DISSERTATION

THE POSITIVITY BIAS AND PERCEIVED FAMILIARITY: DO SMILING FACES INCREASE FALSE RECOLLECTIONS?

Submitted by

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ABSTRACT

THE POSITIVITY BIAS AND PERCEIVED FAMILIARITY: DO SMILING FACES INCREASE FALSE RECOLLECTIONS?

An established body of research suggests that people are biased to perceive faces with positive expressions (e.g., smiling) as more familiar than neutral faces. Newer research suggests that sensing familiarity with something may drive people to confabulate reasons for their sense of familiarity, along with indicators of memory search effort and curiosity-driven information-seeking behaviors. The current study aimed to evaluate whether the established familiarity positivity bias for faces is associated with these patterns. Experiment 1 examined whether smiling faces would generate greater familiarity and more illusory recollection than neutral faces. Contrary to prior findings, there was no familiarity positivity bias (perceived familiarity was comparable for smiling and neutral faces). However, in line with familiarity-driven confabulation, familiarity ratings were positively associated with false recollection. Experiment 2 evaluated whether smiling faces would increase feelings of curiosity about a face's identity compared to neutral faces. Smiling and neutral faces had comparable curiosity ratings and false recollection rates. Across the two experiments, item-based analyses revealed that faces that produced higher familiarity ratings also produced higher false recollection rates, and in Experiment 2, they also produced higher curiosity ratings. Although the familiarity positivity bias was not found, the familiarity-driven false recollection and

curiosity found here provides further insight into the relationship between familiarity and the desire to explain why something feels familiar.

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DEDICATION

First and foremost, I would like to dedicate this dissertation and my educational journey to my family. The past decade has been a long and difficult yet rewarding journey. I could not have done it without the love and support from my family.

Thank you to my parents, Tim Carlaw, Jenifer Dominick, and Scott Dominick for always believing in me. Dad, thank you for always being there for me, whether it was lending an ear to listen or reading and trying to understand my research. Mom, thank you for showing me what it means to be a strong, independent woman. The woman I am today reflects the example you set for me. Thank you to my beautiful siblings, Sarah Shroll and Connor Carlaw, for their love and support along this journey.

I would also like to dedicate this dissertation to Lyndsey Linke. I feel incredibly grateful to have been taken under her wing during my time in Colorado. Lyndsey has always been my role model for what it means to be an intelligent and tenacious female scientist, and I hope to emulate those qualities in my future career.

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Finally, I would like to dedicate this in memory of my grandmother, Millie Carlaw, who passed away during my PhD journey. The love and support she gave me were immeasurable, and I miss her dearly.

TABLE OF CONTENTS

Chapter 1 – Introduction

The Sense of Familiarity

The Sense of Familiarity with a Face

Nearly everyone has had the experience of finding a face strikingly familiar, despite being unable to recall any details about who that person is or the context in which they were seen before. Familiarity is the feeling that an object, place or person has been previously encountered. Perceived familiarity can occur even when recollection (i.e., the ability to recall details, specifics, or contextual information) is unavailable (see Yonelinas, 2002, for a review). An example of this experience with faces was described by Rajaram (1993):

> *"There are times when we meet someone on the street whom we met at a party a few days ago. Although we know that we met this person at the party, we may not remember actually meeting the person, or [their] name" (p. 90).*

During these experiences, one may feel compelled to search their memory to determine who that person is or where they have seen them before (e.g., Carlaw et al., 2022). Thus, from an evolutionary perspective, familiarity may serve an important function, as one can use the information available to determine whether a face is "safe" (familiar) or potentially dangerous (Bagnis et al., 2023; de Vries et al., 2010). Research suggests that the sense of familiarity with a face arises from signals that facial components provide (e.g., Carlaw et al., 2022), helping the person to quickly determine whether the individual is new or previously encountered and therefore safe or unsafe to interact with. This process is illustrated by Young and Bruce (2012) in the following quote:

> *"The human face provides a bewildering variety of important social signals which can be detected and interpreted, very often correctly, by another human…Perhaps because we must watch faces so closely for all these signs and messages, we are able to perceive the often tiny variations between individual faces which can be used to identify them" (p. 2).*

Familiarity may emerge from multiple different mechanisms. As a memory-based cognitive process, familiarity is thought to be brought on by a feature-matching process whereby the features present in a current stimulus are matched with the features stored in memory to produce a signal that varies according to the degree of global feature match. Faces contain numerous features, such as eyes, nose, and mouth, which, when combined, enhance the perceived familiarity of a face, aiding in the recognition of previously known individuals even when that individual cannot be identified (see Carlaw et al., 2022). However, familiarity can also be brought on by attributions based on other qualities of a stimulus not having to do with memory for that stimulus, such as occurs in the familiarity-positivity bias, which is a tendency to find a face more familiar when the face is smiling (Baudouin et al., 2000; Lander & Metcalfe, 2007).

Evidence for the Sense of Familiarity as a Construct

Familiarity as a Cognitive Process for Recognizing

The study of the subjective sense of familiarity has been approached in different ways over the years. One approach has been to treat familiarity like an underlying cognitive process or mechanism that can serve as a basis for recognition. This approach goes back almost to the very beginning of cognitive psychology as a field, with early researchers using signal detection theory from the domain of studying perception to describe how a familiarity signal can serve as a basis for performance on old-new recognition memory tests (see Crowder, 1976, for a review of this early work;

for more recent developments, see Clark & Gronlund, 1996; Dube & Rotello, 2025; Hintzman, 1989; Yonelinas, 2002).

In a typical recognition memory task, a participant first, views (or hears) a list of study words and then receives a recognition test containing a mixture of old (studied) and new (unstudied) items. The task is to discriminate old from new items. Early approaches to recognition memory assumed that recognition memory judgments (i.e., old-new decisions) were based solely on the strength of the familiarity signal elicited by each item. Performance could be described through decision criterion placement along the familiarity strength continuum. If the familiarity signal exceeds the criterion, a decision of "old" is given; if the signal falls below the criterion, a decision of "new" is given. Old-new discrimination could come about by the fact that old items would elicit a stronger familiarity signal than new items, on average, leading to more "old" judgments for old items than for new items (see Crowder, 1976, for a review).

When simple, Gaussian equal-variance signal detection models failed to account for the majority of recognition memory patterns shown in research, many alternative theories began to emerge, such as single-process theories that assumed that recognition performance could still come about through a single familiarity process (e.g., Mickes et al., 2007) and dual-process theories that assumed that recognition performance comes about through either of two different mechanisms: a familiarity signal of varying intensity or recollection of the studied item's occurrence on the study list (see Yonelinas, 2002, for a review). Among the dominant theories of recognition memory over the years, familiarity has played a prominent role, regardless of whether it was assumed to be the sole basis for recognition or not. Today, after decades of research on recognition memory, few would argue that familiarity is not an important construct that operates in the service of recognition memory.

Familiarity as a Subjective Metacognitive Experience

Whereas the above-mentioned research has been concerned with familiarity as a cognitive process, other research has focused on the study of familiarity from a metacognitive perspective. Metacognition is the knowledge of one's own cognition or memory processes (see Flavell, 1979; Koriat, 2007; Nelson & Narens, 1990; Rhodes, 2019). Metacognition is thought to have two components: Monitoring and control (Nelson & Nares, 1990). Monitoring concerns assessing one's ongoing mental processes and feelings. Control concerns making decisions about one's course of action based on what was assessed during monitoring.

Cleary and Schwartz (2025) argue that the subjective sense of familiarity stems from the monitoring component of metacognition. They also argue that as a subjective state of metacognitive awareness of one's own memory, the type of familiarity experience that happens when recognizing a face as familiar without being able to identify why (sometimes described as the butcher-on-the-bus experience; e.g., MacLeod, 2020; Mandler, 1980) may be similar to other subjective states of metacognitive awareness of memory such as the tip-of-the-tongue (TOT) experience. A TOT state is traditionally defined by the feeling of being on the verge of recalling a word, despite the inability to access the information at that moment (see Brown, 1991, Brown, 2012, or Cleary & Schwartz, 2025 for a review). The butcher-on-the-bus experience refers to when one encounters a familiar-seeming face in an atypical setting and fails to recollect who that person is or the context of the prior encounter (Brown, 2020;

MacLeod, 2020; Mandler, 1980). The classic example of how this term came to be is the experience of one recognizing the local butcher in the atypical setting of the town bus, unable to recollect who they are or the usual context in which they've seen the person (i.e., the butcher shop).

TOT states are considered metacognitive because the sensation of being on the verge of retrieval is itself a product of monitoring, and decisions about what to do next (such as search memory for the target information) constitute control. TOT states are often used as heuristics for inferring perceptual fluency and contextual details (Cleary & Claxton, 2015; Huebert et al., 2023).

TOT research often crosses into research on what makes faces seem familiar in the absence of an ability to identify why. Researchers have previously examined the role of positivity judgments for faces and the likelihood of experiencing a TOT for the person's name (Cleary, 2019). When experiencing a TOT state for the celebrity faces, participants were more likely to have positive feelings toward the faces, evidenced by higher ratings that the face was likely an ethical person. Participants were also more likely to experience a TOT state for positively attributed target words. This demonstrates that TOT states, though typically viewed as a "frustrating" (Brown & McNeil, 1966) metacognitive experience, can reflect a "warm glow bias" (Monin, 2003) based on the type of stimuli. However, it is unclear whether the positive feelings toward the stimuli in Cleary's (2019) study influenced the perceived TOT state for the person's name, or if the TOT state influenced the positive state.

Another quality that has been experimentally examined as increasing TOT states for faces is image clarity. Lee and colleagues (2023) found that clearer images of unrecalled faces induced higher TOT rates compared to less clear faces. They also found that name recall was greater for clearer faces than for less clear faces overall. This is consistent with Cleary (2019)'s findings that there is a positivity bias associated with stimuli in a TOT state, similar to a fluency bias.

What Causes the Sense of Familiarity?

Memory Bases: The Role of Feature Overlap

Global Matching Models. As noted above, recognition memory refers to the ability to distinguish whether a current stimulus has been previously encountered. While there are different theories of how that comes about, nearly all posit a role of familiarity in this ability. As far as how the sense of familiarity with a recognition test stimulus is thought to arise, most theories assume that there is a role of feature-matching, whereby incoming features present within the test item are matched with features stored in memory to produce a familiarity signal of varying intensity according to the degree of match (see Clark & Gronlund, 1996, for a review). Even among dual-process theorists (who assume that recognition can arise either from recollection or familiarity), global feature-matching is commonly the assumed mechanism behind familiarity.

Familiarity-detection can be quantified using global matching models of recognition memory, such as Hintzman's MINERVA 2 model (see Hintzman, 1988; also see Clark & Gronlund, 1996 for a review). MINERVA 2 is an episodic recognition memory model which assumes that each encoded item (e.g., word, object, animal, face, musical piece) represents a vector of features, or memory traces (e.g., phonemes, orthographic information for objects, facial parts, isolated pitch and rhythm of songs). When a test item is presented, the degree of match or memory trace-overlap for the previously encoded item and the test item produces a familiarity signal. The greater the degree of feature overlap, the greater the familiarity signal produced for the test item. For example, if the same face was studied in two separate episodes with different features available for each instance (e.g., upper part of the face and lower part of the face) and the whole face was tested, the sum of the feature overlap from the previous study episodes (i.e., facial parts) matching the whole faces produce the sense of recognition for that face (i.e., familiarity intensity).

According to MINERVA 2, when presented with the test probe (i.e., each test item) it is then compared to each memory trace, which is represented as the vector values of +1, -1, or 0 (see Figure 1). A value of +1 or -1 represents the presence of a feature type. A vector value of 0, means a particular feature of the test probe was not stored. If the value for a given vector location is the same in the memory trace and the test probe (i.e., both are +1 or -1), then this constitutes a feature match. When presented with the test probe, a feature-by-feature match process ensues for each of the memory traces in a parallel fashion producing for each memory trace an index of the degree of feature overlap between the probe and that trace. These trace level indices (known as activation values) are then summed to produce the echo intensity—itself the familiarity signal that reflects the level of global match of all memory traces to the probe (Hintzman, 1988).

