

Real or Artifact? Shedding light on *how* and *when* repeated expression can result in  
polarization

by

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## Abstract

Researchers have long noted that repeated expression of a judgment can cause that judgment to become more extreme. Three perspectives were explored for why this effect occurs. The first perspective implied that repeated expression results in changes in the evaluation such that it becomes more extreme. The next implied that individuals misinterpret ambiguous response scales and respond based on confidence which results in extremity. The final perspective implied that participants understand response scales but are sometimes incapable of accomplishing the judgment, and invoke confidence as a heuristic to guide responding. Experiment One tested these ideas in a colour judgment paradigm in a 3 (Level of Frequency: 3 vs. 5 vs. 8) x 2 (Question Order: Paired Judgments vs. Separated Judgments) mixed-model design. Repeated expression resulted in greater extremity, and greater confidence in judgments. Confidence was found to mediate the relationship between repeated expression and increased extremity regardless of question order. Experiment Two further disentangled the relationship between repeated expression and extremity by directly manipulating task difficulty, and by manipulating the nature of the response scale labels. A 3 (Level of frequency: 3 vs. 5 vs. 8) x 2 (Type of scale: numerical rating scale vs. colour shade scale) x 2 (Task Difficulty: 144 judgments versus 80 judgments) mixed-design experiment was conducted. Repeated expression again led to increased confidence in judgments. Results showed that repeated expression led to increased extremity when participants responded to the numeric rating scale that was considered ambiguous, but not when using the less ambiguous colour

shade scale. Confidence fully mediated the effect of repeated expression on extremity in the numeric rating scale condition. In the colour shade scale condition, the mediation of confidence was offset by a direct negative effect of frequency on extremity. Overall, evidence was found for both the response mapping ambiguity perspective and the evaluative change perspective. Evidence did not support the ability perspective.

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polarization

## **Chapter 1: Introduction**

“It's the repetition of affirmations that leads to belief. And once that belief  
becomes a deep conviction, things begin to happen.”

-Muhammad Ali

The research of attitudes has long captured the attention of social psychologists. An attitude is an evaluation of an object on a continuum from negative to positive. It has long been hypothesized that attitudes can have a variety of consequences in our social world, including the ability for attitudes to influence information processing (e.g., Fazio, 1989), and ultimately, to influence behaviour (see Fabrigar, Wegener, & MacDonald, 2010).

However, researchers have come to appreciate that attitudes are not always consequential. For example, sometimes attitudes are predictive of behaviour, other times not. As such, researchers began to investigate when attitudes are consequential, and why. One important discovery that helped to unravel this mystery was that attitudes vary on an underlying continuum of strength. Strong attitudes have four important attributes (Krosnick & Petty, 1995). First, they tend to be stable over time. Strong attitudes are also resistant to persuasion attempts. Additionally, strong attitudes serve as guides for information processing and judgment. Finally, strong attitudes are predictive of behaviour. In contrast, weak attitudes lack these four attributes. As such, the attitude-strength continuum is important for understanding and predicting attitude-relevant outcomes.

## **Antecedents of Attitude Strength**

Given the importance of the attitude strength concept, an obvious question arises as to what determines attitude strength. Research has demonstrated that there are a variety of antecedents to attitude strength, and it has been noted that there can be interplay among these antecedents (Krosnick, Boninger, Chuang, Berent, & Carnot, 1993). Although there are many specific antecedents to attitude strength, they can be conceptualized as falling into four categories: the processes by which attitudes are formed, subjective beliefs, cognitive structure, and the properties associated with the attitude itself (Petty & Krosnick, 1995).

First, some important antecedents of strength are related to the process by which the attitude is formed. For example, attitudes can be formed either by direct or indirect means. A direct means of attitude formation would be through direct experience with an attitude object. Attitudes formed through direct experience tend to be strong (e.g., Regan & Fazio, 1977). Alternatively, indirect attitude formation can occur when an individual receives information about an object without directly interacting with it. A second relevant process pertains to the degree of cognitive elaboration which is afforded to a given attitude object. For example, formation could be a result of careful scrutiny of information pertaining to the attitude object. This would be considered high cognitive elaboration. Alternatively, attitudes could be formed based on heuristics and cues in the environment, with relatively little cognitive elaboration (i.e., peripheral processing). Attitudes formed as a result of high cognitive elaboration tend to be stronger than those formed via peripheral processing (e.g., Petty, Haugtvedt, & Smith, 1995).

Another category of antecedents to attitude strength are subjective beliefs regarding the evaluation itself or subjective impressions of the functionality of the attitude object. For example, consider the construct of importance. Importance is how psychologically significant the attitude is considered to be. Generally, the higher the importance associated with the attitude, the stronger the attitude (e.g., Boninger, Krosnick, Berent & Fabrigar, 1995). Another example of a strength-related belief is certainty. This is the notion of understanding what a specific evaluation is, and the degree to which that evaluation is believed to be accurate. Those attitudes held with more certainty are generally stronger than those that are held with less certainty (Gross, Holtz, & Miller, 1995).

Attitude strength can also be influenced by the attitude structure. In the most basic form, an attitude can be thought of as a two-node semantic network where one node represents the object and the other node represents the global evaluation of that object. The link between these two nodes represents the strength of the association (Fazio, 1995). Such an evaluation can be linked with other knowledge structures in memory. Attitude structure, in addition to the two-node semantic network, therefore, also refers to the content held within associated knowledge structures linked in memory, the number of associated knowledge structures, the strength of the links connecting the attitude with associated knowledge structures, and the patterns of those links (Fabrigar & Wegener, 2010). One relevant feature to structure is thus unsurprisingly the amount of associated knowledge with a given attitude. Attitudes linked with large numbers of knowledge structures tend to be stronger than those attitudes supported by fewer knowledge structures (e.g., Davidson, 1995; Wood,

Rhodes, & Biek, 1995). Another feature relevant to structure is accessibility which is the speed at which an attitude can be brought to mind. Generally, the more accessible the attitude is, the stronger the associative link between the attitude object and the corresponding evaluation (e.g., Fazio, 1986).

### **Extremity and Attitude Strength**

The final category of antecedents of attitude strength involves properties inherent to the attitude itself. An attitude can be decomposed into two components: valence and extremity. Valence is the directionality of the attitude. Extremity, assuming a bi-polar evaluative continuum, is the deviation from the scale midpoint independent of valence. For example, a score of 6 on a 7-point scale is more extreme than a score of 5. However, a score of 5 has the equivalent extremity as a score of 3. These two components can be considered as the properties of the attitude itself. Valence has not received a great deal of attention with respect to attitude strength, whereas extremity has (e.g., Abelson, 1995; Judd & Brauer, 1995; Tesser, Martin, & Mendolia, 1995).

There is a sizable literature demonstrating that extremity is associated with attitude strength. First, more extreme attitudes are more difficult to change than those that are less extreme (Ewing, 1942; Osgood, Suci, & Tannenbaum, 1957; Sarat & Vidmar, 1976). Likewise, increased extremity is also associated with greater attitude-behaviour consistency (e.g., Cacioppo, Petty, Kao, & Rodriguez, 1986; Fazio & Zanna, 1978; Petersen & Dutton, 1975). Attitudes that are extreme tend to be more stable over time than those that are less extreme (Huckfeldt & Sprague, 2000; Prislin, 1996). Extreme attitudes have also been shown to influence information processing and

decision making. For example, extreme attitudes can result in greater selective exposure biases (Brannon, Tagler, & Eagly, 2007). Participants with extreme judgments also tend to overestimate the extremity of the views of others compared to those with less extreme judgments (Judd & Johnson, 1981), and those with extreme attitudes are more likely to view confirmatory evidence as convincing whereas counter-attitudinal evidence is seen as flawed (Lord, Ross, & Lepper, 1979).

Because extremity is associated with strong attitudes, it is important to know what causes an evaluation to become more extreme. One proposed cause arose from the finding that the discussion of attitude judgments within group contexts led those within the group to polarize in their attitudes (e.g., Myers & Lamm, 1976). This group polarization effect is not limited to attitudinal judgments, however. In group contexts, participants not only showed polarization in evaluative judgments pertaining to hypothetical faculty, but participants also polarized in monetary judgments (Myers, 1975). Two examples of possible explanations for group polarization effects could be that individuals learned new information in support of their evaluations (Burnstein & Vinokur, 1977), or perhaps individuals become more extreme as a result of a desire to self-enhance by placing oneself “more” in (dis)favour of the object than the likeminded peers (Myers, 1978).

Attitudes have also been shown to polarize as a result of merely thinking about an attitude object. Generally, in mere thought paradigms, participants are told to consider the attitude object of interest and consider ways in which they have interacted with the object in the past. It is proposed that thinking about an attitude object polarizes attitudes because individuals tend to process in line with an initial evaluation,

thus strengthening that initial attitude. This effect is known as “mere thought” (see Tesser et al., 1995).

### **The Effects of Repeated Expression on Extremity**

Another antecedent of attitude extremity, and the one of focus for this dissertation, is frequency of expression. Increased frequency of expression has been shown to result in greater extremity relative to judgments that are expressed less frequently (Judd & Brauer, 1995). Frequency of expression is different from mere thought because it does not involve thought, per se, at all. Indeed, a frequency of expression manipulation simply involves presenting an individual with an attitude object and having them repeatedly respond to an attitude scale (e.g., Downing, Judd, & Brauer, 1992). This can be contrasted with the mere thought paradigms where individuals list beliefs and thoughts about the attitude object. Frequency of expression manipulations may require no thinking, just retrieving.

In these studies generally, attitudinal objects were presented to participants at varying frequencies, with participants rating each object as good or bad. For example, consider the issue of abortion. In one condition, participants would be asked to judge the issue of abortion as good/bad three times, another condition would have abortion judged five times, and another condition would have it judged eight times. After this initial judgment phase, a final scale-based attitude measure would be given, and the effects of frequency would be explored across conditions.

The above manipulation of frequency of expression has been widely used, but primarily as a manipulation of attitude accessibility. Attitude accessibility is the ease with which an attitude can be called to mind. By frequently making an attitudinal

judgment, accessibility should be heightened. Many studies that used this manipulation have found that the greater the frequency of expression, the greater the accessibility as shown by faster response latencies. More accessible attitudes tended to be stronger than those that were not as accessible (e.g., Fazio, Sonbonmatsu, Powell & Kardes, 1986; Powell & Fazio, 1984). Some researchers have argued that frequency of expression influences solely accessibility, and not other antecedents of attitude strength such as extremity. Consistent with this view, many repeated expression studies have found that increased frequency of expression leads to quicker response times for evaluative judgments suggesting higher accessibility with no effects on extremity (e.g., Fazio et al., 1986; Powell & Fazio, 1984; Roskos-Ewoldsen & Fazio, 1992).

Although previous findings suggested that increased frequency of expression did not influence extremity, some researchers have argued that these conclusions are premature. First, some studies that failed to find effects of frequency on extremity treated extremity as a between-subjects factor, while treating accessibility as a within-subjects factor. Thus, only effects of accessibility were found, but the effect of frequency of evaluation on extremity suffered from a less powerful test. When comparing extremity and accessibility effects, both effects should be treated in the same manner (Downing, Judd, & Brauer, 1992).

A second, more conceptual, criticism is that in many repeated expression studies participants may have developed a scale response consistency bias. In most repeated expression studies, participants made good/bad judgments during the frequency manipulation phase on a multi-point scale, and then later reported a final time on another multi-point response scale. As such, participants may have developed a

memory of where they responded on the earlier response scales (e.g., “towards the right end of the scale”). Thus, even if an evaluation did become more extreme, participants may have felt pressure to respond consistently with earlier responses. This would result in failure to detect shifts in extremity (Downing et al., 1992).

To further explore the effects of repeated expression on extremity, Downing et al. (1992) conducted a study that directly tested whether the nature of an initial judgment led to different extremity ratings depending on frequency of expression. Participants were presented with a series of issues. The frequency with which each issue was shown was manipulated within participants. Initial exposure was conducted in one of two ways: in one condition participants were repeatedly presented issues and asked to evaluate the issues on a multi-point scale. In another condition, participants were told to rate each issue dichotomously, as either good or bad. At a later phase, all participants reported their attitudes towards the issues on a multi-point scale. Similar to Fazio (1984), it was found that when participants initially responded to a multi-point scale, they failed to show extremity effects on the final multi-point scale. However, when participants responded to a dichotomous scale and were only aware of the valence of their evaluation, and not the extremity, they showed more extreme evaluations on the final multi-point scale as a result of increased frequency of expression. Thus, when there was no pressure to respond consistently on similar scales, polarization occurred.

In the above study, it could be argued that polarization effects were caused only in the dichotomous response condition because participants who were initially neutral in their evaluations were forced to judge each issue as good or bad with no option for a neutral evaluation. As a result of being forced to take a stand, originally neutral



evaluations polarized. Thus, in a second study, Downing and colleagues did not require participants to make a clear positive or negative evaluation. Participants were presented with a variety of issues at varying frequencies. In one condition, similar to Study 1, participants initially rated issues on a multi-point scale. In another condition, however, participants were asked to freely vocalize their evaluations for each object, and participants were in no way constrained in their responses. Thus, participants were free to remain neutral in their evaluations. In the final phase, all participants reported their evaluations to each issue on a multi-point scale. Once again, participants who responded initially to a multi-point scale failed to show more extreme evaluations as a result of increased frequency of expression. As expected, however, those participants who freely vocalized their responses did show increased extremity as a result of greater frequency of expression. Thus, the effect of increased expression on extremity was demonstrated without forcing participants with neutral attitudes to take a stand.

Interestingly, Downing et al. (1992) found that polarization resulting from repeated expression is not limited to attitudinal judgments, but also appears for judgments of objective physical properties. In a third experiment, participants were presented with a set of Chinese ideographs that appeared in various colours ranging from a pure blue hue, to various gradations of purple (i.e., reflecting a mixture of red and blue hues), to a pure red hue. Each ideograph was consistently portrayed in one of nine specific gradations within the red-blue spectrum. Characters were viewed either three, five, or eight times and were judged by participants as being primarily “red” or primarily “blue.” After character presentation, participants were shown the ideographs in black with a white background and were asked to recall from memory the

corresponding colour of each ideograph. Participants rated the colour of the ideograph on a 9-point scale with endpoints labeled *red* and *blue*. Results showed that ideographs judged at a higher frequency received more extreme colour ratings than those ideographs shown at an intermediate or low frequency. Response times also decreased for those ideographs shown more often, demonstrating accessibility.

This phenomenon of repeated expression leading to increased extremity has been found for attitudes that are not only expressed, but also for attitudes that were frequently activated (Judd, Drake, Downing, & Krosnick, 1991). Repeatedly expressing an attitude about one particular issue not only led to an increase in the extremity of that particular attitude, but also attitudes on a second, linked issue (but not for an unlinked issue), suggesting that merely activating an attitude leads to polarization. For example, increased frequency of expression of attitudes towards a nuclear testing ban not only led to extremity for that attitude, but also increased extremity of related issues linked in long-term memory. This is known as spreading polarization.

As research exploring repeated expression and polarization progressed, it was discovered that some previous polarization findings may be actually due to repeated expression, and not necessarily the previously accepted mechanisms. For example, as noted, group discussion was found to result in polarization (e.g., Myers & Lamm, 1976). However, it was more recently shown that when participants repeatedly expressed an evaluation during a controlled discussion, they showed greater extremity at the end of the experimental session for that issue (Brauer, Judd, & Gliner, 1995).

Thus, in part, group polarization effects can be explained by individuals frequently expressing a judgment.

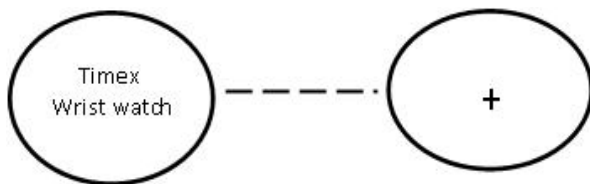
Despite evidence for the effects of repeated expression on judgmental extremity, some critics failed to find the evidence convincing. A criticism of the findings that repeated expression led to greater polarization comes from what is known as the neutrality hypothesis (Fazio, 1995). As noted, it has been argued that responding to a dichotomous response scale during the initial evaluation phase artificially forced participants with neutral attitudes to make directional evaluations. As a result of being forced to “take a stand,” participants may thus have later demonstrated a more extreme attitude. Consistent with this argument, there is some evidence that increased frequency of expression only caused neutral attitudes to polarize, but not those attitudes initially classified as moderate or extreme (Fazio & Powell, 1994 as cited in Fazio, 1995).

There are compelling counter arguments to the neutrality hypothesis, however. First, as reviewed earlier, increased frequency of expression resulted in polarization even when participants did not have to make a directional judgment in the initial judgment phases (e.g., Study 2, Downing et al., 1992). It could be argued that even though participants freely vocalized their judgments, there was still an implicit demand to take a stand. However, these extremity effects emerged even when no evaluation was explicitly made at all as was shown in the spreading polarization studies (Judd et al., 1992). As such, it is difficult to accept this criticism. Additionally, there is a statistical confound associated with the neutrality hypothesis. Neutral attitudes have the most room to “move” on the response continuum. If an attitude object is rated as an

“8” on a 9-point scale, it is only able to deviate 1 point in extremity. A score of 5, however, has the ability to move a full 4 scale points, resulting in a larger magnitude of change. It is thus unsurprising that extremity effects were hard to detect for already extremely held judgments.

### **Mechanisms Underlying Polarization**

Based on available data, a reasonably convincing case can be made for increased frequency of expression leading to greater extremity. However, it is not understood *why* repeated expression leads to greater polarization. Judd and Brauer (1995) proposed a formal model that allows for consideration of how frequency of expression could lead to greater extremity. The model uses a semantic-network approach to represent attitudes and associated structures. Recall that a basic representation of an attitude (shown in Figure 1) would include a node representing the concept idea stored in memory (in this case Timex wrist watches), an evaluative tag associated with the node (in this case positive), and the association between those nodes (as shown by the connecting line) (Fazio, Chen, McDonel, & Sherman, 1982).



*Figure 1.* Semantic network representation of an attitude.

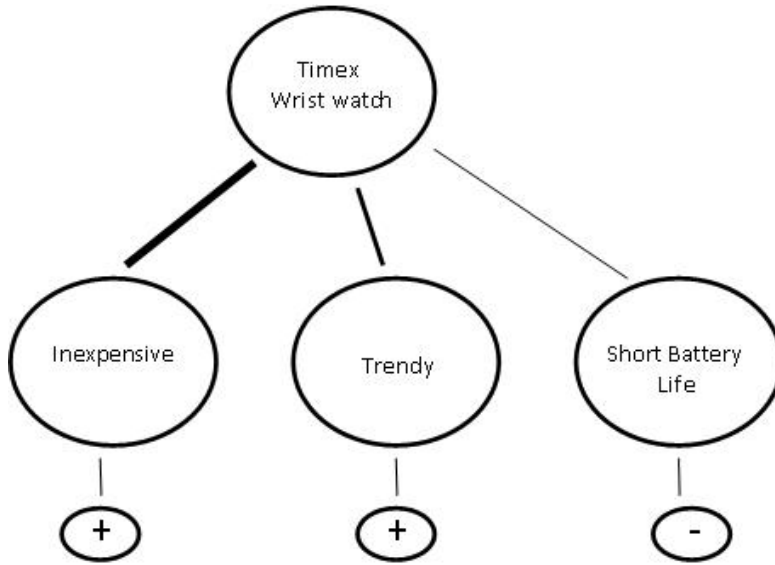
In addition to the link between the attitude object and its global evaluation, the attitude object can also be linked with other associated concepts. The degrees of association between an attitude object, its corresponding evaluation, and other pieces of

related knowledge are represented by lines of varying thickness. Thicker lines represent stronger associations. In this model, there are three stages at which increased frequency could lead to greater extremity: the representational (input) stage, the computational phase, or the mapping (output) phase.

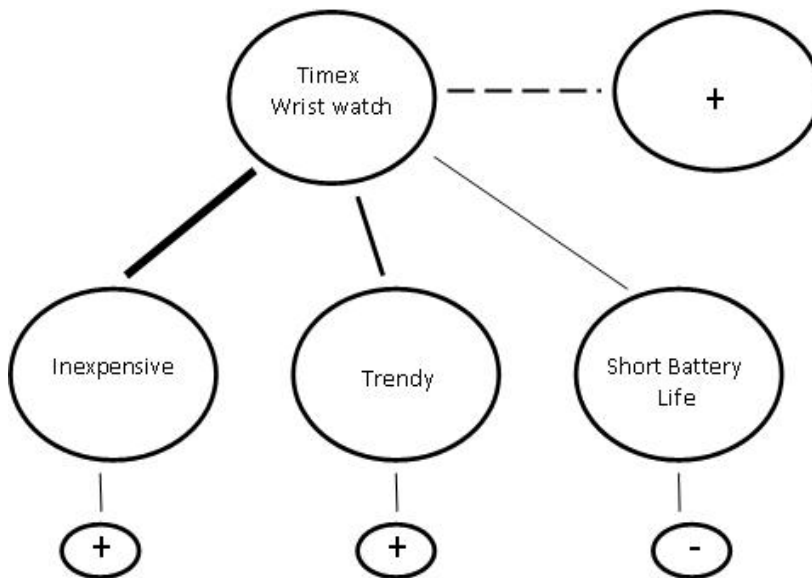
**Cognitive Representational Phase (Input).** To better understand this model, it is useful to consider first how an attitude is formed within this framework. As illustrated in Figure 2a, consider an individual being called upon to make an evaluation of Timex wrist watches for the first time. This individual has never evaluated Timex watches before. As such, the individual calls up relevant information from memory, and evaluates that information in some way to help make the judgment. For the sake of demonstration, assume that the individual calls up all relevant information known about Timex watches, although this is not necessary for the model. This individual has a strong sense that Timex watches are inexpensive, as indicated by thick line linking “inexpensive” with Timex watches. This piece of information is considered to be positive. Timex watches are also considered to be trendy, which is considered to be positive, although this information is not as strongly linked with the watch as is the fact that it is inexpensive (as indicated by a thinner line). The individual also has a sense that the battery life is short with Timex watches, and this is considered to be negative. This negative piece of knowledge is associated relatively weakly with Timex watches as indicated by a thinner line. Based on the knowledge that has been accessed, the individual computes a global evaluation for Timex watches (see Figure 2b). The overall evaluation is positive, but this positive global evaluation is only weakly associated with Timex watches on this initial evaluation, as indicated by the dotted line.

