priorities, and using information (Overbeck & Park, 2006). If conforming to a less powerful co-witness serves the powerholder's goals (for the sake of increased accuracy, social harmony, or otherwise), then she or he may exhibit more memory conformity than a less powerful counterpart. Thus, because of flexible attention, power may lead to *more* conformity towards low-power individuals' responses, or less conformity, depending on the perceived importance and goal relevance of a given task.

Little research has investigated the effect of social power on memory conformity specifically. However, in one such study, Skagerberg and Wright (2008) manipulated power in a co-witness memory conformity paradigm. Two participants arrived at the laboratory; one person was assigned to a low-power role and the other to a high-power role. The low-power individuals were asked to design a restaurant in 5 minutes, whereas the high-power individuals were asked to judge the restaurant design according to various criteria, such as originality and cost-effectiveness. Having to judge or to be judged was used as a proxy for power. Low-power individuals were found to be more influenced by their partners' responses than high-power individuals. Although interesting, the findings of Skagerberg and Wright may be confounded by task demands; that is, the low-power 'designer' role was more cognitively demanding than the high-power 'judge' role. In other words, being asked to design a restaurant from scratch in 5 minutes is arguably more demanding than judging someone else's work subjectively with no time limit. The present study addressed this possible confound by manipulating power via tasks that were more closely matched in terms of cognitive demand for all participants than those of Skagerberg and Wright.

Social power can be viewed as a multifaceted construct, with each facet depending on the particular operationalization of 'power.' Skagerberg and Wright (2008) operationalized power in a manner similar to an educational context, where the low-power person (e.g., a student) performs some task and is assessed by a high-power person (e.g., a teacher). In this context, the focus (and much of the cognitive demand) is on the low-power person. The present study explores a different facet of social power by operationalizing power in a manner similar to the manager–employee relationship, where the high-power person tells the low-power person what to do. In this situation, the low-power person's task is to follow instructions. In the present study, managers were told that they would need to come up with a creative strategy for building a vehicle that their partners must follow, whereas the subordinates were required to follow whatever strategy the managers produced for building the vehicle. However, although both the high-power and low-power participants were given ample time and opportunity to prepare mentally for and to imagine their upcoming role and role-based interactions, neither dyad member actually engaged in the task. An additional improvement of the current design was the addition of a shared-power (i.e., control) condition in which both members of the dyad were assigned to collaborate together in completing the project; the control participants in the study of Skagerberg and Wright participated alone without engaging in a power-related task. The present study's control condition allows us to determine the extent to which high or low levels of social power affect memory conformity compared with a baseline.

There are other methodological differences between the study of Skagerberg and Wright (2008) and the present study. First, high-power participants in the present study may *expect* more cognitive load than low-power participants, even though this cognitive load difference was never actually experienced. This produces an inherent difference between the power roles in both studies: Skagerberg and Wright's low-power individuals presumably experienced more cognitive load than their counterparts, but our low-power individuals experienced and anticipated less cognitive load than both their high-power counterparts and Skagerberg and Wright's low-power participants. Second, the power roles differed in terms of the creative demands placed on participants. Specifically, the low-power participants in the study of Skagerberg and Wright (2008) and the high-power participants in the present study can be considered the more thoughtful and creative roles, as compared with their respective counterparts. Although our high-power participants were never told to design the vehicle-building strategy, we cannot rule out the possibility that these participants thought about this future task during the power manipulation. Third, our participants always responded second (i.e., after the confederate); Skagerberg and Wright (2008) did not use confederates in their design, so each participant responded first to 50 of the images and second to the other 50 images. Thus, participants in the present study, regardless of power role, were not given an explicit opportunity to exert their influence onto their study partners, which could produce differences in how power ultimately affects memory conformity.

Furthermore, the power manipulations in the two studies were qualitatively different. As mentioned earlier, participants in the study of Skagerberg and Wright (2008) experienced power roles akin to a student–teacher relationship, which requires a particular kind of collaboration wherein the assignments are completed creatively by the student. On the other hand, participants in the current study anticipated power roles that were explicitly analogous to a manager–employee relationship, in which the manager has the power to both determine how the task was carried out (i.e., not permitting the subordinate any creative control) and evaluate the subordinate on the task. Although participants in our study never carried out their role-based interactions, the complete dependence of the low-power subordinate on the high-power manager in the role descriptions told participants to expect a clear and rather complete imbalance of power. With this unambiguous distribution of power, we may expect to replicate Skagerberg and Wright's findings but with stronger effects. On the other hand, we may find an entirely different pattern of results. Moreover, referring to participants as managers, subordinates, and collaborators is overtly related to workplace power roles as opposed to Skagerberg and Wright's judge and designer roles. In sum, besides our main

attempts at expanding upon Skagerberg and Wright's manipulation of social power, other methodological differences between the studies could consequently produce differences in how power affects conformity.