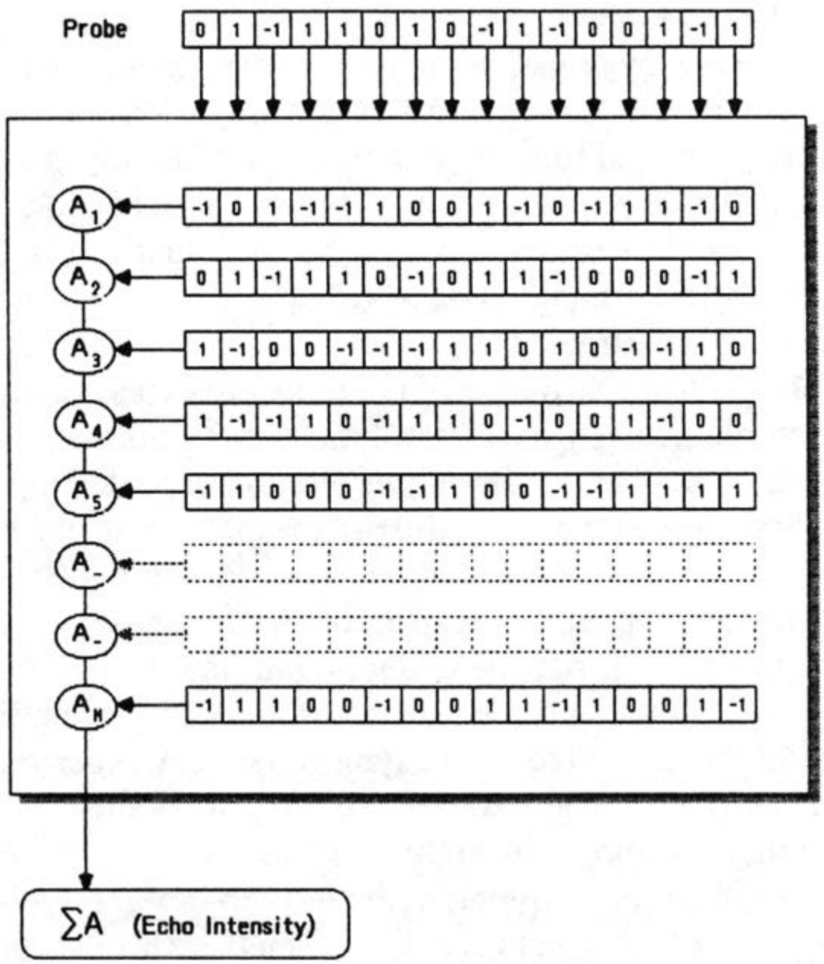

Figure 1
Hintzman's (1988) MINERVA 2 Model.

Experimental Evidence for Global Matching. Some approaches to separating out familiarity experienced without recollection versus recollection itself have capitalized on the feature-matching idea. For instance, researchers found that when participants study a list of words (e.g., *RAINDROP*) and are tested on the word fragments comprising the studied (e.g., *R _ _ ND _ _ P*) and non-studied words (e.g., *VE_ _MO_ _H*), participants judge the fragments of studied words as more familiar during retrieval failure. This finding is referred to as recognition without identification (RWI; Cleary & Greene, 2000; Peynircioğlu, 1990). RWI is usually measured by ratings of perceived familiarity for the available partial information during stimulus identification failure. Thus, RWI is one method for studying familiarity-detection of partial information during retrieval failure. This RWI effect has been extended to other types of stimuli such as geometric shapes in picture fragments (Cleary et al., 2004), phonemic fragments in spoken word fragments (Cleary et al., 2007), orthographic information of common objects and animals (Langley et al., 2008), faces (Carlaw et al., 2022; Cleary & Specker, 2007), and even isolated pitch and rhythm of music (Kostic & Cleary, 2009).

Besides using feature isolation as a method of examining familiarity without recollection, researchers have also relied on the principle of resemblance, or the idea that a whole test stimulus that contains partial features of a studied stimulus will have feature overlap to the studied stimulus in a way that should produce familiarity via feature-matching. This method is known as the recognition without cued recall (RWCR) method, and involves providing cues that potentially resemble studied items; the cues are to be used to attempt recall of a studied item, and are also judged for their familiarity (Cleary, 2004; Cleary et al., 2016; Huebert et al., 2022; McNeely-White et al., 2021; Ryals & Cleary, 2012). RWCR is the finding that participants can discriminate between cues corresponding to studied words and cues not corresponding to studied words among cues for which recall failed. For instance, using the recognition without cued recall (RWCR) paradigm (see Cleary, 2004) participants in Ryals and Cleary (2012) and Huebert et al. (2022) were tested with cues (e.g. POTCHBORK) that overlapped in features with potential studied words (e.g., *PITCHFORK*, *PULLCORK*, *PATCHWORK*, *POCKETBOOK*) to systematically increase the perceived familiarity with the test cue nonword (e.g., *POTCHBORK*) during retrieval failure (Cleary et al., 2016; Huebert et al., 2022). As more studied words matched memory traces of the test cue nonword (four studied words vs. one studied word vs. unstudied), the greater the perceived familiarity for that nonword during retrieval failure for the previously studied words. The RWCR pattern has also been observed using semantic feature overlap in which the test cue item (e.g., *CEDAR*) shares semantic features (e.g., *A TREE, GROWS IN FORESTS*, *IS TALL*, *AND USED FOR MAKING FURNITURE*) with the target word (e.g., *OAK*) (Cleary et al., 2016). During retrieval failure for the target word, test cues that overlapped with semantic features of studied items elicited greater feelings of familiarity for the test cues with a greater number of semantic feature overlap.

Both the feature isolation (RWI) and cue resemblance (RWCR) methods have been used to examine feature-based familiarity-detection during retrieval failure for other types of stimuli as well, such as musical pieces and faces. Using isolated musical features (rhythm and pitch) from well-known piano pieces (e.g., “Mary Had A Little Lamb”) that came from an earlier feature isolation study of musical familiarity (Kostic & Cleary, 2009), McNeely-White et al. (2021) examined how exposure to these components contributed to the overall sense of familiarity for the whole song presented at test. Participants either studied the rhythm-only, pitch-only, or both rhythm and pitch studied separately—and were asked to identify the song. At test, participants were presented with the whole musical piece that the isolated features made up and asked to indicate if it was familiar and identify the song. For the participants that studied the isolated musical features, their perceived familiarity for the whole test song systematically increased based on the number of features studied [rhythm-only = pitch-only < (rhythm + pitch)]—therefore, studying two separate features of the musical piece resulted in higher perceived familiarity for the whole musical piece presented at test, compared to only studying one feature, resulting in an additive fashion [(rhythm-only + pitch-only) = (rhythm + pitch)]. Thus, from a global matching perspective, encoding isolated features can boost the overall familiarity of auditory stimuli such as music.

Similar to research on musical features contributing to a rise of familiarity for the whole song presented at test (McNeely-White et al., 2021), facial components have also been examined (Carlaw, 2023). In a follow-up to earlier RWI research on perceived familiarity with unidentifiable faces (Cleary et al., 2013), Carlaw (2023) carried out a study in which one-at-a-time, participants viewed novel partially occluded faces wearing a pair of sunglasses (sunglasses-only) or a surgical face mask (mask-only), or two separate instances of the same face wearing sunglasses and then a face mask (mask + sunglasses). All faces were studied wearing a hood, to restrict encoding to internal facial features only. Participants were tested on unoccluded, previously studied faces and unstudied faces. Studying parts of the faces systematically and combinedly boosted the overall familiarity for the whole novel face presented at test [(unstudied < (mask-only + sunglasses-only)]. Consistent with prior research on recognition without identification of partially occluded faces (Carlaw et al., 2022), the unoccluded faces felt equally familiar in the mask-only and sunglasses-only conditions, demonstrating that the parts of the face are equal for familiarity-based recognition. In contrast to the musical features study that comprised of well-known songs (McNeely-White, 2021), novel faces were used instead of previously known faces to examine if new faces can be encoded in parts (memory traces) that are later processed in a holistic manner (the whole unoccluded face at test) to boost the overall echo intensity for recognition (Carlaw, 2023). These patterns are consistent with global matching models of recognition memory (e.g., Hintzman, 1988), in which the degree in overlap of stored features produces a familiarity signal.

Since the beginning of the COVID-19 pandemic, research on the effects of a partial face occlusion (e.g., surgical face mask) have been increasingly studied. Using another variation of the RWI paradigm analogous to the aforementioned study, Carlaw et al. (2022) investigated, 1) how do partial face occlusions (i.e., surgical face mask or sunglasses) affect identification ability for celebrity faces, and 2) if identification is hindered for the partially occluded faces, will there be a sense of recognition for the previously-known celebrity faces that are unidentifiable with the face obstruction? Would there be an RWI effect of the faces, just as previously found using a gaussian monochromatic noise filter (Cleary et al., 2013) to obstruct identification ability? Participants were presented celebrity and non-celebrity faces, wearing a surgical face mask or sunglasses, both with a hood. Similarly, participants were asked to rate their perceived familiarity for that face and given the opportunity for identification. Then, participants viewed the unoccluded and unhooded celebrity faces only and were asked to attempt to identify the face if they could.

Carlaw et al. (2022) found that wearing a partial facial occlusion was significantly impairing for identification of previously known celebrity faces, suggesting that face processing is inhibited. An RWI effect was present, highlighted by the partially-occluded celebrity faces feeling more familiar in the absence of identification, compared to the partially-occluded, non-celebrity faces. There was no difference in the RWI effect as a function of the type of partial facial occlusion, suggesting that familiarity-detection for available facial components are equal among parts of the face. However, faces wearing sunglasses were less identifiable than faces wearing medical face masks—demonstrating that though people rely heavily on the eye region for identification, the visible features are still equally processed for familiarity-based recognition.

Bias Bases: The Role of Positivity in Familiarity

The sensation of familiarity does not always come from genuine memory stores; it can also arise from cognitive biases. That is, people can feel as if something is familiar due to a false attribution of familiarity that is grounded in some other stimulus quality. For instance, faces rated as attractive strongly correlate with perceived familiarity, reflecting what is known as the warm glow bias (Monin, 2003). There is also the beautiful-is-familiar-effect, in which faces rated highly attractive are more likely to be recognized as “old” using an old/new task, regardless of whether the face was previously studied. If attractive and positively associated faces are perceived as familiar, another area of interest in the literature is whether emotional expression is related to familiarity (Corneille et al., 2005; Monin, 2003).

This familiarity positivity bias has also been observed with happy facial expressions. Faces that have a happy, positive, or smiling expression are perceived as more familiar than neutral faces, despite no previous exposure to that face. This is also seen for previously known faces (famous individuals), in which smiling or positive faces increased the perceived familiarity for those faces (Baudouin et al., 2000; Lander & Metcalfe, 2007). Interestingly, the perceived familiarity for negative facial expressions has also been observed as less recognizable than neutral and happy faces, further strengthening the theory that facial expressions influence familiarity (Lander & Metcalfe, 2007).

The positivity bias can also be present during encoding, leading to stronger encoding of facial components. Faces that were studied with happy facial expressions and tested with neutral expressions were also recognized more than faces that were studied with neutral or angry expressions (D'Argembeau et al., 2003). Alternatively, it could be that the face initially felt more familiar when first viewed with a happy expression compared to the other expressions, and when that same face was later tested with a neutral expression, the prior familiarity inflated the sense of recognition for that face.

While the previous studies support the familiarity positivity bias for happy faces, other research examining familiarity for facial expressions showed no bias (Liao et al., 2013). Although participants had a strong preference for happy faces and sad faces were less familiar than neutral faces, happy faces were no more familiar than the neutral faces, despite participants correctly labeling the emotional expression for those faces. However, unlike the previously mentioned studies, real-life faces were not used; rather, FaceGen software was utilized to generate the faces (Liao et al., 2013). Virtual faces are often perceived as "eerier" and less familiar than real-life faces (see Di Natale et al., 2023).[1] It is quite possible that the happy faces appeared no more familiar than the neutral faces, due to the eeriness of the generated faces. This raises concern as to whether generated faces should be used in facial recognition studies, as they could

[1] It is important to note that the virtual faces (e.g., FaceGen) differ from artificial intelligence-generated (AI-generated) faces. Research suggests that AI-generated faces are often indistinguishable from real human faces and are perceived more familiar (see Nightingale & Farid, 2022; Miller et al., 2023).

influence familiarity sensitivity. While these findings appear inconsistent with prior research (Baudouin et al., 2000; D'Argembeau et al., 2003; Lander & Metcalfe, 2007), it may be attributed to methodological differences, highlighting the importance of further exploration in positivity biases for faces.

