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Guilty By Association: Time-Dependent Memory Consolidation And The Generalization Of Person-Specific Traits To Other Group Members

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"*Alright then Luke, you keep up that good work" – Leland Duane Enge*

"Learning how to think really means learning how to exercise some control over how and what you think…being conscious and aware enough to choose what you pay attention to and to choose how you construct meaning from experience." – David Foster Wallace

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Introduction

Generalization is a ubiquitous concept across multiple areas of psychology. Conceptually, generalization is similar to creating a schema, or ones' ability to form and apply overarching rules or concepts to facilitate making inferences in novel situations (Lewis & Durrant, 2011). Thus, one may develop a schema for "school" early on in life – one is required to sit still, be quiet and complete homework assignments. This "school" schema is then translated to other, novel situations (e.g., from middle school to high school), updated and further applied to other novel scenarios (e.g., training seminars for your job). Generalization is also a core concept in how humans generate inferences about concepts and people (Anderson, 1971; Hummel & Holyoak, 2003; Ellenbogen, Payne, Hu, Titone, & Walker, 2007) and judge and perceive others (Bem, 1981; Wyer & Srull, 1989; 1994). Recently, research from the cognitive sciences highlights the role of time-dependent memory consolidation, specifically through mechanisms acting during offline states such as sleep, in facilitating the formation of generalized – or "gist" – memories (Lewis & Durrant, 2011; Walker & Stickgold, 2013).

In the context of social and cognitive psychology, generalization is hypothesized as one of the key mechanisms underlying stereotypes and prejudice; traits and behaviors (e.g., "aggressive"), albeit often false in content, are ascribed to individual group members (e.g., Joe, an African American) based on their overarching social group membership (part of the racial group African American; Allport, 1945; Fiske & Neuberg, 1990). Indeed, this is a well-documented effect in social and cognitive psychology; as social perceivers we automatically and almost without fail categorize others based on salient physical features that denote social category membership (e.g., sex, race, age) which in turn activates known stereotypes and prejudices about that group member (Tajfel & Turner, 1986; Dovidio, Evans, & Taylor, 1986;

Brewer, 1988; Fiske & Neuberg, 1990; Zárate and Smith, 1990; Fazio, Jackson, Dunton, & Williams, 1995; Greenwald, Schwarz, & McGhee, 1996;; Brewer, 2002; Freeman & Ambady, 2009). Despite our robust understanding of how social category membership and group information (e.g., prejudices and stereotypes) influences perceptions of individual group members (as in traditional studies of stereotyping and prejudice), it has yet to be investigated how those generalizations about the group form. Here, we hypothesize that generalizations ascribed to an entire social group form from the generalization of group-member specific traits (e.g., "I just saw John cut someone off in traffic. John is rude") to other members of that group (e.g., "Joe is friends with John so Joe must be rude to"), despite not knowing any behavioral or trait information about that group's other members (in this example, "Joe"). Conceptually, we refer to this effect as guilty by association; despite never knowing any personal information about a social group member, we perceive that group member in the context of other, known (individuated) members of that group. Thus, participants infer that *all* members of a social group possess traits that only a *subset* of actual group members exemplifies.

To test this hypothesis, we merged theories from the cognitive sciences on learning and memory consolidation with social cognitive research on group perception to test the general hypothesis that time-dependent memory consolidation facilitates the generalization of target-specific traits about an individual group member to other members of that same group. Methodologically, this implies a departure from the traditional social-cognitive methodology of assessing social perception and judgment during one experimental session (e.g., Zárate and Smith, 1990; Freeman & Ambady, 2009) to assessing social perception and judgment across multiple experimental sessions (e.g., Zárate & Enge, 2013). Thus, in addition to the hypotheses proposed above the current work sought to expand the current social-cognitive methodology to test the dynamic nature of social psychological processes (e.g., person and group perception).

Supporting research

Recent research from our lab provides evidence that time-dependent memory consolidation qualitatively changes how social memories- specifically person memories - are accessed in a Lexical Decision Task where latencies (reaction times or RTs) were used to index how quickly they accessed particular person memories (this version of the LDT will be described in further detail below). Arms-Chavez, Enge, Lupo, Rivera, & Zárate (2013, in preparation), taught participants individuating information about novel social targets. For example, participants saw a photograph of "Joe" with an individuating trait (e.g., "Active") and two behavioral descriptions consistent with that trait (e.g., "I enjoy running in the park," "I exercise every morning before work"). Then, participants returned later that day (time delay without sleep) and performed a Lexical Decision Task (LDT) to test the relative strength of association between learned (or individuated) targets and individuating vs. stereotypic traits. For example, participants were primed with a learned photograph (e.g., of Joe) followed by a letter string, being either the learned trait (active), a stereotype-consistent trait (macho) or an irrelevant trait (honest). Participants returned, again, 48-hours later (after 2 nights of sleep) and performed a similar LDT (different targets were tested during each test session). Results demonstrated that after a time delay containing sleep (48 hours), participants more readily responded to learned (individuating) information paired with individuated targets (studies 1 & 2) and with repeated exposure to that learned information responded faster to individuating information ("active") than relevant group stereotypes ("macho;" study 1). These data demonstrated that after individuating information is integrated into memory, individuation is facilitated, and with interleaved learning, is responded to faster than group relevant stereotypes.

In a related line of research using a similar learning and test paradigm, Enge, Lupo, & Zárate (2013) demonstrated that time dependent memory consolidation differentially influenced the consolidation of positive versus negative information for racial in- versus out-group members, respectively. Enge et al. trained participants on a series of negative and positive news traits (each trait was embedded in a news article) paired with racial in- and out-group targets. Participants were then tested both 2-6 hours and 48 hours after training. Results demonstrated that participants more readily responded to learned negative information paired with racial out-group members and learned positive information paired with racial in-group members. Importantly, these differences were revealed only after the 48-hour time-delay. Thus, time-dependent memory consolidation facilitates the integration of person-specific trait information; this effect is stronger when the learned trait information is consistent with maintaining a positive social identity in respect to a racial out-group. This research demonstrated an increase in accessibility to that person-trait association, as measured with an implicit memory task; the current research extends this paradigm to explicit measures. Namely, we investigated if person-specific trait memories are generalized to other, familiar members of a person's social group as a function of time-dependent memory consolidation.

How are groups perceived as "groups?": Similarity and group entitativity

Group entitativity is defined as the extent to which a group is perceived as an actual group, or more colloquially, the extent to which it has "groupness" (Dasgupta, Banaji, & Abelson, 1999). For a group to be perceived as a group its' members must possess some level of cohesion or similarity in terms of physical and psychological traits (Dasgupta et al, 1999). Thus, physical and/or psychological similarity allows the social perceiver to extract a general impression of what that group is like (e.g., a stereotype).

As suggested above, physical similarity is an important determinant of group entitativity. Physical similarity has been treated in terms of both socially defined group labels (e.g., race) and artificial group labels (e.g., clothing and physical features). Regardless of the form of group similarity, it produces perceptions of a cohesive group, which leads to judgments of psychological homogeneity (Dasgupta, Banaji, & Abelson, 1999). Dasgupta et al. (1999) exposed participants to a set of inanimate caricatures (greebles) that were entitative (same color greebles) or non-entitative (different color greebles). Participants then judged the likelihood that each group would engage in a series of positive and negative behaviors toward an out-group. Results demonstrated that despite being novel and unfamiliar, the entitative group was perceived as exemplifying the same behaviors (psychological homogeneity) and as more likely to exhibit negative behaviors towards an out-group than the less entitative group. Thus, when group members are physically similar, the group is perceived as being more entitative. Further, individual members of entitative groups are expected to exhibit the same behaviors and traits and as a whole, the group is expected to act negatively towards other groups.