The present study investigated how workplace social power moderates memory conformity while reducing the disparity in cognitive load among power roles. In line with the findings of prior research on power and memory conformity, we predicted that subordinates would display significantly more memory conformity than both managers and collaborators. However, given the differences in how power was manipulated between the present study and Skagerberg and Wright (2008), we could easily expect a pattern of results inconsistent with their results.

METHOD

The present study had three main independent variables: (i) power role (high power versus low power versus equal/collaborative) was manipulated between subjects; (ii) picture type ('new' versus 'old') was manipulated within subjects; and (iii) what the confederate said (new versus old) was manipulated within subjects. Power was manipulated *after* the memory encoding and *before* the memory test.

One-hundred eighty-three undergraduates (57% female; $M_{age} = 21$ years; $SD_{age} = 5.96$; 62% Hispanic; 12% Black; 9% White, non-Hispanic; 8% Asian) participated in exchange for research credit. After providing informed consent, participants were instructed with the following: 'You will be viewing 50 pictures on the computer monitor. They will each be presented for 1 second, so please pay attention as it will go by very quickly.' Participant–confederate pairs were then presented 50 images (1 second each in random order) on a computer screen. All images were randomly chosen from the same pool of monochromatic 'clip art' drawings, with the only exclusionary criterion being that no two images could be directly related to one another (e.g., the image pool contained one image of a boat and one image of a clock). After viewing these images, pairs were informed that their task was to build a realistic-looking vehicle by using K'NEX (similar to Lego) pieces. Next, pair members were randomly assigned to one of the following conditions: (i) the subject as the manager and the confederate as the subordinate; (ii) the subject as the subordinate and the confederate as the manager; or (iii) both the subject and confederate as collaborators. Participants were randomly assigned to one of the experimental conditions prior to their arrival. However, during the study, they were misled to believe that role assignments were determined by drawing a numbered piece of paper from a cup. Managers were told they would design a strategy for building the vehicle that the subordinate must follow, and subordinates were told that they would follow the design to build the vehicle. Collaborators were told they would work together with their partner towards the goal of completing the vehicle puzzle. Descriptions of the manager, subordinate, and collaborator roles and responsibilities were adapted from the study of Anderson and Berdahl (2002) (Appendix A, Appendix B, and Appendix C).

To assist participants in psychologically adopting and preparing for their assigned roles, participants were instructed to write for 5 minutes regarding their feelings about their assigned role, their expectations about their assigned role, and their expectations and thoughts about the upcoming interaction. Specifically, participants were told: 'Please take the next 5 minutes to describe: 1) your feelings about your role as manager/subordinate/collaborator, 2) your expectations for yourself as manager/subordinate/collaborator, and 3) your expectations and thoughts about the upcoming interaction with your fellow subordinate/manager/collaborator.' Writing manipulations have been used successfully to induce high-power and low-power psychological states (e.g., Galinsky et al., 2003). Further, they can be transcribed and analyzed to estimate how participants feel about their respective tasks.

After the writing task, subjects were told that before they engaged in the vehicle-building task, their memories for the 50 images would be tested. Participant–confederate pairs were presented 100 images (50 old and 50 never before seen). For each image, each pair member decided whether the image was old (i.e., one of the original 50 images) or new (i.e., not one of the original 50 images). On a sheet of paper numbered from 1 to 100, confederates responded to each image first, which was determined by the experimenter 'randomly assigning' participants their responding orders; confederates always pulled a piece of paper with the number 1 from the cup. After each response, confederates passed the response sheet to the subjects for their responses; this occurred for all 100 images. Confederates responded correctly to half of the images and incorrectly to the other half. After the memory task, participants were debriefed as to the true purpose of the study. No actual role-playing took place.