Familiarity's Influence on Other Behaviors

Familiarity-driven Curiosity and Information-seeking

Familiarity-detection, presumably a product of the monitoring component of metacognition, appears to drive other feelings and behaviors that are more characteristic of the control component of metacognition. One example is curiosity (see McNeely-White & Cleary, 2023 for a review). Curiosity can apply to external information-seeking behaviors, such as typing in information related to the stimulus, or internal memory search (Brooks et al., 2021; Huebert et al., 2025b). Prior research (Huebert et al., 2025b) has shown that familiarity-detection can drive curiosity and information-seeking behaviors. Using the RWCR paradigm described above (Cleary, 2004; Ryals and Cleary, 2012) to systematically increase cue overlap, Huebert and colleagues (2025b) found that as cue feature overlap to studied items increased, perceived familiarity for the test cue during retrieval failure increased, and curiosity also increased correspondingly as a function of cue familiarization. This increased curiosity was accompanied by behaviors indicative of information-seeking and memory search effort. Not only did participants use more of their limited opportunities to be shown whether and what studied item corresponded to a given cue as cue familiarization increased, but commission errors also increased—whereby participants were more likely to guess a possible target word rather than leave the cued recall prompt blank. These results highlight that familiarity can drive feelings of curiosity and information-seeking behavior.

In a similar pattern of findings, McNeely-White and Cleary (2023) found that déjà vu states are associated with feelings of curiosity and increased commission errors. The Region of Proximal Learning (RPL) framework suggests that curiosity occurs when individuals feel on the verge of knowing information that is almost accessible (Huebert et al., 2025b; Loewenstein, 1994; Metcalfe, 2023; McNeely-White & Cleary, 2023). The idea that familiarity can drive a sense of curiosity and lead to information-seeking behaviors is consistent with the idea that there is an inherent need to explain why familiar stimuli feel familiar.

Familiarity-detection's Role in Retrieval Search Effort

Familiarity-flip-of-attention Theory

Recent researchers have explored familiarity's role in retrieval search effort (e.g., Cleary et al., 2023; Cleary et al., 2025). One theory that provides insight into this process is the familiarity-flip-of-attention theory (Cleary et al., 2025). Conscious cognitive processes can be categorized as externally oriented attention and internally oriented attention (see Chun et al., 2011; Dixon et al., 2014). Externally oriented attention is viewed as thought processes focused on the external environment, whereas internally oriented attention focuses on thoughts and memories (Chun et al., 2011; Servais et al., 2023). The familiarity-flip-of-attention theory suggests that familiarity-detection may serve as an indicator to direct the focus of attention from externally oriented attention of environmental stimuli to internally oriented attention, to search memory for any relevant information (Cleary et al., 2023; Cleary et al., 2025).

Broader Evidence for the Familiarity-flip-of-attention Theory

Cleary et al. (2023) proposed that familiarity-detection—although traditionally viewed as a component of dual-process theory of memory—may also serve a role in prompting selective attention to focus on an internal search of memory for any relevant information about the current environmental stimuli. Cleary et al. (2023) argued that one well-known memory phenomenon, the primacy effect in memory for repetitions (DiGirolamo & Hintzman, 1997), could potentially be explained by the familiarity-flip-of-attention theory. DiGirolamo and Hintzman (1997) had participants view images five times, except that in some cases the first image (first-different condition) or the last image (fifth-different condition) was flipped. Across all three conditions, the orientation of the first image presented was the image participants tended to remember at test, indicating that the primacy effect held even in the first-different and fifth-different conditions. From a global matching perspective, repetitions of the image following the first presentation, regardless of orientation, contain overlapping features that produce a sense of familiarity. This detected familiarity likely pulls attention inward toward searching memory for the source of the detected familiarity, resulting in a failure to notice any difference in orientation across presentations.

Cleary et al. (2025) proposed that DiGirolamo and Hintzman's (1997) study serves as an example of attention being externally oriented to encode the first image due to its novelty or salience (Wickens et al., 2023) and for the subsequent presentations that have been familiarized by the first, attention is flipped inward due to familiarity-detection arising from overlapping features. As a result, participants exhibited the primacy effect across all conditions because they failed to notice a difference in orientation due to internally directing their attention to search memory instead of attending to and encoding the changed features in the stimulus.

Evidence of Inward Attention for Familiar-seeming Faces

The familiarity-flip-of-attention theory may also serve as an explanation for instances where retrieval failure occurs with intense feelings of familiarity, leading to an internal search of memory to generate information—which may not always be accurate to the current environmental stimulus. Despite the expertise in recognizing facial cues (e.g., shape and structure of features, skin texture and pigmentation), the abundance of cues and many faces a person encounters in their lifetime increase the likelihood of misattributing familiar cues to incorrect contextual information. As previous research (Carlaw & Cleary, 2024) has shown, for faces that were unfamiliar (novel) but perceived as familiar, participants were more likely to claim they had previously seen that face in a studied scene, falsely recollecting a context for a face that had not actually been presented in an earlier context. This illustrates a real-world context in which a person encounters someone they perceive as familiar, only to falsely attribute this feeling to a different context, demonstrating that subjective feelings of familiarity might drive false recollection of details (i.e., generating false context).

Familiarity-driven False Recollection

Recollective Confabulation

A possibly related phenomenon to the idea of familiarity-driven recollective search effort is familiarity-driven false recollection. According to Moulin (2018), *recollective confabulation* is a clinical term referring to patients who experience a chronic false sense of familiarity, typically a symptom of a memory impairment or dementia. Despite experiencing the chronic false sense of familiarity, patients are unaware it is false, instead believing that their life is truly repeating. Patients that experience recollective confabulation tend to justify their sense of familiarity by falsely recollecting information about the current situation. Thus, these patients have an inherent need to explain the source of their familiarity with a situation. Moulin (2018) explained this further:

> *"In this way, it is proposed that the patients' making sense of their feeling of familiarity is a natural reaction that has been learned throughout the lifetime. When we have a strong feeling of familiarity, it triggers a search in memory. If we are able to recover some specifics from the study phase, we will use those, but perhaps if not, we will still attempt a justification" (p. 124).*

It is important to distinguish that the need for recollective confabulation in patients to elaborate on their false sense of familiarity is not the same as clinical déjà vu—the strong sense that one has experienced the current situation before, despite knowing otherwise (see Brown, 2003). Rather, patients have an inherent need to recollect details, regardless of whether they are experiencing déjà vu. As Moulin (2018) pointed out, this tendency to elaborate on information related to the current situation may reflect a general property of human memory that is amplified in cases of clinical recollective confabulation.

Evidence for Familiarity-driven False Recollection in Non-clinical Participants

Prior research indicates that during instances of cued recall failure, not only does familiarity increase as a function of the number of cues studied, but false recollection of contextual details also increases (Huebert et al., 2022). Utilizing the RWCR method (Ryals and Cleary, 2012), Huebert et al. (2022) added a contextual detail with each word at study. The contextual details were an arrow below the study word with the direction pointing left or right, background color (green or blue), or an auditory tone played with the presentation of the study word (high or low pitch tone). At test, participants were asked to rate their perceived familiarity for the word (‘Do you feel like this cue resembles a studied word?’) and indicate if they feel like they know the direction of the arrow (experiment 1), the background color (experiment 2), or the auditory tone (experiment 3) for the study cues. Finally, they indicated the direction, background color, or which auditory tone they believed to have been present for the study cues and recall the word from the study list if they could. Replicating past RWCR findings (Ryals & Cleary, 2012), during cued-recall failure, as the number of word cues studied increased, the perceived familiarity for the test word was greater, supporting global matching models of recognition memory (Clark & Gronlund, 1996; Huebert et al., 2022; Hintzman, 1988) in which studied features increased the global matching signal for memory. Moreover, feelings of knowing (FOKs) for the direction of the arrow, background color, or auditory tone increased as a function of the number of cues studied, despite actual recall ability being close to chance. Thus, objectively demonstrating that perceived feelings of familiarity are accompanied with illusory recollection during instances of retrieval failure. Findings such as these are consistent with Moulin’s (2018) idea that people have the inherent need to explain why something feels familiar.

Illusory recollection during instances of recall failure have also been observed in TOT states (Huebert et al., 2023). Participants studied target answers and afterward attempted to answer general knowledge questions if they could. For each unretrievable target word, they were asked if they were experiencing a TOT, if they could provide partial information, and asked for perceived ratings of characteristics of the inaccessible word such as the first letter, or self-report a contextual detail (left or right arrow, small or large font size) from the study target presentation. TOT states elicited: 1) more partial information responses, despite the tendency for them to be *incorrect* compared to information conjured for non-TOT states, 2) more reports of knowing the first letter of the word—despite being wrong, and 3) increased illusory recollection of contextual details. Therefore, TOTs—a metacognitive state that is associated with intense familiarity in the absence of recollection—can drive illusory recollection of contextual information.

Huebert et al. (2025a) systematically increased the familiarization of video-tour scenes by having participants study a scene tour either once, three times, or not at all, where the studied scene was spatially configured similarly to the test scene. When presented with the test scenes, participants were more likely to report feelings of prediction (FOPs) during retrieval failure for the next direction of the turn if they had previously studied a scene that was spatially similar to the current test scene. As the number of studied exposures to the spatially similar scene increased, participants were more inclined to report higher FOPs. However, prior research indicates that during metacognitive states such as déjà vu and experiencing feelings of prediction for scenes, participants are unable to accurately label the correct direction (i.e., their accuracy was at chance), meaning that these are illusions of prediction (Cleary & Claxton, 2018). Therefore, FOPs increased as a function of familiarization with the spatially similar scenes (Huebert et al., 2025a). These findings suggest that familiarity can be manipulated in correspondence with the intensity of metacognitive states (i.e., FOPs) during retrieval failure. This provides further evidence that familiarity-detection can cause metacognitive states in which illusory recollective details are produced.

Familiarity-driven Commission Errors

A possibly related phenomenon to familiarity-driven false recollection is the persistent finding of familiarity-driven commission errors. This phenomenon has been shown in a number of studies with a variety of stimulus-types (e.g., Huebert et al., 2025b; McNeely-White & Cleary, 2023; Okada et al., 2024), and is the general finding that participants are more likely to type a guessed but incorrect recall response in the cued recall prompt (as opposed to leaving it blank) the more familiar the cue is. It has also been shown with partially occluded celebrity faces that could not be identified (Carlaw et al., 2022). After providing the familiarity rating for each partially occluded celebrity face, participants were asked:

> *“Can you identify this person? If so, type in the person’s name below. If you feel that you recognize them but cannot think of their name, then try to type in any information about them that you can think of (for example, the name of a movie or program that they starred in or what they are famous for). If you can think of nothing about them at all, then just leave it blank by progressing to the next question.”*

When previously known celebrity faces were occluded using a surgical face mask or pair of sunglasses—with a hood—participants were more likely to type incorrect information about the face (i.e., a commission error) than leave the prompt blank (i.e., an omission error) during retrieval failure (Carlaw et al., 2022). This is also consistent with other research examining face familiarity and recollection, in which participants generated commission errors for faces that were perceived as familiar, despite being unstudied, novel faces (Carlaw, 2023; Carlaw & Cleary, 2024). Thus, commission errors for faces may serve as a proxy for familiarity-driven false recollection of details. These examples all serve as evidence supporting Moulin's (2018) notion that people have the inherent need to explain familiar stimuli.

The Present Study

Does Positivity Drive Retrieval Search Effort?