Using actual social groups, studies on group entitativity have also demonstrated that the extent to which a group is perceived as entitative mediates the relationship between social category memberships and associated group-relevant stereotypes. In these studies, highly entitative groups are defined as groups about which the perceiver possessed pre-existing knowledge (e.g., how the group generally behaves). Conceptually, highly entitative groups are similar to an individuated social target in that the unique trait information about that group is well-known, remembered and therefore more efficient and less effortful to recall when used to judge that group (Hamilton & Sherman, 1997; Spencer-Rodgers, Hamilton & Sherman, 2007). Therefore, highly entitative groups (e.g., a family) are generally stereotyped less in terms of broad social categories; groups perceived as being low in entitativity (e.g., racial groups) are generally stereotyped more so than groups who are high in entitativity, as judgments about those groups are derived from group representations (e.g., stereotypes) vs. unique characteristics of that group (Crump, Hamilton, & Sherman, 2010; Spencer-Rodgers et al., 2007). Thus, when a group is less entitative (e.g., a racial group), it is cognitively efficient to generalize limited trait knowledge to the entire because the general psychological structure of a low entitative group is difficult to infer given that limited trait knowledge - therefore a more general, often false, structure is inferred about that group (e.g., a stereotype; Crump, et al., 2010). When perceivers possessed adequate trait and behavioral information about the group to infer a general psychological structure of that group, they perceived the group in the context of that information instead of perceiving them consistent with social stereotypes as they did with low entitative groups.

Collectively, the research on group entitativity demonstrates that less entitative groups are perceived as more psychologically homogenous; limited trait and behavioral information is more readily applied to the entire group (e.g., a racial stereotype; Crump et al., 2010) and this process occurs as a function of physical similarity (e.g., Dasgupta et al., 1999). In the context of highly entitative groups (e.g., families), however, the group is perceived in terms of the actual traits they possess (e.g., one member might be funny; another rude). This research, however, has not directly tested how trait and behavioral information become generalized to a whole group as as a function of actual learned trait and behavioral information about specific group members (e.g., one may meet their academic advisor prior to the entire lab and the traits the advisor possess may generalize to the entire lab – guilty by association). Thus, the current study extended this research on group entitativity to directly test how trait information becomes generalized to an entire group and whether learned positive and negative information is differentially associated with groups, as Dasgupta et al. (1999) found for perceptions of less entitative, non-social groups.

To generate hypotheses about the conditions under which generalization would occur, we integrated research on time-dependent memory consolidation and its' role in the formation of generalized memories.

The role of time-dependent memory consolidation in the formation of generalized memories

Time dependent memory consolidation is hypothesized to occur primarily during offline states. Before it occurs, recently learned information is represented as a series of separated, orthogonal representations (McClelland, McNaughton, & O'Reilly, 1995; O'Reilly & Rudy, 2002). This type of pattern separation suggests encoding and storage of episodic detail, at the expense of semantic relationships amongst those recently learned items (O'Reilly et al. 2002; Norman, 2000; McClelland et al.,1995). Thus, before consolidated, recently learned information is remembered in terms of specific details regarding the stimuli, with less ability to extract semantic relationships (e.g., generalities; rules) between those representations. After consolidation, however, information is represented in an overlapping and distributed fashion, allowing for extant interconnections between different networks of information. This architecture of consolidated memories is hypothesized to facilitate a more general, semantic, or "gist" based representation of that learned information (Lewis & Durrant, 2011; McClelland, McNaughton, & O'Reilly, 1995; Stickgold et al., 2013; Walker & van der Helm, 2009).

In tandem with the evidence discussed above, the effects of time-dependent memory consolidation on generalization and inference have also been demonstrated behaviorally. Ellenbogen et al. (2007) gave participants a series of premise pairs (e.g., A>B; B>C; C>D, etc) to learn during an initial session. Then, participants were tested for inferring relationships amongst distant (e.g., Is A > D?) and proximal (e.g., Is A > B?) premise pairs with or without a period of sleep. Results demonstrated that after a period of sleep, participants more readily inferred relationships amongst distant (vs. proximal) premise pairs. In a related line of research, Durrant et al. (2010) trained participants on a series of sequential (auditory) tones, some of which had the same underlying statistical structure in terms of the ordering of the tones. For example, understanding the underlying structure of the tones would allow participants to use a tone in one part of the sequence to predict the next tone in the sequence. After participants heard each individual sequence, they were required to come back either after a night's sleep or an equivalent time period without sleep. Results demonstrated that participants who slept (vs. those who did not sleep) for one night in between learning and test showed greater improvement in deriving the general statistical structure of the tone sequences (predicting the next tone in the series). Thus, with time, connections between learned items facilitate making inferences in novel situations that contain those learned items.

In addition to the work described above on generalization, research has also demonstrated a bias to consolidate negative (over neutral) information. In a series of studies, Payne and colleagues (Payne et al., 2008; 2010; 2011) taught participants a combination of emotionally negative (e.g., a picture of a snake) and emotionally neutral scenes (e.g., a picture of buildings). Participants returned either with or without a night of sleep and were tested on recognition memory (old/new judgments). Results consistently demonstrated that negative information benefits from a time-delay with sleep while neutral information does not (positive information has not been tested). Given this bias, then, we expect for our generalization effects to be pronounced when the trait information is negative. We expect similar, but weakened effects for positive information as this information is emotional, but may not be as salient as negative information (e.g., a homicide is more memorable than someone winning a scholarship. While these two examples are different in terms of arousal, that is not the aim of the current study. Given the role of arousal in emotion perception and memory, arousal is discussed in the context of the data reported here in a later section).

The current research

The study reported here built on the methodology traditionally used in social perception to directly test how person and group perception processes are formed over time. The proposed study provided a direct test of three core concepts in the person and group perception literature – how social information becomes integrated, accessed, and generalized from one specific social target to other, novel, social targets (e.g., Srull & Wyer, 1989; Smith & Zárate, 1992; Hamilton & Sherman, 1996; Dasgupta, et al.; 1999). We broadly hypothesized that social perceivers would more readily generalize learned trait information to other social targets (familiar, but familiar targets) when were given a 48-hour time-delay between learning and test, allowing for offline consolidation processes to occur.

Experimental Overview and Hypotheses

Eighty-four participants completed the study for partial course credit. Eleven participants reported Spanish as being their dominant language and were dropped from the analyses reported here. Four participants reported sleeping in the short-delay condition and were also dropped from analyses reported here. Thus, the study reported here analyzed the remaining sixty-nine (N = 69;

39 females, *Mage* = 22.02; *SD* = 5.05) subjects of which thirty-two (*n* = 32) were in the short-delay test condition and thirty-seven (*n* = 37) in the long-delay condition. We analyzed all ethnic groups with our sample being 74% Latino/a. Thus, the sample we collected was reflective of El Paso demographics in general (primarily Latina).

The following study used a 3(Face Type: Individuated vs. Familiar vs. Novel) X 2(Time of test [Between-subjects]: Without vs. With Sleep) mixed model design. Individuated targets are those about whom group membership and personal information are known. Non-individuated targets are those about whom only group membership is known and will be referred to as familiar targets from this point on. No information was provided about novel targets and therefore our participants had no previous exposure to them. Our main dependent variables were trait ratings (e.g., How considerate is this person?), valence ratings (How would you evaluate this person?) and similarity ratings (How similar are these two people?). Furthermore, time to complete each rating was recorded.

Participants were given a set of 12 photographs and told to group those photographs into 2 separate groups. Participants were given feedback about which member was in each artificial group (A or B, respectively) until they were able to correctly group the set of 12 photographs into 2 artificial groups (A or B) twice without error. After learning these groups to criterion, participants saw 2 photographs from each group (2 from A; 2 from B) paired with individuating information (e.g., "I am Joe; I am considerate," "I volunteer at homeless shelters every weekend," "I always think of others before making decisions"). At test, participants returned 2-6 hours (short-delay time of test) and 48 hours (long-delay time of test) after this initial learning session to complete our dependent measures. A primary aim is to test how individuating information about a known group member generalizes to other, familiar members of the same group. Thus, participants rated how each level of face type exemplifies a learned vs. novel trait. It was hypothesized that in the long-delay condition, participants' trait ratings for individuated targets would be associated with higher trait ratings on the same learned trait for familiar targets. We hypothesized that in the long-delay condition participants' trait ratings to Individuated targets would be associated with higher trait ratings for familiar targets. We also hypothesized this same pattern of effects for evaluative ratings. For similarity ratings, we hypothesized that within each group (e.g., Individuated targets in the negative group vs. familiar targets in the negative group), similarity ratings would be higher in the long-delay (versus the short-delay) condition. Furthermore, we hypothesized that when comparing targets between each group, participants would perceive them as less similar in the long-delay (versus the short-delay).