RESULTS

Table 1 shows the proportion of trials that the subject said old to new items (i.e., the false alarm rate) and to old items (i.e., the hit rate), broken down by whether the confederate said new or old, and the experimental condition. The hit rates are larger than the false alarm rates (overall, 71% compared with 23%), which shows that memory accuracy is above chance. The hit and false alarm rates are higher in each condition when the confederate said old (hit rate, 77%; false alarm rate, 28%) than when the confederate said new

Table 1. False alarm and hit rates for power conditions dependent on whether the confederate said new or old

	False alarm rate		Hit rate		
	Confederate says:		Confederate says:		MC effect (*SE*)
	New	Old	New	Old	
Manager	0.19	0.32	0.65	0.79	0.760 (0.063)
Subordinate	0.19	0.25	0.68	0.76	0.425 (0.060)
Collaborator	0.15	0.28	0.64	0.76	0.755 (0.065)

Note: Values for the false alarm and hit rates are the proportion of times the subject said 'old.' The MC (memory conformity) effect is the estimated coefficient (in *logit* units) for each condition from a model including whether the item was old, and allowing random variation for both subjects and items.

(hit rate, 66%; false alarm rate, 17%), which shows the impact of what the confederate said. A relatively new statistical procedure is used to incorporate potential moderators and for statistical inference. Details of this procedure are provided in APPENDIX D. Analyses are performed by predicting the binary variable, whether the participant says old for each trial. First, whether the target image was previously shown (i.e., whether the image was old or new) was entered into the model, and this increased the fit, $\chi^2(1) = 317.51$, $p < .001$. Adding what the confederate said, we further increased the fit, $\chi^2(1) = 316.96$, $p < .001$. This shows both that memory was accurate and that memory conformity occurred. Next, the condition was included as a three-category variable with simple contrasts comparing managers with collaborators and subordinates with collaborators. The main effect was non-significant, $\chi^2(2) = 2.67$, $p = .26$, but was retained to explore possible interactions. The main purpose of this study was to test if power condition interacted with what the confederate said. It did, $\chi^2(2) = 17.34$, $p < .001$. The manager and collaborator conditions did not differ significantly, $\beta = .12$ (manager higher), $SE = 0.09$, $z = 0.18$, $p = .86$, but there was significantly *less* memory conformity for subordinates than collaborators, $\beta = -.31$, $SE = 0.09$, $z = -3.49$, $p < .001$. A subsequent direct comparison of the manager and subordinate conditions was also significant, $\beta = .32$, $SE = 0.09$, $z = 3.70$, $p < .001$. Estimates of the memory conformity effect for each condition are shown in Table 1. These values can be transformed into odds ratios: for managers, 2.14; for subordinates, 1.53; and for collaborators, 2.13. Chen, Cohen, and Chen (2010) stated that small, medium, and large correspond to odds ratios of 0.52, 1.25, and 1.90. By using this terminology, the effects for subordinates are medium sized, whereas the effects for managers and collaborators are large. Thus, our prediction that subordinates would display significantly *more* memory conformity than both managers and collaborators was *not* confirmed.

Codings

To assess the degree to which participants embraced their assignments (i.e., assessing for possible psychological reactance), two blind raters coded the written descriptions participants gave about their randomly assigned roles on a 1 (*great discomfort or disliking*) to 5 (*great comfort or liking*) scale. The blind raters' scores correlated 0.70. The average of the coders' ratings was taken and standardized so that the sample mean was 0 and sample *SD* was 1. The means were −0.04 for managers, −0.31 for subordinates, and +0.39 for collaborators. The difference among these values is statistically significant, $F(2, 175) = 8.13$, $p < .001$, $\eta = 0.29$. The collaborators were significantly different from both managers, $t(175) = 2.40$, $p = .02$, and subordinates, $t(175) = 4.01$, $p < .001$.

This comfort variable was included in the model, and although the main effect did not significantly improve the fit, $\chi^2(1) = 0.08$, $p = .78$, it was retained so that interactions could be explored. The interaction between comfort and what the confederate said was non-significant, $\chi^2(1) = 0.37$, $p = .54$, but was also retained so that further interactions—namely the interaction among power role, what the confederate said, and comfort—could be explored. The interaction between comfort and condition was statistically significant, $\chi^2(2) = 7.48$, $p = .02$, but must be interpreted in light of a three-way interaction. The three-way interaction among power condition, what the confederate said, and comfort was also statistically significant, $\chi^2(2) = 9.48$, $p = .01$. As managers and collaborators become more comfortable, they also become more suggestible. The opposite is found for the subordinates: as they become more comfortable, they become less suggestible.

DISCUSSION

The current study investigated the extent to which power disparity between co-witness dyads moderates memory conformity while exploring a different facet of social power and addressing methodological limitations of previous research. Participants were asked to view a series of images and then were randomly assigned to a high-power, low-power, or equal-power role for a vehicle-building task, unrelated to any memory tests. Finally, participants were asked to make old/new judgments about 100 images, half of which had been seen previously and the other half had not. A confederate responded to each image first, providing correct and incorrect answers during the recognition task according to a predetermined response pattern.