According to the model, at the representational stage, every time an evaluation of Timex watches is expressed, the cognitive representation, in whole or in part, will be activated. As can be seen in Figure 2c, with subsequent expressions of the Timex watch evaluation, some associations strengthen, and others weaken. This is because during initial classification, the object is categorized based on some salient features. With repeated retrieval, those associations that facilitate the classification are selectively retrieved. Associations that are retrieved more often become stronger due to repeated activation, serving to reinforce and strengthen the global evaluation. Those associations that are not activated, or that are not activated frequently, could suffer from memory decay over time, and ultimately might completely disappear from the network. In this instance, “inexpensive” is facilitated by the initial evaluation and is more readily accessed in subsequent judgments, leading to a stronger association. The association between Timex Watches and “short battery life,” however, might be suppressed because it is incongruent with the other information. As the global expression is repeatedly made, confidence in that expression and the classifications that led to the expression also increase. As a result, the global evaluation strengthens rapidly compared to other associations. With numerous expressions over time, congruent associations will continue to strengthen, but continued lack of activation for incongruent associations could result in incongruent associations eliminated from the network altogether. Illustrating this, as can be seen in Figure 2d, the association between Timex watches and short battery life has disappeared completely, which ultimately results in an even more positive global evaluation.

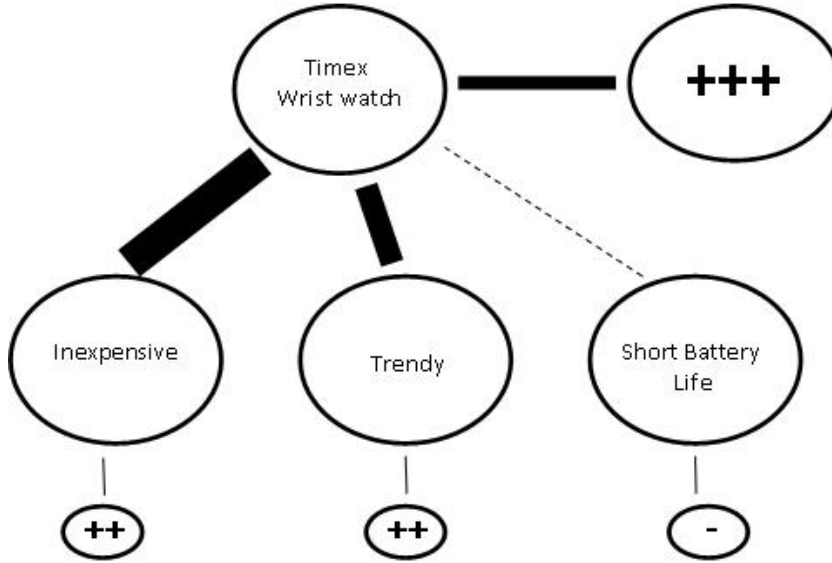
A: Pre-Evaluation



B: Initial Evaluation



C: Representation after a moderate number of evaluations



D: Representation after numerous evaluations

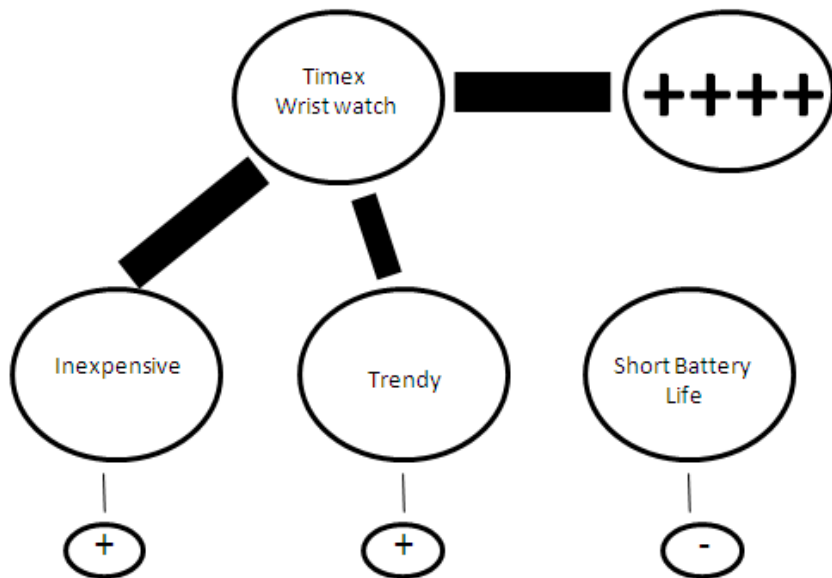


Figure 2. The creation and subsequent representation of an attitude.



**Computational Stage.** To arrive at an evaluation, individuals engage in a type of cognitive computation. As such, attitudes can be considered products of cognitive computation. In this model, people weight information that has been activated within the relevant semantic network. Some attributes are weighted more heavily than others, perhaps for reasons such as increased personal relevance, or certainty. Recall that at the representational level, although some associations between concepts strengthen, it is possible for others to decay and disappear altogether. However, at the computational phase, even if incongruent attributes are activated, it is still possible to see an attitude polarize. For the sake of demonstration, in the following example it will be assumed that individuals weight information according to the degree to which they are certain of it.

To show the effects of cognitive computation, consider the first time an evaluation of Timex watches is made (see Figure 2a). There is no global evaluation of Timex watches yet. To form an evaluation of Timex watches, associated knowledge, evaluations tagged with that knowledge, and the strength of associations with those links are considered. As seen in Figure 2a, the individual has a relatively strong association between Timex watches and “inexpensive.” Because this association is strong, perhaps the individual is also relatively certain of this association. For the sake of demonstration, this person is 80% certain that Timex watches are inexpensive. As a result, in the cognitive computation for a Timex evaluation, “inexpensive” is weighted at .80. In addition, the individual has a sense that Timex watches are “trendy,” and is perhaps 60% certain in this association. As such, “trendy” is weighted at .60 in the computation. Both of these evaluations are positive, and for the sake of demonstration,

both have the same magnitude of positivity which is represented as 1. The individual has a relatively weak association between Timex watches and “short battery life,” however, and thus is less confident in the judgment, and weights this information at .30. The magnitude of negativity is weighted at 1. Note that each piece of information has a weight representing the degree of certainty about the association, as well as a weight representing the magnitude of directionality. Thus, the initial evaluation of Timex watches would look like this:

$$\begin{aligned} \textbf{Initial Evaluation} &= .80[\text{Inexpensive } \{+1\}] + .60[\text{Trendy } \{+1\}] \\ &+ .30[\text{Short battery life } \{-1\}] \end{aligned}$$

$$\textbf{Initial Evaluation} = 1.10$$

For subsequent evaluative expressions, the associated structures are once again called up to be included in the computation. The second time an evaluation is made the computation changes to include the now present global evaluation of Timex watches. Because it is brand new, the global evaluation is not yet held with a great deal of certainty in the second evaluation. As such, it is only weighted at .20. The evaluation is positive, and is weighted at .8 for magnitude. This is because there are some positive associations, as well as a negative association. Assuming no other relevant information has changed, the second evaluation computation could look like this:

$$\begin{aligned} \textbf{Second Evaluation} &= .20[\text{Timex watches } \{+.80\}] + .80[\text{Inexpensive} \\ &\quad \{+1\}] \\ &+ .60[\text{Trendy } \{+1\}] + .30[\text{Short battery life } \{-1\}] \end{aligned}$$

$$\textbf{Second Evaluation} = 1.26$$

As can be seen from the equations, the judgment of Timex watches has become more extreme as a result of one additional expression.

As the evaluation is repeatedly expressed, the weighting of each piece of information could change as some associations become stronger whereas other associations stay the same or begin to decay. For example, if “inexpensive” is repeatedly called to mind, it may be allocated more computational weight as certainty in that association increases. However, as the congruent positive associations strengthen, doubt may arise for the incongruent associations causing them to be assigned less weight. Arguably though, the most important piece of information to the computation is the outcome of past global evaluations. For example, if in the past Timex watches were considered as good, this is a useful piece of information for future computations. As a result of repeated expression of the global evaluation, both confidence in and magnitude of the global evaluation would rapidly increase thus leading to a more rapid increase in computational weight relative to other changes. Thus, the computation might look like this:

$$\begin{aligned} \text{Moderate Number of Evaluations} &= .80[\text{Timex watches } \{+1\}] \\ &+.90[\text{Inexpensive } \{+1\}] + .75[\text{Trendy } \{+1\}] + .10[\text{Short battery life } \{-1\}] \end{aligned}$$

$$\text{Moderate Number of Evaluations} = 2.35$$

Again, more expressions of this evaluation cause the evaluation become more extreme.

With continued frequency of expression, associations between the attitude object and incongruent information may stop receiving computational weight altogether. Perhaps confidence in the global evaluation causes incongruent information to become completely discredited. As a result, the incongruent association receives no

weight and the global evaluation becomes more positive. In addition, with each instance of expression, the positive associations continue to strengthen, also leading to greater polarization.

$$\mathbf{Numerous\ Evaluations} = .95[\text{Timex watches } \{+1\}] + .90[\text{Inexpensive } \{+1\}]$$

$$+ .8[\text{Trendy } \{+1\}] + .00[\text{Short battery life } \{-1\}]$$

$$\mathbf{Numerous\ Evaluations} = 2.65$$

Ultimately, past global evaluations could become so strong that they in fact drive future evaluations almost exclusively.

At a conceptual level it makes sense to distinguish between representational and computational changes in an evaluation. Attributes associated with a target object can disappear at the representational level. At the computational level, even if an attribute is still present, changes in computational weight could result in different evaluative outcomes. That said, at some practical level, it could be difficult to distinguish representational changes and computational changes. Indeed, it is likely that the two are interdependent: changes in cognitive representation lead to changes in computation. Thus, at the empirical level, it would be difficult to know whether an attribute is no longer a part of the associated network, or whether an attribute is still present and activated but given no weight. Regardless, changes at the representational and computational stages both lead to the same outcome: a change in the evaluation itself.

**Response Mapping Stage (Output).** Although changes in both the representation and computation stages of this model necessarily result in changes in the actual attitude, this is not always the case when it comes to response mapping. This

output stage is when individuals report their attitude. Depending on the nature of the provided scale, despite the underlying attitude remaining the same, the reported evaluation could vary (as seen in Figure 3). For example, if endpoints are moderately labeled, responding at the extremes of the continuum seems plausible. However, if scale endpoints are strongly worded, an individual might be tempted to respond more moderately (Ostrom & Upshaw, 1968). Note that in both cases, the attitude could be identical: the variance in responding is based solely on the nature of the response scale.

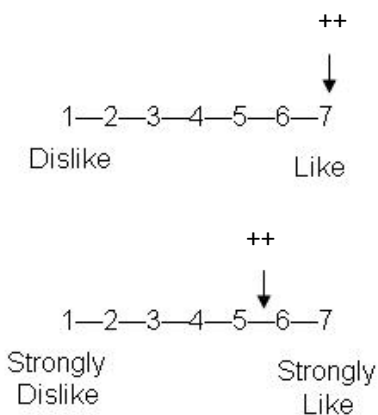


Figure 3. Response mapping effect.

Although the nature of the scale does not necessarily lead to changes in the representation or computation of an evaluation, it has been argued by Judd and Brauer (1995) that perhaps responding to a scale provides the individual with new information that they *do* incorporate into their representation. For example, the “7” that is selected becomes stored in memory, and it may be noted that this “7” is an extreme score. The more frequently such an evaluation is made, the more accessible and fluid that “7” becomes, perhaps leading it to be more strongly weighted. As a result, subsequent expressions would be more extreme. With repeated expressions, this “7” might also

translate into more extreme scores on other multi-point scales as the extremity of “7” becomes a part of the stored evaluation, and as confidence in this assessment increases. Although possible, upon close inspection this explanation does not fully account for past extremity findings. As previously noted, when participants were not constrained to a response scale, repeated expression still resulted in greater extremity. Additionally, while increased fluidity might account for a faster response, it is not clear how increased fluidity and accessibility would result in greater extremity in responses. As such, this specific mapping explanation cannot fully explain extremity effects.

Although response mapping could feed back and result in changes at the representation or computation of an attitude, it is also possible for frequency of expression to result in polarization at the response mapping stage with no changes to the evaluation itself. Although not explicitly discussed by Judd and Brauer (1995), it is important to note that the intent of a given question could be inherently ambiguous. This ambiguity is one mechanism by which polarization might occur as a result of increased frequency. A 7-point attitude measure may seem like an “easy” task to social psychologists, but responding to them can actually prove somewhat difficult. For example, once an evaluation for Timex watches has been expressed many times, the individual knows that Timex watches have a positive global evaluation. But what does one do with that? Generally, individuals are called to report their global evaluations onto a scale. For example, if an individual is responding to a 1-7 scale ranging from dislike to like, the difference between choosing a 5, 6 and 7 on that scale could be unclear. As researchers, we like to think that a “5” means “like a little,” and a “7” means “like a lot,” and that a higher response number reflects an increased degree of

liking. However, this is not the only way such a response scale could be interpreted. Perhaps more extreme responses reflect the degree of certainty with which one “likes” the attitude object. Thus, a “7” does not represent more liking for the object, but perhaps the confidence with which someone knows that they like it. For example, I am very confident that I like Timex watches even though I might not have an extreme amount of inherent “liking” for them. Thus, because the scale is ambiguous, participants provide more extreme responses as a result of increased confidence due to repeated expression, which does not necessarily imply a change in the evaluative extremity. This can be considered a response mapping ambiguity explanation for polarization due to repeated expression.

Whereas in some cases individuals might not understand the intent of the scale, perhaps in other cases the individual does understand the intent of a scale, but the task is too difficult for the individual to successfully carry out. As a result, the individual might rely on heuristics to guide scale responding. Thus, a second reason why polarization might result from increased frequency of expression could be because of task difficulty. This explanation would perhaps be especially likely for judgment tasks involving objective properties, such as colour. Recall that in some studies, participants were shown ideographs and were asked to judge whether the ideograph was red or blue (Downing et al., 1992). It could be that despite repeated initial judgments of colour, an individual has imperfect memory of the exact colour that an ideograph was shown in when responding to the final response scale. Thus, when responding to the scale, the individual could know what is being asked of them (i.e., “how blue was this ideograph?”), but is unable to answer the question. Despite not knowing the exact

colour, the individual might feel very confident that the ideograph was blue, and thus perhaps assume that if confidence is very high, this must mean that the ideograph was pure blue. The representation of the colour in memory has not changed, the ideograph is not seen as any more “blue,” but confidence is used to help guide responding. As a result, the judgment appears as more extreme. This can be considered an ability explanation based on response mapping processes for polarization due to repeated expression.

### **Goals of the Current Research**

At each stage of the model proposed by Judd and Brauer, there are interesting possible explanations as to why repeated expression leads to polarization. However, despite speculation, to date there has been little empirical attention towards these mechanisms. Given that possible mechanisms for repeated expression leading to polarization have gone largely untested, the primary goal of this dissertation is to begin disentangling possible mechanisms. These mechanisms can be classified into two broad categories. The first category captures polarizing mechanisms due to repeated expression that are caused by changes to the evaluation itself. These changes could be due to a representational and/or a computational change. The second category captures mechanisms where polarization due to repeated expression is a result of response mapping, with no changes to the evaluation itself.

The distinction between polarization resulting from evaluation change versus response mapping is important. Extreme attitudes tend to be strong. Therefore, if an attitude is truly polarizing as a result of repeated expression, there are possible strength-related consequences (e.g., greater resistance to persuasion). Indeed, the processes that



lead to extremity could be closely tied with processes that lead to attitude strength. For example, repeated expression could also serve to reinforce associative links. As a result, it would become increasingly difficult to weaken those associations in the future, which could contribute to various strength outcomes. Thus, in addition to frequency of expression leading to polarization, frequency of expression might also provide some understanding for *why* resulting extreme attitudes are strong. Alternatively, if repeated expression leads to polarization solely because of the output process, strength-related consequences likely would not occur.

Given the consequences associated with attitude strength, understanding of mechanisms leading to polarization as a result of repeated expression is theoretically interesting. Not only are polarization effects of potential importance for attitude theory, but there are also possible implications for psychometrics. For example, if extremity due to repeated expression appears because of response mapping, scales should be constructed in such a way to prevent this artifact. Of course it could be that polarization due to repeated expression is a result of both evaluative change and response mapping. Because of implications for both attitude theory and psychometrics, the primary goal of the current research is to begin to disentangle the mechanisms that cause repeated expression to lead to polarization. This will be accomplished by evaluating three explanations for why repeated expression could result in polarization.

The first of the three explanations to be explored is based on the response mapping ambiguity perspective. As noted previously, this perspective implies that individuals misinterpret ambiguous response scales such that extreme endpoints are interpreted to reflect confidence in the judgment. The second explanation is based on

the response mapping ability perspective. This perspective implies that individuals know what is being asked of them when responding to a scale, but that they are unable to do the task. The final perspective to be explored is based on evaluative change. This perspective implies that with repeated expression results in changes at either the representation and/or computation such that an evaluation becomes more extreme.

In order to test these proposed explanations, two experiments were conducted using a colour judgment paradigm. In both studies, participants were asked to dichotomously judge the colour of Chinese ideographs that were presented at various frequencies and in various shades of red and blue. Participants were later asked to report the objective property of colour for each ideograph, and it was this final colour judgment that was measured for extremity. In addition, participants were asked to report their confidence associated with each colour judgment. This colour paradigm was chosen because there is an objective referent from which to gauge judgments which is important for disentangling the extremity phenomenon. With objective properties, it is possible to construct unambiguous scales that have a “correct” response, and thus it is possible to see whether judgments are truly being reported as more extreme than the objective referent.

The goal of Experiment One was to reduce scale ambiguity, and to better understand the role of confidence in polarization. Conversational norms dictate that people do not ask for redundant information (see Schwarz, 1996; 1999). It would be strange to ask the same question twice, and so people interpret seemingly related questions as being distinct. As such, Experiment One attempted to disambiguate scale intent by manipulating question order. For example, in one condition, question order

was manipulated so that related, but distinct, judgments were presented together. Specifically, an ideograph was presented in a shade of red or blue, and participants were asked to indicate the colour of the ideograph on a 9-point scale. Immediately following this judgment of colour, individuals were asked to report their confidence for the preceding colour judgment. Presumably, presenting the two related, but distinct, questions together would allow participants to rapidly disambiguate the intent of the colour question, and thus it would not be misinterpreted to measure confidence. In contrast, other participants made all colour judgments first, with confidence only being asked after all colour judgments were made. As a result of the question separation, it was thought that there would be ambiguity associated with the colour question, and that due to this ambiguity perhaps participants would misinterpret extreme scale points to measure confidence.

Hypotheses for this study varied as a function of polarization perspective. The response mapping ambiguity explanation for extremity would imply that extremity should disappear when questions are paired together because question intent is no longer ambiguous. In the separated order condition, however, where ambiguity is present, the extremity effect due to repeated expression should appear, and confidence should mediate the relationship between repeated expression and extremity. The ability explanation would predict that manipulating question order should have no effect on extremity: the task is too difficult, and disambiguating question order will not help. As such, confidence should act as a mediator between frequency of expression and extremity in both order conditions. The evaluative change explanation would predict that changing question order will not influence the impact of frequency on extremity

scores, because the evaluation really has changed to become more extreme.

Confidence could mediate the relationship (although this is not required), but only because it might act as a proxy for changes in representation and/or computation.

Whereas Experiment One manipulated scale ambiguity through question order, Experiment Two manipulated scale ambiguity by changing features associated with a response scale. Typically, individuals map responses onto numeric response scales. As noted, this can be an ambiguous task. Thus, a very unambiguous scale was created. In this unambiguous scale, rather than traditional numeric points on a continuum, a continuum was created where the exact same shades of colour were used that participants saw during the presentation phase. It was thought that mapping colour judgments onto a scale with those exact shades of colour would reduce any potential ambiguity that could be present in traditional numeric response scales. Hypotheses associated with the scale type manipulation again varied as a function of polarization perspective. The ambiguity explanation would predict that extremity should disappear when the response scale intent is clear. However, when ambiguity is present, confidence should mediate the relationship between repeated expression and extremity due to intent misinterpretation. This mediation would not occur when the scale is unambiguous because the intent of the question would be clear. The ability explanation would predict that manipulating scale clarity should have no effect on extremity: the task is too difficult, and an unambiguous scale will not help. As such, confidence will act as a mediator between frequency of expression and extremity regardless of scale type. The evaluative change explanation would predict that changing question order will not influence extremity scores, because the evaluation really has changed to

become more extreme. Confidence could mediate the relationship, but only because it might act as a proxy for changes in representation and computation.

In addition to manipulating scale clarity, Experiment Two also manipulated task difficulty. It was thought that by greatly reducing the number of judgments, scale responding would become much easier, and thus ability to accurately report colour judgments would increase. The ability explanation would predict that reducing the number of judgments should eliminate extremity effects since ability would be high, and thus the task would now be achievable. Alternatively, if ability is low, confidence would mediate the relationship because confidence would be invoked as a heuristic for responding. The evaluative change explanation would predict that reducing the number of judgments would not influence extremity because extreme responses reflect the true evaluation. Confidence would only act as a mediator in this explanation if it serves as a proxy for strength of representational links or computational weight.

## Chapter 2: Experiment One

The purpose of Experiment One was to begin to disentangle two broad categories of mechanisms that could explain why increased frequency of expression leads to greater extremity: changes in the evaluation, and response mapping effects. This experiment manipulated question order so as to disambiguate scale intent.

### Method

#### Design

This experiment was a 3 (Level of Frequency: 3 vs. 5 vs. 8) x 2 (Question Order: Paired Judgments vs. Separated Judgments) mixed-model design. Level of frequency was manipulated within subjects, such that some characters were shown 3 times, others 5 times, and others 8 times. Question order was manipulated between subjects such that half of the participants responded colour judgments immediately followed by confidence judgments, whereas the other half of participants reported colour judgments for all stimuli, and then reported confidence for all previous colour judgments.

#### Participants

Participants were 611 introductory undergraduate students who participated for 1% course credit, or \$5. All participants self-reported as not being colour blind.