Novel targets had no a-priori hypotheses regarding generalization, as they were targets that participants had no previous exposure to and had no connection with the groups that participants learned about. Given, however, that all groups were either all males or all females, and thus shared a common social category membership, we included novel targets as an exploratory test that information might be generalized to these novel targets on the basis of gender, and not specific to our group learning manipulation (c.f., Payne et al. 2009). Thus, the inclusion of novel targets was secondary and exploratory in terms of the hypothesized generalization effects hypothesized for familiar targets.

Methods

Experimental protocol: Group Learning and Person Impression Tasks

Facial stimuli During both of the learning tasks and test session, participants viewed frontal head and neck color photographs of Mexican-American males or females. These photographs were pre-tested for physical similarity such that within each set of male and female groups, faces were perceived as equally similar; thus, all groups were equated on physical similarity before this study was conducted. Furthermore, as indicated above, there no salient physical features that denoted membership in one of the two groups (described in further detail below). Consistent with previous research (e.g., Rivera, Arms-Chavez & Zarate, 2012; Zarate et al., 2008), all photographs were cropped at 3.5 inches wide X 6 inches tall and were equated on luminance and contrast with the use of Adobe PhotoShop CS6.

Group Learning Task Participants were told that they were participating in a study on categorization. Upon arrival, participants completed informed consent and a demographics questionnaire. Participants were told that they would see a series of 12 photographs (either all men or all women, counterbalanced between subjects) and their task was to categorize the photos into Group A or Group B. Participants received feedback regarding their performance (correct or incorrect) in categorizing each photograph as “A” or “B”. Both groups were arbitrary; no salient physical characteristic (e.g., a beard) denoted membership in either group A or B. Thus, this group categorization task was a randomized series of photographs with no characteristic denoting group membership. As such, we provided participants with feedback regarding their categorizations that is described in further detail below.

First, a fixation point appeared on the screen for 1000 ms. Then, a photograph was presented for 3000 ms, during which participants pressed, on a response pad, button “A” or button “B,” denoting group membership. Participants received feedback on their categorizations. On correct trials, the next photograph in the sequence appeared and on incorrect trials, the photograph reappeared until the participant made the correct response. All participants first completed 20 successive blocks of group learning, after which their performance was checked was to ensure they learned the groups to criterion at least once. If participants did not learn the groups to criterion after 20 blocks, they then completed another 20 blocks after which their performance was again checked (62 of 69 (93%) participants learned the groups to criterion twice).

Person Impression Task After the group-learning task, participants were shown four photographs, 2 from Group A and 2 from Group B, with some personal trait information about those individuals (see Appendix 3). Group A targets possessed all negative traits and Group B targets possessed all positive traits (counterbalanced between subjects). Participants were told that their task was to read the personal information carefully and complete an impression formation questionnaire (see Appendix 2). Once these instructions were made clear, the task was delivered via a timed Microsoft Powerpoint Slide Show, where participants saw the four photographs first for 30 seconds where they completed the impression formation questionnaire and then, two more blocks for 15 seconds each. Each block of photographs was presented in a randomized order.

Each person impression trial contained a photograph, a name, a trait and 2 behavioral descriptions of that trait. The photographs used were the same photographs from the group-learning task. Consistent with previous research, all traits and behavioral descriptions were written in the first person as if the target wrote the sentences themselves (Carlston & Skowronski, 1994; Zárate et al, 2008). The positive traits used in this task were “warm” and “considerate,” and the negative traits used were “cold” and “cruel.” For example, a photo of a Latino appeared next to his name (“I am Carlos”), a trait (“I am considerate”), and two behavioral descriptions of that trait (“I always help others when they are in need” “I think of other people before I make a decision”).

Time of tests

Short and long-delay testing sessions

Participants were randomly assigned to complete our dependent measures either 2-6 hours (referred to as “short-delay”) or 48 hours after (referred to as “long-delay”) the person and group-learning tasks. This factor will be referred to as “test condition” (each level described in the preceding sentence). The first time of test took place no less than 2 hours, but no more than 6 hours after the initial learning sessions. Participants in the short-delay condition completed a check-up questionnaire to assess how active they were during the short (2-6 hour) delay and whether or not they slept during the short-delay. Previous research has shown that even a short nap can yield consolidation effects (Gais, 2004), thus participants who slept during this delay were dropped from final analyses (N = 4). Participants in the long-delay condition completed a different check-up questionnaire to assess the quantity and quality of their sleep over the intervening 48-hour time delay. After completing either questionnaire participants completed the trait-rating, valence and similarity comparison dependent variables via Superlab 4.0 (Cedrus Corporation). Participants first completed trait ratings, valence ratings and then similarity ratings. Trait ratings present the strongest test of our generalization hypothesis and represent stereotype development. For this reason, trait ratings were always presented first. Each dependent measure is described in further detail below.

Dependent measures

Trait Ratings

At test, participants were tested on all 12 targets (individuated and familiar) and 12 novel targets as well. Participants were shown (via SuperLab 4.0) a centrally presented photograph paired with the question "*How (trait) is this person?*" (1-7 Likert type scale on a computer response pad: 1 – not at all; 7 – completely). Each level of face type was paired with four different traits: Learned trait (e.g., warm), other learned trait (considerate), opposite learned trait (cold), opposite other learned trait (cruel), a trait semantically orthogonal to the learned trait (e.g., intelligent) and a trait semantically orthogonal to the opposite learned traits (e.g., lazy). For example, participants learned that one target from group A (A1) is warm and the other target (A2) is considerate, whereas for group B they learned that one target (B1) is cold and the other target (B2) is cruel during the initial person impression task. At test, for target A1, they were asked to rate to what extent that target is warm (learned trait), considerate (other learned trait), cold (opposite learned trait), cruel (opposite other learned trait), intelligent (orthogonal positive trait) and lazy (orthogonal negative trait). Alternatively, for target B1, they were asked to rate to what extent that target is "cold" (learned trait), cruel (other learned trait), warm (opposite learned trait) and considerate (opposite other learned trait), intelligent (orthogonal positive trait) and lazy (orthogonal negative trait). Participants completed these ratings for all 12 learned targets (4 individuated, 8 familiar) and all 12 novel targets. Thus, trait ratings consisted of 6 measurements for each target type (24 photos total) for a total of 144 trait-rating trials. The order of these trials was done in a different, randomized sequence for each participant. Individual photographs and trait ratings appeared on the screen for 5 seconds or until the participant responded. After responding, the next trial was presented.

Valence Ratings

For the valence ratings, participants were shown a centrally presented photograph paired with the question *"In general, how would you evaluate this person?"* (1-7 Likert-type scale on a computer response pad; 1- Generally Negative; 7 – Generally Positive). Participants completed valence ratings for each target type thus completing a total of 24 trials (12 learned and 12 novel targets). Individual photographs and trait ratings appeared on the screen for 5 seconds or until the participant responded. After responding, the next trial was presented. Total time taken to complete each valence rating was recorded in milliseconds.

Similarity Ratings

For the similarity ratings, participants were shown two centrally presented photographs paired with the question "*How similar are these two people?"*(1-7 Likert type scale on a computer response pad; 1- Not at all similar; 7 – Very Similar). The photographs presented were pairings between individuated and familiar targets and pairings between individuated and individuated targets for a total of 21 similarity ratings (21 trials).

While viewing each pair of photographs, participants were told to indicate on a 7-button response pad the extent to which those people are similar (1 – not at all similar; 7 – highly similar). Each participant was told to try to use all 7 points of the scale, such that 1 and 7 indicate polar extremes and each midpoint (2-6) indicates a differing level of each scale anchor. Each button on the response pad were labeled with the number (left to right; 1, 2, 3, 4, 5, 6, 7). Buttons 1 and 7 indicated the endpoint labels (1 – not at all similar; 7 – highly similar). Photograph pairs and similarity ratings appeared on the screen for 5 seconds or until the participant responded. After responding, the next trial was presented. Total time taken to complete each valence rating was recorded in milliseconds.