Our initial analyses replicated the typical patterns observed in memory conformity research: participants' memory was above chance, showing that they were able to distinguish between old and new images, and participants conformed to what confederates said. Beyond replication, our findings showed that power did affect memory conformity. Contrary to our prediction, managers and collaborators conformed at similar rates, with both conforming significantly *more* than subordinates. These results are different from what Skagerberg and Wright (2008) found, which we believe is because of the different ways in which power was operationalized. In their study, power was operationalized in a manner analogous to an educational context. The high-power 'judges' evaluated restaurant designs that were created by the low-power 'designers'. In the present study, we manipulated power in a manner analogous to many workplace settings where the high-power person *instructs* the low-power person to perform a given task, but that both individuals are responsible for the outcome, albeit in different ways. In many workplace settings, it is often the powerholders who are evaluated most regarding the final product, whereas subordinates are tasked with completing much of the product.

There are three related accounts for our data. The first account is that managers and collaborators viewed the memory task as being less important than the subsequent vehicle-building task, which was to require ample time and attention on their part. Subordinates, on the other hand, may have believed the memory task to be more important than the vehicle-building task because they expected to simply follow orders throughout the vehicle-building task. Prior research shows that powerholders have flexible attention that is dependent on the expectations and responsibilities that are

important to them (Guinote, 2008; Overbeck & Park, 2001, 2006). In this study, powerholders were confronted with two tasks: one that was relevant to their power role (i.e., vehicle-building task) and one that was arguably irrelevant to their power role (i.e., memory task). Thus, they may have chosen to focus on their managerial role rather than expend cognitive resources and attention on a seemingly meaningless (memory) task. That is, managers may have allocated their resources to thinking about the managerial role they needed to perform rather than thinking about the pictures they had seen previously. Although they were in a qualitatively different power role, collaborators may have behaved similarly to managers in that they perceived the upcoming vehicle-building task to be more important (and thus worthy of more cognitive resources) than the memory task. Future research should measure and analyze the contribution of personal importance of roles and role tasks to study outcomes.

The second account for our data is that the managers and collaborators were more likely to conform than subordinates because of the perceived social value in agreeing with the other person. Specifically, managers anticipated having to tell subordinates to follow their instructions during the vehicle-building task. Managers may therefore have believed that agreeing with their subordinates on the memory task would facilitate this upcoming vehicle puzzle. Similarly, collaborators anticipated working together with their partners to build the vehicle, so they may have conformed in an effort to increase the chances of their collaborative venture being fruitful. Subordinates, however, were unlikely to have comparable levels of normative influence because in the latter task they would not be relying on the managers cooperating with them. This second account could explain the patterns shown in Figure 1, which shows that when managers are comfortable in their role, they should be trying to create a situation where they receive social approval from the subordinate with the aim of having the subordinate follow instructions dutifully.

A third account may explain the pattern observed among low-power individuals, where our results showed that memory conformity was lowest for subordinates compared with that of both the managers and collaborators. This finding differs from that of Skagerberg and Wright (2008) and from much of the extant research on power's effect on memory. We believe that subordinates conforming the least may have been a product of psychological reactance. Reactance occurs when a person's behavioral freedoms are threatened or eliminated (Brehm & Brehm, 1981). Our low-power participants expected to be told what to do during the vehicle-building task, with no room for personal input or creative freedom. As a result, subordinates may have perceived the memory task as important because it was their last opportunity to behave freely and autonomously. In other words, because subordinates would be told what to do during the vehicle-building task, they would react preemptively on the memory task by responding contrary to the manager as often as possible. Our data may provide further support for this potential explanation: of the three different power roles, subordinates felt the least comfortable with their assignments. Being unhappy with the hand they were dealt, low-power participants reacted in an effort to increase comfort and establish autonomy.

The important points to take away from this study are that there is a complex relationship between social power and memory conformity, and that how power is operationalized matters. We believe that the operationalization depends heavily on the goal(s) of the task used to create the power differential. In the study of Skagerberg and Wright (2008), the low-power person may have had more incentive to agree with the high-power person than vice versa. Also, the low-power person had already completed the designing task and was only to be assessed. The high-power person could not influence this task, so they should have believed that agreeing with their subordinates was unnecessary. Thus, individuals in low-power roles can conform more than those in high-power roles. In contrast, the managers and collaborators in the present study believed that they were about to engage in a task that would require collaboration and thus may have felt strong normative pressures to agree.