If familiarity-detection can drive recollective search effort and illusory recollective experiences, then could a source of familiarity bias drive false recollection? The primary aim of the present study was to evaluate whether a positive emotional facial expression could inflate feelings of familiarity for faces that were not previously encountered, and whether these instances increase control behaviors related to search effort (e.g., false recollection of details to explain away the perceived familiarity) and curiosity. Previous research shows that face stimuli with positive expressions are perceived as more familiar or are more likely to be recognized than neutral faces (Baudouin et al., 2000; Lander & Metcalfe, 2007). The present study investigated whether, given familiarity's demonstrated role in directing recollective search effort, participants would use a face's positivity (that is construed as familiarity) to initiate recollective search effort, and whether a face's positivity would lead to greater curiosity regarding the face.

The first aim was to determine if the familiarity positivity bias can be replicated for novel faces and if greater feelings of familiarity will increase false recollective details. In Experiment 1, participants viewed partially occluded neutral faces wearing a surgical face mask in a background scene and were then tested only with entirely new (unstudied), unoccluded happy and neutral faces in new background scenes. Participants were tasked to rate their perceived familiarity for each face and to generate any information about the context in which they believe they have previously seen the face. The study phase in Experiment 1 was as a “counterfeit” list, as all test faces were novel. If the familiarity positivity effect was replicated, then on average, happy faces were expected to be judged as more familiar than neutral faces. If there is no familiarity positivity bias, this could be reflected as the neutral faces being judged as more familiar than the happy faces, demonstrating a neutral bias. Given the growing evidence of there being a positivity familiarity bias for faces (Baudouin et al., 2000; D’Argembeau et al., 2003; Lander & Metcalfe, 2007) this would be unlikely. If there is no difference in perceived recognition among the facial expression types, this would indicate that there is no facial expression bias associated with perceived familiarity, consistent with prior research reporting a lack of perceived familiarity bias for facial expressions (Liao et al., 2013).

The second aim of Experiment 1 was to determine whether, among positive faces, and during instances of high familiarity, false recollection would be more likely in the form of attempting to generate a prior context in which the face (that is entirely new) may have been seen. Prior research indicates that even unstudied faces are sometimes judged as familiar (Carlaw, 2023; Carlaw & Cleary, 2024), which could prompt attempts to generate details about where the face was encountered despite being novel. Therefore, it was expected that there would be attempts to generate a prior context in the present study among faces that are experimentally novel. If feelings of familiarity do increase false recollection, then higher reported feelings of familiarity should increase the likelihood of the participant attempting to generate a context. This would be consistent with the growing evidence that familiarity likely increases false recollection of details (Carlaw et al., 2022; Carlaw, 2023; Carlaw & Cleary, 2024; Huebert et al., 2022;

Huebert et al., 2023). Importantly, if positive expressions lead to increased feelings of familiarity for faces, then we expected to find that experimentally novel test faces with positive expressions would have a greater likelihood of attempts at generating prior contexts in which they may have been seen (false recollections).

Experiment 2 used the same design and procedure as Experiment 1, except that feelings of curiosity were prompted for instead of familiarity. As noted by Moulin (2018), people seem to have an inherent need to explain why something feels familiar. But do people feel an inherent need to explain if something is curious to them? Given that there is an association with familiarity-detection, feelings of curiosity, and information-seeking behaviors, it was expected that if the familiarity-positivity bias held in Experiment 1, then in Experiment 2, the smiling faces would prompt higher reported feelings of curiosity. It was also expected that faces that are rated as eliciting more curiosity would also lead to a greater likelihood of generating illusory recollective information. This would have been consistent with prior research indicating that curiosity can prompt internal and external information-seeking behaviors (Brooks et al., 2021; Huebert et al., 2025b). Alternatively, if there were no difference in curiosity ratings across faces, it is possible that the novel faces did not elicit a high enough threshold of familiarity to prompt curiosity or information-seeking. It would also be possible that there may be no difference in information-seeking behavior (i.e., typing illusory information) across smiling or neutral faces, indicating that facial expression does not influence information-seeking behavior or curiosity. However, this would be unlikely as metacognitive states during retrieval failure are more likely to increase feelings of curiosity and information-seeking behaviors (e.g., Brooks et al., 2021; Huebert et al., 2025b; McNeely-White & Cleary, 2023).

Through Experiments 1 and 2, the current study addressed whether a positivity familiarity bias causes false recollection, whereby happy faces are perceived as more familiar than neutral faces and thereby increase the recollection of illusory contextual information. If so, the present study would provide insight into how familiarity can be manipulated for faces, demonstrating that facial expressions—or components of those expressions, such as a smile—can serve as a memory trace in global matching models of recognition memory (Clark & Gronlund, 1996; Hintzman, 1988). This would also provide further evidence that familiarity drives recollection of illusory details (Carlaw et al., 2022; Carlaw, 2023; Huebert et al., 2022; Huebert et al., 2023). Finally, the current study also addressed if the positivity familiarity bias held, and if it was associated with feelings of curiosity and information-seeking behaviors. As prior research has manipulated familiarity from a memory basis to increase curiosity and information-seeking behaviors (Huebert et al., 2025b), the current study aimed to manipulate familiarity using cognitive biases to see if this can increase curiosity and information-seeking behaviors. In doing so, the current study has the potential to provide more evidence of the association between familiarity, curiosity, and information-seeking behaviors.

Chapter 2 – Experiment 1

Feelings of Familiarity and Recollection for Smiling Versus Neutral Faces

Method

Participants

Participants consisted of 56 individuals from the online research platform Prolific. Prior research on the familiarity-positivity bias did not report effect sizes. However, past research on the warm glow bias for faces during TOT states (Cleary, 2019) reported a medium effect size (Experiment 3b; *d* = .56). Therefore, the minimum sample size was determined using G*Power (Faul et al., 2007) and a medium effect size. A high power of 95% with a standard alpha of .05 for a medium effect size (*d* = .50; two-tailed) required a sample size of 54 participants. Participant recruitment was limited to individuals whose primary spoken language is English and who reside in the United States.[2] All individuals on Prolific are required to be over 18 years of age. All participants were paid $12 per hour for their participation in the experiment. Demographic data collected at the end of the experiment included participant age, gender identity, educational level, ethnicity, and whether they are a native English speaker (see Appendix A for participant demographics).

Design

The experiment is a within-subjects design with two conditions in which participants were tested on faces displaying either: 1) a neutral expression, or 2) a

[2] Participants were sampled from the United States rather than other English-speaking countries due to potential regional differences in terminology for scenes.

smiling expression. The experiment consisted of two phases: Phase 1) a counterfeit "study" phase in which participants viewed randomly ordered neutral faces within scenes, with a surgical face mask covering the bottom half of the face; Phase 2) a test phase in which participants viewed novel, unoccluded smiling or neutral faces presented in random order. In the test phase, each participant only viewed one version of each face (smiling or neutral), with counterbalancing accounted for across two versions of the experiment, so each face appears in both expression conditions across participants. The primary dependent variables of interest were perceived familiarity (familiarity ratings) and recollective responses (typed contexts) for the test faces.

Materials

The experiment was implemented online using Qualtrics on the Prolific Platform. The stimuli consisted of 158 face images total: 30 images of neutral faces presented in Phase 1, and 120 images of 60 novel faces, each face having two versions: one smiling and one neutral (see Figure 2) in Phase 2. An additional 8 studied faces were randomly selected and presented in Phase 2 to prevent participants from realizing that the primary test faces of interest were novel. Faces were selected from the Face Research Lab London Set (DeBruine & Jones, 2017) and saved as JPEG files. Each face image was 1350 × 1350 pixels, full color, with similar lighting and a grey background.

The 30 Phase 1 faces included 15 female and 15 male faces. The primary 60 Phase 2 faces included 30 female and 30 male faces. Across both phases, all 90 faces accounted for diversity in race and ethnicity within the stimulus set (see Table B1 for a comprehensive list of faces from the Face Research Lab London Set and Table B2 for the proportion of face ethnicities used in Phases 1 and 2 of Experiments 1 and 2 in Appendix B).[3]

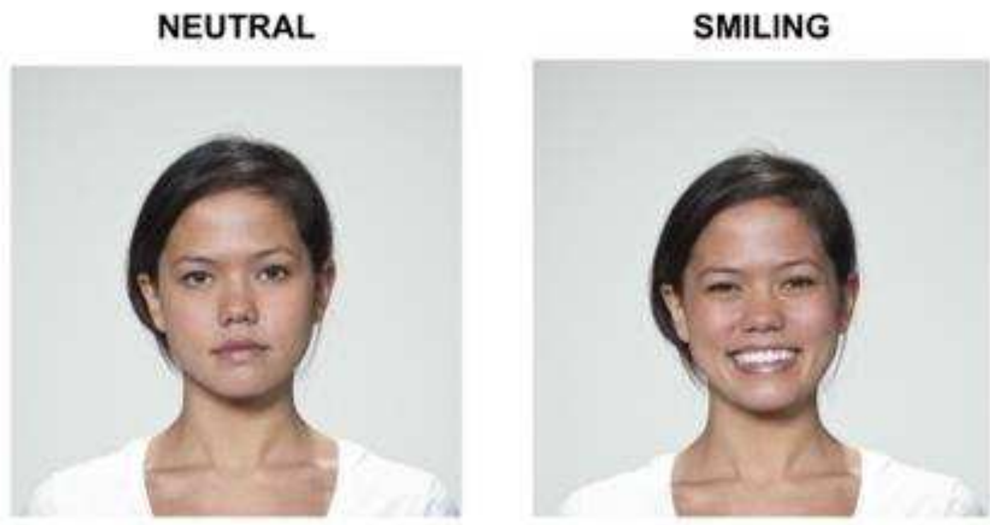

Figure 2
Example of a face that was presented in Phase 2 from the stimulus pool. The first image shows a neutral expression; the second shows a smiling expression. Images are from the Face Research Lab London Set (DeBruine & Jones, 2017): https://doi.org/10.6084/m9.figshare.5047666.v5.

All faces in Phase 1 (see Figure 3 for an example) of the experiment havde a surgical face mask edited onto them using Adobe Photoshop. The surgical face mask image was downloaded from Canva Pro (https://www.canva.com), saved at 2140 × 1301 pixels, and adjusted to fit the faces. Using Adobe Photoshop, a standard grey oval cut-out, color-matched to the grey background with the eyedropper tool, was created and overlaid onto each of the partially occluded faces to cover external features that could influence participants' ability to distinguish the Phase 2 faces from the Phase 1

[3] The faces (N = 102) from the Face Research Lab London Set (DeBruine & Jones, 2017) consist of 69% White faces.

faces. Faces were adjusted laterally or vertically as needed to fit within the standard oval cut-out.

Figure 3
Example of a face that was presented in Phase 1 of Experiments 1 and 2. Face Image is from the Face Research Lab London Set (DeBruine & Jones, 2017): https://doi.org/10.6084/m9.figshare.5047666.v5 and surgical face mask is from Canva Pro (https://www.canva.com).

There were 98 images of unique background scenes presented behind the faces in both experimental phases. All scene stimuli were selected from Konkle et al. (2010; https://bradylab.ucsd.edu/stimuli.html; see Table B3 in Appendix B for a comprehensive list of the scene stimuli).[4] Using Adobe Photoshop, each scene image was cropped to a 4:3 ratio and saved at 600 × 450 pixels in full color. In the upper-left corner of each

[4] The scenes were assigned to either the counterfeit "study" (Phase 1) or the test phase (Phase 2) by generating random values using the RAND function in Microsoft Excel and sorting the scene values from lowest to highest. The first 30 scenes were assigned to Phase 1, and the remaining 68 scenes were assigned to Phase 2. The scenes were then paired with the previously designated face stimuli. During Phase 1, 30 masked faces were paired with 30 scenes. During the Phase 2, 60 novel faces (30 smiling and 30 neutral) were paired with 60 scenes. To prevent a situation where it was noticeable that all the test faces were not previously studied, eight studied faces (4 smiling, 4 neutral) from Phase 1 were included in all Phase 2 versions, resulting in 68 total test trials. Five versions of Phase 1 and five versions of Phase 2 were created, containing different randomly generated face-scene pairings. The Qualtrics survey was programmed to randomly select one of the five Phase 1 versions and one of the five Phase 2 versions for each participant. Because this was not a true old-new memory test (the interest was in unstudied items), there was no concern regarding presentation effects based on the specific scene paired with a given face.

counterfeit “study” scene, the name of the scene was labeled, with the text digitally superimposed in 40-point Arial font in black with a white background to provide the illusion that participants would need to remember the name of the scene for Phase 2 of the experiment. The face and scene image sizes were adjusted in Qualtrics using JavaScript as needed so that the face image is positioned centrally within the scene.