Results

Approach to analysis

For both trait and evaluative ratings, we took the same analysis approach. We analyzed targets separately by valence (positive or negative; a within subjects predictor) and included responses to familiar and novel targets as separate dependent variables in separate models. Thus, for trait ratings we conducted four separate ANOVAs (negative with familiar targets; negative with novel targets; positive with familiar targets; positive with novel targets, presented in that order below). For evaluative ratings also conducted four separate ANOVAs (negative with familiar targets; negative with novel targets; positive with familiar targets; positive with novel targets, presented in that order below). Each ANOVA included test condition as a between-subjects predictor (recall, either 2-6 hours [short-delay] or 48 hours after [long-delay] completing the learning session) with responses to individuated targets as a continuous predictor and responses to either familiar or novel targets as our dependent variable (as discussed above). After conducting these ANOVAs, we regressed responses to individuated targets on either familiar targets or novel targets, separated by test condition (short versus long-delay). Thus, for both trait and evaluative ratings there were 8 separate regressions (4 for familiar targets and 4 for novel targets as with the ANOVA's that were discussed above). For similarity ratings, we ran 3 separate one-way ANOVAs to determine if participants in the long-delay condition would perceive targets within a group as more similar. Each of these ANOVAs included test condition as a between subjects predictor with similarity ratings between individuated and familiar or individuated and individuated targets as the dependent variable.

Manipulation Check

Before testing our primary hypotheses, we tested if learning was facilitated by sleep in general. Thus, we tested whether or not trait ratings for individuated targets in the long-delay condition were significantly higher than trait ratings for individuated targets in the short-delay condition, F (1, 67) = .02; p = .89. Second, we tested whether or not our individuated targets were actually perceived in the context of learned information (positive or negative) and that individuated targets were rated as exemplifying learned traits to a greater extent than familiar targets. Thus, we first examined valence ratings for individuated targets only. If individuated targets were perceived in terms of the positive or negative information they were paired with, then positive targets should be rated as significantly more positive than negative targets. In this model, time of test was as a between-subjects factor with valence included as a repeated factor and evaluative ratings for individuated targets in the positive group and individuated targets in the negative group as the dependent variables. This analysis revealed a main effect of valence. Regardless of when participants were tested on the individuated targets, participants perceived individuated targets in the positive group (M = 4.92; SD = 1.42) as significantly more positive than individuated targets in the negative group (M = 2.74; SD = 1.40; F (1, 67) = 85.07; p < .001 and was not qualified by an interaction with test condition.

In the second model, we tested if individuated targets were rated as exemplifying learned traits to a greater extent than familiar targets. In this model, time of test was included as a between-subjects factor with the type of target (learned-individuated or familiar) as a repeated factor and trait ratings for each target type as the dependent variables. Consistent with our manipulations, this analysis revealed a main effect for target type, F (1, 67) = 47.09; p < .001. Regardless of time of test, participants rated individuated targets (M = 4.95; SD = 1.32) as exemplifying learned traits significantly more than familiar targets (M = 3.65; SD = .74; $t(68)$ = 6.95; p < .001). Thus, individuated targets were perceived in a way consistent with the trait information they were paired with and this did not differ by the test group they were in.

Trait Generalization

Do the traits about individuated targets generalize to familiar targets of the same group?

To test the extent to which perceptions of individuated targets generalized to familiar targets we first analyzed trait ratings. If traits about individuated targets are generalized to familiar targets, then trait ratings to familiar targets in the long-delay (versus the short-delay) condition should 1.) demonstrate statistically different patterns across the two test conditions and 2.) be associated with an increase in trait ratings as a function of trait ratings to individuated targets. That is, trait ratings to individuated targets should be associated with significant increases in traits ratings to familiar targets.

Because the two groups were described as orthogonal in terms of traits; that is, one was positive and the other negative with no relationship between the two groups (generalization should occur only within each respective group) we analyzed trait ratings separately by valence. In addition to the manipulation check reported above, this decision was further justified in that trait ratings to individuated targets from, for example, the positive group, were not related to trait ratings to familiar targets in the negative group (and vice versa) in either the short or long-delay condition (all *p's* > .40).

Table 1 – Table of Means for Trait Ratings (1 – not at all exemplifies trait; 7 – highly exemplifies trait) for Individuated, Familiar and Novel Targets, split by time of test and valence:

Trait Ratings	**Short-Delay (M (SD))**	**Long-Delay (M (SD))**
Individuated targets		
Negative	4.90 (1.97)	4.85 (1.56)
Positive	5.04 (1.70)	4.98 (1.29)
Familiar		
Negative	3.27 (.97)	3.05 (1.14)
Positive	4.13 (.96)	4.39 (1.00)
Novel		
Negative	3.47 (.66)	3.49 (.83)
Positive	4.09 (.66)	4.22 (.92)

Negative group

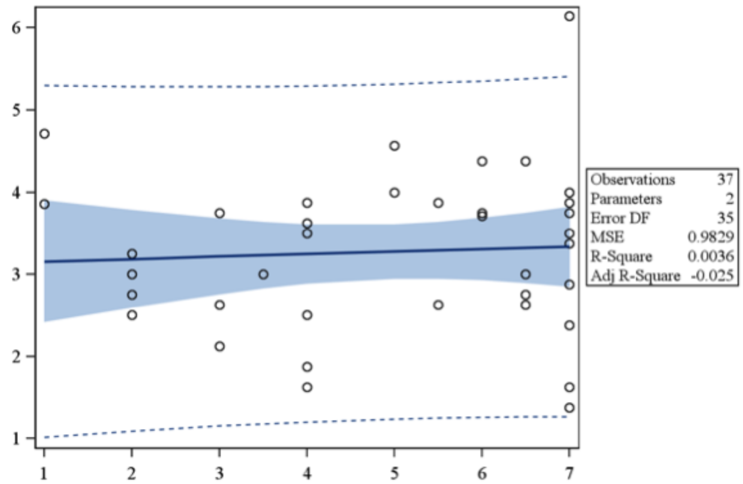
As described in our approach to analysis section, we first ran an ANOVA with test condition as a between-subjects predictor, trait ratings to individuated targets as a continuous predictor and trait ratings to familiar targets as our dependent variable. This analysis revealed a significant main effect of test condition (short versus long-delay), $F(1, 65) = 5.17$; $p = .02$; the main effect for trait ratings to individuated targets paired with learned information was not significant ($p = .10$). The predicted, 2-way interaction between trait ratings to individuated targets and test condition, however, was significant, F (1, 66) = 5.26; p = .02. To follow-up this interaction (between a continuous and dichotomous predictor), we regressed trait ratings to individuated targets on responses to familiar targets.

In the long-delay condition, trait ratings for individuated targets in the negative group were associated with significantly higher trait ratings for familiar targets, $\beta = .28$; $t(30) = 2.27$; $p = .03$ (see figure 4B for the regression/fit plot), and accounted for a modest, but significant amount of variance in predicting trait ratings for familiar targets, $R^2 = .14$, F (1, 30) = 5.13; $p = .03$. In the short-delay condition, however, trait ratings to individuated targets in the negative group were not significantly associated with higher trait ratings for familiar targets, $p > .55$ (see figure 4A for the regression/fit plot). Consistent with these effects, in the long-delay condition, trait ratings to individuated targets were significantly correlated with trait ratings for familiar targets, $r(32) = .38$; $p = .03$. Consistent with our hypothesis, these correlations were not significant ($r = -.10$; $p > .55$) in the short-delay condition.