From an applied perspective, Skagerberg and Wright's (2008) operationalization of social power was akin to the teacher–student relationship. Our operationalization was analogous to that of the manager–employee relationship common in the workplace. While still manipulating social power, our study revealed that powerholders will not always be more influential than low-power individuals. Our methodological approach allowed us to investigate a context in which low-power individuals may actually conform significantly less than high-power individuals. It is clear then that people with and without power do not always behave as expected. Future studies should explore other possible differences between 'educational' and 'workplace' power, as well as other contexts in which there are power differentials

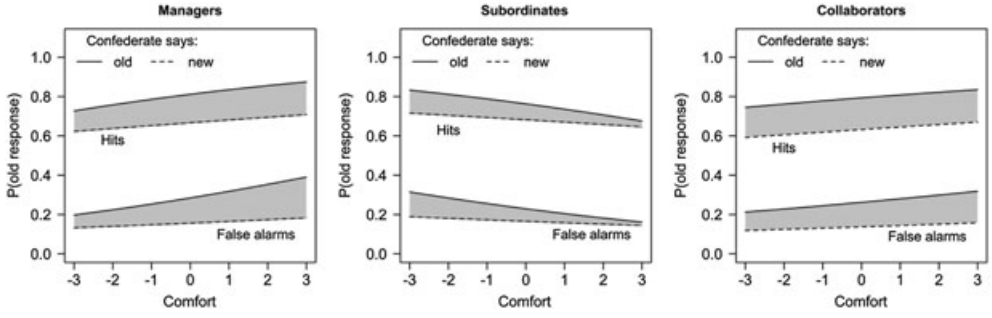

Figure 1. The probability of responding 'old' by the power condition, by hits versus false alarms (as labeled in the graphs), and by whether the confederate said old (solid lines) or 'new' (dashed lines). The gray areas represent the difference depending on what the confederate said and show the memory conformity effect.

(e.g., mother–child, therapist–client, and police officer–witness), to shed light on their particular effects on memory conformity. Further, among varying workplaces, different types of power relationships and goals exist, and these should also be explored.

Limitations

The present study had some limitations. First, the study required participants to come into a highly controlled scenario, which they are less likely to encounter outside of the laboratory. Second, it is also possible that participants were suspicious of the confederate, which could have influenced their responses during the memory task. However, very few participants reported being suspicious of the study's methodology during debriefing, because both power assignments and response orders were seemingly randomized. Third, the way in which social power was manipulated in the study may also have affected the results. That is, the situation that participants were placed in was unusual in terms of how power is acquired. Some might argue, for example, that power in the workplace is *earned*, rather than assigned, and that process itself may affect memory conformity differently than it did in this study. Also, because of subject-pool constraints, we did not recruit enough male participants to assess any gender differences in conformity. Some might argue that gender disparities affect workplace relationships, which may in turn play a role in how men and women conform during a memory task depending on their respective power roles. Nevertheless, the results of the current study show that social power does influence memory conformity. Future studies could investigate other types of power dynamics, gender issues, and even field investigations to increase ecological validity and generalizability.

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APPENDIX A

Manager role description

Manager: As the manager, you are in charge of directing and evaluating your subordinate partner in the completion of the vehicle puzzle.
You are responsible for the following:

1. Specifying the actions/strategy your subordinate will apply to the puzzle.
2. Deciding what outcome is most desirable for the puzzle.
3. Privately determining what standards/criteria you will use to judge your subordinate's performance.
4. Privately determining what score or grade to assign your subordinate once the puzzle is completed according to your specifications.

APPENDIX B

Subordinate role description

Subordinate: As subordinate, you are in charge of carrying out the instructions given to you by your manager and receiving an evaluation from your manager in the completion of the vehicle puzzle.
You are responsible for the following:

1. Carrying out the actions/strategy your manager specifies on the puzzle.
2. Adhering to the outcome the manager decides is most desirable for the puzzle.
3. Your manager will privately determine the standards that will be used to judge your performance.
4. Your manager will privately determine what score or grade to assign you once the puzzle is completed according to his or her specifications.

APPENDIX C

Collaborator role description

Collaborator: As a collaborator, you are required to work together with your partner towards the goal of completing the vehicle puzzle.
You are responsible for the following:

1. Carrying out the actions/strategy you and your partner agree on for solving the puzzle.
2. Adhering to the agreed-upon outcome that you both decide is most desirable for the puzzle.
3. You and your fellow collaborator will determine the standards that will be used to judge your performance.
4. You and your fellow collaborator will determine what score or grade to assign to each other once the puzzle is completed according to the agreed-upon standards.