Procedure

Upon providing consent, the experiment began with a welcome screen instructing participants that they will first study faces wearing a surgical face mask in different scenes. The welcome instructions also included that they will be tasked with trying to remember which scenes the faces were in, as they will be tested on their memory for those faces (see Appendix C for instructions). Once participants proceeded by clicking the arrow, they were presented with the 30 partially occluded faces within unique scenes in a randomized order, one at a time for 4 seconds.

Once the first phase of the experiment was completed, participants were presented with instructions for the second phase, which informed them that they will be tested on faces with the face mask removed, and that some of the faces may or may not have appeared in the study phase. They were asked to provide a familiarity rating for each face, on a scale of 0-10 (see below), and to type in the name of a prior scene if they could recall one. Participants viewed 60 novel, unoccluded faces (30 smiling, 30 neutral) and 8 studied, unoccluded faces (4 smiling, 4 neutral) within unique, novel scenes in a randomized order, one at a time. Below each face and scene, there was a prompt that asked participants to indicate how familiar-seeming that face is:

“On a scale of 0-10, how familiar does this face feel?
0 = Not at all familiar seeming 10 = Extremely familiar-seeming”

Once participants selected their response to the familiarity prompt, they then clicked the arrow below the rating to proceed to the next prompt. They were then prompted with the following typed-response question:

> *"Do you feel that you can recall a prior context in which you saw this face in the study phase? If so, type the scene(s) below. If you cannot recall a prior scene, then just leave it blank."*

Below the recollection prompt, participants were asked to press the arrow to continue. Once both responses were provided, they were presented with the next randomly selected face and scene with the familiarity and recollection prompts, until all 68 faces were tested (see Figure 4 for a visual illustration of the experimental procedure).

Throughout the second phase, there were 8 questions unrelated to the task presented randomly as an attention check. There were four random instances of the attention check in which a numerical choice prompt and a typed-response prompt were asked. Each numerical choice prompt began with, "Select the number…", and the four numbers were 6, 2, 10, and 7. Following the numerical choice question, there was a prompt eliciting a typed response. Each typed-question began with, "If you're reading this, type…", and the four neutral words were *button*, *folder*, *napkin*, and *remote*. For example, one question was, "If you're reading this, type '**BUTTON**'." In order to be included for analyses, participants were required to correctly answer at least 6 out of the 8 attention checks.

Once all faces were tested, the experiment advanced to the demographics survey, in which participants were asked to answer each question one at a time (see Appendix D for demographics instructions and prompts). Finally, a screen appeared thanking participants for their participation in the experiment, instructing them to read the debriefing, and to advance to the next page to receive credit.

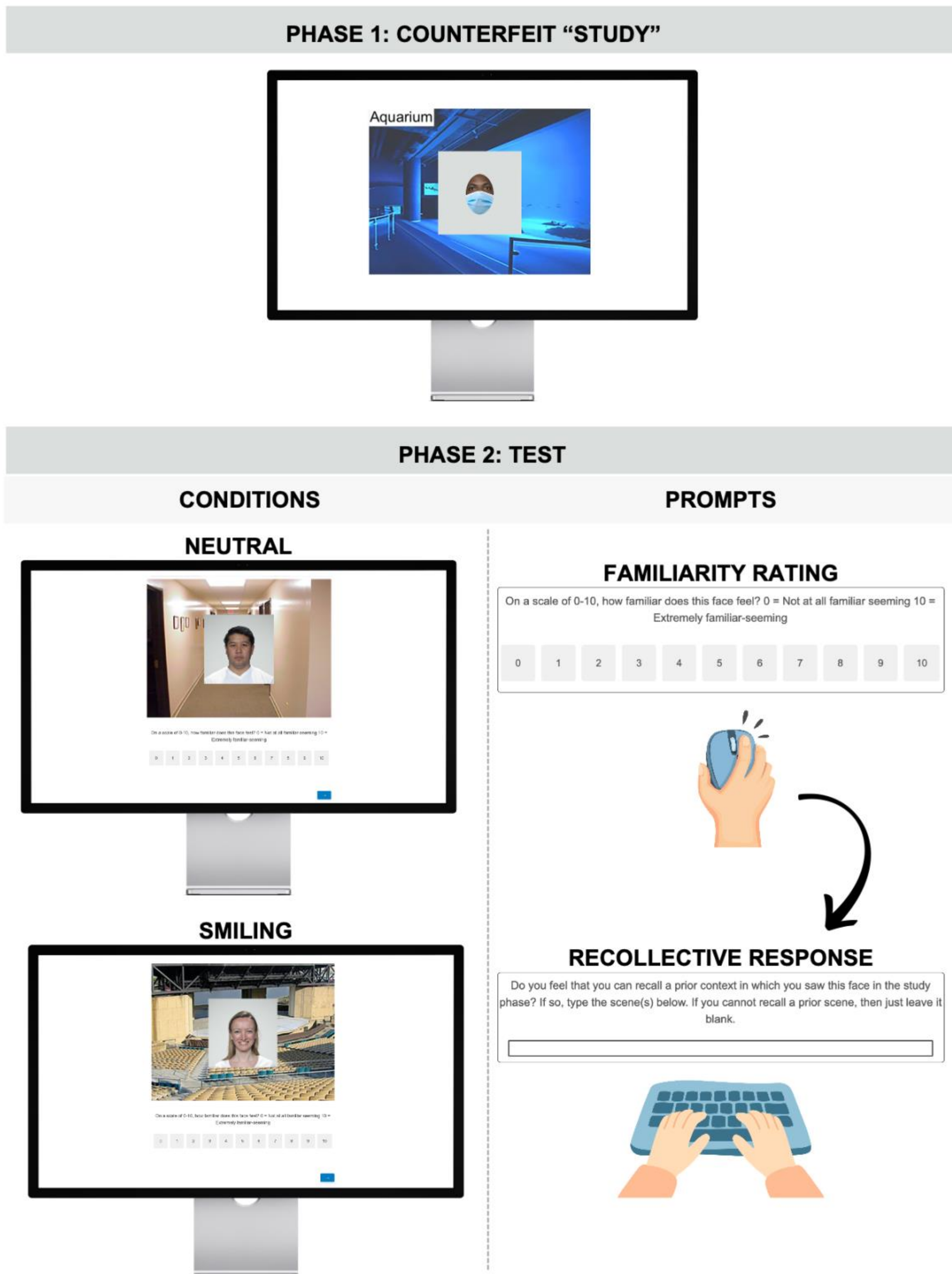

Figure 4

Visual illustration of Experiment 1’s procedure, including Phases 1 and 2, and the smiling and neutral face conditions. Image created using Canva Pro (https://www.canva.com).

Results

Data were analyzed using null hypothesis significance testing (NHST) and Bayesian methods. All *p*-values and effect sizes produced from NHST analyses were reported. Bayes factors (BFs) were computed in JASP using the Jeffreys-Zellner-Siow (JZS) prior, with evidence interpreted according to the recommendations of Wagenmakers (2007).[5] No participants were excluded from analysis, as all 56 participants in Experiment 1 successfully completed all attention checks (8 out of 8 prompts). The eight studied faces that were presented in Phase 2 of the experiment were excluded from all analyses.

Primary Analyses

Both primary analyses included Cohen's *d* effect size.

Familiarity Ratings

Examining the average familiarity ratings for test faces across the facial expression conditions, there was no significant difference between familiarity ratings for smiling faces (M = 3.06, SD = 1.65) and neutral faces (M = 2.99, SD = 1.61), $t(55)$ = 0.61, SE = 0.11, p = .546, d = 0.08, BF_{01} = 5.75. In short, there was no familiarity positivity effect shown. The BF indicates that there was substantial evidence in favor of the null hypothesis.

[5] BF_{01} was reported when arguing in favor of the null hypothesis, and BF_{10} was reported in favor of the alternative hypothesis. Concerning the strength of the BFs, values between 1 and 3 were interpreted as *anecdotal evidence*, values between 3 and 10 were interpreted as *substantial evidence*, values between 10 and 30 were interpreted as *strong evidence*, values between 30 and 100 were interpreted as *very strong evidence*, and values greater than 100 were interpreted as *extreme evidence* in favor of either the null or alternative hypothesis.

False Recollective Responses

Since the test faces of primary interest were novel (unstudied), all typed responses to these items were treated as commission errors and therefore served as false recollections. A paired-samples *t*-test examining the proportion of false recollective responses across the emotional expression conditions found no significant difference between the likelihood of falsely recollecting information between smiling faces (M = .13, SD = .18) and neutral faces (M = .15, SD = .19), $t(55) = 1.33$, $SE = 0.01$ $p = .188$, $d = 0.18$, $BF_{01} = 2.97$, indicating anecdotal evidence in favor of the null hypothesis.

In Experiment 1, there were nine participants that did not make any recollective attempts. A paired-samples *t*-test examining false recollective responses with these participants excluded (N = 47), also revealed no significant difference between smiling faces (M = .16, SD = .18) and neutral faces (M = .17, SD = .20), $t(46) = 1.34$, $SE = 0.01$, $p = .188$, $d = 0.20$, $BF_{01} = 2.75$, indicating anecdotal evidence in favor of the null hypothesis.

Relationship Between Familiarity and False Recollective Responses

A point-biserial Pearson correlation revealed that there was a significant positive association between familiarity ratings and false recollection likelihood for test faces, such that higher ratings of familiarity were correlated with a greater likelihood of false recollection, $r = .37$, $p < .001$, 95% CI [.34, .40], $BF_{10} = 3.33 \times 10^{104}$, indicating extreme evidence in favor of the alternative hypothesis.

Item-based Familiarity Quartile Analyses

Using the R tidyverse package, average familiarity ratings were calculated for each face at the item level, and these faces were then categorized into quartiles ranging from the least familiar-seeming (Q1) to most familiar-seeming (Q4). Mauchly's test of sphericity indicated that the assumption of sphericity was violated for both repeated-measures ANOVAs; therefore, a Greenhouse-Geisser correction was applied.

Familiarity Ratings Across Familiarity Quartiles

A 2 Facial Expression (Smiling, Neutral) × 4 Quartile (Q1, Q2, Q3, Q4) repeated-measures ANOVA was conducted. As a manipulation check, there was a significant main effect of Quartile status, $F(1.99, 109.26) = 70.74$, $MSE = 1.96$, $p < .001$, $\eta^2 = .379$, $BF_{10} = 3.57 \times 10^{36}$, indicating that participants' familiarity ratings differed across the item-based familiarity Quartiles, with ratings increasing from Q1 to Q4.. There was no main effect of facial expression, indicating that familiarity ratings did not differ between smiling and neutral faces, $F(1,55) = 0.28$, $MSE = 1.32$, $p = .600$, $\eta^2 < .001$, $BF_{01} = 8.24$, indicating substantial evidence in favor of the null hypothesis. There was also no significant Facial Expression × Quartile interaction, $F(2.74, 150.62) = 0.19$, $MSE = 1.09$, $p = .885$, $\eta^2 < .001$, $BF_{01} = 305.67$, indicating extreme evidence in favor of the null hypothesis. Descriptive statistics are presented in Table 1.

Table 1
Average familiarity ratings by Facial Expression and Familiarity Quartile.

Facial Expression	Quartile	*M*	*SD*	*N*
Neutral	Q1	2.03	1.36	56
	Q2	2.73	1.68	56
	Q3	3.24	1.94	56
	Q4	4.17	2.19	56
Smiling	Q1	1.96	1.62	56
	Q2	2.60	1.90	56
	Q3	3.31	1.85	56
	Q4	4.08	1.93	56

False Recollective Responses Across Familiarity Quartiles

A 2 Facial Expression (Smiling, Neutral) × 4 Quartile (Q1, Q2, Q3, Q4) repeated-measures ANOVA was conducted. There was a significant main effect of Quartile status, $F(2.33, 127.94) = 10.02$, $MSE = 0.02$, $p < .001$, $\eta^2 = .080$, $BF_{10} = 27{,}682.24$, indicating that the likelihood of falsely recollecting differed across familiarity Quartiles; as shown in Figure 5, this difference was such that false recollection increased with increasing face familiarity. There was no main effect of facial expression, indicating that false recollection rates did not differ between smiling and neutral faces, $F(1, 55) = 0.28$, $MSE = 0.01$, $p = .600$, $\eta^2 < .001$, $BF_{01} = 8.60$, indicating substantial evidence in favor of the null hypothesis. There was no significant Facial Expression × Quartile interaction, $F(2.60, 143.02) = 0.19$, $MSE = 0.01$, $p = .877$, $\eta^2 = .001$, $BF_{01} = 318.46$, indicating extreme evidence in favor of the null hypothesis (see Figure 5).