#### Procedure

**Phase 1: Instructions.** Participants were brought into the lab in groups of one to six where they read a letter of information and signed the consent form (for ethics documents see Appendix A). Participants were then randomly assigned to condition,

reflecting the between subjects manipulation of question order. Random assignment to condition was conducted through the use of randomizer.org which provided a series of random numbers representing condition.

The method of this study was based on that used by Downing et al. (1992). Participants were told that they would be presented with a variety of Chinese characters, and that they had three tasks. First, they were asked describe out loud what each character reminded them of and they were told that the computer would record their responses. This was done to ensure processing of the stimuli. Responses were not actually recorded. Second, participants were to try and remember the colour of each character presented to them, and finally they were asked to use the mouse to click “red” if the character looked red or “blue if the character looked blue. They were told that clicking the “red” or “blue” button would bring up a new character to be judged. Participants were told to put on headphones if there was more than one participant in a room to prevent distraction as they described the characters out loud, and were told that the instructions would also appear on screen before they began the task (see Appendix B for experimental materials).

**Phase 2: Presentation.** During the presentation phase, participants judged the colour of 27 Chinese characters. Frequency of expression was manipulated within subjects. Across participants, nine characters were shown 3 times, a different nine characters were shown 5 times, and the other nine characters were shown 8 times. Thus, participants made a total of 144 colour judgments during the presentation phase. It is important to note that three different sets of characters were constructed so that the frequency associated with a given character changed across character sets. For example,

Character 1 was shown three times for 1/3 of the participants, five times for a different 1/3 of the participants, and eight times for the remaining 1/3 of participants. This guaranteed that across the entire sample, frequency of expression was not confounded with character.

Characters were constructed so that they appeared in one of nine equally graduated colours ranging from 100% red to 100% blue, with incremental steps between the two poles (e.g. 89% red / 11% blue, 76% red / 24% blue, 63% red / 37% blue, 50% red/50% blue, etc). Colour percentages were created using MicroSoft Paint (see Appendix B for shade construction). Each colour appeared in 3 different characters (3 characters x 9 shades = 27 characters overall). As such, three characters appeared as 100% red, three characters appeared as 100% blue, three characters appeared as 89% red/11% blue, etc. Across the sample, each gradation of colour was shown equally across every frequency (i.e., one pure blue character in the low frequency condition, one in the intermediate frequency condition, and one in the high frequency condition).

**Phase 3: Final Judgment.** Once the presentation phase ended, participants encountered another instruction page via the computer. It was here that the between subjects manipulation of question order took place. In the separated scale condition, participants were asked to report as quickly and as accurately as possible what colour each character previously appeared as. Characters were shown in black on a white background with a 9-point numeric rating scale appearing beneath the character. All 27 colour judgments were made sequentially. Once all 27 colour judgments were made, participants were again presented with an instruction page asking participants to now



rate how confident they were in their recent colour judgments. Again each character appeared in black on a white background with the rating scale appearing beneath the character. They then sequentially rated confidence for each colour judgment in the same order as they judged colour.

In contrast to the separated scale response condition, participants who were in the paired scale condition were presented with an instructions page outlining that for each character, participants would first judge the colour they remember the character to be, and then immediately following the colour judgment would rate their confidence in that judgment. It was thought that when scales were paired together, it would be made clear via conversational norms that the two questions were asking for two separate judgments, therefore disambiguating the colour question. For example, if the colour question was intended to measure confidence, it would be strange to then ask for a separate confidence judgment. As such, individuals should not misinterpret the colour judgment to be asking for confidence. Thus, a character would appear in black on a white screen with a 9-point numeric rating scale below intended to measure colour. Once that judgment was made, the same character would appear with a scale below intended to measure confidence. In both conditions, once participants finished rating both colour and confidence, this study ended and they moved on to other tasks.

## **Measures**

**Extremity.** Chinese ideographs appeared in black on a white background with a 9-point numeric rating scale beneath the character measuring colour. The endpoints of the scale were labeled “red” and “blue.” Intermediate scale points had numeric labels, but no verbal labels. Extremity for each judgment was calculated by computing the

deviation from scale midpoint. Thus, a score of “0” represented a response at the scale midpoint, whereas a score of “4” represented a response at the very extreme of the scale. These individual extremity scores were then averaged to create three aggregate scores: one representing the average extremity for judgments made three times, one representing the average extremity for judgments made five times, and finally one representing the average extremity for those judgments made eight times. Scores ranged from 0-4 in which 0 represented all responses at the midpoint for that frequency, and 4 represented all scores at the maximum scale extremity for that frequency.

**Confidence.** Again characters appeared in black on a white background with a 9-point scale beneath the character, this time measuring confidence. Endpoints were labeled “Not At All Confident” and “Extremely Confident.” Intermediate scale points again were not labeled. Aggregate confidence scores were created for each level of frequency. Confidence ratings for judgments made three times were averaged to create an aggregate form, and the same was done for those judgments made three and five times. Scores ranged from 1-9 in which 1 represented no confidence at all for judgments made at that frequency, and 9 represented complete confidence for judgments made at that frequency.

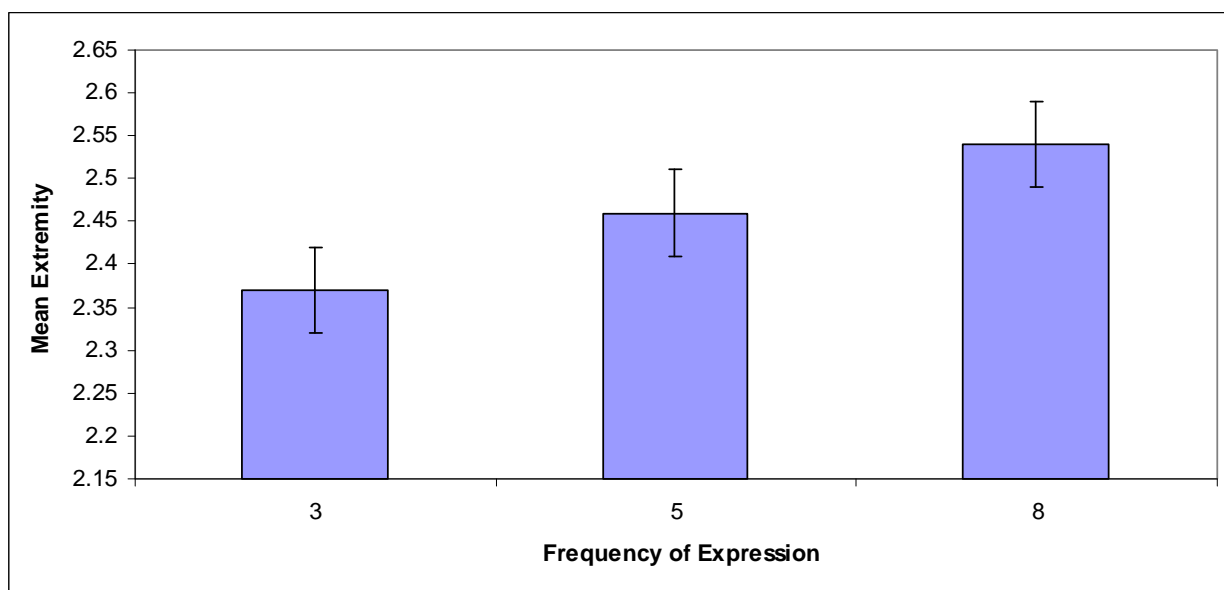
## **Results**

### **Extremity**

To explore the effects of repeated expression on extremity, a 3 (Level of Frequency: 3 vs. 5 vs. 8) x 2 (Question Order: Paired Judgments vs. Separated Judgments) mixed-model General Linear Model was conducted, with mean extremity ratings as the dependent variable. Level of frequency was manipulated within subjects,

and question order was manipulated between subjects. The first effect of interest was the main effect of frequency on extremity. Hypotheses for this main effect were dependent on the perspective taken. For both the evaluative change and ability perspectives, a significant main effect was predicted. However, the ambiguity hypothesis predicted that increased frequency would only lead to greater extremity when scale intent was ambiguous. Thus, from the ambiguity perspective, the main effect might not emerge because it was only expected for half of participants.

Consistent with the evaluative change and ability perspectives, the main effect of frequency was significant  $F(2, 1218) = 31.22, p < .01$ . As can be seen in Figure 4, extremity ratings increased with repeated expression (Three expressions  $M = 2.37$ , 95% CI [2.32, 2.42]; Five expressions  $M = 2.46$ , 95% CI [2.41, 2.51]; Eight expressions  $M = 2.54$ , 95% CI [2.49, 2.59]). There was a significant increase in extremity with each increase in frequency of expression. This was evidenced by the estimated marginal mean value for each level of expression falling outside of the boundaries of all other confidence intervals.



*Figure 4.* Estimated marginal mean extremity ratings for each level of frequency of expression with 95% confidence intervals.

The next effect of interest was the main effect of question order. None of the three perspectives contained clear predictions for a main effect of question order when collapsed across all levels of frequency. However, a marginal main effect was found  $F(1, 609) = 3.50, p = .06$ . Given this effect was close to traditional statistical significance, it was prudent to look at the effect. Extremity was greater when questions were paired together ( $M = 2.50, 95\% \text{ CI } [2.44, 2.56]$ ) compared to when they were presented separately ( $M = 2.42, 95\% \text{ CI } [2.35, 2.48]$ ).

Of primary interest in this analysis was the interaction between frequency of expression and question order. Both ability and evaluative change perspectives implied that question order should make no difference in extremity effects. The response mapping ambiguity perspective clearly implied a two-way interaction such that when questions were paired together, extremity effects due to repeated expression should weaken. Interestingly, the interaction between frequency and question order was not found to be significant,  $F(2, 1218) = 1.15, p = .32$ . Thus, disambiguating the intent of questions via question order failed to attenuate extremity due to repeated expression, potentially ruling out the ambiguity perspective.

### **Confidence**

To explore the effects of repeated expression on confidence, a 3(Level of Frequency: 3 vs. 5 vs. 8) x 2(Question Order: Paired Judgments vs. Separated Judgments) mixed-model General Linear Model was conducted, with mean confidence ratings as the dependent variable. It was hypothesized that as frequency of expression increased, so would confidence in the judgments. It was also hypothesized that

confidence could act as a mediator between repeated expression and extremity. This mediational effect was implied by the ability perspective, potentially implied by evaluative change, and implied in one case for the ambiguity perspective. If confidence was acting as a mediator, and thus was a more proximal consequence of repeated expression, and extremity was a more distal consequence, the main effect of frequency on confidence would be much larger than the main effect of frequency on extremity observed in the prior analysis. Consistent with hypotheses, there was a main effect of frequency  $F(2, 1218) = 120.65, p < .01$ . As can be seen in Figure 5, confidence in judgments significantly increased with increased frequency of expression (Three expressions  $M = 5.90, 95\% \text{ CI } [5.79, 6.01]$ ; Five expressions  $M = 6.20, 95\% \text{ CI } [6.08, 6.31]$ ; Eight expressions  $M = 6.45, 95\% \text{ CI } [6.33, 6.56]$ ), and this main effect was much larger than the main effect of frequency on extremity. As can be seen from the confidence intervals, each increase in frequency of expression resulted in a significant increase of confidence: no estimated marginal mean confidence rating was contained in any other 95% confidence interval.

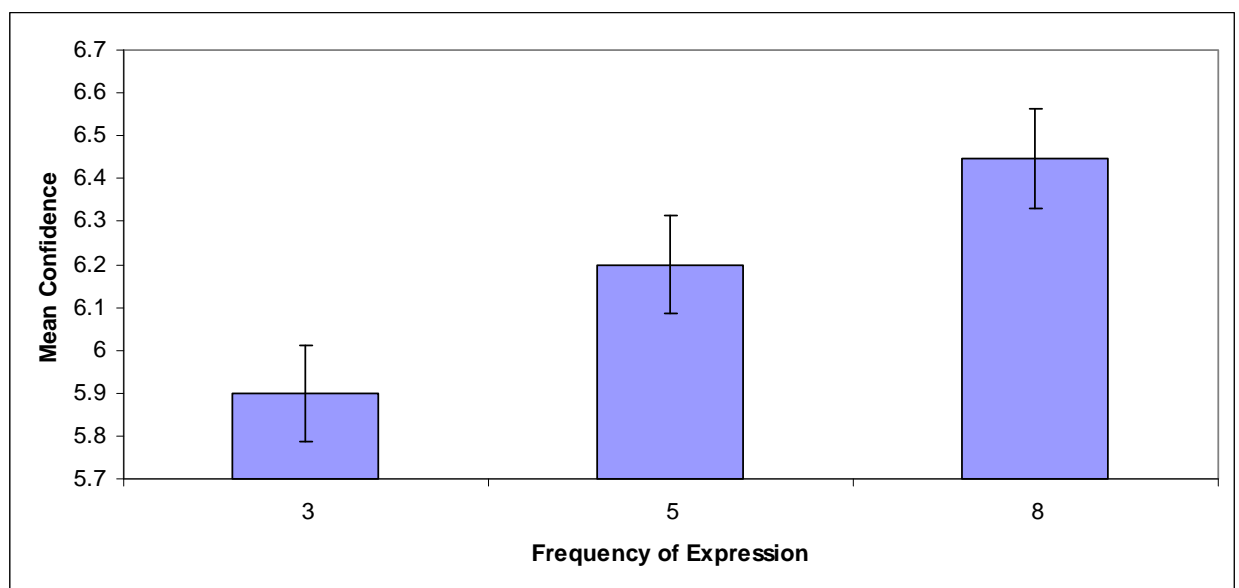


Figure 5. Estimated marginal mean confidence ratings for each level of frequency of expression with 95% confidence intervals.

No perspective specified a hypothesis regarding the effect of question order on confidence. Interestingly, as can be seen in Figure 6, there was a significant main effect of order  $F(1, 609) = 13.05, p < .01$ . Those who made their judgments together showed significantly more confidence ( $M = 6.38, 95\% \text{ CI } [6.23, 6.53]$ ) than those who made them apart ( $M = 5.99, 95\% \text{ CI } [5.84, 6.14]$ ). It could be that individuals were more confident immediately after making a judgment as opposed to when they were asked to retrospect on a judgment made previously.

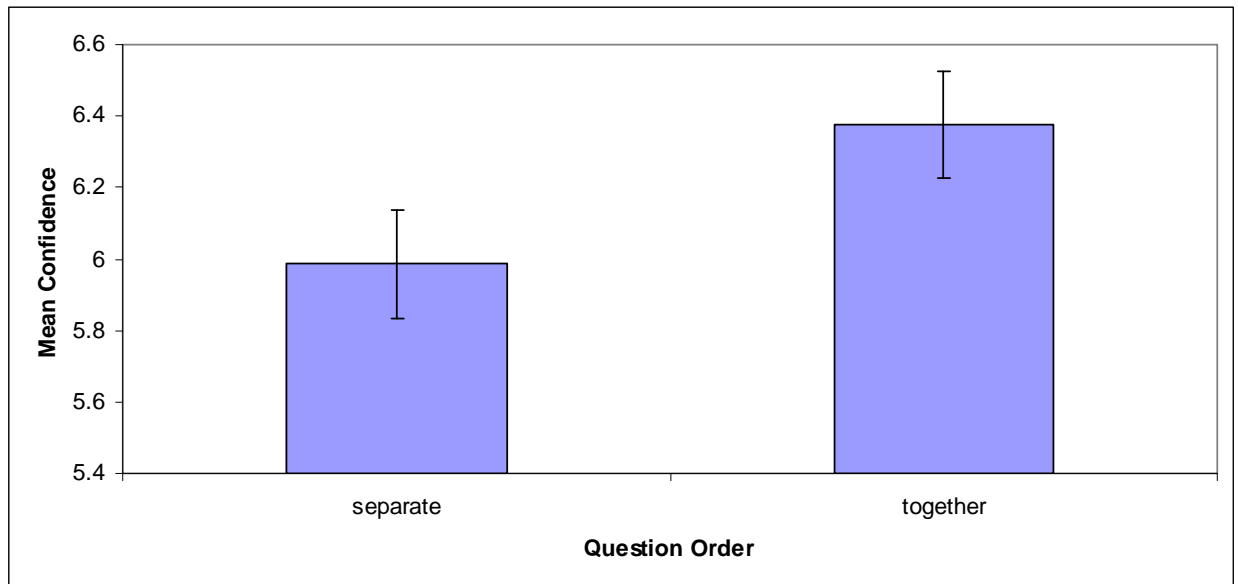
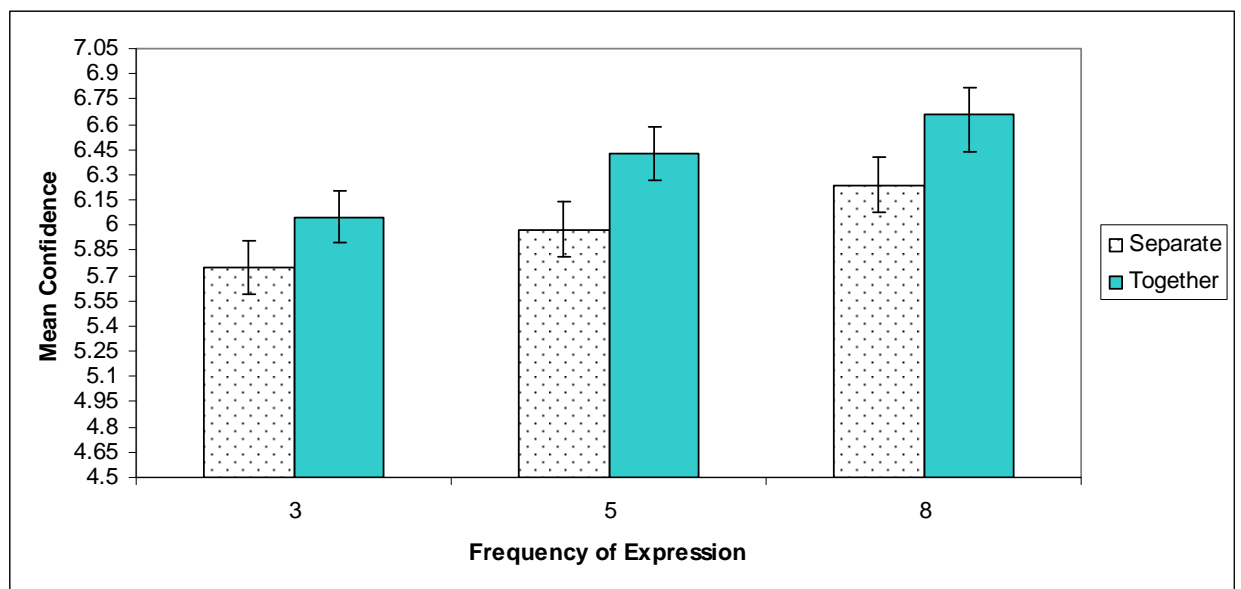


Figure 6. Estimated marginal mean confidence ratings for each question order with 95% confidence intervals.

Finally, there was no reason to expect frequency to have differential effects on confidence as a result of question order. Interestingly, there was a marginal interaction between frequency and question order  $F(2, 1218) = 2.53, p = .08$ . Because this effect was close to the traditional level of statistical significance, it was further explored. As can be seen in Figure 7, in both order conditions, confidence increased with increased

frequency of expression as expected. When questions were paired together confidence was greater (Three expressions:  $M = 6.05$ , 95% CI [5.90, 6.21]; Five expressions:  $M = 6.43$ , 95% CI [6.26, 6.59]; Eight expressions:  $M = 6.66$ , 95% CI [6.49, 6.82]) than when questions were separated (Three expressions:  $M = 5.75$ , 95% CI [ 5.59, 5.91]; Five expressions:  $M = 5.97$ , 95% CI [5.81, 6.14]; Eight expressions:  $M = 6.24$ , 95% CI [6.07, 6.40]). It appeared that increased frequency of expression had a more substantial impact on confidence when questions were paired, exerting an especially large influence from 3 to 5 expressions, whereas in the separated question order condition the effect of frequency was more constant.



**Figure 7.** Estimated marginal mean confidence ratings and 95% confidence intervals for each level of frequency associated with each question order.

### The Mediational Effects of Confidence

The role of confidence in the relationship between frequency of expression and resulting extremity is an important one. Indeed, each of the three perspectives led to predictions about the role of confidence. It was inferred from the ability perspective

that if the task was difficult, people should fall back onto confidence to guide responding. The evaluative change perspective led to no specific confidence hypothesis per se. However, this perspective allowed for the possibility that confidence might act as a proxy for changes in representation and/or computation, and as such confidence would appear to mediate the relationship between frequency of expression and extremity in both order conditions (because the evaluative change would occur regardless of question order). The response mapping ambiguity perspective implied that confidence would mediate the relationship to a greater degree when question intent was ambiguous as compared to unambiguous. Given the conflicting implications, mediational models were explored to better understand the role of confidence.

Previous analyses showed that increased frequency led to greater subsequent extremity and confidence ratings. As noted, the effects of frequency on confidence were much stronger than the effects on extremity. Therefore, it did seem possible that confidence mediated the relationship between frequency of expression and extremity. Typically, mediation is tested using a set of regression models (see Baron & Kenny, 1986). In this particular data set, however, the independent variable was within-subjects. As such, standard regression was inappropriate, and within-subjects regression was used.

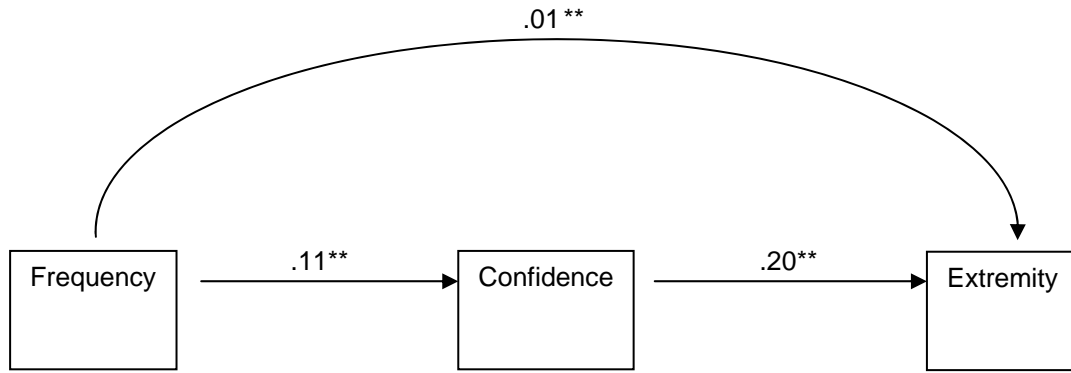
Because of the nature of the data, a new data set had to be created to appropriately test this model. Each participant was represented by three lines of data: one line of data for each level of frequency. Included in each line of data was a variable representing participant number, the between-subjects variable of question order, level of frequency, the average extremity rating associated with that level of



frequency, and the average confidence rating associated with that level of frequency. With the data structured this way, it was possible to then create dummy variables to account for the non-independent observations associated with each participant, thus controlling for unique effects caused by individual participants. Thus, the reported regression models always included 610 dummy variables representing participants, and depending on the equation being tested, included a continuous extremity variable, a continuous confidence variable, and a continuous frequency variable. Coefficients for participant dummy variables will not be reported in analyses.