Figure 4A & 4B – Fit plots for trait ratings to Learned Negative targets predicting responses to Familiar Targets, separated by time of test:

4A: Short-delay; p = .55

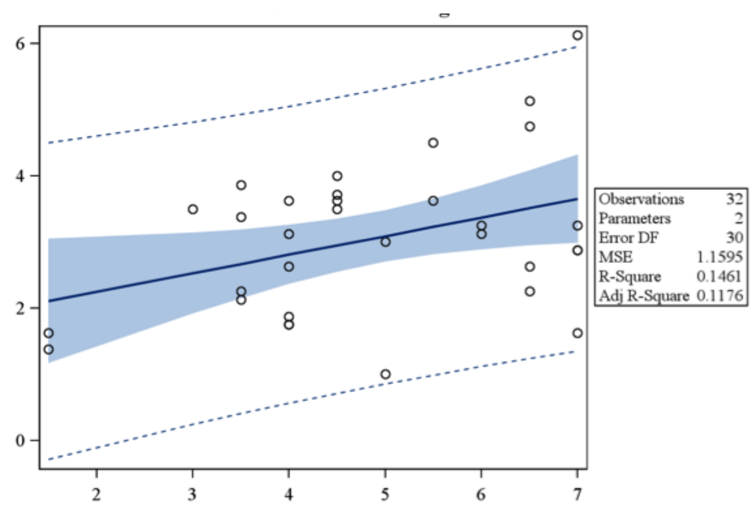
Trait Ratings for Non-Individuated Targets



Trait Ratings for Individuated Targets

4B: Long-delay; p = .03

Trait Ratings for Non-Individuated Targets



Trait Ratings for Individuated Targets

Novel targets paired with learned negative information

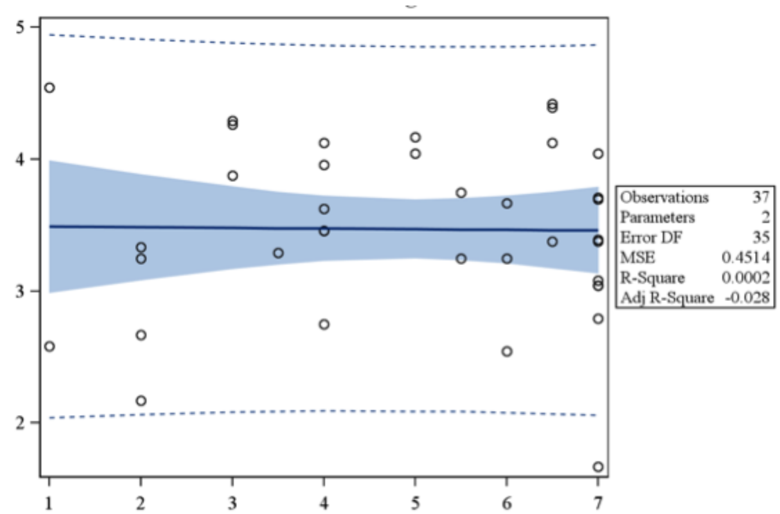
We also tested the extent to which trait ratings for individuated targets were associated with trait ratings for novel targets. We took the same analysis approach as above expect with trait ratings to novel targets as our dependent variable. The ANOVA revealed a significant main effect for test condition, $F(1, 67) = 9.86$; $p = .002$ and for trait ratings to individuated targets, $F(1, 67) = 10.32$; $p = .002$. Trait ratings to individuated targets were associated with a significant increase in trait ratings to novel targets paired with negative information, $\beta = .11$, $t(67) = 2.17$; $p = .03$ regardless of test condition. Furthermore, these analyses revealed a significant 2-way interaction between trait ratings to individuated targets and test condition $F(2, 66) = 11.32$; $p = .001$.

To decompose this interaction we adopted the same analysis strategy for familiar targets and regressed responses to individuated targets on responses to novel targets with sleep as a between-subjects factor. In the long-delay condition, trait ratings to individuated targets were associated with significantly higher trait ratings for novel targets paired with learned negative traits, $\beta = .33$; $t(30) = 3.77$; $p = .007$ (see figure 5B for the regression/fit plots) and accounted for a significant amount of variance in predicting trait ratings for novel targets paired with negative traits in the long-delay condition, $R^2 = .32$, $F(1, 30) = 14.19$; $p = .007$. In the short-delay condition, however, trait ratings for individuated targets were not significantly associated with novel targets paired with those same learned negative traits, $p > .90$ (see figure 5A below for regression/fit plots).

Figure 5A & 5B – Fit plots for trait ratings to Learned Negative targets predicting responses to Novel Targets, separated by time of test:

6A: Short-delay; p = .93

Trait Ratings for Novel Targets

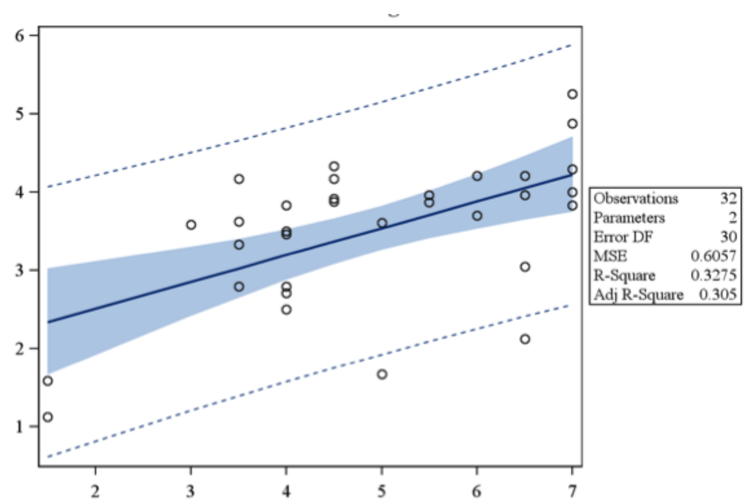


Trait Ratings to Individuated Targets

Fit 95% Confide

6B: Long-delay; p = .0007

Trait Ratings for Novel Targets



Trait Ratings to Individuated Targets

Positive group

Familiar and novel targets

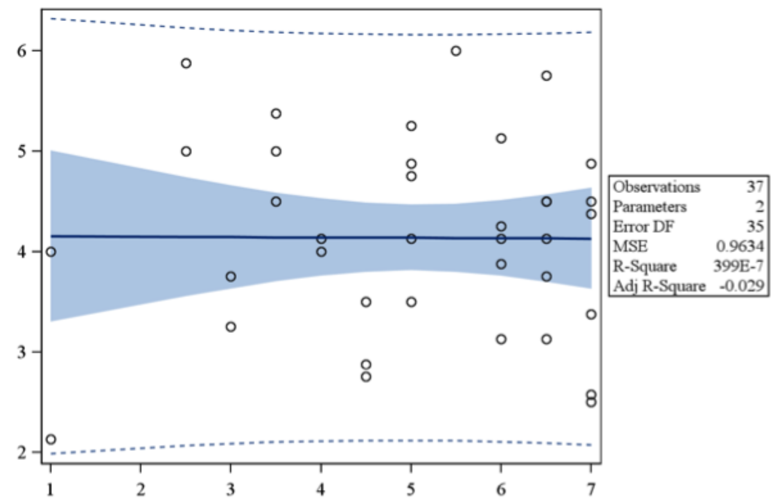
All main effects and interactions between trait ratings to individuated targets and test condition with trait ratings to familiar targets as our dependent variables were not significant, all *p's* > .30. Relatedly, trait ratings to individuated targets were not significantly associated with trait ratings for familiar targets in neither the long-delay, *p* > .20, nor the short-delay condition, *p* > .90 (see figures 6A and 6B below for regression/fit plots). Correlations between learned and familiar targets were also not significant in either condition, all *p's* > .40.

For novel targets paired with positive information, all main effects and interactions between trait ratings to individuated targets and test condition were not significant, all *p's* > .19. In the short- and long-delay condition trait ratings to individuated targets were not significantly associated with trait ratings for novel targets paired with learned positive traits, all *p's* >.16 (see figures 7A and 7B below for the regression plots).