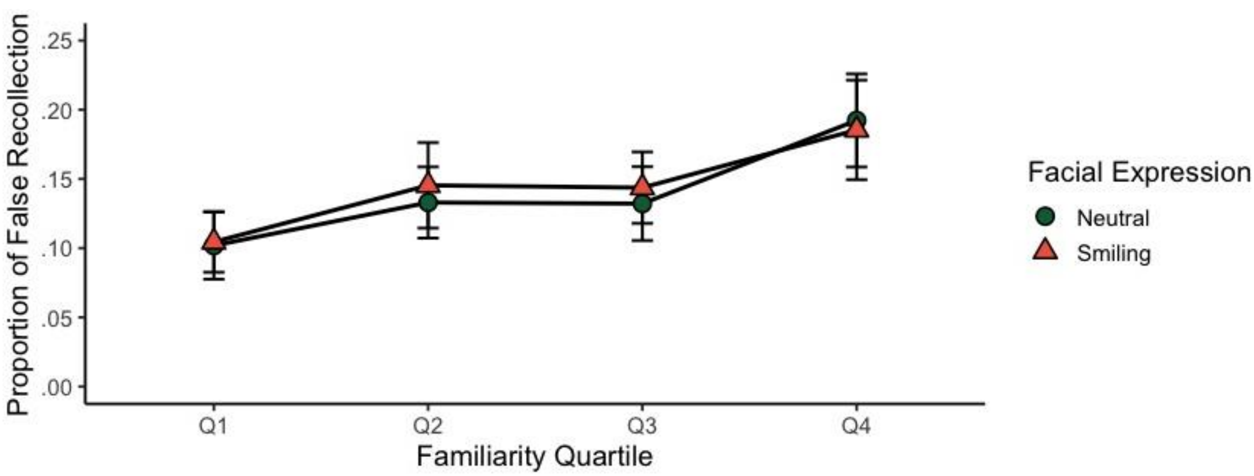

Figure 5
Mean Proportion of False Recollections as a function of item-level Familiarity Quartile and Facial Expression. Plotted error bars represent ±1 standard error of the mean.

Bonferroni-corrected post-hoc tests revealed that faces in the highest Quartile of average familiarity ratings (Q4) elicited a higher rate of false recollection than Q1 ($p < .001$), Q2 ($p = .012$), and Q3 ($p = .009$). Contrast tests revealed there was a significant linear pattern across Quartiles, $t(165) = 5.14$, $SE = 0.01$, $p < .001$, indicating that the rate of false recollection increased as the familiarity Quartile increased. Descriptive statistics are presented in Table 2.

Table 2
Rate of False Recollection by Facial Expression and Familiarity Quartile.

Facial Expression	Quartile	*M*	*SD*	*N*
Neutral	Q1	0.10	0.18	56
	Q2	0.13	0.19	56
	Q3	0.13	0.20	56
	Q4	0.19	0.25	56
Smiling	Q1	0.11	0.16	56
	Q2	0.15	0.23	56
	Q3	0.14	0.19	56
	Q4	0.19	0.27	56

Summary

Experiment 1 results revealed no familiarity positivity bias. The paired-samples *t*-test examining average familiarity ratings among smiling and neutral faces indicated that there was no significant difference. Given this, it was not surprising that there was no significant difference between false recollection rates for smiling and neutral faces. Despite the null findings for facial expression on familiarity and recollective rates, the point-biserial Pearson correlation revealed a moderate positive correlation, such that higher familiarity ratings were associated with a greater likelihood of falsely recollecting, in line with past research on familiarity-driven false recollection (e.g., Huebert et al., 2022).

The item-based familiarity Quartile analyses produced a consistent story with the previously reported findings. The 2 Facial Expression (Smiling, Neutral) × 4 Quartile (Q1, Q2, Q3, Q4) repeated-measures ANOVA revealed that there was a main effect of

Quartile status, in which the faces that had the highest average familiarity across items, demonstrates that the items naturally produced a variety of familiarity ratings. Also consistent with the prior analyses, there was no main effect of facial expression nor an interaction, therefore depicting that there was no familiarity positivity bias.

Finally, examining the item-based familiarity Quartiles and false recollective proportions using the 2 Facial Expression (Smiling, Neutral) × 4 Quartile (Q1, Q2, Q3, Q4) repeated-measures ANOVA, revealed once again a main effect of Quartile status. Further post-hoc and contrast tests revealed that faces in the highest item-based familiarity Quartile produced a higher rate of false recollective responses than faces in the lower Quartiles. Moreover, there was a significant linear pattern indicating that as the familiarity Quartile increased, so did the false recollection likelihood.

Chapter 3 – Experiment 2

Feelings of Curiosity and Recollection for Smiling Versus Neutral Faces

Method

Participants

Participants consisted of 54 individuals from the online research platform Prolific. Prior research on the familiarity-positivity bias did not report effect sizes. However, past research on the warm glow bias for faces during TOT states (Cleary, 2019) reported a medium effect size (Experiment 3b; $d = .56$). Therefore, the minimum sample size was determined using G*Power (Faul et al., 2007) and a medium effect size. A high power of 95% with a standard alpha of .05 for a medium effect size ($d = .50$; two-tailed) required a sample size of 54 participants. Participant recruitment was limited to individuals whose primary spoken language is English and who reside in the United States.[6] All individuals on Prolific are required to be over 18 years of age. All participants were paid $12 per hour for their participation in the experiment. Demographics data collected at the end of the experiment included participant age, gender identity, educational level, ethnicity, and whether they are a native English speaker (see Appendix A for participant demographics).

Design

Experiment 2 was nearly identical to Experiment 1, in that it is a within-subjects design with two conditions in which participants were tested on faces displaying either:

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[6] Participants were sampled from the United States rather than other English-speaking countries due to potential regional differences in terminology for scenes.

1) a neutral expression, or 2) a smiling expression. The experiment consisted of two phases: Phase 1) a counterfeit “study” phase in which participants viewed randomly presented faces within scenes, with a surgical face mask covering the bottom half of the face; Phase 2) a test phase in which participants viewed novel, unoccluded smiling or neutral faces presented in random order. Each participant only viewed one version of each face (smiling or neutral), with counterbalancing accounted for across two versions of the experiment, so each face appears in both expression conditions across participants. The primary dependent variables of interest are curiosity and recollective responses for the test faces. The reason for separating the familiarity and curiosity measures into two experiments is that it is possible that the curiosity prompt may increase information-seeking behavior, which could itself influence recollective responses.

Experiment 2 was nearly identical to Experiment 1, in that it is a within-subjects design with two conditions in which participants were tested on faces displaying either: 1) a neutral expression, or 2) a smiling expression. The experiment consisted of two phases: Phase 1) a counterfeit “study” phase in which participants viewed randomly ordered neutral faces within scenes, with a surgical face mask covering the bottom half of the face; Phase 2) a test phase in which participants viewed novel, unoccluded smiling or neutral faces presented in random order. In the test phase, each participant only viewed one version of each face (smiling or neutral), with counterbalancing accounted for across two versions of the experiment, so each face appears in both expression conditions across participants. The primary dependent variables of interest were curiosity and recollective responses for the test faces. The reason for separating the familiarity and curiosity measures into two experiments is that it is possible that the curiosity prompt could have increased information-seeking behavior, which could have itself influenced recollective responses.

Materials & Procedure

Experiment 2 followed the same materials and procedure as Experiment 1, except that the familiarity prompt was replaced with the following:

> *"On a scale of 0-10, how curious are you about who this person is?*
> *0 = Not at all curious 10 = Extremely curious"*

The instructions for Experiment 2 also matched Experiment 1, with the exception that the participants were instructed to rate how curious they felt about who the person was (see Appendix C for instructions).

Results

Data were analyzed using null hypothesis significance testing and (NHST) Bayesian methods. All *p*-values and effect sizes produced from NHST analyses were reported. Bayes factors (BFs) were computed in JASP using the Jeffreys-Zellner-Siow (JZS) prior, with evidence interpreted according to the recommendations of Wagenmakers (2007).[7] No participants were excluded from analysis, as all 54 participants in Experiment 1 successfully answered at least 75% of attention checks (6 out of 8 prompts) with a 99.54% average success rate. Most participants correctly answered 8 out of 8 prompts (N = 52), while two participants correctly answered 7 out of the 8 prompts. The eight studied faces that were presented in Phase 2 of the experiment were excluded from all analyses.

Primary Analyses

Both primary analyses included Cohen's *d* effect size.

Curiosity Ratings

Examining the average curiosity ratings for test faces across the facial expression conditions, there was no significant difference between curiosity for smiling faces (M = 4.14, SD = 2.16) and neutral faces (M = 4.08, SD = 2.12). The paired-samples *t*-test revealed that there was no facial expression effect on feelings of curiosity for who the person was, $t(53) = 0.59$, $SE = 0.10$, $p = .555$, $d = 0.08$, $BF_{01} = 5.70$. The BF indicates that there was substantial evidence in favor of the null hypothesis.

[7] BF_{01} was reported when arguing in favor of the null hypothesis, and BF_{10} was reported in favor of the alternative hypothesis. Concerning the strength of the BFs, values between 1 and 3 were interpreted as *anecdotal evidence*, values between 3 and 10 were interpreted as *substantial evidence*, values between 10 and 30 were interpreted as *strong evidence*, values between 30 and 100 were interpreted as very *strong evidence*, and values greater than 100 were interpreted as *extreme evidence* in favor of either the null or alternative hypothesis.

False Recollective Responses

Like in Experiment 1, since all the test faces of interest were novel, all typed responses were treated as commission errors and therefore served as false recollections. Examining the proportion of false recollection responses across the facial expression conditions, a paired-samples *t*-test revealed no significant difference between the likelihood of falsely recollecting information between smiling faces (M = .15, SD = .20) and neutral faces (M = .16, SD = .20), $t(53) = 1.24$, $SE = 0.01$, $p = .220$, d = 0.17, $BF_{01} = 3.26$, indicating substantial evidence in favor of the null hypothesis.

In Experiment 2, there were 10 participants that did not make any recollection attempts. A paired-samples *t*-test examining false recollective responses with these participants excluded (N = 44), also revealed no significant difference between smiling faces (M = .18, SD = .20) and neutral faces (M = .20, SD = .20), $t(43) = 1.24$, $SE = 0.01$, $p = .220$, $d = 0.19$, $BF_{01} = 2.98$, indicating anecdotal evidence in favor of the null hypothesis.

Relationship Between Curiosity and False Recollective Responses

A point-biserial Pearson correlation revealed that there was a significant positive association between curiosity ratings and false recollection for test faces, such that higher ratings of curiosity were correlated with a greater likelihood of false recollection, r = .14, $p < .001$, 95% CI [.11, .18], $BF_{10} = 5.60 \times 10^{12}$, indicating extreme evidence in favor of the alternative hypothesis.

Item-based Familiarity Quartile Analyses

Because perceived familiarity was not measured in Experiment 2, to examine the effects of face familiarity on curiosity ratings and false recollection likelihood, the

Quartiles created from the average item-based familiarity ratings that had been calculated in Experiment 1 were used again in Experiment 2 as a four-level experimental variable (Q1 vs Q2 vs Q3 vs Q4).