The first model tested the mediational effect of confidence across all subjects, regardless of question order. In order to test whether confidence mediated the relationship between repeated expression and polarization, two regression models were computed to estimate the effects of frequency on confidence, the indirect effect of frequency on extremity via confidence, and the effect of frequency on extremity when confidence was controlled for (see Figure 8). Frequency significantly predicted confidence scores such that greater frequency of expression resulted in higher confidence scores, as demonstrated by the unstandardized regression coefficient,  $F(1, 1225) = 231.31, p < .01$ . It was found that increased confidence led to significantly greater extremity  $F(1, 1224) = 137.02, p < .01$ . There was also a direct effect of frequency on extremity,  $F(1, 1224) = 8.09, p < .01$ . As such, confidence mediated the relationship between frequency and extremity. That is, the model provided evidence that repeated expression led to higher confidence, and that this higher confidence resulted in greater extremity. To statistically demonstrate this, a Sobel test was conducted. Sobel tests allow for the test of the indirect influence of the independent

variable on the dependent variable via the mediator (Sobel, 1982). In this model, confidence captured a great deal of variance due to repeated expression as a mediator ( $Z = 9.20, SE = .002, p < .01$ ).



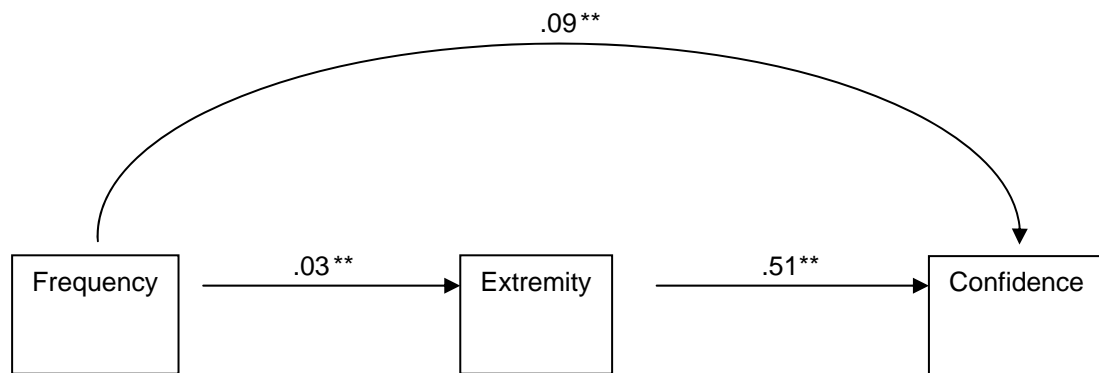
\*\* $p < .01$

Figure 8. Confidence mediation across all participants, Experiment One.

Because frequency was manipulated, it can be assumed that frequency caused the increase in both extremity and confidence and not vice versa. However, because the other variables were not manipulated, the same causal assumption cannot be made for the effects of confidence on extremity. As such, the above mediation model is subject to an alternative interpretation. That is, perhaps the above model was misspecified. It could be that repeated expression led to greater extremity, and that it was greater extremity that resulted in higher confidence, and not the other way around as hypothesized. In order to test this alternate interpretation, the reverse causality model was tested as shown in Figure 9.

When the reverse causality model was explored, there was a significant direct path from frequency to extremity such that increased frequency of expression resulted in greater extremity,  $F(1, 1225) = 60.34, p < .01$ . There was also a significant path from extremity to confidence, such that increased extremity led to greater confidence,  $F(1,$

1224) = 137.02,  $p < .01$ . There was a significant direct effect of frequency on confidence such that increased frequency of expression resulted in greater confidence,  $F(1, 1224) = 171.98, p < .01$ . Although the Sobel test for this model was significant ( $Z = 6.87, SE = .003, p < .01$ ), a descriptive comparison shows that this Sobel value was smaller than the Sobel value in the hypothesized model. Ultimately, because extremity captured less variance as a mediator, this reverse causal model was considered a less plausible model than the hypothesized model.

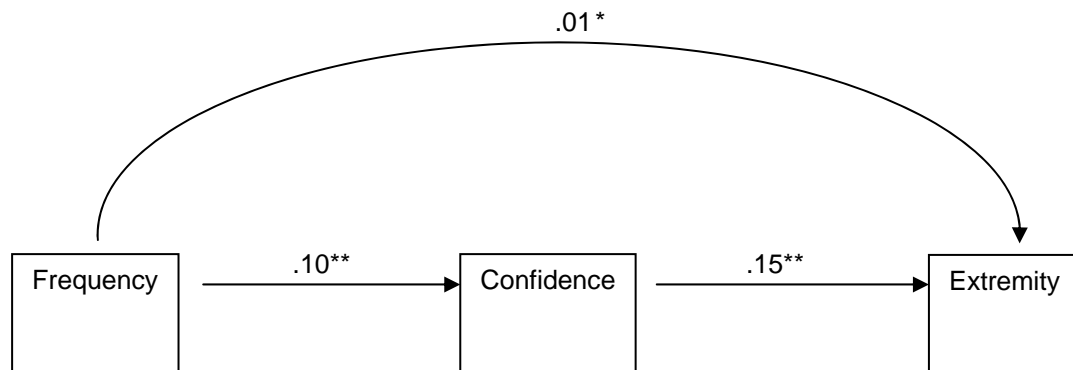


\*\*  $p < .01$

Figure 9. Extremity mediation across all participants, Experiment One.

The mediational analyses, paired with the Sobel tests, provided evidence that confidence mediated the effects of frequency of expression on extremity, and that the reverse causal model was less plausible. These findings provided some evidence for the ability perspective, and potentially provided evidence for the evaluative change perspective (if confidence taps into representational and/or computational changes). However, the response mapping ambiguity perspective specifically led to the hypothesis that confidence would only mediate the effect of frequency on extremity for the ambiguous question order. To test this hypothesis, the same mediational models were tested within each order condition.

**Mediational Models Within Each Question Order.** According to the response mapping ambiguity perspective, when only looking at those participants who received the ambiguous question order (i.e., separated questions), confidence should mediate the effect of frequency on extremity. As can be seen in Figure 10, within the separated question order condition, increased frequency of expression led to greater confidence,  $F(1, 606) = 105.93, p < .01$ . Greater confidence, in turn, led to greater extremity,  $F(1, 605) = 32.62, p < .01$ . There was also a direct effect such that increased frequency of expression led to greater extremity,  $F(1, 605) = 4.60, p = .03$ . The Sobel test for this model was significant ( $Z = 5.11, SE = .003, p < .01$ ), and confidence did act as a mediator.



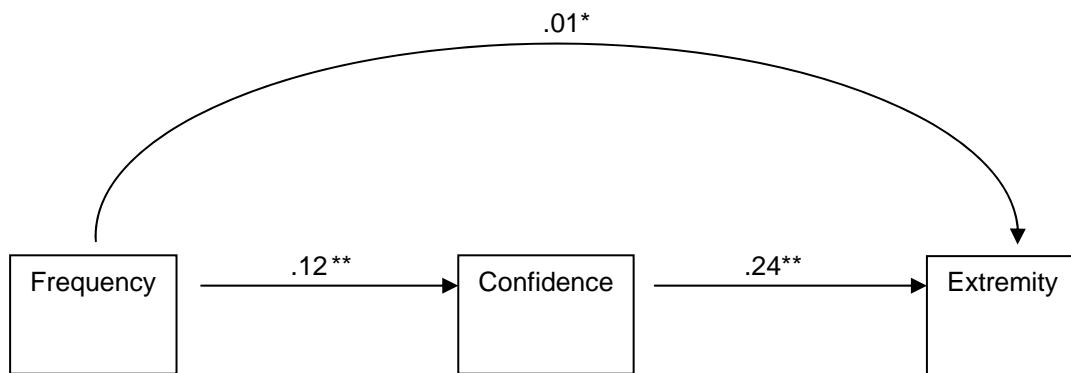
\* $p < .05$

\*\* $p < .01$

Figure 10. Confidence as mediator in the ambiguous question order condition.

According to the ambiguity perspective, when question intent was clear, the mediational effect of confidence should have attenuated as compared to when question intent was unclear. When only looking at those participants who received the unambiguous, paired question order (as seen in Figure 11), increased frequency of expression led to significantly greater confidence,  $F(1, 618) = 125.71, p < .01$ . Greater

confidence led to significantly greater extremity,  $F(1, 617) = 111.76, p < .01$ . There was also a direct effect such that increased frequency of expression led to greater confidence,  $F(1, 617) = 3.77, p = .05$ . The Sobel test for this model was significant ( $Z = 7.89, SE = .003, p < .01$ ). Thus, this mediational model provided further evidence against the ambiguity hypothesis given its similarity with the model in the ambiguous question order condition: confidence mediated the relationship even when question intent was clear.



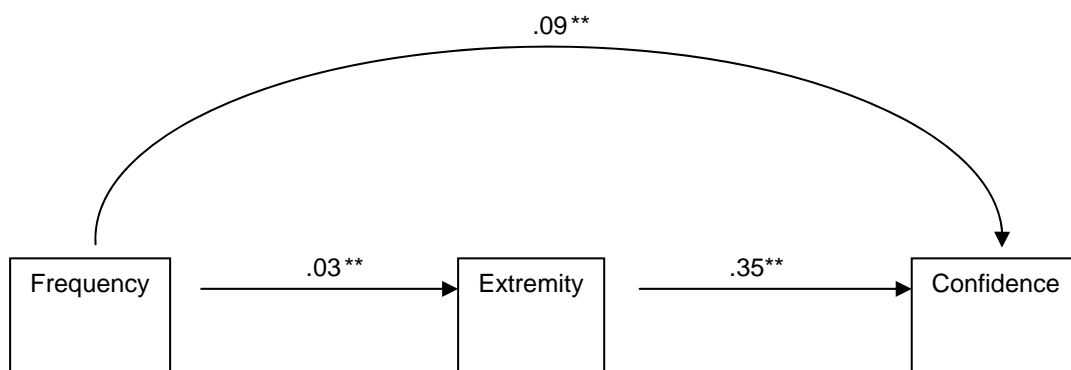
\* $p < .05$

\*\* $p < .01$

Figure 11. Confidence as mediator in the unambiguous question order condition.

Further contradictory evidence for the ambiguity perspective can be seen by examining the coefficients for the path from confidence to extremity. When questions were presented together, confidence exerted a stronger influence on extremity ( $b = .24, SE = .02$ ), as compared to when questions were paired ( $b = .15, SE = .03$ ). Statistically supporting this conclusion, a test of coefficients showed that there was a significant difference between these two coefficients,  $Z = 3.95, p < .01$ . This finding directly conflicts with the ambiguity perspective: confidence was more strongly related with extremity when ambiguity was low.

**Reverse Causality Models Within Each Question Order.** As previously noted, given the nature of the variables, it could be argued that the reverse models could better capture the data: perhaps increased frequency of expression led to greater extremity which in turn caused higher confidence. Thus, the model was tested where extremity served as the mediator between frequency and confidence for those participants who received the ambiguous question order (see Figure 12). Frequency of expression led to significantly greater extremity,  $F(1, 606) = 21.10, p < .01$ . Greater extremity, in turn, predicted greater confidence,  $F(1, 605) = 32.62, p < .01$ . When extremity was controlled for, there remained a significant effect of frequency of expression on confidence,  $F(1, 605) = 87.06, p < .01$ . The Sobel test for this model was significant, suggesting that extremity did account for some variance from repeated expression. This Sobel test, at a descriptive level, was smaller than the statistic computed for the hypothesized model,  $Z = 3.61, SE = .003, p < .01$ . As such, the model with confidence as the mediator was considered more plausible.

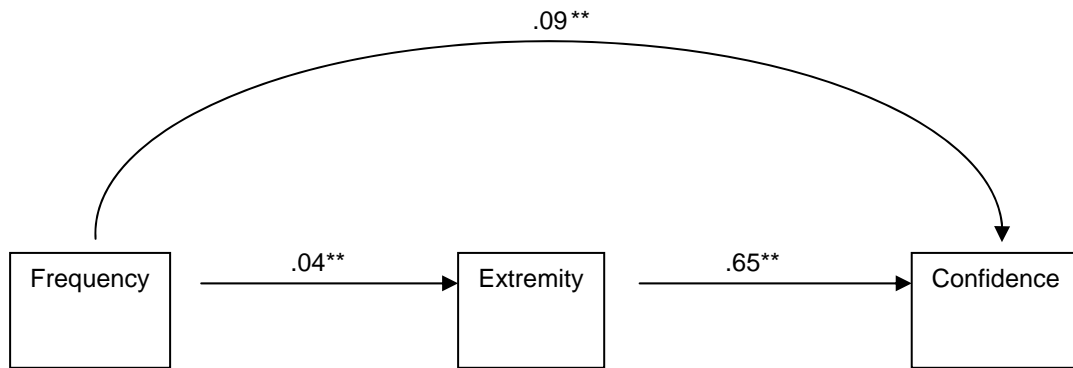


\*\* $p < .01$

Figure 12. Extremity as mediator in the ambiguous question order condition.

To rule out the possibility that extremity was the more plausible mediator of frequency effects in the unambiguous condition, the reverse causality model was again

tested (see Figure 13). There was a significant path from frequency to extremity such that increased frequency led to greater extremity,  $F(1, 618) = 40.34, p < .01$ . There also was a significant effect of extremity leading to confidence,  $F(1, 617) = 111.76, p < .01$ . However, the direct effect of frequency on confidence remained,  $F(1, 617) = 84.26, p < .01$ . Similar to previous findings, the Sobel test was significant, but again it was smaller than the model where confidence was tested as the mediator,  $Z = 5.63, SE = .005, p < .01$ . As such, the reverse model was considered less plausible than the hypothesized model.



\*\* $p < .01$

Figure 13. Extremity as mediator in the unambiguous question order condition.

### Discussion

The purpose of Experiment One was to begin disentangling three competing perspectives. In order to do so, Experiment One had to accomplish two tasks. First, the classic effect of repeated expression resulting in polarization had to be replicated. This was achieved. Second, Experiment One had to test whether confidence played a role in the relationship between repeated expression and polarization which had not been previously done. This too was achieved.

Not only did Experiment One demonstrate that confidence increased as a function of repeated expression, it also explored how confidence might play a role as a mediator in the repeated expression to polarization relationship. To summarize, repeated expression led to greater extremity in both question order conditions. Confidence mediated the relationship between frequency and extremity regardless of question order. Reverse causal models were tested where extremity was treated as a mediator with confidence as the outcome. In all cases, the reverse models were considered as less plausible alternatives to the hypothesized models. These data were consistent with the ability perspective. If confidence served as a proxy for representational and/or computational changes, the fact that confidence mediated the relationship between frequency and extremity could also be construed as support for the evaluative change perspective.

The response mapping ambiguity explanation, however, failed to receive empirical support. Here, it was expected that extremity would only increase with repeated expression in the ambiguous, separated question order condition. Counter to hypotheses, this effect occurred regardless of question order. The manipulation of ambiguity through question order was a very subtle manipulation, and as such may not have been effective at fully disambiguating question intent. This could be especially true for a university sample where students are accustomed to completing scales, and as such might be less sensitive to the non-redundancy norm (i.e., introductory students often complete psychological measures for course credit where there are similar items tapping into the same construct).



The ambiguity perspective also implied that confidence would more strongly mediate the effect of repeated expression on polarization in the ambiguous question order condition. Unexpectedly, when exploring the coefficients associated with the meditational analyses, the opposite effect was found. When question intent was unambiguous, confidence exerted a statistically stronger influence on extremity than in the ambiguous question intent condition. This was in direct conflict with the ambiguity perspective. It could be that by pairing questions together, confidence in judgments was made more salient. As such, confidence was able to exert a stronger influence on extremity.

### **Chapter 3: Experiment Two**

Experiment One provided evidence for the overall effect of repeated expression leading to extremity. Experiment One also provided the first evidence that confidence could play a role in the relationship between repeated expression and extremity. The purpose of Experiment Two was to more precisely disentangle the three perspectives for extremity effects, again within the context of colour judgments.

To directly test the ability perspective for some participants, the task was made substantially easier. First, the number of characters being presented to participants was reduced from 27 characters to 15 characters. From a memory standpoint, for individual characters, this would make the task difficulty dramatically lower. The number of shades that the 15 characters were presented in was also reduced from nine shades to five shades. Thus, the distinctions between shades were less subtle, which made the gradations easier to distinguish. Finally, given that both the number of characters and the number of shades were reduced, the number of judgments was also reduced thereby decreasing the likelihood of respondent fatigue. In the high difficulty condition, participants made 144 judgments. In the reduced difficulty condition, participants only made 80 judgments. If the ability perspective was true, it was hypothesized that if the task was difficult, overall repeated expression would lead to greater extremity. Confidence was expected to mediate this relationship in high difficulty contexts, because confidence would be invoked as a heuristic to guide responding. However, if the task was made easier, the effects of frequency on extremity should be attenuated, and confidence would no longer mediate the relationship as confidence would no longer be invoked to guide responding.

To more precisely test the ambiguity perspective, the type of scale was also experimentally manipulated. It was hypothesized that an ambiguous scale would lead to an overall effect of repeated expression resulting in polarization, but that confidence would mediate this relationship. When the task was clear, individuals would no longer misinterpret the scale, and the effects of repeated expression on polarization would be attenuated. Thus, some participants reported colour judgments on a 9-point numeric rating scale followed by confidence ratings, as in the separated order condition in Experiment One. Other participants, however, reported colour judgments onto a 9-point scale with colour shades as response options rather than numeric labels prior to rating confidence. This colour shade scale was less ambiguous than the numeric rating scale because the response options were the exact physical properties that participants were being asked to report. It is unlikely that participants would misconstrue colour shades as measuring confidence. Thus, the effects of repeated expression on extremity should be attenuated when the scale was unambiguous.

In contrast to the response mapping perspectives, the evaluative change perspective implied that repeated expression led to true polarization of the evaluation. As such, evidence for the evaluative change perspective would be present if repeated expression always resulted in polarization, regardless of scale type or difficulty level. Evidence would also support evaluative change if reported shade extremity was significantly higher than true shade extremity in an unambiguous scale where misconstrual of scale intent would be unlikely. If confidence acted as a proxy for representational or computational changes, confidence should always mediate the relationship between repeated expression and polarization in the same way. Neither of

the other two perspectives would suggest that repeated expression would always lead to polarization, and they both make differential predictions about the mediational effect of confidence across relevant conditions.

## **Method**

### **Design**

This experiment was a 3 (Level of Frequency: 3 vs. 5 vs. 8) x 2 (Scale type: Numeric rating scale vs. Colour Shade Scale) x 2 (Task Difficulty: 144 judgments vs. 80 judgments) mixed-model design. Level of frequency was manipulated within subjects, such that some characters were shown 3 times, others 5 times, and others 8 times. Scale type was manipulated between subjects such that half of the participants reported colour judgments on a numeric rating scale (NRS) which was thought to be ambiguous. The other half reported colour judgments to a colour shade scale (CSS), thought to be unambiguous. Task difficulty was also manipulated between subjects such that some participants judged 27 characters in nine shades for a total of 144 judgments which was thought to be difficult. The others judged 15 characters in 5 shades for a total of 80 judgments, which was less difficult.

### **Participants**

Participants were 293 introductory undergraduate students who participated for 1% course credit, or \$5. All participants self-reported as not being colour blind.

### **Procedure**

**Phase 1: Instructions.** Participants were brought into the lab as in Experiment One (for ethics documents see Appendix C). Participants were then randomly assigned to condition based on numbers generated from randomizer.org, reflecting the between

subjects manipulations of scale type and task difficulty. Participants were then given the same instructions as in Experiment One (see Appendix D for experimental materials unique to Experiment Two).

**Phase 2: Presentation.** During the presentation phase, task difficulty was manipulated. In the “high difficulty” condition, participants judged the colour of 27 Chinese characters. As in Experiment One, across participants frequency of expression was manipulated within subjects: nine characters were shown 3 times, a different nine characters were shown 5 times, and the other nine characters were shown 8 times. Thus, participants made a total of 144 colour judgments during the presentation phase. Participants in the lower difficulty condition, however, only judged the colour of 15 characters. Across participants, frequency of expression was again manipulated within subjects: five characters were shown 3 times, a different five characters were shown 5 times, and the remaining five characters were shown 8 times. Thus, in the low difficulty condition, participants only made 80 judgments.

It is important to note that, as in Experiment One, in each task difficulty condition, three different sets of characters were constructed so that the frequency associated with a given character changed across character sets. For example, Character One was shown three times for 1/3 of the participants, five times for a different 1/3 of the participants, and eight times for the remaining 1/3 of participants. This guaranteed that across the entire sample, frequency of expression was not confounded with character.

As in Experiment One, in the high task difficulty condition, characters were constructed so that they appeared in one of nine equally graduated colours ranging from

100% red to 100% blue, with incremental steps between the two poles. In the low difficulty condition, however, characters were chosen so that they appeared in one of five graduated colours ranging from 100% red to 100% blue (e.g., 100% red, 76% red / 24% blue, 50% red/50% blue, etc). This further eased the task by only having five shades represented. Each colour appeared in three different characters (3 characters x 9 shades = 27 characters overall, or 3 characters x 5 shades = 15 characters overall). As such, three characters appeared as 100% red, three characters appeared as 76% red/24% blue, three characters appeared as 50% red/50% blue, etc. Across the character sets, each gradation of colour was shown equally across each level of frequency (i.e., one pure blue character in the low frequency condition, one in the intermediate frequency condition, and one in the high frequency condition). Thus, shade extremity was not confounded with frequency.