Figure 6A & 6B – Fit plots for trait ratings to Learned Positive targets predicting responses to Familiar Positive Targets, separated by time of test:

5A: Short-delay condition; p = .97

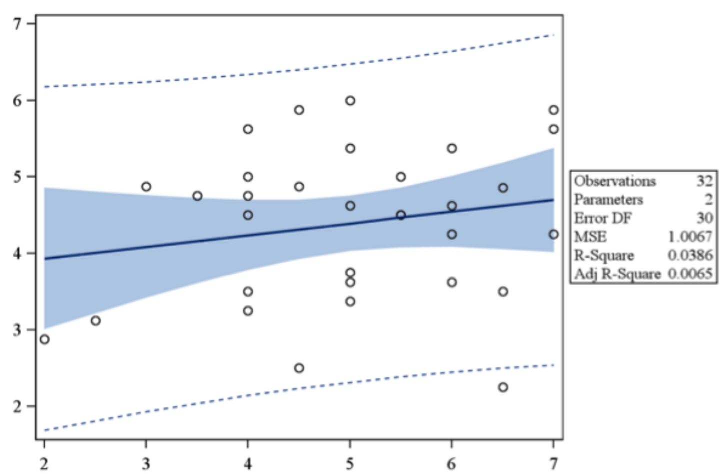
Trait Ratings for Non-Individuated Targets



Trait Ratings for Individuated Targets

5B: Long-Delay condition p = .20

Trait Ratings for Non-Individuated Targets

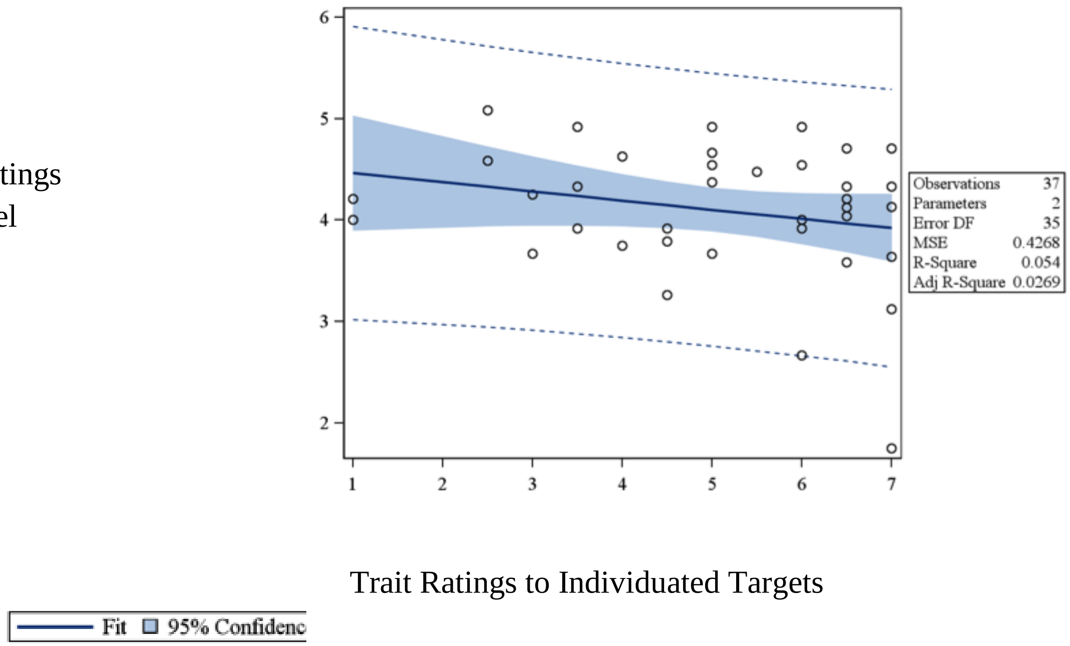


Trait Ratings for Individuated Targets

Figure 7A and 7B – Fit plots for trait ratings to Learned Positive targets predicting responses to Novel Targets, separated by time of test

7A: Short-delay; p = .16

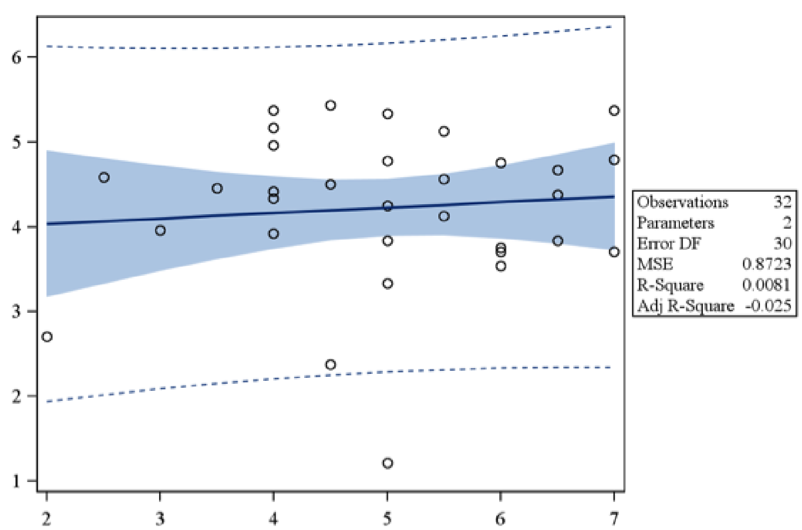
Trait Ratings for Novel Targets



Trait Ratings to Individuated Targets

7B: Long-Delay = .66

Trait Ratings for Novel Targets



Trait Ratings to Individuated Targets

Were traits generalized due to learned target-specific trait information or due to the global valence of the learned trait information (generally positive or negative)?

While our targets were paired with specific positive or negative traits, we also tested our individuated and familiar targets on traits that were equivalent in valence to the learned information (positive or negative, respectively), but semantically orthogonal (e.g., intelligent or lazy, respectively). If traits about our individuated targets generalized to the familiar targets because of the target-specific trait information paired with the individuated targets, then trait ratings on the orthogonal traits for individuated targets should not significantly predict trait ratings on the orthogonal trait ratings for familiar targets. Conversely, if traits about our individuated targets generalized to the familiar targets because of the global valence of the learned stimuli (e.g., "s/he is cruel and therefore probably possesses other negative traits as well") then trait ratings to orthogonal traits (intelligent or lazy) for individuated targets should significantly predict trait ratings to the orthogonal traits for familiar targets in the long-delay test condition.

As outlined in the approach to analysis section, we first conducted the same ANOVA and regressions reported for the positive and negative group trait ratings reported above (orthogonal items were analyzed separated by valence as well), except with trait ratings to orthogonal items as the dependent variables. For negative orthogonal traits, all main effects and the interaction (which would suggest generalization) were not significant, all $p's > .17$. Again, we conducted the follow-up regressions, trait ratings to individuated targets were not significantly associated with responses to familiar targets in either the short- or long-delay conditions, all $p's > .52$.

For positive orthogonal traits, all main effects and the interaction between trait ratings to individuated targets and test condition were not significant, all $p's > .20$. Nonetheless, we conducted the follow-up regressions as we did above for learned traits; in both the short- and long-delay condition, trait ratings to individuated targets were not significantly associated with responses to familiar targets, all *p's* > .20

Evaluative Generalization

Do evaluations of individuated targets generalize to familiar and novel targets?

To test the hypothesis that evaluative ratings about individuated targets generalize to familiar and novel targets, we conducted the same ANOVA and regressions reported for the positive and negative group trait ratings, except with evaluative ratings to familiar targets in the positive and negative group as our main dependent variables (see Figure 2 for means and standard deviations). As with the previous section and consistent with our hypotheses, evaluative ratings were analyzed separately by valence (negative then positive) and target type (non-individuated then novel targets)

Table 2 – Table of Means for Valence Ratings (1 – Negative; 7 – positive) Individuated, Familiar and Novel Targets, split by time of test and valence:

Valence Ratings	**Short-Delay (M (SD))**	**Long-Delay (M (SD))**
Individuated targets		
Negative	2.78 (1.32)	2.78 (1.53)
Positive	4.72 (1.54)	5.14 (1.25)
Familiar		
Negative	4.39 (.84)	4.79 (1.01)
Positive	4.06 (.99)	4.45 (1.10)
Novel		
Overall	4.09 (.68)	4.34 (.80)

Negative Group

Do evaluations of individuated targets generalize to familiar targets in the negative group?