Experiment 2's Curiosity Ratings Across Experiment 1's Familiarity Quartiles

A 2 Facial Expression (Smiling, Neutral) × 4 Familiarity Quartile (Q1, Q2, Q3, Q4) repeated-measures ANOVA revealed a significant main effect of Familiarity Quartile, $F(2.52, 133.61) = 14.25$, $MSE = 0.89$, $p < .001$, $\eta^2 = .115$, $BF_{10} = 1.55 \times 10^7$, indicating extreme evidence in favor of the alternative hypothesis. This effect was such that curiosity ratings increased with increasing Familiarity Quartile (see Figure 6). There was no main effect of facial expression, indicating that curiosity ratings did not differ between smiling and neutral faces, $F(1, 53) = 0.08$, $MSE = 1.00$, $p = .775$, $\eta^2 < .001$, $BF_{01} = 7.89$, indicating substantial evidence in favor of the null hypothesis. There was no significant Facial Expression × Quartile interaction, $F(2.77, 146.72) = 0.98$, $MSE = 0.49$, $p = .399$, $\eta^2 = .005$, $BF_{01} = 171.04$, indicating extreme evidence in favor of the null hypothesis (see figure 6).

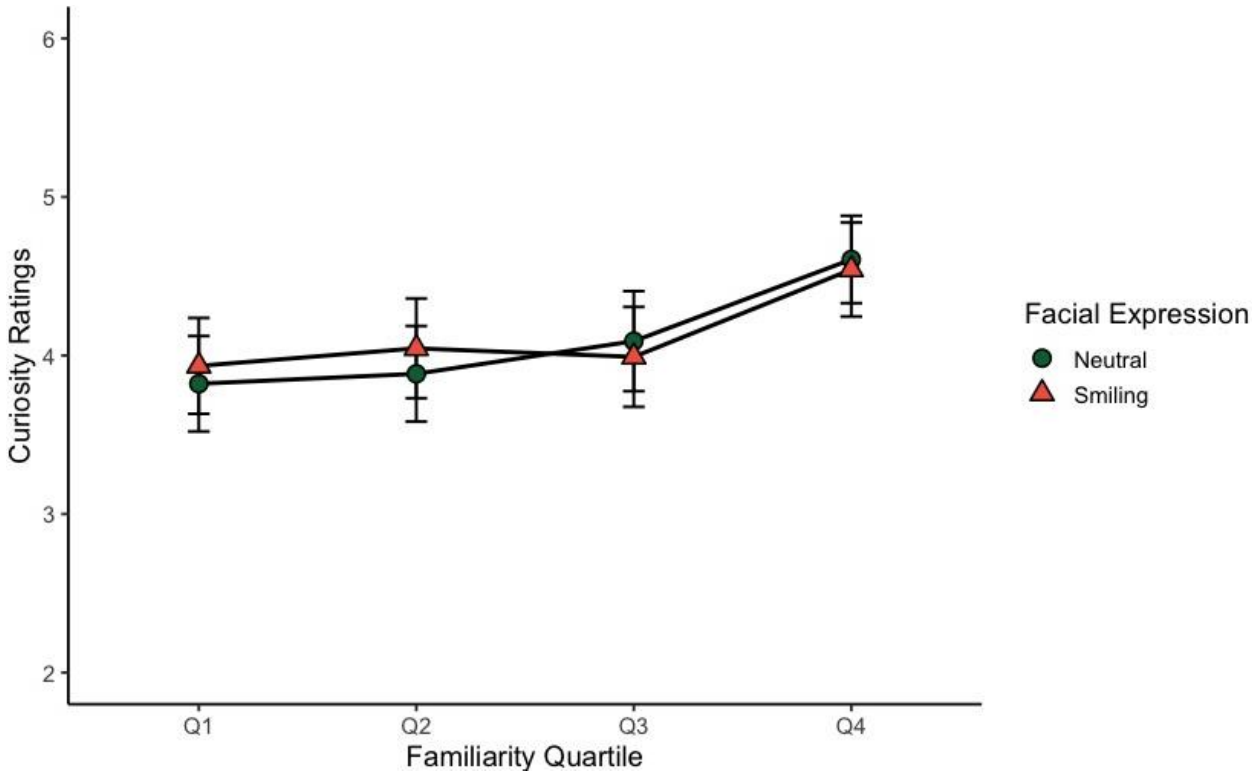

Figure 6
Mean curiosity ratings in Experiment 2 as a function of Experiment 1's item-level Familiarity Quartile and Facial Expression. Plotted error bars represent ±1 standard error of the mean.

Bonferroni-corrected post-hoc tests revealed that faces in the highest Quartile of average familiarity from Experiment 1 (Q4) elicited higher curiosity ratings than Q1 (p < .001), Q2 (p < .001), and Q3 (p < .001). Contrast tests revealed there was a significant linear pattern across Quartiles, $t(159) = 5.83$, $SE = 0.08$, $p < .001$, indicating that curiosity ratings increased as the Familiarity Quartile increased. Descriptive statistics are presented in Table 3.

Table 3
Experiment 2's average curiosity ratings by Facial Expression and Experiment 1's Familiarity Quartile.

Facial Expression	Quartile	*M*	*SD*	*N*
Neutral	Q1	3.82	2.21	54
	Q2	3.88	2.22	54
	Q3	4.09	2.32	54
	Q4	4.61	2.03	54
Smiling	Q1	3.93	2.22	54
	Q2	4.05	2.31	54
	Q3	3.99	2.32	54
	Q4	4.54	2.18	54

Experiment 2's False Recollection Likelihoods Across Experiment 1's Familiarity Quartiles

A 2 Facial Expression (Smiling, Neutral) × 4 Familiarity Quartile (Q1, Q2, Q3, Q4) repeated-measures ANOVA revealed no significant main effect of Familiarity Quartile, $F(2.65, 140.22) = 2.52$, $MSE = 0.02$, $p = .068$, $\eta^2 = .019$, $BF_{01} = 4.27$, indicating substantial evidence in favor of the null hypothesis. There was no main effect of facial expression, indicating that false recollection did not differ between smiling and neutral faces, $F(1, 53) = 1.40$, $MSE = 0.02$, $p = .243$, $\eta^2 = .003$, $BF_{01} = 5.65$, indicating substantial evidence in favor of the null hypothesis. There was also no significant Facial Expression × Quartile interaction, $F(2.74, 145.27) = 2.07$, $MSE = 0.02$, $p = .113$, $\eta^2 = .018$, $BF_{01} = 61.43$, indicating very strong evidence in favor of the null hypothesis.

Contrast tests revealed there was a significant linear pattern across Quartiles, $t(159) = 2.58$, $SE = 0.01$, $p = .011$, suggesting that the rate of false recollection tended to increase as the familiarity Quartile increased. Descriptive statistics are presented in Table 4.

Table 4
Experiment 2's false recollective responses by Facial Expression and Experiment 1's Familiarity Quartile.

Facial Expression	Quartile	*M*	*SD*	*N*
Neutral	Q1	0.14	0.22	54
	Q2	0.12	0.18	54
	Q3	0.18	0.24	54
	Q4	0.20	0.27	54
Smiling	Q1	0.14	0.20	54
	Q2	0.16	0.22	54
	Q3	0.15	0.23	54
	Q4	0.15	0.23	54

Summary

As in Experiment 1, Experiment 2 failed to find evidence for the familiarity positivity bias. The paired-samples *t*-test examining curiosity ratings, indicated that there was no significant difference between smiling and neutral faces. Moreover, both paired samples *t*-tests on the proportion of false recollection also demonstrated no significant difference between the facial expression conditions. The point-biserial Pearson correlation revealed a weak positive association between curiosity and false recollection, in which higher ratings of curiosity about the identity of the face were associated with a greater likelihood of falsely recollecting.

Importantly, the familiarity item-based Quartiles that were generated from Experiment 1 were applied to the Experiment 2 analysis of curiosity ratings. The 2 Facial Expression (Smiling, Neutral) × 4 Familiarity Quartile (Q1, Q2, Q3, Q4) repeated-measures ANOVA revealed that there was a significant main effect of Familiarity Quartile, indicating that faces that elicited higher familiarity ratings in Experiment 1 also elicited greater curiosity ratings in Experiment 2. Consistent with the prior analyses, there was no main effect of facial expression nor an interaction present. Post-hoc tests revealed that faces that produced the highest familiarity ratings (Experiment 1 item-based familiarity Quartiles) also produced higher curiosity ratings than the other lower Quartiles. Further examination of these relationships using contrast tests revealed a linear pattern between curiosity and Familiarity Quartiles.

Finally, using Experiment 1's item-based Familiarity Quartiles and examining the rates of false recollection in Experiment 2, there were no significant main effects of Familiarity Quartile or Facial Expression, nor an interaction. However, contrast tests revealed that there was a significant linear pattern across the Familiarity Quartiles for the Experiment 2 false recollective proportions. This suggests that rate of false recollection in Experiment 2 tended to increase as the Familiarity Quartile increased; this contrast test should be interpreted cautiously, as there was no significant main effect present in the repeated-measures ANOVA for Quartile-status (p = .068).

Chapter 4 – General Discussion

Overview of Present Study

Recent research has indicated that memory-based familiarity during retrieval failure can increase information-seeking behaviors, such as greater feelings of curiosity and even increases in recollecting false information (Huebert et al., 2025b). However, the current literature has not addressed whether false recollection, information-seeking behaviors and feelings of curiosity are associated with bias-based familiarity. Since familiarity can drive false recollection of contextual information for faces (Carlaw & Cleary, 2024), the current study aimed to manipulate a potential variable of interest that could increase subjective familiarity: the familiarity positivity bias. The familiarity positivity bias occurs when happy, positive, or smiling faces tend to be perceived as more familiar than neutral faces (Baudouin et al., 2000; Lander & Metcalfe, 2007). This has also been observed when comparing positive and negative facial expressions, such that happy faces are perceived as more familiar than sad faces (Lander & Metcalfe, 2007). Thus, the present study aimed to observe whether manipulating the emotional expression of a face would: 1) increase perceived familiarity (demonstrating the basic familiarity positivity bias), 2) increase feelings of curiosity, and 3) increase the rate of false recollection for contextual details.

Across both experiments, participants studied faces that were each wearing a medical face mask within a random labeled scene. Participants were later tested on unoccluded (maskless) smiling and neutral faces in new scenes. Unbeknownst to the participants, the primary focus was on test faces that had not appeared in the study phase. In this way, the current study aimed to examine whether the familiarity positivity bias could be replicated with unknown faces. In Experiment 1, participants were asked to rate their feelings of familiarity for the unoccluded faces, while in Experiment 2, participants were asked to rate how curious they felt about the identity of those faces. Following the familiarity (Experiment 1) or curiosity (Experiment 2) prompts, participants were asked if they could recall a prior instance in the study phase that they believe they had previously seen that face. Participants were provided the opportunity to type the name of the scene or any information that they believed was previously associated with the face.

Familiarity Positivity Bias

First, it was predicted that the familiarity positivity bias would be replicated such that smiling faces would produce higher feelings of familiarity than neutral faces. However, this was not found in the current study. The present study found no evidence for the familiarity positivity bias. In Experiment 1, there was no significant difference in familiarity ratings between smiling and neutral faces. This is contrary to prior research that observed a familiarity positivity bias for facial expression (Baudouin et al., 2000; Lander & Metcalfe, 2007). To understand potential explanations for why the familiarity positivity bias for facial expression was not replicated in the current study, it is important to reexamine prior research in this domain.

Baudouin et al. (2000) evaluated whether smiling or neutral expressions on famous and unknown faces would influence participants' familiarity toward those faces. Although they found a smiling bias for both famous and unknown faces, there is a clear methodological difference between their study and the present study: participants were asked to rate their familiarity for each face using a scale from *totally unknown* to *very famous*. Although this study had similar goals as the present study, the familiarity famousness scale does not necessarily capture the same construct as the familiarity scale used in the present study.

One potential explanation for the lack of bias in the present study was the intensity of the emotional expressions. In particular, Lander and Metcalfe (2007) had control participants label the type of emotion (negative, neutral, positive) and rate the intensity or strength of the facial expression shown. Overall, neutral faces were rated as less intense than positive or negative faces. It is possible that the smiling faces from the Face Research Lab London Set (DeBruine & Jones, 2017) used in the present study were less emotionally intense than the stimuli used in prior studies that observed a familiarity positivity bias. Future research should include a control study or manipulation check in which participants would be asked to label the emotion of the Face Research Lab London Set faces as angry, happy, neutral, or sad in order to determine: 1) whether participants accurately perceive the smiling and neutral facial expressions, and 2) the perceived emotional intensity of both facial expressions for each person. It could be that some of the smiling facial expressions were not more intense than their neutral expression. If that is the case, then the familiarity positivity bias may be partially driven by the intensity of the facial expression or quality of the expression may be more important than the specific expression itself.