APPENDIX D

The procedure used both to estimate the memory conformity effect and to test if it is moderated by other variables is relatively new, so it deserves further explanation. We begin with a conceptual description. Consider the data in the first row of Table 1. These are the proportions for subjects saying old to items that were not shown (the false alarm rates) and to items that were shown (the hit rates). These were broken down depending on whether the confederate said new or old and the experimental condition. The standard method in memory recognition research to operationalize memory accuracy is by comparing the hit rate with the false alarm rate. If someone has a good memory, then the probability of saying old to a previously shown item should be much higher than the probability of saying old to an item that was not previously shown. In a similar manner, the memory conformity effect is operationalized by comparing the probability of saying old after another person has said old with the probability of saying old after another person has said new (or with other designs compared with a control condition).

There are two main technical issues that need to be considered for statistical analyses. The first is that the hit rate and false alarm rates are proportions, so it is inappropriate to simply subtract them. Instead, in traditional analyses, the hit and false alarm rates for each individual would be transformed and then compared. The most common transformations are the *probit* and *logit* transformations. These transformations are used in probit regression and logistic regression, which will be beneficial for taking into account the second issue. They are *link* functions for these regression procedures (types of *generalized linear models*).

The second issue is that subjects took part in 100 trials, and therefore, these trials are dependent on each other. It is also useful to take into account that the same 100 pictures were shown to each person. It may be, for example, that some pictures look more familiar than others. To account for these factors, we used a multilevel logistic regression with random effects for both subjects and pictures. In technical terms, this is often described as a cross-classified model (see Goldstein, 2011, for an account written for statisticians; see Baayen, Davidson, & Bates, 2008, and Wright, Horry, & Skagerberg, 2009, for accounts written for psychologists). Multilevel logistic regression has been used for many recent memory conformity papers.

In all statistical models, some of the effects are fixed effects and some are random effects. In a purely between-subjects design, usually the only random effect is the single residual term, e_i. The minimum for a multilevel model is to allow the intercept to vary by subject. This means that each subject can have a different intercept, denoted with the subscript j. With a cross-classified model, the intercept is also allowed to vary by the stimulus, which can be denoted with the subscript k. Thus, the estimated value for the intercept, $\beta 0_{jk}$, depends on both the subject and the stimulus. The same can be carried out for the effect associated with measuring memory, $\beta 1_{jk}$. We assume that some people will have better memory than others and that some stimuli will be more easily remembered. We also allow the memory random

effects to be correlated with the intercept random effects. These are the random effects for the model.

The interest in most psychology analyses is with the fixed effects. The effect for whether the item is old or new is first included in the model. Next, the effect for what the confederate says is included. If two subjects are used, then it is important to test the effect of what the first subject says after including whether the item is old or new, because these will be correlated (i.e., for an easy task, both people would likely be correct for most items even if there were no social influence). The next step is including potential moderators. For this study, the main variable of interest is the condition to which the person was assigned. The main effect tests if the threshold for responding old differs among conditions. The interaction between condition and what the confederate says tests if the memory conformity effect is moderated by condition. To test the significance of effects, researchers compare models with and without the effect of interest and usually report the likelihood ratio χ^2 test.

The R package lme4 (Bates, Maechler, & Bolker, 2011) was used for all analyses. The following code tests the model that the experimental condition moderates the memory conformity effect. The first command predicts the probability of responding old for each trial from condition, whether the item is a target, and if the confederate says old. In addition, the intercept and the effect for whether the item is a target are allowed to vary by subject and picture (allowing a random intercept is the default if any other effects are allowed to be random). The family = binomial tells the package that the response is binomial and the default link function is the logit. The second command adds the interaction between condition and what the confederate says to the model. The third command compares these two models and finds the difference significant. The following are the commands with abbreviated output.

```
m1 <- lmer(sayold ~ condition + istarget + confedsaysold +
   (istarget|subjectno) + istarget|pictureno),family=binomial)
m2 <- update(m1, .~. + ondition:confedsaysold)
anova(m1,m2,test="Chisq")

   Df   AIC   BIC  logLik  Chisq Chi Df Pr(>Chisq)
m1 11 19233 19318 -9605.4
m2 13 19220 19321 -9596.7 17.343      2  0.0001714 ***
```