**Phase 3: Final Judgment.** It was at the final judgment phase that the between subjects manipulation of scale type took place. In the numeric rating scale condition, participants were asked to report as quickly and as accurately as possible what colour each character previously appeared as. As in Experiment One, characters were shown in black on a white background with a 9-point numeric rating scale appearing beneath the character with the endpoints labeled “red” and “blue.” All colour judgments were made sequentially. Once all colour judgments were made, participants were asked to rate how confident they were in their recent colour judgments. Again, each character appeared in black on a white background with the same 9-point numeric rating scale measuring confidence as in Experiment One appearing beneath the character. They

sequentially rated confidence for each colour judgment in the same order as they judged colour.

Participants in the colour shade scale condition were also asked to report as quickly and as accurately as possible what colour each character previously appeared as. Characters were shown in black on a white background, but rather than a numeric rating scale beneath the character, there was a 9-point colour shade scale. The nine colour shade responses were the same colours represented as in the high task difficulty condition, and they ranged from red to blue in incremental order. These nine shades included the five shades shown in the low difficulty condition. Participants in both task difficulty conditions responded to the same 9-point colour shade scale. All colour judgments were made sequentially. Once the colour judgments were completed, participants then sequentially rated confidence for each colour judgment in the same order as they judged colour. Confidence judgments were made on the same 9-point numeric rating scale as in the numeric rating scale condition. If the ambiguity perspective was true, it was thought that when the response scale was clearly measuring colour, individuals should not misinterpret the colour judgment to be asking for confidence. Thus, extremity due to repeated expression would be attenuated in the colour shade response scale condition, and confidence would no longer mediate the relationship.

## **Measures**

**Extremity.** Extremity was measured in the same way as in Experiment One. Aggregate extremity scores for each level of repeated expression ranged from 0-4 in

which 0 represented all responses at the midpoint for that frequency, and 4 represented all scores at the maximum scale extremity for that frequency.

**Confidence.** Confidence was measured in the same way as Experiment One. Aggregate confidence scores for each level of repeated expression ranged from 1-9 in which 1 represented no confidence at all for judgments made at that frequency, and 9 represented complete confidence for judgments made at that frequency.

## **Results**

### **Extremity**

To explore the effects of repeated expression on extremity, a 3 (Level of Frequency: 3 vs. 5 vs. 8) x 2 (Scale Type: Numeric rating scale vs. Colour shade scale) x 2 (Task Difficulty: 144 judgments vs. 80 judgments) mixed-model General Linear Model was conducted, with mean extremity ratings as the dependent variable. The first effect of interest was the main effect of frequency on extremity. Hypotheses for this main effect were again dependent on the perspective taken. The evaluative change perspective would imply that a significant main effect of frequency should appear. However, both the ability perspective and the ambiguity perspective implied that increased frequency of expression would lead to greater extremity for only a subset of participants. Specifically, the ability perspective implied that only those in the 144 judgments condition (i.e., high difficulty) would show the frequency effect. The ambiguity perspective implied that only participants in the numeric rating scale condition (i.e., high ambiguity) would show the effect. Thus, neither the ability nor ambiguity perspective necessarily led to hypotheses about a main effect of frequency.

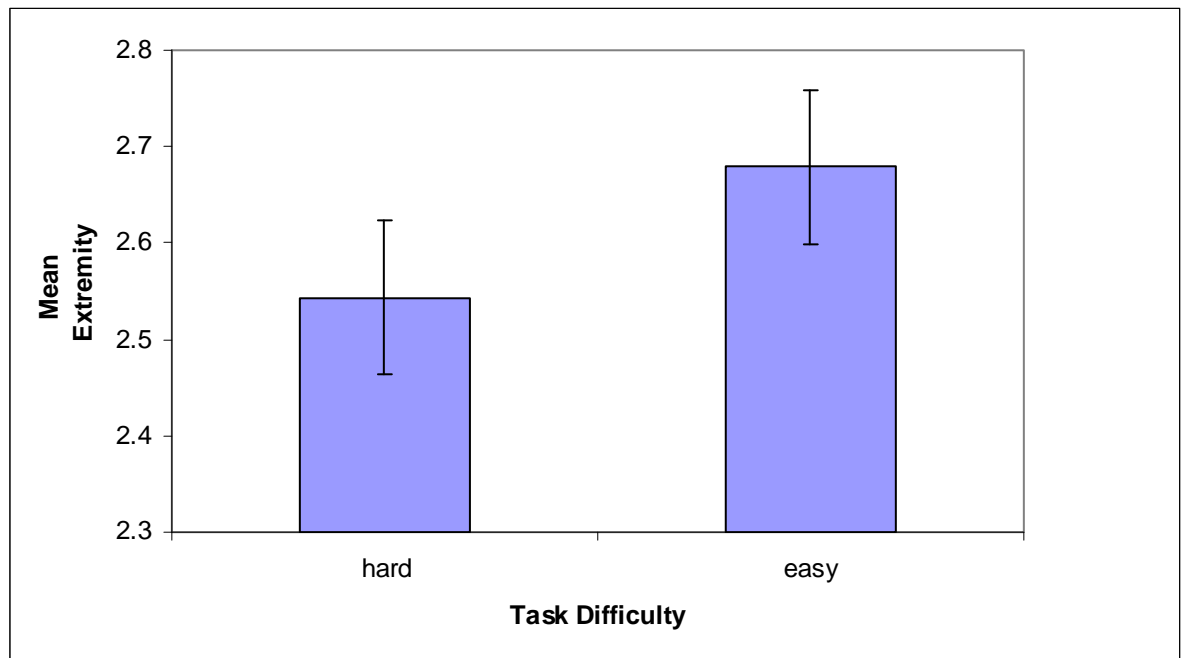


In contrast to the evaluative change perspective, the main effect of frequency was not significant  $F(2, 578) = .60, p = .55$ .

The next effect of interest was the main effect of scale type. When collapsed across all levels of frequency, no perspective led to clear hypotheses of an effect of scale type. No main effect of scale was found,  $F(1, 289) = .51, p = .48$ . The next effect to be explored was the main effect of task difficulty on extremity. Although no perspective led to clear predictions of the effect of task difficulty on confidence when collapsed across all levels of frequency, there was a difference in the true colour extremity of characters shown between the two difficulty conditions. Recall that only 5 shades were represented in the low difficulty condition. In the low difficulty condition, the true mean extremity of those 5 shades was 2.40. In the high difficulty condition where there were 9 shades shown, the true extremity value was lower at 2.22. As such, given the nature of the stimuli, one would expect those in the lower difficulty condition to be more extreme. Consistent with this, there was a main effect of task difficulty,  $F(1, 289) = 5.62, p = .02$ . As can be seen in Figure 14, those in the low difficulty condition reported greater extremity ( $M = 2.68, 95\% \text{ CI } [2.60, 2.76]$ ), than those in the high difficulty condition ( $M = 2.54, 95\% \text{ CI } [2.46, 2.62]$ ).

If the ability perspective was true, it was thought that making the task easier should improve accuracy for colour judgments. As such, the mean reported extremity in both task difficulty conditions was tested against the true mean extremity value associated with each task difficulty condition. This was done using one-sample t-tests. Interestingly, in both conditions, participants reported shades as more extreme than the true mean extremity values (Low difficulty:  $t(146) = 6.31, p < .01$ ; High difficulty:

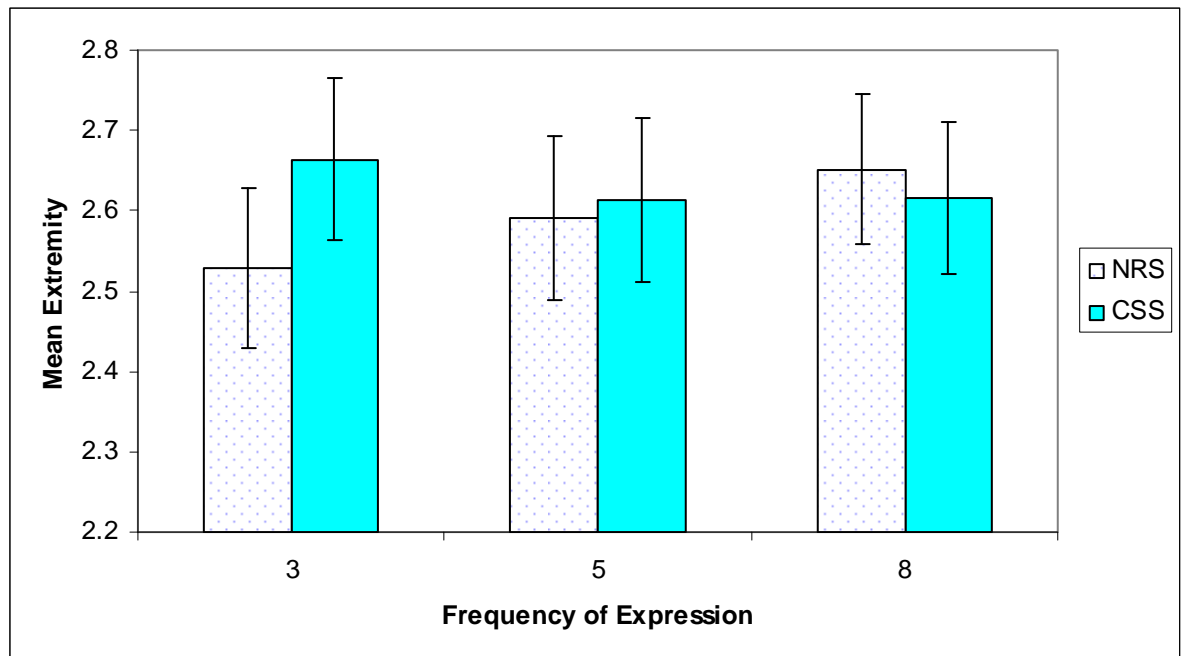
$t(145) = 9.27, p < .01$ ). Consistent with the ability perspective, there was a marginal effect such that participants tended to report colour shades with more distortion if the task was difficult ( $d = 1.54$ ) than if the task was easy ( $d = 1.04$ ),  $Z = 1.76, p = .08$ . It is of note that although there were differences in true extremity between the task difficulty conditions, the effects of interest involve the differential effects of frequency on reported extremity across conditions.



*Figure 14.* Estimated marginal mean extremity ratings for each level of task difficulty with 95% Confidence Intervals.

There were three interactions of theoretical importance, all involving frequency of expression. The first was a two-way interaction between frequency of expression and scale type. The ambiguity perspective would imply an interaction such that increased frequency of expression would result in greater extremity when the scale intent was ambiguous, but that the effects of repeated expression on extremity would be lessened if scale intent was clear. Consistent with this prediction, there was a significant two-

way interaction,  $F(2, 578) = 2.93, p = .05$ . As pictured in Figure 15, in the numeric rating scale (NRS), as expected, as frequency of expression increased, so did extremity (Three expressions:  $M = 2.53$ , 95% CI [2.43, 2.63]; Five expressions:  $M = 2.59$ , 95% CI [2.49, 2.69]; Eight expressions:  $M = 2.65$ , 95% CI [2.56, 2.75]). As can be seen from the confidence intervals, judgments made only 3 times were significantly less extreme than those made 8 times. Although the trend was such that repeated expression led to greater extremity, there were no other significant differences. In contrast to the incremental nature of extremity ratings for the numeric rating scale, when participants responded to the colour shade scale (CSS), extremity did not increase with frequency of expression (Three expressions:  $M = 2.66$ , 95% CI [2.56, 2.77]; Five expressions:  $M = 2.61$ , 95% CI [2.51, 2.72]; Eight expressions:  $M = 2.62$ , 95% CI [2.52, 2.71]). As can be seen from the confidence intervals, there were no differences in extremity ratings across levels of repeated expression within the colour shade scale.



*Figure 15.* Estimated marginal mean extremity ratings and 95% confidence intervals for each level of frequency associated with each scale type.

The next interaction of interest was between frequency of expression and task difficulty. The ability perspective implied that repeated expression would result in greater extremity when the task was difficult, but not when the task was easy. No such interaction was found,  $F(2, 578) = .38, p = .69$ . As such, there was no evidence that reducing the number of judgments reduced the effect of repeated expression on extremity. No perspective led to clear implications for a three-way interaction between frequency of expression, scale type, and task difficulty, and no three-way interaction was found,  $F(2, 578) = 2.56, p = .12$ .

### **Confidence**

To explore the effects of confidence, a 3 (Level of Frequency: 3 vs. 5 vs. 8) x 2 (Scale Type: Numeric rating scale vs. Colour shade scale) x 2 (Task Difficulty: 144 judgments vs. 80 judgments) mixed-model General Linear Model was conducted, with mean confidence ratings as the dependent variable. Similar to Experiment One, it was hypothesized that as frequency of expression increased, so would confidence. If confidence was mediating the relationship between repeated expression and extremity, the effect of frequency on confidence should be greater than the effect of frequency on extremity. Consistent with these hypotheses, there was a main effect of frequency,  $F(2, 578) = 58.90, p < .01$ . As pictured in Figure 16, as frequency of expression increased, so did confidence (Three expressions:  $M = 5.81, 95\% \text{ CI } [5.64, 5.98]$ ; Five expressions:  $M = 6.15, 95\% \text{ CI } [5.99, 6.32]$ ; Eight expressions:  $M = 6.46, 95\% \text{ CI } [6.30, 6.63]$ ). As can be seen by the confidence intervals, this effect was significant for each increase in repeated expression, as each mean value fell outside of all other confidence intervals.

This effect of repeated expression on confidence was certainly larger than the effect of frequency on extremity, as there was no overall effect of frequency on extremity.

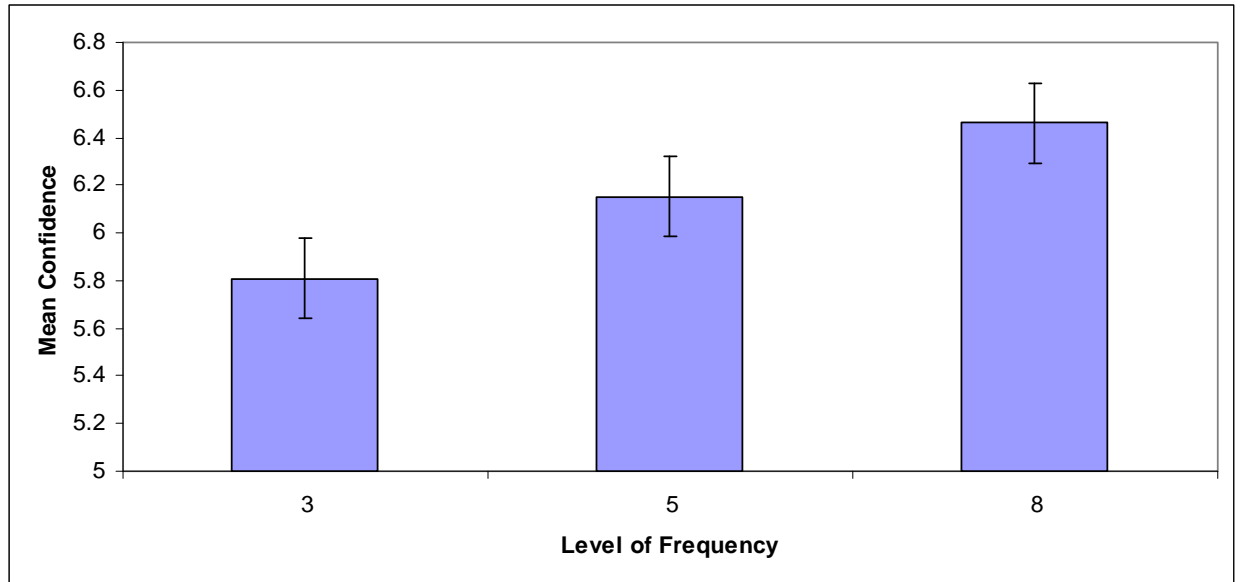


Figure 16. Estimated marginal mean confidence ratings for each level of frequency of expression with 95% confidence intervals.

No perspective led to a hypothesis about a main effect of scale type collapsed across all levels of frequency. No main effect of scale type was found,  $F(1, 289) = .17$ ,  $p = .68$ . Thus, neither scale was associated with greater confidence. However, there was a hypothesis about a main effect of task difficulty when collapsed across all levels of frequency. Those in the low difficulty condition were expected to be more confident since the task was cognitively easier. Consistent with this, a main effect emerged,  $F(1, 289) = 5.87$ ,  $p = .02$  (see Figure 17). Those who made fewer judgments were more confident ( $M = 6.33$ , 95% CI [6.11, 6.55]) than those who made more judgments ( $M = 5.95$ , 95% CI [5.74, 6.17]).

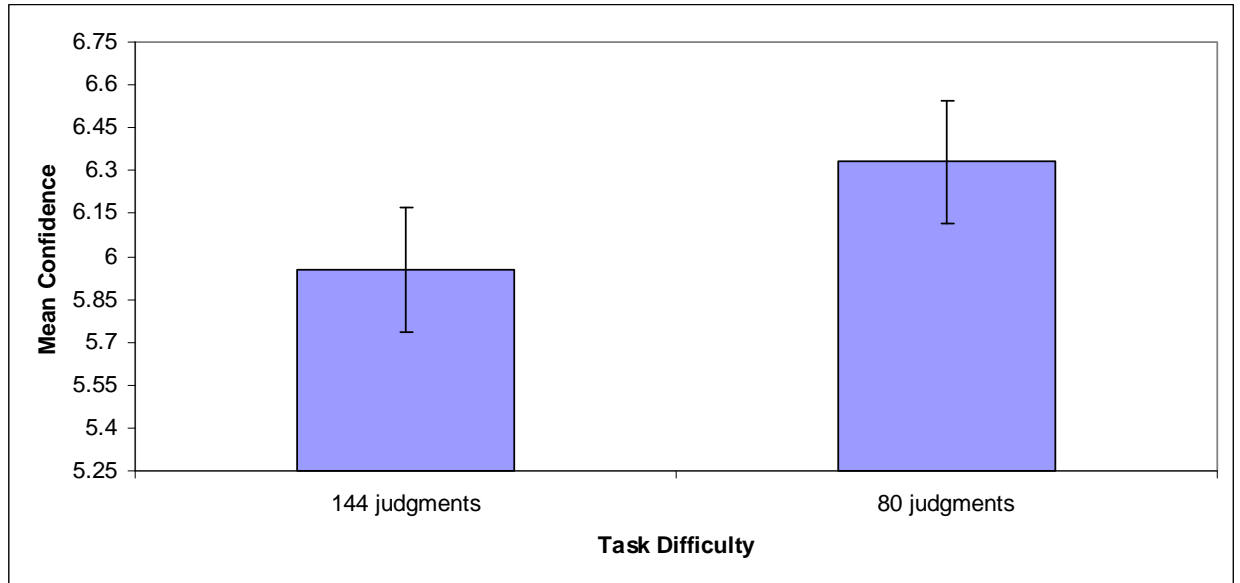


Figure 17. Estimated marginal mean confidence ratings for each level of difficulty with 95% confidence intervals.

There were three interactions of theoretical interest, all of which involved frequency of expression. No perspective led to clear hypothesis about a two-way interaction between frequency of expression and scale type on confidence, yet a marginal effect emerged,  $F(2, 578) = 2.31, p = .10$ . Because the effect was marginal, it was further explored (see Figure 18). The effect showed that the biggest increase in confidence just happened at different levels of repeated expression across the two scales. In the numeric rating scale condition, confidence increased with each increase of frequency of expression, but confidence seemed to increase the most from three to five expressions (Three expressions:  $M = 5.77, 95\% \text{ CI } [5.53, 6.01]$ ; Five expressions:  $M = 6.24, 95\% \text{ CI } [6.01, 6.48]$ ; Five expressions:  $M = 6.51, 95\% \text{ CI } [6.27, 6.74]$ ). In the colour shade scale condition, there was no significant difference in confidence ratings between three and five expressions, but there was a difference between three and eight, and five and eight expressions (Three expressions:  $M = 5.85, 95\% \text{ CI } [5.61, 6.08]$ ; Five

expressions:  $M = 6.06$ , 95% CI [5.82, 6.30]; Eight expressions:  $M = 6.42$ , 95% CI [6.18, 6.66]). Of course this effect is marginal and should be interpreted as such.

However, although the effect was marginal, across scale types frequency of expression resulted in greater extremity as would be expected. The interaction was a result of frequency of expression exerting a stronger influence on confidence at different levels of expression.

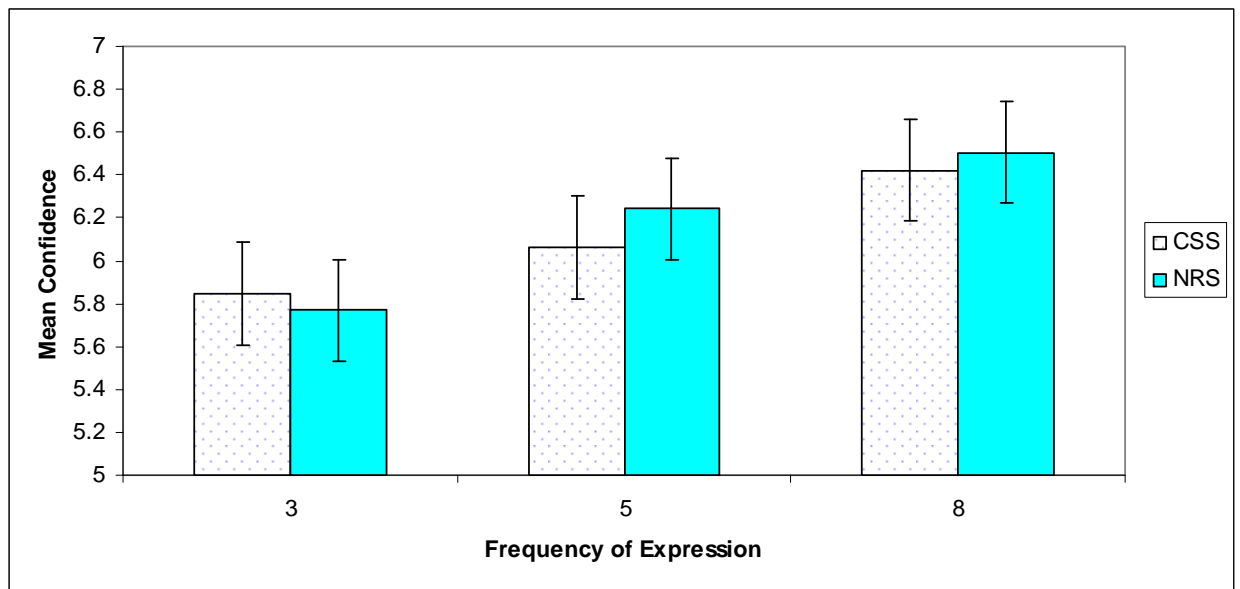


Figure 18. Estimated marginal mean confidence ratings and 95% confidence intervals for each level of frequency associated with scale type.