As with the analyses reported above, we first tested for the main effects and interaction between evaluative ratings to individuated targets and test condition with evaluative ratings to familiar targets as our dependent variable. Test condition had no statistical effect, p = .52. The interaction between evaluative ratings to learned targets in the negative group and test condition was not significant, p = .83. Nonetheless, we conducted the same follow-up regression where we regressed evaluative ratings to individuated targets on evaluative ratings for familiar targets. In the long-delay condition, evaluative ratings to individuated targets were not significantly associated with higher evaluative ratings for familiar targets in the long-delay condition, p =.28. In the short delay condition, these effects were also not significant, p = .33.

Do evaluations of individuated targets generalize to novel targets paired with negative information?

Similar to the analyses above, we first tested for the main effects and the interaction between evaluative ratings to individuated targets and test condition with evaluative ratings of novel targets paired with negative information as our dependent variable. Test condition had no statistical effect, p = .12. Evaluative ratings to Individuated targets had a significant main effect, $F(1, 67) = 6.00$; p = .01. Evaluative ratings to Individuated targets were associated with a significant increase in evaluative ratings to novel targets, $\beta = .15$, $t(67) = 2.46$; p = .01. The interaction between evaluative ratings to learned targets in the negative group and test condition was significant, $F(1, 66) = 5.58$; p = .02. Thus, we regressed evaluative ratings to individuated targets to evaluative ratings for novel targets. In the long-delay condition, evaluative ratings to individuated targets in the negative group were significantly associated with higher evaluative ratings for novel targets, $\beta = .29$ $t(30) = 3.46$; p = .001 and accounted for a significant amount of variance, $R^2 = .28$, $F(1, 30) = 11.97$; p = .001. In the short delay condition, these effects were not statistically significant, $p > .95$.

Positive Group

Do evaluations of individuated targets generalize to familiar targets in the positive group?

As with the analyses reported above, we first tested for the main effects and interaction between evaluative ratings to individuated targets and test condition with evaluative ratings to familiar targets as our dependent variable. Test condition had no statistical effect, p = .49 and neither did evaluations to individuated targets, $p = .09$. The interaction between evaluative ratings to individuated targets and test condition was not significant, $p = .28$. We then regressed evaluative ratings to individuated targets on evaluative ratings for familiar targets. In the long-delay condition, evaluative ratings to individuated targets were not significantly associated with evaluative ratings to familiar targets in the positive group, $p = .10$. These effects were not statistically significant in the short-delay condition, $p = .59$.

Do evaluations of individuated targets generalize to novel targets paired with positive information?

Similar to the analyses above, we first tested for the main effects and the interaction between evaluative ratings to individuated targets in the negative group and test condition with evaluative ratings to novel targets paired with negative information as our dependent variable. There was no effect of time of test, $p = .58$. Evaluative ratings to individuated targets had a significant main effect, $F(1, 67) = 4.10$; $p = .04$. Evaluative ratings to Individuated targets were marginally associated with a decrease in evaluative ratings to novel targets, $\beta = -.14$, $t(67) = -1.86$; $p = .06$. The interaction between evaluative ratings to learned targets in the negative group and test condition was not significant, $p = .88$. Nonetheless, we regressed evaluative ratings to individuated targets in the positive group to evaluative ratings for novel targets paired with positive traits. In both the long-delay ($p = .19$) and short-delay conditions ($p = .12$), evaluative ratings to individuated targets in the positive group were not significantly associated with evaluative ratings to novel targets paired with positive information.

Perceived Similarity

Will participants in the long-delay condition have increased perceived similarity between members (familiar and individuated) of the group and decreased perceived similarity between members of different groups (positive versus negative)?

To test the hypothesis that a time-delay including a period of sleep would increase the perceived similarity between individuated targets and familiar targets from the same group (e.g., positive or negative), we ran four separate ANOVAs with time of test as a between-subjects factor to test if similarity ratings for individuated targets versus familiar targets were higher in the long-delay than the short-delay condition for positive and negative groups separately and if learned targets within a group were perceived as more similar (see Figure 3 for means and standard deviations). For the negative group, similarity ratings between individuated and familiar targets in the long-delay condition ($M = 3.32$; $SD = .86$) were not significantly different than similarity ratings between individuated and familiar targets in the short-delay condition ($M = 3.48$; $SD = .79$; $F(1, 67) = .71$; $p = .40$). For the positive group, similarity ratings between individuated and familiar targets in the long-delay condition ($M = 3.75$; $SD = 1.01$) were not significantly different than similarity ratings between individuated and familiar targets in the short-delay condition ($M = 3.77$; $SD = 1.04$; $F(1, 67) = .01$; $p = .93$). For individuated targets within each group, we conducted a one-way between subjects ANOVA to test if similarity ratings were higher in the long-delay condition (versus short-delay conditions) for targets within each group. This analysis was not significant, $p = .57$.

The results reported above demonstrated that participants generalize person-specific trait information to other, familiar, but familiar targets of the same group and novel targets as well but only when that trait information was negative in valence. This guilty by association effect occurred only after a time-delay that contained the opportunity (via offline states such as sleep) for memory consolidation processes to occur. This result was consistent with our primary hypothesis about trait generalization. While we hypothesized this same pattern of results for positive information (albeit with smaller effects), unexpectedly, positive information was not generalized at all. We also found evidence that negative trait information is also generalized to novel targets. For evaluative ratings in the negative group only, evaluations of individuated targets generalized to evaluations of novel targets, but no familiar targets as we had hypothesized. This generalization effect did not occur for similarity ratings for familiar targets

Discussion

Summary of Results

In the study reported here, participants learned semantic information about two groups; one group that was paired with negative trait information and one that was paired with positive trait information. Participants learned this group structure (negative versus positive) by first learning to differentiate the two different groups on a group-learning categorization task. Then, participants saw two members from each group that possessed either positive or negative trait within each respective group that they learned about. Thus, participants learned trait information about individual members of a group and participants only knew group information about the other group members. This allowed us to test the extent to which impressions of individual group members generalize to other, familiar but not individuated members of the same group.

After learning this group and person information, participants returned either before (2-6 hours after learning) or after (48 hours after learning) a time-delay containing sleep to complete our dependent measures: Trait, valence and similarity ratings. For trait ratings in the negative group, ratings for individuated targets were significantly associated with higher trait ratings to both familiar and novel targets, but only in the long-delay condition. Positive information, however, was not generalized. Despite learning both types of information equally well, participants demonstrated a bias to generalize negative information from specific group members to both familiar group members (familiar targets) and entirely novel targets. In contrast to our predictions, evaluations of individuated targets were not significantly associated with evaluations of familiar (familiar) group members or novel targets. This same pattern of null findings was also found for similarity ratings. Nonetheless, our primary hypothesis about trait generalization was found and this pattern of results was only found in the long-delay test condition.

Memory consolidation, generalization and social perception in both negative and positive contexts

The research reported here demonstrated a bias in generalizing negative information from specific group members to familiar, but familiar, members of the same group and novel targets. These familiar and novel targets were guilty by association; simply being a member of a group with an individual that is, for example, “cruel” or “cold” makes one cruel and cold as well. This effect was revealed only after a time-delay containing sleep. The study reported here provides converging evidence that time-dependent memory consolidation – and potentially sleep itself – qualitatively changes how memories are accessed and retrieved whereby, after a time-delay containing sleep, memories are accessed in a more generalized manner (Lewis et al., 2011; Zárate & Enge, 2013; Enge et al., 2013; Ellenbogen et al., 2007; Payne et al., 2009; Durrant et al., 2010).

In the study reported here, positive information was not generalized with a longer time-delay. This is consistent with other research demonstrating that neutral, low arousing information does not benefit from a time-delay containing sleep (e.g., Payne et al., 2008; 2011). Thus, the study reported here extends the findings from Payne and colleagues and suggests that positive information does not benefit from time-dependent memory consolidation and more, specifically does not generalize to other familiar and novel targets in the same way as other information (c.f., Ellenbogen et al., 2007). Future research would benefit from including positive information that is equated on arousal with the negative information (e.g., erotica [positive] versus a gun [negative]; c.f., Sabatinelli, Bradley, Fitzsimmons, & Lang, 2000) during the learning session to determine the extent to which this negative bias effect is due to arousal (e.g., if more – versus less - arousing information at learning leads to better memory in general after a time-delay containing sleep).