No perspective led to specific predictions of a two-way interaction between frequency of expression and task difficulty on confidence. None emerged,  $F(2, 578) = .76, p = .47$ . Thus, repeated expression did not cause confidence to vary depending on the number of judgments made. There were also no predictions of a three-way interaction between frequency of expression, scale type and task difficulty and none emerged,  $F(2, 578) = .98, p = .37$ .

### The Mediational Effects of Confidence

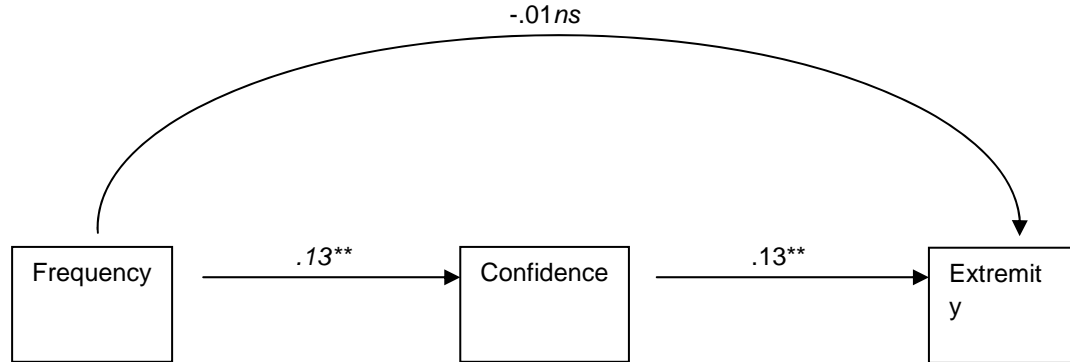
The role of confidence in the relationship between repeated expression and resulting extremity was of great interest. Recall that each of the three perspectives reviewed led to predictions about the role of confidence. It could be inferred from the ability perspective that people would fall back on confidence to guide responding when the task was difficult, but not when the task was easy. The ambiguity hypothesis implied that individuals would respond based on confidence when the scale was ambiguous and thus individuals misinterpreted question intent, but not when scale intent was clear. The evaluative change perspective implied that the effects of confidence should be constant. In order to determine the role of confidence, several mediational models were explored.

Mediational models were computed in the same manner as in Experiment One. All models included 292 dummy variables representing participants, and depending on the analysis, included a continuous variable representing extremity, a continuous variable representing confidence, and a continuous variable representing frequency of expression. Unstandardized regression coefficients indicated the relationships among these variables. Coefficients for relationships involving participants were not reported as they were not relevant to the questions of interest.

Previous Experiment Two analyses showed that increased frequency of expression led to greater confidence, but not greater extremity. Given that the effects of frequency on confidence were stronger than those on extremity, it seemed plausible that confidence could be mediating the relationship between frequency and extremity. Thus, the first mediation of interest for this experiment was the mediational effect of confidence between frequency of expression and extremity across all participants (see



Figure 19). Frequency significantly predicted confidence scores such that increased frequency of expression led to greater confidence,  $F(1, 585) = 114.03, p < .01$ . Increased confidence led to significantly greater extremity,  $F(1, 584) = 28.95, p < .01$ . There was no direct effect of frequency on extremity,  $F(1, 584) = 1.35, p = .25$ . Thus, confidence fully mediated the relationship between repeated expression and extremity. The Sobel test associated with this test was significant suggesting that confidence captured variance due to repeated expression as the mediator,  $Z = 4.81, SE = .003, p < .01$ .

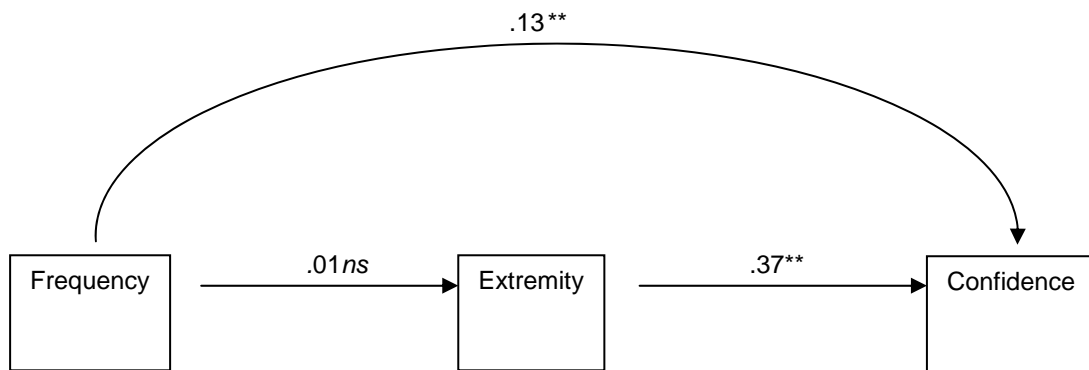


\*\* $p < .01$

Figure 19. Confidence mediation across all participants, Experiment Two

As noted in Experiment One, because confidence and extremity were both measured variables, it was possible that the reverse causal model might be a more plausible interpretation of the relationship. In order to test this possibility, a mediational model was explored where extremity was treated as a mediator between frequency and confidence. In the reversed model, repeated expression did not predict extremity,  $F(1, 585) = 1.16, p = .28$ . Thus, extremity could not mediate the effect of repeated expression on confidence. Extremity, however, did predict confidence such

that greater extremity led to greater confidence,  $F(1, 584) = 28.95, p < .01$ . There was also a direct path from frequency to confidence such that increased frequency of expression led to greater confidence,  $F(1, 584) = 114.07, p < .01$ . The Sobel test associated with this model was not significant, further suggesting that extremity did not mediate this relationship,  $Z = 1.12, SE = .003, p = .26$ . As such, this reversed model was considered as less plausible than the hypothesized model.

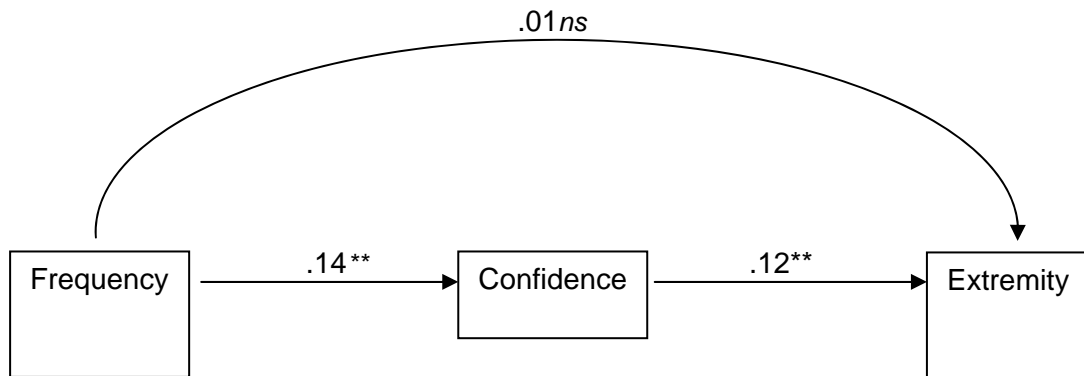


\*\* $p < .01$

Figure 20. Extremity mediation across all participants, Experiment Two

**Mediational Models Within Each Scale Type.** Based on the response mapping ambiguity perspective, confidence should mediate the relationship between repeated expression and extremity more strongly when question intent is ambiguous. For this experiment, that would result in full mediation in the numeric rating scale condition, but not in the colour shade scale condition. When looking at only those participants in the numeric rating scale condition (see Figure 21), increased frequency of expression led to significantly greater confidence,  $F(1, 293) = 55.32, p < .01$ . Increased confidence led to greater extremity,  $F(1, 292) = 15.88, p < .01$ . As predicted, there was no direct path from frequency to extremity,  $F(1, 292) = .39, p = .53$ . Thus, supporting the

ambiguity perspective, confidence fully mediated the relationship between repeated expression and extremity when the scale was ambiguous. The Sobel test for this model was significant,  $Z = 3.55$ ,  $SE = .005$ ,  $p < .01$ .

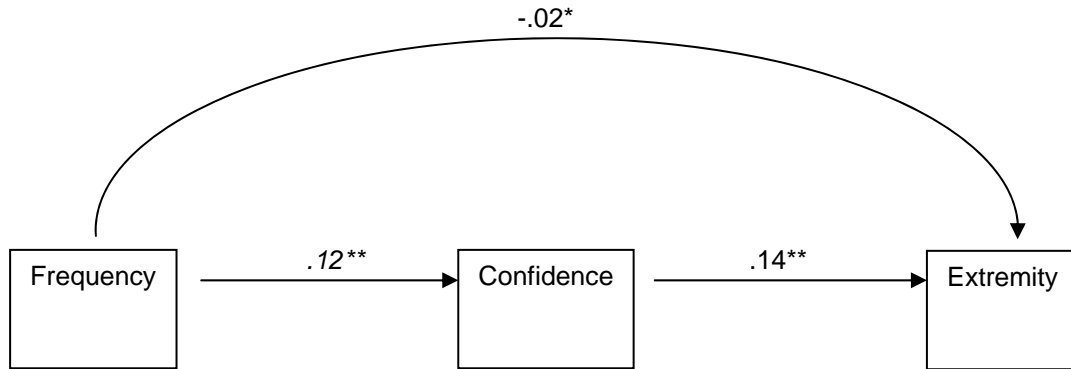


\*\* $p < .01$ .

Figure 21. Confidence as the mediator in the Numeric Rating Scale condition

The response mapping ambiguity perspective clearly implied that confidence would *not* fully mediate the relationship between repeated expression and extremity when scale intent was clear. This was because if scale intent was clear, the questions would not be misinterpreted as measuring confidence. The mediational model was tested for those participants who responded to the colour shade scale (see Figure 22). Increased frequency of expression led to significantly greater confidence,  $F(1, 291) = 61.87$ ,  $p < .01$ . Increased confidence resulted in greater extremity,  $F(1, 290) = 12.14$ ,  $p < .01$ . However, when participants responded to an unambiguous scale, there was still a direct effect of frequency on extremity,  $F(1, 290) = 5.10$ ,  $p = .03$ . This direct effect was very interesting, as it was in the negative direction ( $b = -.02$ ,  $SE = .01$ ). This meant that repeated expression led to reduced extremity. Signaling that confidence did

partially mediate the relationship, the Sobel test for this mediation was significant,  $Z = 3.19$ ,  $SE = .005$ ,  $p < .01$ .



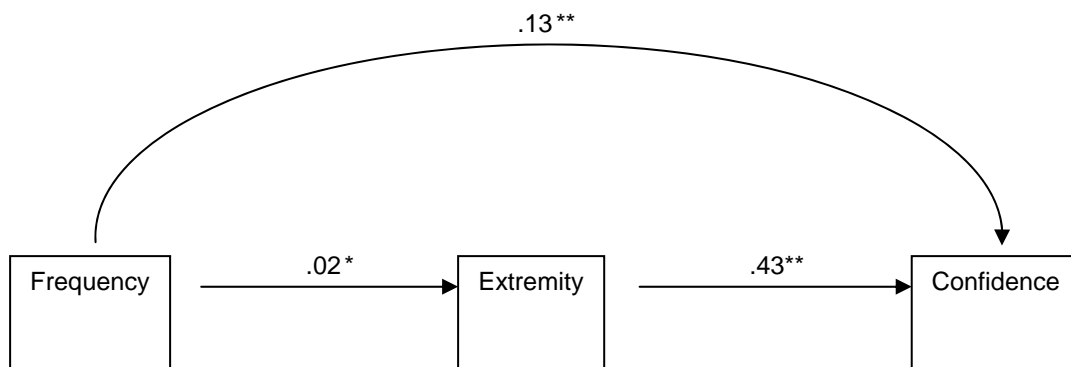
\* $p < .05$

\*\* $p < .01$

Figure 22. Confidence as the mediator in the Colour Shade Scale condition.

It was expected that the meditational effects of confidence would attenuate within the colour shade scale condition as compared to the numeric rating scale. It was thought that frequency of expression would lead to greater confidence, but because question intent was clear, this confidence would not exert as strong of an influence on extremity. This hypothesis was supported by the fact that there was a two-way interaction between scale type and frequency in the earlier reported General Linear Model. Responses were more extreme with repeated expression in the numeric rating scale condition, but not in the colour shade scale condition. However, while the overall effect was in the hypothesized direction, providing some evidence for the response mapping ambiguity perspective, the mediational model in the colour shade scale condition shed unexpected light on why the attenuation of extremity may have occurred, as reviewed in the discussion.

**Reverse Causality Within Each Scale Type.** In order to rule out the possibility that extremity was the more plausible mediator in the mediational analyses within each scale type condition, the reverse models were also explored. In the numeric rating scale condition (see Figure 23), increased frequency of expression led to greater extremity,  $F(1, 293) = 5.54, p = .02$ . Increased extremity led to increased confidence,  $F(1, 292) = 15.88, p < .01$ . There was a direct path from frequency to confidence such that increased frequency of expression resulted in greater confidence,  $F(1, 292) = 49.14, p < .01$ . Thus, extremity failed to fully mediate the effect of repeated expression on confidence. The Sobel test was significant,  $Z = 2.06, SE = .005, p = .04$ . However, because extremity failed to fully mediate the effect of repeated expression, it was considered a less plausible model than the hypothesized model.



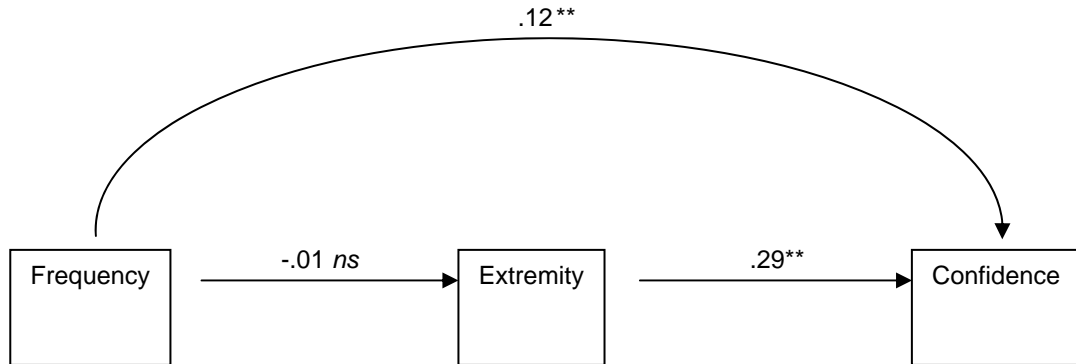
\* $p < .05$

\*\* $p < .01$

Figure 23. Extremity as a mediator in the numeric rating scale condition.

In the colour shade scale condition, repeated expression failed to lead to greater extremity,  $F(1, 291) = .75, p = .39$ . Extremity did lead to greater confidence,  $F(1, 290) = 12.14, p < .01$ . There remained a direct path from repeated expression to confidence,

$F(1, 290) = 66.93, p < .01$ . The Sobel test was not significant,  $Z = -.87, SE = .003, p = .38$ . This was not considered a plausible model (see Figure 24).

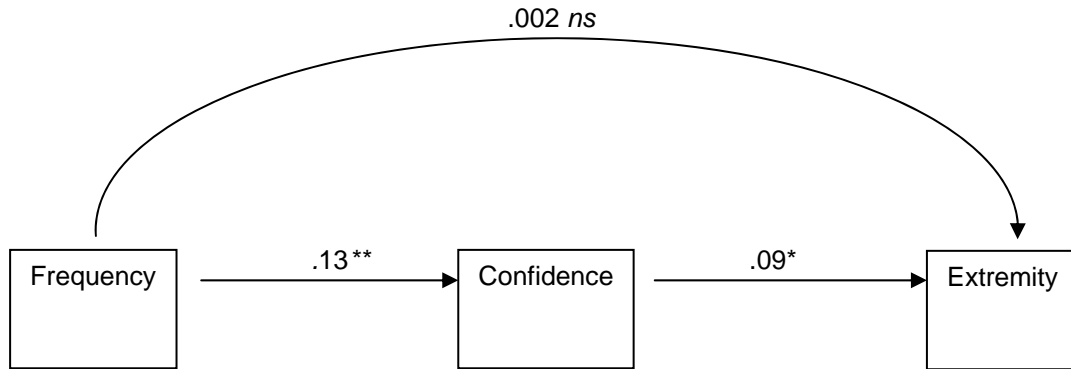


$^{**}p < .01$

Figure 24. Extremity as a mediator in the colour shade scale condition.

**Mediational Models Within Each Level of Task Difficulty.** While there was no interaction signaling that repeated expression varied depending on task difficulty, because the ability perspective led to clear mediational predictions, two models were explored. The first model tested confidence as a mediator between repeated expression and frequency in the high task difficulty condition where participants made 144 judgments (see Figure 25). There was a significant effect of frequency on confidence such that increased frequency of expression led to greater confidence,  $F(1, 291) = 91.52, p < .01$ . Greater confidence, in turn, led to greater extremity,  $F(1, 290) = 4.81, p = .03$ . There was no direct path from frequency to extremity, however,  $F(1, 290) = .04, p = .85$ . Thus, as implied by the ability perspective, when task difficulty was considered high, confidence fully mediated the relationship between frequency and extremity. The Sobel test was significant, showing that confidence captured a

statistically significant amount of variance due to repeated expression,  $Z = 2.15$ ,  $SE = .005$ ,  $p = .03$ .

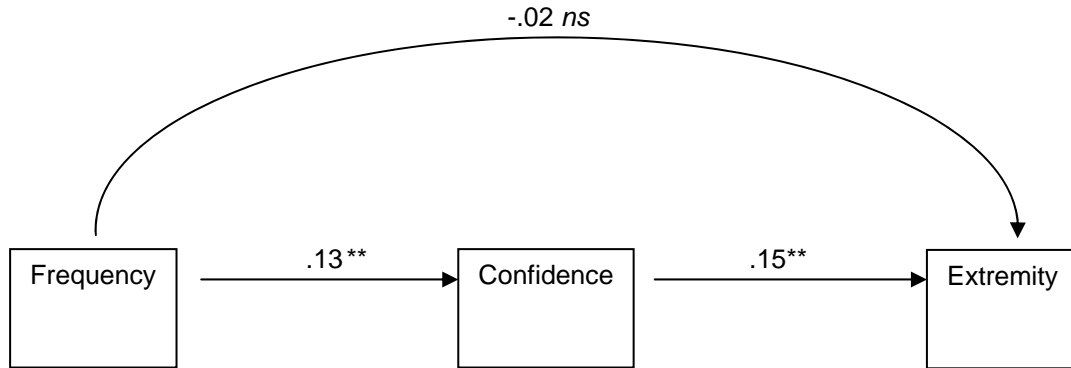


\* $p < .05$

\*\* $p < .01$

Figure 25. Confidence as mediator in the high task difficulty condition.

Counter to expectations derived from the ability perspective, in the reduced task difficulty condition where participants only made 80 judgments, the overall pattern looked similar to the higher difficulty condition (see Figure 26). There was a significant path such that increased frequency of expression led to greater confidence,  $F(1, 293) = 42.07$ ,  $p < .01$ . Greater confidence led to greater extremity,  $F(1, 292) = 22.69$ ,  $p < .01$ . However, contrary to the ability perspective, confidence again fully mediated the relationship between repeated expression and extremity. There was no direct path from repeated expression to extremity,  $F(1, 292) = 2.23$ ,  $p = .14$ . The Sobel test was significant,  $Z = 3.83$ ,  $SE = .005$ ,  $p < .01$ .



\*\* $p < .01$

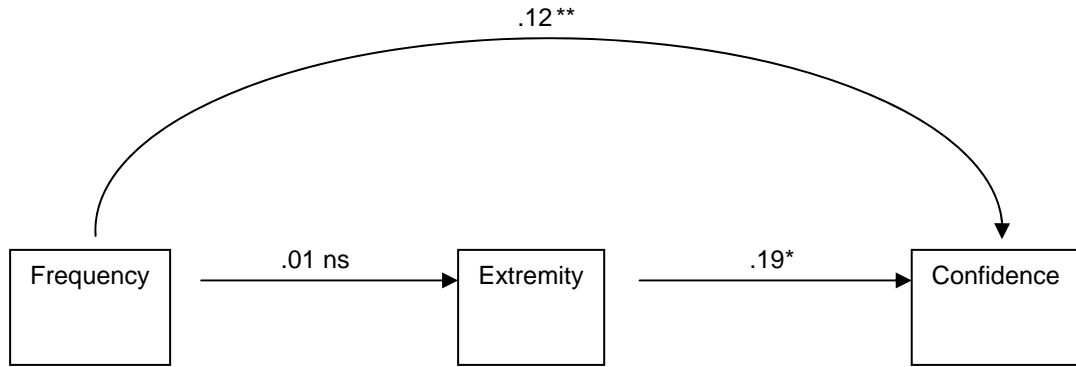
Figure 26. Confidence as a mediator in the low task difficulty condition.

Based on the mediational models, task difficulty did not change the effect of confidence on extremity. Indeed, this was supported by a test of coefficients that failed to find a difference between the mediated effect of confidence on extremity in the two conditions ( $Z = 1.18, p = .24$ ). Overall, the ability perspective, as interpreted, failed to gain support. It was originally thought that if the task was less difficult, participants would be able to do the task objectively and not need to rely on confidence as a heuristic for responding. However, participants used confidence regardless of task difficulty. It was possible that the reduction of judgments made the task less difficult, but yet some difficulty remained.

**Reverse Causality Within Each Level of Task Difficulty.** Two additional mediational models were explored to verify that reverse causality was not a concern within the task difficulty conditions. In the high difficulty condition, frequency failed to have a significant effect on extremity, and thus no mediation occurred,  $F(1, 291) = 2.09, p = .15$ . Increased extremity led to greater confidence,  $F(1, 290) = 4.81, p = .03$ . There was a direct path from frequency to confidence,  $F(1, 290) = 88.54, p < .01$ . The



Sobel test for this model was not significant,  $Z = 1.21$ ,  $SE = .002$ ,  $p = .23$ . This model was not considered plausible (see Figure 27).

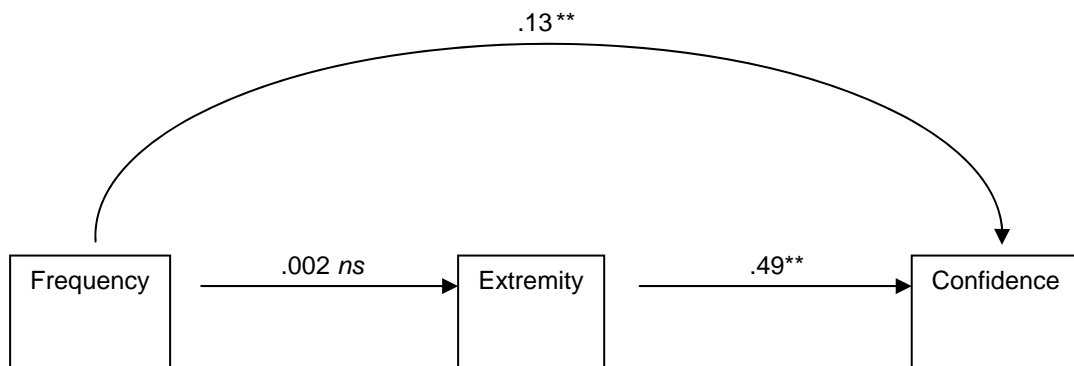


\* $p < .05$

\*\* $p < .01$

Figure 27. Extremity as a mediator in the high task difficulty condition.

In the low difficulty condition, frequency also failed to have an effect on extremity,  $F(1, 293) = .04$ ,  $p = .84$ . Extremity did lead to greater confidence,  $F(1, 292) = 22.69$ ,  $p < .01$ . There remained a direct effect of frequency on confidence,  $F(1, 292) = 44.42$ ,  $p < .01$ . The Sobel test for this model was not significant,  $Z = .18$ ,  $SE = .005$ ,  $p = .86$ . This model was not considered more plausible than the hypothesized model (see Figure 28).



**\*\* $p < .01$**

*Figure 28.* Extremity as a mediator in the low task difficulty condition.

## **Discussion**

The purpose of Experiment Two was to further disentangle competing perspectives for why repeated expression leads to greater judgmental extremity. As in Experiment One, this experiment first had to accomplish two tasks. To begin, the classic effect of repeated expression had to be replicated in appropriate cells. It was not necessarily expected that an overall effect of repeated expression would be found across all conditions. Some perspectives implied the relationship would only be present in specific cells. Consistent with this, repeated expression did lead to greater extremity in the numeric rating scale condition, showing that the effect could be replicated given the proper conditions. Second, increased frequency of expression resulted in greater confidence, replicating the finding of Experiment One. This was critical for understanding the role of confidence in the relationship between repeated expression and extremity.

Two of the perspectives explored were based on response mapping processes. The first perspective implied that lack of ability was a possible mechanism leading to extreme responding. Despite making the task significantly easier, counter to hypotheses associated with this perspective, there was no interaction between repeated expression and task difficulty on extremity. Furthermore, there was also no difference in the mediational effects of confidence between the two task difficulty conditions. As such, there was no compelling evidence for the ability perspective when it was directly tested.

The second perspective associated with response mapping effects was based on response mapping ambiguity. Evidence for this perspective was more complicated. At the overall level, it appeared that unambiguous response scales attenuated extremity effects, as would be predicted based on this perspective. However, the mediational models provided evidence that the effect was more complicated than initially expected. It was found that regardless of scale type, confidence still resulted in greater extremity for some participants, as shown by the significant path from confidence to extremity. Indeed, as shown by the test of coefficients, confidence was used to the same degree in the colour shade scale as in the numeric rating scale. Interestingly, in the colour shade scale condition there was evidence of a suppressor effect. Specifically, there was significant direct negative relationship between repeated expression and extremity such that the more frequently a judgment was made, the less extreme that judgment was reported. This direct negative effect and the positive mediational effect masked each other at the overall level. So while there was evidence for the ambiguity perspective, it seems likely that ambiguity is only a partial explanation. This will be revisited in the general discussion.

The final perspective explored was based on evaluative change. This perspective implied that there should be no variation in extremity due to repeated expression across either scale types or task difficulty levels. Consistent with this, there was no variation in extremity across task difficulty levels. However, there was a change in extremity levels depending on scale type at the overall level: extremity due to repeated expression was reduced when the scale type was unambiguous. While at the overall level extremity attenuated when the scale was considered unambiguous, the mediational

models were more complicated. These models provided evidence that regardless of scale type, confidence mediated the relationship between repeated expression and extremity. Recall that confidence could be a proxy for changes at the representational and/or computational level. If confidence acted as a proxy for evaluative change, it would be expected that confidence would mediate the relationship between repeated expression and extremity in the same way. Thus, it seems plausible that perhaps evaluative change did occur, but that this was being offset by a second, countervailing process. As such, it seems that while evaluative change is one mechanism for why repeated expression leads to extremity, it does not seem to be the only one. This too will be revisited in the general discussion.

## **General Discussion**

### **Summary of Results**

As expected, this program of research provided further evidence that repeated expression can lead to greater extremity. This program of research also provided the first evidence that confidence can play a role in the relationship between repeated expression and resulting extremity. Specifically, Experiment One provided evidence that increased frequency of expression resulted in greater extremity. There was also evidence that confidence in colour judgments increased with repeated expression. Neither effect was moderated by a manipulation of question order. Mediation models were explored. Although confidence mediated the relationship between repeated expression and polarization in both order conditions, the mediational effect of confidence was stronger in the question order condition deemed more unambiguous.

Experiment Two provided evidence that increased frequency of expression resulted in greater extremity, but only when participants responded to a numeric rating scale deemed to be ambiguous. When scale intent was clarified, frequency no longer resulted in greater extremity at the overall level. There was no moderation of extremity effects based on task difficulty. This experiment replicated the finding that increased frequency of expression led to greater confidence. Interestingly, in both scale conditions, confidence mediated the effect of repeated expression on extremity to the same degree. However, in the colour shade scale condition, there was a direct effect of repeated expression on extremity in the negative direction which masked the mediational effects of confidence at the overall level.

### **Implications of Findings**

The finding that repeated expression can lead to polarization had been largely established by past research. It was less clear what mechanisms led to this effect. The current program of research introduced several new manipulations to shed light onto the mechanisms that cause repeated expression to lead to extremity. These included manipulations of question order, the nature of the response scales, and task difficulty. Additionally, this program of research provided the first evidence that confidence mediates the relationship between repeated expression and extremity. It is useful to consider the current data in light of the three perspectives explored.

**Response Mapping Ability Perspective.** The first perspective explored was based on ability. This perspective did not imply that evaluations change as a result of repeated expression, but that repeated expression would cause an increase in confidence. Based on this perspective, individuals understand what is being asked of

them when they respond to scales. However, if memory challenges are too great and an individual is unable to do the task, the individual might fall back onto heuristics like confidence to guide responding. Experiment One did not directly test the ability perspective. However, Experiment Two tested this perspective through the manipulation of task difficulty.

In Experiment Two, task difficulty was manipulated in three ways. First, participants in the low difficulty condition had to judge fewer characters overall, reducing demands on memory. Second, these participants had to distinguish between fewer, more distinct shades of colour thus making the task perceptually easier. Finally, these participants had to make fewer judgments overall thus reducing respondent fatigue. Despite making the task easier, the manipulation of task difficulty failed to influence the effect of repeated expression on extremity. Polarization occurred regardless of whether the task was more or less difficult. Mediation models further supported the conclusion that task difficulty had no influence on repeated expression effects. Despite the manipulation of task difficulty, there were no changes in the mediational effects of confidence between repeated expression and polarization.

The failure of task difficulty to influence the effect of repeated expression on extremity was a null effect. Therefore, it was possible that perhaps that even with the task being made substantially easier it was still too hard, although this does not seem likely for two reasons. First, the task was eased in three ways: fewer characters were shown, fewer shades were judged, and fewer judgments were made overall. There was empirical evidence that these changes psychologically made the task easier: confidence was higher for those participants in the low difficulty condition. Second, there was also

empirical evidence that when the task was easier, participants were more accurate at recalling colour shade. Specifically, although participants in both task difficulty conditions reported shades as being more extreme than reality, participants in the high task difficulty condition exhibited marginally greater distortion in colour judgments than those participants in the lowered task difficulty condition. Because the manipulation of task difficulty impacted both confidence and accuracy, it seems that the manipulation was successful. However, despite changes in confidence and accuracy, there was no evidence that moderating task difficulty influenced the relationship between repeated expression and polarization as would be implied by the ability perspective. Indeed, there was not even evidence of a trend such that if the task was easier the effects of repeated expression on extremity were reduced. Thus, although it is possible that the manipulation of task difficulty was not strong enough, it seems improbable.

Further evidence inconsistent with the ability perspective arose from looking at the effects of repeated expression on polarization across scale types. According to the ability perspective, changing the nature of the scale should have had no influence on extremity because this perspective implies that respondents understand the scale, they are just unable to complete the task. However, the effects of repeated expression on polarization changed depending on the response scale. Nothing about the task was made easier by changing the scale. Indeed, the stimuli were the same. Despite the task being no easier, the change in response scale had a large influence on the effects of repeated expression on extremity such that the colour shade scale completely attenuated the extremity effects. It is unclear how the ability perspective could account for this

effect. Consequently, the current studies provide no compelling evidence for this response mapping ability perspective.

**Response Mapping Ambiguity Perspective.** This perspective implied that individuals are *able* to respond to questions properly, but that individuals can misunderstand the intent of response scales if the scale is ambiguous. Specifically, individuals could misinterpret extreme scale points to reflect confidence, not the property of interest (in this case, the shade of colour). Thus, if a response scale was ambiguous, repeated expression would lead to greater extremity, and this effect would be mediated by confidence. If the response scale was clear, the effect of repeated expression on extremity should attenuate, and confidence should no longer mediate the relationship.

Experiment One tested the ambiguity perspective by manipulating question order. It was thought that when questions of colour and confidence were paired, question intent would be disambiguated and thus extremity effects would be attenuated. There was no evidence that manipulating question order affected extremity effects which was inconsistent with the ambiguity perspective. This could be due to the fact that question ambiguity does not moderate extremity effects, or it could be that the question order manipulation was too subtle to create differences between the two groups. Unexpectedly, confidence exerted a stronger influence on extremity when question intent was unambiguous, which was also inconsistent with the ambiguity perspective. It could be that by pairing questions, confidence was made more salient and thus played a bigger role in the judgment of colour extremity. Ultimately, the data seemed to suggest that another mechanism other than ambiguity was, at least in part, causing repeated



expression to lead to polarization. This was because confidence mediated the effects in all conditions.

Experiment Two, however, did provide evidence for the ambiguity perspective. To begin, the ambiguity perspective implied that manipulating task difficulty should not influence extremity effects. That is, regardless of task difficulty the individual simply does not understand what is being asked of them, and as such cannot respond appropriately to the scale. Consistent with this, manipulating task difficulty had no impact on polarization. Next, the ambiguity perspective would imply that the unambiguous colour shade scale should attenuate the effects of repeated expression on extremity. In the General Linear Model results, this was effect found. At the mediational level, this perspective implied that confidence should have mediated the effect of repeated expression on extremity when participants responded to the ambiguous numeric rating scale. However, if the unambiguous colour shade scale was responded to, there should have been no direct effect of repeated expression on polarization. Additionally, the mediational effect of confidence should have weakened or disappeared completely. Partially supporting these predictions, confidence fully mediated the relationship between repeated expression and extremity when participants responded to the numeric rating scale. Contrary to the ambiguity perspective, however, confidence also mediated the relationship when participants responded to the colour shade scale. Interestingly, within the colour shade scale, the mediational effect of confidence was offset by a direct effect in the opposite direction.

The two opposing effects within the colour shade scale condition suggested that there were two competing mechanisms influencing extremity. Because this direct

negative effect did not occur in the numeric rating scale condition, it seems the colour shade scale changed participant construal of how to respond to the scale. It could be that, as intended, participants understood what was being asked of them in the colour shade scale and they tried to report colour accurately. However, the colour shade scale may have altered what participants saw as reasonable for consideration in their judgments. For example, frequency of expression might have been considered as a legitimate reason for increased confidence, and participants may not have realized that this confidence would have an influence on resulting extremity. However, they might have thought that repeated expression would have a direct effect on shade judgments. Past research has demonstrated that individuals will correct for perceived biases (e.g., Wegener & Petty, 1997). Thus, participants may have overcorrected for the perceived effect of frequency on extremity, but not corrected at all for the effect of confidence on extremity. This would result in the direct negative effect of repeated expression on extremity, and the continued mediation of repeated expression effects by confidence.

What did not fit with the ambiguity perspective, however, was the finding that confidence still strongly mediated the relationship between repeated expression and polarization in the colour shade scale condition. One potential explanation for this was that perhaps not all participants recognized the true intent of the scale. This was not likely given that participants were explicitly told to report colour shade, and given that the response options were the exact physical shades of colour judged earlier. Indeed, it is hard to imagine a more unambiguous scale. Another explanation for the confidence mediation would be that ambiguity was not the only mechanism that led to extremity, and it was this alternate process that was the cause of the confidence mediation within

the colour shade scale. Thus, although overall there was evidence that creating a less ambiguous scale attenuated polarization, Experiment Two raised the possibility that ambiguity was not the sole mechanism behind extremity effects.

**Evaluative Change Perspective.** This perspective implied that repeated expression led to true evaluative change such that the evaluation actually became more extreme. Thus, repeated expression should lead to greater extremity regardless of any manipulations. If confidence acted as a proxy for computational and/or representational change, any mediational effects of confidence should also be consistent across manipulations.

Consistent with the evaluative change perspective, in Experiment One repeated expression always resulted in polarization. However, confidence exerted a greater influence on extremity when the question order was considered unambiguous. This was not expected based on the evaluative change perspective. That said, confidence mediated the effects of repeated expression on polarization in both question order conditions. This could be suggestive of true evaluative change if confidence acted as a proxy for representational and/or computational changes.

Experiment Two provided further evidence that could be indicative of evaluative change. The evaluative change perspective implied that task difficulty would not influence extremity effects: it did not. However, the evaluative change perspective would predict that disambiguating the scale also would not influence extremity effects. Contrary to this perspective, when the response scale was considered unambiguous, extremity effects attenuated. At the mediational level, the pattern of results was more complex. Recall that confidence mediated the effect of repeated expression on

polarization regardless of scale type. This was exactly what the evaluative change perspective would imply if confidence acted as a proxy for representational and/or computational change. Thus, the evaluative change perspective was able to account for the confidence mediation across scale types; however it was unable to account for the direct negative effect of repeated expression on polarization. It does not seem likely that evaluative change was the only mechanism leading to polarization due to repeated expression.

Further evidence for the role of evaluative change came from examining colour judgments in light of true shade extremity. Indeed, one reason that a colour judgment paradigm was chosen was so that there was an objective referent from which to judge accuracy. Recall that the ambiguity perspective would imply that individuals are able to do a task, but they misunderstand the response scale. As such, if the response scale is unambiguous, it might be expected that individuals should be more accurate as compared to when the response scale is ambiguous. Thus, in Experiment Two it might be expected that when participants responded to the colour shade scale, they would exhibit greater accuracy in colour judgments. The true average extremity of characters presented was 2.31 across both difficulty levels. As can be seen in Figure 15, participants responding to the unambiguous scale were universally more extreme in their colour judgments regardless of level of frequency. Indeed, t-tests showed that participants in both scale conditions judged colour as significantly more extreme than reality (NRS:  $M = 2.61$ ,  $t(147) = 6.71$ ,  $p < .01$ ; CSS:  $M = 2.63$ ,  $t(145) = 8.73$ ,  $p < .01$ ). There was no difference in extremity ratings between the two scale conditions ( $Z =$

1.23,  $p = .22$ ). If extremity was solely a result of ambiguity, judgments should not have been systematically more extreme than reality in the unambiguous scale condition.

A question arises as to why participants were universally more extreme in their judgments when responding to the colour shade scale. The ambiguity perspective seems unable to account for this pattern of results. However, this pattern does fit with the evaluative change perspective. It could be that memory of colour shade changed to become more extreme across all levels of frequency, and thus participants reported what was consistent with their memory. The lowest level of frequency of expression was three. It was possible that by three expressions evaluative change had already occurred. Supporting this possibility, past research has explored how repeated expression influences other cognitive mechanisms. One such mechanism was accessibility. It was found that with only three expressions accessibility had increased and begun to reach asymptote (Powell & Fazio, 1984). This raises the possibility that representational and computational changes also occur mostly within the first three expressions of a judgment. Because this program of research was designed to replicate the initial colour judgment paradigm as closely as possible (Downing et al., 1992), there was no one-expression level of frequency. However, it would be interesting to test whether at one expression individuals were more accurate. If so, it would provide further evidence for evaluative change.

In summary, there was evidence supportive of the evaluative change perspective. However, this perspective could not account for the fact that reduced scale ambiguity attenuated polarization. While it cannot be argued that evaluative change accounted for

all findings in Experiment Two, it is possible that evaluative change played a role in polarization, in conjunction with ambiguity.

If one were to consider all three perspectives based on their ability to account for all data, overall the data fit most poorly with the response mapping ability perspective. Both the response mapping ambiguity and evaluative change perspectives, however, did receive empirical support, although neither was able to account for the whole pattern of results. However, it seems plausible that *both* contribute to repeated expression leading to extremity. Therefore, while this program of research has not fully delineated the causes of extremity, it has certainly propelled the research forward. These studies provide the first evidence in opposition to an ability explanation for repeated expression leading to polarization, and also provided the first evidence of possible mechanisms underlying the effect.

**Psychometric implications of the current research.** The goal of this program of research was to test theories as to why repeated expression results in polarization. In doing so, this research also addressed broader implications for the field of psychometrics. There has been a long history within psychometrics of how altering question order can influence responding. Indeed, question order is presumed to have an effect on responding for a variety of reasons (Schwarz, 1994; Schwarz, Strack, Hippler, & Bishop, 1991). The current research explored the effects of question order in terms of question content construal. Specifically, it was thought that if two similar questions were presented sequentially, question intent should be disambiguated. Disambiguation should occur because conversational norms suggest that questions should be non-redundant and thus individuals would be able to parse overlapping construals of item

intent. Initial evidence for this effect of question order was found through explorations of meditational models. Interestingly, exploring the effects of question order via mediation has been comparatively rare within the literature. Generally these effects have been studied through bivariate correlations of item responses depending on question order, or comparisons of item endorsement depending on item placement across order conditions. Thus, this program of research provides another example of how question order can alter construal, but does so using new methods.

Within the field of psychometrics, there has also been a great deal of research exploring the nature of the response scale (see Krosnick & Fabrigar, 1997). Experiment Two can be thought of as manipulating scale labelling to enhance understanding. However, rather than manipulating verbal or numerical labels, in this experiment, response options were manipulated so that in one case the response options were the exact property of interest. Past research has shown that the response scale labels can alter responding due to changes in response scale ambiguity and response scale interpretation. Specifically, changing endpoint labels can result in changes in how the response scale is interpreted by test takers. For example, a response scale ranging from -5 to +5 was construed differently by participants than a scale ranging from 0 to 10 (Schwarz, Knäupper, Hippler, Noelle-Neumann, & Clark, 1991). The current research extends previous findings by demonstrating that scale labels do not only change construal of the response scale, but may also change construal of the construct of interest.

Finally, a truism within psychometrics is that using multiple items to measure a single construct provides the most accurate assessment of that construct. Using

multiple items allows for the presentation of a construct in differing lights, providing more comprehensive measurement of a construct, and generally increasing reliability among items (e.g. Nunnally, 1978). However, the current research raises a new question: perhaps repeated expression of judgments about a single construct results in changes in responses. Specifically, perhaps repeatedly using similar items actually changes the judgment of interest, or perhaps if the response scale is ambiguous responses will appear artificially extreme.

Interestingly, within personality psychology, there has been prior investigation of a similar phenomenon. It has been found that as test-takers progress through a multi-item scale, consistency in responses increases, and there is a tendency for polarized responding for those items placed at the end of a scale (Knowles, 1988). It has been demonstrated that these effects can be the result of test-takers gaining an understanding of context and question intent from surrounding items (Knowles, Coker, Scott, Cook, & Neville, 1996). However, the current research would suggest other possible mechanisms for why multiple similar items would result in response changes. Specifically, it could be that multiple similar items within a scale result in true evaluative change as the judgments are repeatedly expressed. Additionally, perhaps multiple similar judgments lead to polarization due to response mapping ambiguity, and these effects could be attenuated with a different response scale.

### **Unresolved Issues and Future Directions**

Given that the current program of research was an initial exploration into polarization effects due to repeated expression, there are a number of interesting future directions worth pursuing. Of primary interest would be to further disentangle the



effects of ambiguity and evaluative change. Evidence so far has suggested that both could play a role in polarization due to repeated expression. However, most of the evidence for the evaluative change perspective was indirect in the sense that it was the failure of a manipulation to result in a change in the pattern of results. Thus, in order to feel more confident with the evaluative change perspective, there should be direct tests of the perspective. One way to do this would be to conduct an experiment that included a one-expression level of frequency in a colour judgment paradigm. Thus it would be possible to examine the accuracy of judgments that are only expressed once. If evaluative change occurs with repeated expression, it is hypothesized that when participants respond to an unambiguous response scale, judgments made once should be more accurate than those made multiple times. The current research did not conduct such a comparison because the intent of the research was to replicate the initial colour judgment paradigm (Downing et al., 1992).