From a social psychological perspective, high arousing positive information (e.g., your best friend just won the lottery; the attractive person who sits next to you in class left their phone number on your desk) may facilitate learning and subsequent memory, as it is both more motivationally significant (e.g., you can borrow money from your friend or the opportunity for a potential mate) and more arousing than the information presented here. In the context of these data, however, it is possible that because more attention is paid to negative information in general during initial perception of emotional information (c.f., Nummenmaa, Hyona, & Calvo, 2006), these attentional biases at encoding may have facilitated further processing and thus better overall memory. Future studies would benefit from testing these factors – at learning and during retrieval – through which negative and positive information are perceived in a social context.

Generalization, false memories and social perception

This study demonstrated that negative information is generalized from specific social targets to other social targets of the same group. One signature of group-based processing (stereotyping and prejudice) is generalizing traits across an entire social group despite knowing no personal information about specific members of that group (Allport, 1954). Generalization, then, could involve the application of false knowledge (semantic information) to a particular person because of social group membership. Research has demonstrated that while memory consolidation facilitates the formation of generalized, "gist," based memories (e.t., Ellenbogen et al., 2011), it does so at the expense of episodic detail; Payne et al. (2009) demonstrated that in a Deese-Roediger-McDermott paradigm, time-delays with sleep increased the number of false hits during the recall phase, especially when those test stimuli were similar. These findings suggested a role for memory consolidation in “filling-in-the-gaps” of previous experiences such that experiences are not retrieved in their veridical form, but rather in a way that holds the general semantic meaning of experiences. Although false memory formation was not a primary aim of the study reported here, in the context of the research reviewed above, the fact that we found both trait (familiar and novel targets) and evaluative generalization (novel targets only) suggests that false memory mechanisms acting during memory consolidation may be exaggerated with negative social memories. Positive information is not consolidated (or to a lesser, non-significant degree) and negative information becomes (mis)-generalized on both semantic and evaluative levels. Collectively, future research would benefit from directly testing the role of forgetting in the development of social memories over time and teasing apart the roles of semantic versus evaluative learning experiences on later social judgments and retrieval processes. Indeed, semantic and affective experiences have different downstream consequences for stereotyping and prejudice, respectively (Amodio & Devine, 2006).

The novel targets in this study, however, did not represent true novel targets in a group context. A new group member implies that s/he is somehow connected to the group. The novel targets in this study had no corresponding group information and thus they were not directly associated with group “A” or “B;” the only way these targets were related, on a group level, was in terms of gender (the groups were all male and all female; however no gender differences were found and as such target and participant gender did not seem to be factors). Future studies will manipulate this feature of novel targets (e.g., Ranganeth & Nosek, 2008) to directly test trait generalization to novel targets associated with the known group.

Implications for models of group perception and entitativity

The study reported here demonstrated that given trait information about specific group members, and time for that information to be consolidation, that trait information (if negative) is generalized to the entire group. Previous research has typically focused on how perceptions of similarity produce generalized attitudes towards a group (c.f., Dasgupta et al., 1999). The work reported here builds on this research and demonstrates that trait information – with time – is sufficient to produce generalized perceptions of a group. In terms of the similarity findings from this study, it is difficult to discern to if physical similarity is a mechanism that facilitates long-term formation of group representations (does group perception involve an increase in perceived physical similarity?), or if physical similarity is a static social clue that certain people are part of a group (e.g., a group of males wearing the same color t-shirt may be perceived as a team and this perception does not change).

In this study, our hypotheses regarding similarity ratings were not supported. We had initially hypothesized that sleep, in addition to binding together group representations, via associations between trait information, group members and group membership, would also increase perceived similarity. One explanation is that because our primary hypothesis concerned semantic generalization (via paired associated trait learning), trait ratings were included first. Given that those trait ratings constituted 144 trials, it is possible that participants were not attentive when completing the similarity ratings. Future studies will randomize the order of these dependent variables to determine if order effects are present in the data reported here. This may also clarify the reliability of the generalization effects reported here for novel targets. Nonetheless, our primary hypothesis was about trait (semantic) generalization and thus trait ratings were always presented first. Lastly, the question used to measure similarity did not cue the participant to any specific feature. Thus, while we intended to measure participants' perceived physical similarity between targets, this may have not been the case. Future studies will provide a cue as to what type of similarity the participant should attend to.

Conclusion

The study presented here tested how trait and behavioral information about a specific, individuated (known) group member are integrated, accessed and generalized to other, familiar social targets. We hypothesized that social information is more readily generalized to these familiar social targets after a time-delay containing a period of sleep. We found partial support for this hypothesis in that trait ratings for individuated targets were associated with higher trait ratings for familiar targets when participants learned negative information; this difference was only revealed after a time-delay containing sleep. This generalization effect was not significant when participants learned positive information about social targets with or without a time-delay containing sleep.

Future research will benefit from adding additional experimental controls to determine the extent to which social information is generalized to other targets. Thus, the next study will introduce familiar targets at test (e.g. "This person is from Group A") to determine the extent to which social information is generalized to novel group members (recall, in this study novel targets had no connection to either of the learned groups) when that group information has not yet been consolidated about those familiar targets – that is, how is that target perceived initially when the social perceiver determines that are part of a specific group. This follow-up study will also include entirely novel targets as an a-priori baseline test of participants' preference for associating social targets with negative information in general (tendency to respond negatively). Thus, with this added experimental manipulation it allow us to determine the extent to which social information is generalized and how much of this is (partially) due to a bias to remember negative information in general (comparing familiar targets introduced at test to entirely novel social targets).

Collectively, these data add to a growing body of research from our lab that demonstrates a crucial role for time-dependent memory consolidation in social perception and memory (Zárate et al. 2013; Enge et al., 2013; Arms-Chavez et al., 2013) and a bias to remember and maintain negative information in general (Payne et al. 2009; 2010; 2011). For the social and cognitive neuroscientist, this underscores the importance of investigating perception and memory over the course of time – a departure from the traditional social cognitive methodology of one-session studies - to allow the researcher to investigate the dynamic and malleable nature of psychological phenomena that require learning new information (e.g., individuation).

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Curriculum Vitae

Luke Robert Enge was born in Fargo, North Dakota in 1987. The only child of James and Elizabeth Enge, he graduated from Cretin-Derham Hall high school, Saint Paul, Minnesota in the spring of 2005 and entered The University of Minnesota-Twin Cities in the fall initially pursuing a BA in Chemistry. While pursuing a bachelor's degree in chemistry, he took Psychology courses with Dr. Richard Lee and Dr. Chad Marsolek at which point he switched over to Psychology. Under the mentorship of Dr. Marsolek (Cognitive Neuroscience lab) and Dr. Lee (Ethnic Minority Mental Health lab), he completed dual Bachelor's degrees in Psychology and Spanish Studies in 2008 with an honors thesis investigating hemispheric asymmetries in face perception. His overarching fascination with investigating stereotyping, prejudice and discrimination from behavioral, neurological and computational perspectives led him to pursue his doctorate under the mentorship of Dr. Michael Zárate and Dr. Stephen Sands at the University of Texas at El Paso in the fall of 2010. Luke has co-authored a book chapter and has a first-author revise/resubmit at *Psychological Science*. Currently, he has two second-author papers under review at the *International Journal of Psychophysiology* and *NeuroImage;* First-authoring a manuscript on the temporal dynamics of cultural frame switching and second-authoring a manuscript with Amber Lupo and Dr. Zárate on group perception. Recently, he has developed collaborative relationships with Dr. Jonathon Freeman at Dartmouth College and Dr. Hugo Sandoval at Texas Tech. Collectively, his research aims at understanding the dynamics of person and group perception over time with the use of a variety of behavioral measures, EEG, eye and mouse tracking.

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