A second way to directly test the evaluative change perspective would be to include measures that should capture changes in representation and computation. One possible measure would be accessibility. Such measures of evaluative change, in addition to confidence, could be simultaneously tested in the same model. If evaluative change does take place, it would be expected that measures of representational and computational change should always mediate the effects of repeated expression on polarization to a greater degree than confidence, and that these mediational effects would be impervious to manipulations of scale ambiguity.

The literature exploring the effects of repeated expression on polarization originated in the domain of attitudes. The current program of research, however,

tested this phenomenon in the context of colour judgments so that it was possible to determine judgmental accuracy. That said, it is important to take evidence gained from this program of research and to consider it in the context of attitudes. It could be that mechanisms leading to extremity within a colour judgment paradigm do not carry over to attitudinal judgments. However, there is no reason to think that response mapping ambiguity and evaluative change are any less likely to lead to extremity due to repeated expression in an attitudinal domain than in a colour judgment domain. However, one might argue that the effects of evaluative change might be even *stronger* in an attitudinal domain. This is because an evaluation of an object generally requires an individual to aggregate across a variety of features associated with that object. In contrast, colour judgments are unidimensional and therefore have fewer points in memory at which change could occur. Thus, one might expect more associations to be strengthened within an attitudinal paradigm, resulting in greater polarization.

There are a number of ways to explore polarization due to repeated expression within the context of attitudes. For example, future research could explore the effects of scale intent ambiguity in an attitudinal paradigm by manipulating question order, as done in Experiment One. A more novel way to disambiguate scale intent would be by changing the properties associated with a given response scale. For example, an unambiguous scale could be created where response options are faces with the mouths ranging from a smile to a frown. Each step between the two extremes would be an incremental shift in the degree of smile/frown. Thus, it should be clear to participants that they are being asked for their evaluation of the object ranging from good to bad, not their confidence in that evaluation.

In addition to scale ambiguity, it would also be interesting to consider the effect of one expression of an attitudinal evaluation on extremity as compared to evaluations made multiple times. Mediational models could provide insights as to whether evaluative change occurred. For example, if evaluative change occurred, repeated expression should result in extremity regardless of scale ambiguity. Additionally, measures of evaluative change (e.g., accessibility) should mediate the effects of repeated expression similarly across both ambiguous and unambiguous response scales. If ambiguity results in polarization, extremity effects should be attenuated when participants respond to an unambiguous scale. Additionally, confidence, not accessibility, should mediate the relationship between repeated expression and polarization when the response scale is ambiguous. Of course, as noted, it is possible that both ambiguity and evaluative change result in polarization due to repeated expression.

Finally, recall that judgments that are truly extreme have a variety of strength related consequences. Thus, another way to explore the effects of repeated expression on polarization within an attitudinal context would be to test whether extremity mediates the effects of repeated expression on strength related outcomes. For example, would extremity mediate the effect of repeated expression on resistance to persuasion? If this were the case, it would be further evidence that evaluations truly do change to become more extreme as a result of frequency of expression, and that the polarization effect is not solely a result of ambiguity.

So far all of the future directions discussed have followed out of the current program of research. However, there are broader linkages. This program of research

approached extremity as an outcome of situational variables. However, within the field of personality, the tendency to respond at scale extremes has been considered as an individual difference variable. The two approaches need not be mutually exclusive, and indeed there are interesting linkages between the two approaches. Through the lens of personality research, there is an individual difference in extreme responding. The current research used random assignment so presumably individual differences would be equally dispersed across conditions. However, it could be that those who are more prone to extreme responding are also more susceptible to the effects of repeated expression. Alternatively, if those who engage in extreme responding consistently respond at the extremes, perhaps repeated expression would not lead to further polarization since the response would already be at the scale end point. To date these ideas have yet to be tested.

While extreme responding has been studied at the individual difference level, the precise mechanisms underlying this individual difference are not yet well understood. To date, most research has focused on the degree to which extreme responding is associated with a variety of demographic characteristics. For example, extreme responding tends to be associated with lower education, older participants, and females (e.g. Weijters, Geuens, & Schillewaert, 2010). However, the current research provides a new approach from which to view extreme responding at an individual difference level. Specifically, perhaps individual differences in extreme responding are due to individual differences in response mapping and/or evaluative change. A possible example from response mapping could be that perhaps some individuals interpret verbal labels as more (or less) extreme than other individuals, and thus respond based

on that that interpretation. It seems plausible that there would be not only individual differences in the ways such verbal labels are construed, but perhaps also cultural differences. There might also be individual differences in the clarity with which an evaluation is held. Perhaps for some individuals, repeated expression rapidly increases accessibility and as such those individuals would demonstrate greater polarization compared to others. To date, this framework has not been explored within the context of individual differences, but it does provide new and interesting hypotheses as to why there are individual differences in extreme responding.

### **Conclusions**

This program of research shed light on how repeated expression could lead to polarization within a colour judgment paradigm. Three perspectives were explored that implied ways in which this polarization could occur. It was clear that, under certain conditions, repeated expression resulted in polarization. It was also clear was that confidence can mediate this effect. Overall, results showed that both ambiguity and evaluative change likely play a role in polarization due to repeated expression. While there is more research to be conducted in this area, it is hoped that this systematic evaluation of perspectives has highlighted the need for careful measurement and interpretation of scale responses. It is also hoped that this research will provide a framework for future research to continue elucidating the “why” question behind polarization.

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## Appendix A

### Experiment One Ethics Materials

#### “Colour” Letter of Information

This study is being conducted by a Graduate Student, Meghan Norris, under the supervision of Dr. Leandre R. Fabrigar, a Psychology Professor at Queen’s University in Kingston, Ontario.

The purpose of this research is to investigate how people make judgments of ambiguous stimuli. We will ask you to make judgments about the features of various characters and then ask you to remember and rate these features. There are no known physical, psychological, economic, or social risks associated with them; this research has been cleared by the Queen’s University General Research Ethics Board. This session will not take longer than 60 minutes to complete.

You will receive 1% course credit or \$5 for your participation in this session.

Your participation in this study is voluntary and you are free to withdraw at any time without penalty. If you choose to withdraw, you may also ask that your data in not used in analysis. You may also choose not to answer any question that you find objectionable or that makes you feel uncomfortable. This study has no known physical or psychological risks.

Please be assured that the data will be kept in a secure location, that all of your responses will be coded to conceal your identity, and that your responses will be pooled with those of a larger number of individuals. Thus, individual results will not be available to you and your responses will remain confidential and anonymous; only authorized researchers will have access to the data. The data will be published in aggregate form only.

*This study has been granted clearance according to the recommended principles of Canadian ethics guidelines, and Queen's policies.*

In the event that you have any questions, concerns, or complaints about this research, please feel free to contact Dr. Leandre R. Fabrigar ([fabrigar@queensu.ca](mailto:fabrigar@queensu.ca)). If you have ethical concerns, please contact the Chair of the Queen’s University General Research Ethics Board, c/o Queen’s University Research Services (533- 6081/ [chair.GREB@queensu.ca](mailto:chair.GREB@queensu.ca)).

Please feel free to ask any questions now.

Thank you for your time. Your interest in participating in this research study is greatly appreciated.

Dr. Lee Fabrigar  
Associate Professor, Dept. of Psychology

Meghan Norris  
Graduate Student

COLOUR

**Consent Form**

Name (please print clearly): \_\_\_\_\_

1. I have read the information sheet and have had any questions answered to my satisfaction.
2. I understand that I will be participating in the study called Colour. I understand that this means that I will be asked to rate my judgments of various stimuli.
3. I understand that my participation in this study is voluntary and that I may choose not to answer any questions and to terminate my participation at any time. I understand that such withdrawal will have no adverse consequences. I understand that this session is expected to take 60 minutes in total.
4. I understand that I may choose not to answer any question that I find objectionable or that makes me feel uncomfortable.
5. I understand that the anonymity and confidentiality of my responses will be maintained now and in the future.
6. I understand that individual results will not be made available but I am entitled to a debriefing at the completion of the study in which the purpose and expected outcome will be made available to me.
7. If I have any questions concerns or complaints, I understand that I may contact Dr. Leandre R. Fabrigar ([fabrigar@queensu.ca](mailto:fabrigar@queensu.ca)). If I have ethical concerns, I can contact the Chair of the Queen's University General Research Ethics Board, c/o Queen's University Research Services (533-6081/ [chair.GREB@queensu.ca](mailto:chair.GREB@queensu.ca)).

I have read the above statements and freely consent to participating in this research:

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

## COLOUR

### Debriefing Form

Psychological research has shown that the mere expression of an attitude can lead to an increase in attitude extremity. For example, if you have a positive attitude about bananas, just expressing this attitude can lead to your attitude to become more extreme, in this case, to become more positive about bananas. More recently, research has shown that the mere expression of a non-evaluative judgment leads to an increase in judgmental extremity. For example, simple expressions about the colour of an object can lead to a more extreme colour judgment (i.e., indicating that a blue square is more blue than it actually is). Currently, it is clear that the mere expressions of judgments leads to more extreme judgments, however, it is less clear why this occurs. Various explanations exist that attempt to account for this effect.

One explanation suggests that our judgments become more extreme because of repeated expressions of these judgments. That is, repeated expressions of a feature judgment (i.e., colour) leads to a more extreme judgment (i.e., indicating that the colour is more extreme than it actually is). Another explanation suggests that our judgments do not change, however, because of response scale ambiguity, participants must rely on their confidence when making their judgments (i.e., participants use extreme values because they are confident in one direction), and that confidence mediates the observed effect of frequency on extremity. We are exploring these theories, as in addition to looking for other possibilities.

You were asked to verbalize your experience of a variety of characters. These verbal responses were not recorded as was suggested to you. Verbalizing your experience helps to facilitate associations in memory which was important for the rating tasks. Only your computer responses will be analyzed.

In the event that you would like to see a counsellor as a result of participating in this, or any research study, please contact Health, Counselling and Disabilities Services at 533-2506. They are located at 146 Stuart in the St. LaSalle Bldg, (across the street from Adelaide Hall). Also, please feel free to talk to the experimenter for more information on this study.

Regarding the topic of research addressed here, below is a related reference that might be of interest to you should you like to obtain further information:

Judd, C. M., & Brauer, M. (1995). Repetition and Evaluative Extremity. In R.E. Petty & J.A. Krosnick (eds.), *Attitude Strength: Antecedents and Consequences* (pp. 43-71). Mahwah: New Jersey,: Erlbaum.

In the event that you have any questions, concerns, or complaints about this research, or would like to know the results, please feel free to contact Dr. Leandre R. Fabrigar ([fabrigar@queensu.ca](mailto:fabrigar@queensu.ca)). If you have ethical concerns, please contact the Chair of the Queen's University General Research Ethics Board, c/o Queen's University Research Services (533-6081/chair.GREB@queensu.ca).

This is an ongoing research project: **PLEASE DO NOT DISCUSS THIS PROJECT WITH ANYONE**, as knowledge about the procedure or our goals may alter the results we obtain from future participants. Thank you for your cooperation! We appreciate your time and effort!

Appendix B  
Experiment One Materials  
Stimulus Characters

多 自 代 美 了 人 各 形 台  
來 世 和 有 助 生 們 以 力  
同 現 己 合 更 亞 技 交 於



### Ideograph Colour Percentages:

1. 100% Red / 0% Blue (255 R, 0 G, 0 B)
2. 89% Red / 11% Blue (227 R, 0 G, 28 B)
3. 76% Red / 24% Blue (193 R, 0 G, 62 B)
4. 63% Red / 37% Blue (161 R, 0 G, 94 B)
5. 50% Red / 50 % Blue (127 R, 0 G, 127 B)
6. 37% Red / 63% Blue (94 R, 0 G, 161 B)
7. 24% Red / 76% Blue (62 R, 0 G, 193 B)
8. 11% Red / 89% Blue (28 R, 0 G, 227 B)
9. 0% Red / 100% Blue (0 R, 0 G, 255 B)

Numbers in the brackets indicate the precise location of each gradation of colour as represented in the characters. Colour percentages were created using MicroSoft Paint. A pure primary colour received a value of 255. In using a traditional 9-point scale, nine colour values were created approximately 28 units apart. This ensured that the spectrum increased in the most equal gradations as possible.

## Character Frequency Sets

### Character Set # 1

Three times: 1, 6, 7, 10, 13, 16, 19, 22, 25

Five times: 2, 5, 8, 11, 14, 17, 20, 23, 26

Eight times: 3, 4, 9, 12, 15, 18, 21, 24, 27

### Character Set # 2

Three times: 3, 4, 9, 12, 15, 18, 21, 24, 27

Five times: 1, 6, 7, 10, 13, 16, 19, 22, 25

Eight times: 2, 5, 8, 11, 14, 17, 20, 23, 26

### Character Set # 3

Three times: 2, 5, 8, 11, 14, 17, 20, 23, 26

Five times: 3, 4, 9, 12, 15, 18, 21, 24, 27

Eight times: 1, 6, 7, 10, 13, 16, 19, 22, 25

## Presentation Phase Instructions

You are now going to be presented with a set of characters. Each character will appear in various shades of red and blue. It is important to understand that the main task is to memorize the colour of each character. Once presented with a particular character it is asked that you initially describe out loud what the character resembles or reminds you of (i.e., a boat, a house, the letter “B”, etc.).

After verbally describing the character then indicate whether you believe the character is primarily red or primarily blue by clicking on the appropriate response, either the button “red”, or the button “blue”.

## Dichotomous Response Scale



**RED**

**BLUE**

### Colour Response Instructions: Separated

You are now going to be presented with each character that was just observed with one difference. Now, each character will appear in pure black.

Please indicate, as quickly and as accurately as possible, which colour you think this character appeared as during the previous stage of this study.

### Confidence Response Instructions: Separated

You are now going to be presented with the same black characters that you just completed rating. This time you are going to be asked to indicate how confident you were in each of your judgments. Please indicate, as quickly and as accurately as possible, how confident you were in your colour judgment for each character that was presented.

### Paired Response Instructions

In the next phase of the experiment, you will be asked to indicate what colour each character was. You will then rate how confident you are in this judgment.

Each character that you saw will appear in black. You will first report as quickly and as accurately as possible the colour that you believe the character appeared in. Following this, you will be asked to report how confident you were in that judgement.

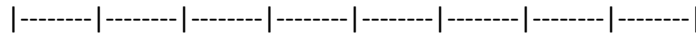
Numeric Colour Response Scale

有

*Red*

*Blue*

1 2 3 4 5 6 7 8 9

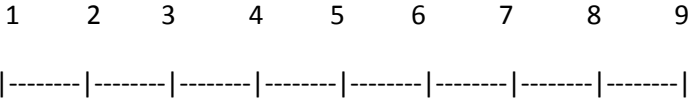


Confidence Scale



*Not at all confident*

*Extremely confident*



**Appendix C**  
Experiment Two Ethics Materials  
Letter of Information

This study is being conducted by a Graduate Student, Meghan Norris, under the supervision of Dr. Leandre R. Fabrigar, a Psychology Professor at Queen's University in Kingston, Ontario.

The purpose of this research is to investigate how people make judgments of ambiguous stimuli. We will ask you to make judgments about the features of various characters and then ask you to remember and rate these features. We estimate that it takes about 30 minutes to complete these tasks and that there are no known physical, psychological, economic, or social risks associated with them; this research has been cleared by the Queen's University General Research Ethics Board.

You will receive 0.5% course credit for your participation in this study.

Your participation in this study is voluntary and you are free to withdraw at any time without penalty. If you choose to withdraw, you may also ask that your data in not used in analysis. You may also choose not to answer any question that you find objectionable or that makes you feel uncomfortable. This study has no known physical or psychological risks.

Please be assured that the data will be kept in a secure location, that all of your responses will be coded to conceal your identity, and that your responses will be pooled with those of a larger number of individuals. Thus, individual results will not be available to you and your responses will remain confidential and anonymous; only authorized researchers will have access to the data. The data will be published in aggregate form only.

In the event that you have any questions, concerns, or complaints about this research, please feel free to contact Meghan Norris ([meghan\\_e\\_norris@yahoo.ca](mailto:meghan_e_norris@yahoo.ca)), Dr. Leandre R. Fabrigar ([fabrigar@post.queensu.ca](mailto:fabrigar@post.queensu.ca)), Dr. Vernon Quinsey (Head of the Queen's Psychology Department, 533-2492), or the Queen's University General Research Ethics Board, c/o Queen's University Research Services (533-6081).

Please feel free to ask any questions now.

Thank you for your time. Your interest in participating in this research study is greatly appreciated.

Dr. Lee Fabrigar  
Associate Professor, Dept. of Psychology

Meghan Norris  
M.A. Graduate Student



## Experiment Two COLOUR

### Consent Form

Name (please print clearly): \_\_\_\_\_

1. I have read the information sheet and have had any questions answered to my satisfaction.
2. I understand that I will be participating in the study called Colour. I understand that this means that I will be asked to rate my judgments of various stimuli.
3. I understand that my participation in this study is voluntary and that I may choose not to answer any questions and to terminate my participation at any time. I understand that such withdrawal will have no adverse consequences.
4. I understand that I may choose not to answer any question that I find objectionable or that makes me feel uncomfortable.
5. I understand that the anonymity and confidentiality of my responses will be maintained now and in the future.
6. I understand that individual results will not be made available but I am entitled to a debriefing at the completion of the study in which the purpose and expected outcome will be made available to me.
7. If I have any questions concerns or complaints, I understand that I may contact Meghan Norris ([meghan\\_e\\_norris@yahoo.ca](mailto:meghan_e_norris@yahoo.ca)), Dr. Leandre R. Fabrigar ([fabrigar@post.queensu.ca](mailto:fabrigar@post.queensu.ca)), Dr. Vernon Quinsey (Head of the Queen's Psychology Department, 533-2492), or the Queen's University General Research Ethics Board, c/o Queen's University Research Services (533-6081).

I have read the above statements and freely consent to participating in this research:

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

## Experiment Two COLOUR Debriefing Form

Psychological research has shown that the mere expression of an attitude can lead to an increase in attitude extremity. For example, if you have a positive attitude about bananas, just expressing this attitude can lead to your attitude to become more extreme, in this case, to become more positive about bananas. More recently, research has shown that the mere expression of a non-evaluative judgment leads to an increase in judgmental extremity. For example, simple expressions about the colour of an object can lead to a more extreme colour judgment (i.e., indicating that a blue square is more blue than it actually is). Currently, it is clear that the mere expressions of judgments leads to more extreme judgments, however, it is less clear why this occurs. Various explanations exist that attempt to account for this effect.

One explanation suggests that our judgments become more extreme because of repeated expressions of these judgments. That is, repeated expressions of a feature judgment (i.e., colour) leads to a more extreme judgment (i.e., indicating that the colour is more extreme than it actually is). Another explanation suggests that our judgments do not change, however, because of response scale ambiguity, participants must rely on their confidence when making their judgments (i.e., participants use extreme values because they are confident in one direction), and that confidence mediates the observed effect of frequency on extremity. We are exploring these theories, as in addition to looking for other possibilities.

You were asked to verbalize your experience of a variety of characters. These verbal responses were not recorded as was suggested to you. Verbalizing your experience helps to facilitate associations in memory which was important for the rating tasks. Only your computer responses will be analyzed.

In the event that you would like to see a counsellor as a result of participating in this, or any research study, please contact Health, Counselling and Disabilities Services at 533-2506. They are located at 146 Stuart in the St. LaSalle Bldg, (across the street from Adelaide Hall). Also, please feel free to talk to the experimenter for more information on this study.

Regarding the topic of research addressed here, below is a related reference that might be of interest to you should you like to obtain further information:

Judd, C. M., & Brauer, M. (1995). Repetition and Evaluative Extremity. In R.E. Petty & J.A. Krosnick (eds.), *Attitude Strength: Antecedents and Consequences* (pp. 43-71). Mahwah: New Jersey, Erlbaum.

In the event that you have any questions, concerns, or complaints about this research, please feel free to contact Meghan Norris (meghan\_e\_norris@yahoo.ca), Dr. Leandre Fabrigar (533-6492), Dr. Vernon Quinsey (533-2492), Head of the Psychology Department, Queen's University, or the Queen's University General Research Ethics Board, c/o Queen's University Research Services (533-6081). If you are interested in obtaining information about the results of the study once it is completed feel free to contact Dr. Leandre Fabrigar (533-6492).

This is an ongoing research project: **PLEASE DO NOT DISCUSS THIS PROJECT WITH ANYONE**, as knowledge about the procedure or our goals may alter the results we obtain from future participants. Thank you for your cooperation! We appreciate your time and effort!

**Appendix D**  
Experiment Two Materials

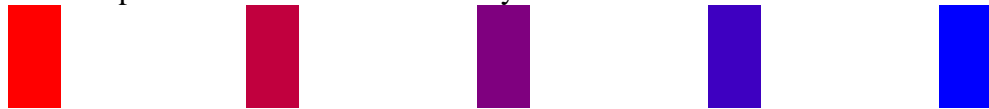
Stimulus materials in the high task difficulty condition used the same characters as in Experiment One. Stimulus characters for the lower task difficulty condition are below.

多	來	同
代	和	己
了	助	更
各	們	技
台	力	於

Shades represented in high task difficulty:



Shades represented in low task difficulty:



100% Red / 0% Blue	(255 R, 0 G, 0 B)
76% Red / 24% Blue	(193 R, 0 G, 62 B)
50% Red / 50% Blue	(127 R, 0 G, 127 B)
24% Red / 76% Blue	(62 R, 0 G, 193 B)
0% Red / 100% Blue	(0 R, 0 G, 255 B)

### Presentation Phase Instructions

You are now going to be presented with a set of characters. Each character will appear in various shades of red and blue. It is important to understand that the main task is to memorize the colour of each character. Once presented with a particular character it is asked that you initially describe out loud what the character resembles or reminds you of (i.e., a boat, a house, the letter “B”, etc.).

After verbally describing the character then indicate whether you believe the character is primarily red or primarily blue by clicking on the appropriate response, either the button “red”, or the button “blue”.

### Colour Response Instructions

You are now going to be presented with each character that was just observed with one difference. Now, each character will appear in pure black.

Please indicate, as quickly and as accurately as possible, which colour you think this character appeared as during the previous stage of this study.

### Confidence Response Instructions

You are now going to be presented with the same black characters that you just completed rating. This time you are going to be asked to indicate how confident you were in each of your judgments. Please indicate, as quickly and as accurately as possible, how confident you were in your colour judgment for each character that was presented.

Colour Shade Scale

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