One potential limitation of the current study that should be considered was that it lacked a manipulation check to determine if the emotional expressions on the faces were recognizable. If one cannot distinguish a smiling or happy expression of a particular face from their neutral expression, then that could explain why there was no familiarity positivity bias present. However, past research that was unable to replicate the familiarity positivity effect, did have a successful manipulation check (Liao et al., 2013). Liao et al. presented participants with a pair of faces for one person depicting two different emotions (happy and neutral or sad and neutral) and asked them a preference prompt and a familiarity-based prompt stating, "Which face do you feel is more familiar, —like a déjà vu experience?". They implemented a manipulation check in which later additional participants were presented the pairs and asked to rate their relative emotional valence such as, "What face do you feel is happier?" for happy trials and, "What face do you feel is sadder?" for sad trials. It was found that happy faces were rated as happier than neutral faces, and sad faces were rated sadder than neutral faces. Through this manipulation check, they were able to run an item-by-item correlation to examine emotional valence and familiarity for the faces. However, they did not find that the emotional valence of happy faces correlated with familiarity, nor was there a significant correlation between the emotional valence of sad faces and familiarity. These findings further raise questions about whether the existing familiarity positivity effect is a robust enough finding in the literature. These findings also suggest that emotional intensity may not be the main driver for the familiarity positivity bias that has been observed in other studies.

Another factor that has not been extensively examined that could potentially confound the familiarity positivity bias seen in prior studies is the attractiveness of faces. Since familiarity correlates with attractiveness and attractive faces are more likely to be recognized (Corneille et al., 2005; Monin, 2003), it is possible that this may also be a driver of the familiarity positivity bias. Therefore, if emotional facial expressions were manipulated and the attractiveness of faces were measured, this could help disentangle the contributions of facial expression and attractiveness on perceived familiarity. Given that attractiveness is associated with greater subjective familiarity—this this could help inform understanding of familiarity positivity bias triggers.

Familiarity Driving False Recollection

I had also hypothesized that during instances of high familiarity, participants would be more likely to falsely recollect contextual information for the novel test faces. Although there was no effect of facial expression on false recollection likelihood (which is unsurprising given the lack of a familiarity positivity bias in the first place), the point-biserial Pearson correlation revealed that there was a significant, moderate positive correlation such that faces that elicited higher ratings of perceived familiarity were more likely to produce greater false recollection proportions. This supports the hypothesis that familiarity can drive an inclination to falsely recollect details and is consistent with prior research on novel faces, in which unstudied faces are sometimes judged as familiar (Carlaw, 2023; Carlaw & Cleary, 2024) and recent evidence that familiarity likely increases false recollection of information (Carlaw et al., 2022; Carlaw & Cleary, 2024; Huebert et al., 2022; Huebert et al., 2023).

Another important piece of evidence from the present study as it pertains to familiarity and false recollection rates was the item-based repeated-measures ANOVA that indicated participants were more likely to falsely recollect information for faces that elicited higher familiarity ratings across the sample. This is similar to the established pattern of familiarity driving commission errors with other stimulus types (Huebert et al., 2025b; McNeely-White & Cleary, 2023; Okada et al., 2024) as well as with previous research on famous faces (Carlaw et al., 2022). Familiarity likely feeds into the monitoring component of metacognition in which one assesses their mental processes (Cleary & Schwartz, 2025). The more intense the sense of familiarity is for the current stimulus, the more likely one may be driven to try to explain away their familiarity sensation (Moulin, 2018). A potential driver of this sensation could be the intensity of the experience, which may trigger one to direct their attention inward to search memory for potentially relevant details (Cleary et al., 2023). Hence, faces that elicited stronger familiarity in the present study may have triggered participants to search their internal memory store to attempt to recollect any relevant details. Since all the primary faces at test were novel, this may have led participants to falsely recollect information that they deemed potentially relevant, such as a recollected scene from the study phase even though the face had nothing to do with that scene in actuality.

Information-seeking Behaviors and Curiosity

For Experiment 2, it was hypothesized that if the familiarity positivity bias held in Experiment 1, there would potentially be a difference in perceived curiosity for faces, such that smiling faces would elicit more feelings of curiosity for the identity of the face, compared to neutral facial expressions. Since the familiarity positivity bias was not replicated in Experiment 1, it is unsurprising that the paired-samples *t*-tests examining curiosity ratings and false recollective responses showed no significant differences among facial expressions. The point-biserial Pearson correlation revealed a positive association between curiosity ratings and false recollection, such that faces that piqued higher curiosity also produced higher rates of false recollection of details. However, this finding should be interpreted with caution as the positive association was weak.

It is previously known that familiarity drives information-seeking behaviors such as producing commission errors (Carlaw et al., 2022; McNeely-White & Cleary, 2023; Okada et al., 2024) and even feelings of curiosity (Huebert et al., 2025b). Some analyses from the current study were consistent with this theory that familiarity drives curiosity and curiosity-related behaviors. As the Familiarity Quartiles established in Experiment 1 went from Q1 to Q2 to Q3 to Q4, curiosity for who that face was increased. It is possible that the familiar faces led participants to feel as though they were on the verge of knowing the information, which could be viewed as a feeling of closeness, which in turn is known to underlie curiosity (see Huebert et al., 2025b; Loewenstein, 1994; Metcalfe, 2023; McNeely-White & Cleary, 2023). Further studies should evaluate familiarity and curiosity measures in one experiment; this could potentially strengthen the current findings of familiarity and curiosity's connection with novel faces.

Another noteworthy finding appeared when utilizing the Familiarity Quartiles from Experiment 1 and applying them to the recollective responses from Experiment 2. Although there was no main effect of the repeated-measures ANOVA, it approached significance and linear contrast tests revealed a linear pattern such that as the Familiarity Quartiles went from Q1 to Q2 to Q3 to Q4, false recollection in Experiment 2 increased. These findings must be cautiously interpreted, as the main effect of Familiarity Quartile did not reach significance. However, these findings further demonstrate the need for additional research examining face familiarity and curiosity as potential modulators of false recollection. It could be that the participants were not necessarily monitoring their memory as extensively when prompted with the curiosity rating (Experiment 2) as they were prompted with familiarity ratings (Experiment 1). Moreover, future research should evaluate search times, as prior research shows that participants spend more search time, attempting to recall information during familiarity-like metacognitive states (i.e., déjà vu; McNeely-White & Cleary, 2023).

Future Directions and Conclusions

The current study investigated whether the familiarity positivity bias would be present for novel, unstudied faces such that smiling faces would be perceived as more familiar than neutral faces. The current study further investigated whether the familiarity positivity bias would increase false recollection of contextual details. The lack of finding a familiarity positivity bias shines a light on the concern that the familiarity positivity bias may not be a robust finding or that there are specific factors that need to be present for such a bias to be present. Future research should address these factors more closely such as the emotional intensity of the facial expressions, differences in familiarity scales, the ability to distinguish the emotional expressions of such faces, and the attractiveness of faces. Future research should also examine whether demonstrations of the familiarity positivity bias in the literature may be due to other confounds rather than positivity per se. In the meantime, despite the lack of familiarity positivity bias, the present study found evidence that higher feelings of familiarity for test faces were associated with more false recollection of details and greater curiosity about the identity of the face, highlighting the potentially useful and adaptive function of subjective familiarity as a cue that may trigger attentional resources to internally search memory for relevant information. Although this process can be a helpful function, it can be at the expense of false recollection for new stimuli that is erroneously recognized.

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Appendix A

Experiment 1 Participant Demographics

All participants (*N* = 56) responded to the end-of-experiment demographic questions. The average age of participants was 36 years (*n* = 56, *M* = 36.18, *SD* = 10.32) and the average number of years of education completed was 15 years (*n* = 55, *M* = 15.09, *SD* = 2.56). Most participants (*n* = 52, 92.86%) reported that they were a native English speaker. Four participants (7.14%) reported that they were not native English speakers and had spoken English for an average of 32 years (*M* = 32.75, *SD* = 8.66).

Table A1
Participant gender identity demographics in Experiment 1.

Gender Identity	*n*	%
Female	29	51.79
Male	27	48.21
Non-Binary/Third Gender	0	0.00
Prefer Not to Say	0	0.00
Prefer to Self-identify	0	0.00

Table A2
Participant ethnicity demographics in Experiment 1.

Ethnicity	*n*	%
Caucasian/White (non-Hispanic)	29	51.79
Black (non-Hispanic)	14	25.00
Asian or Pacific Islander	5	8.93
Native American or Alaskan Native	1	1.79
Hispanic	7	12.50
Prefer Not to Say	0	0.00
Other	0	0.00

Experiment 2 Participant Demographics

All participants (N = 54) responded to the end-of-experiment demographic questions. Similar to Experiment 1, the average age of participants was 36 years (n = 54, M = 36.89, SD = 12.42) and the average number of years of education completed was 15 years (n = 52, M = 15.60, SD = 2.56) in Experiment 2. Most participants (n = 53, 98.15%) reported that they were a native English speaker. One participant reported that they were not a native English speaker and had spoken English for 33 years.

Table A3
Participant gender identity demographics in Experiment 2.

Gender Identity	*n*	%
Female	33	61.11
Male	21	38.89
Non-Binary/Third Gender	0	0.00
Prefer Not to Say	0	0.00
Prefer to Self-identify	0	0.00

Table A4
Participant ethnicity demographics in Experiment 2. Among the two participants that reported "Other", the self-reported responses were, "East Asian and White" and "Multiracial French".

Ethnicity	*n*	%
Caucasian/White (non-Hispanic)	30	55.56
Black (non-Hispanic)	12	22.22
Asian or Pacific Islander	5	9.26
Native American or Alaskan Native	0	0.00
Hispanic	4	7.41
Prefer Not to Say	1	1.85
Other	2	3.70

Appendix B

Table B1

Comprehensive list of face stimuli from the Face Research Lab London Set (DeBruine & Jones, 2017; https://doi.org/10.6084/m9.figshare.5047666.v5) used for Experiments 1 and 2, including age, sex, ethnicity, and the experimental phase in which each face was used.

**Eight studied faces appeared in Phase 2, to prevent participants from noticing that all the test faces were novel.*

Face ID	Face Age	Face Sex	Face Ethnicity	Experimental Phase
X002	24	Female	White	2
X003	38	Female	White	2
X004	30	Male	White	2
X005	28	Male	East Asian	1
X006	31	Female	West Asian	2
X007	21	Female	White	2
X008	25	Male	West Asian	2
X009	22	Female	White	2
X010	26	Female	White	1
X011	36	Female	White	2
X012	24	Male	White	2
X013	26	Female	White	1
X014	23	Female	White	2
X017	34	Male	White	1
X019	24	Female	White	1
X020	35	Female	White	1
X021	48	Male	White	2
X022	29	Male	White	2
X024	47	Male	East Asian	2
X025	21	Female	Black	2
X029	26	Male	White	2
X030	24	Female	East Asian	2
X031	N/A	Male	White	2
X032	36	Female	White	1
X033	28	Male	White	1
X034	24	Female	East Asian	2
X036	21	Male	East Asian/White	2
X037	37	Male	West Asian	1 & 2*
X038	40	Female	West Asian	2
X039	27	Female	White	1
X041	29	Male	White	2
X042	27	Male	Black	1

X043	20	Male	Black	2
X044	22	Male	Black	2
X045	23	Male	East Asian	2
X061	40	Male	Black	2
X062	30	Female	Black	2
X063	19	Male	White	2
X064	25	Female	West Asian	2
X066	22	Female	West Asian	1
X067	29	Male	East Asian	2
X069	21	Male	White	1
X070	31	Male	West Asian	2
X081	25	Female	White	1 & 2*
X082	20	Male	Black	2
X083	21	Female	White	1 & 2*
X086	23	Female	White	2
X087	31	Female	East Asian	2
X090	29	Female	White	1
X091	20	Female	White	2
X092	32	Male	White	1
X094	25	Female	White	1
X096	23	Male	Black	2
X097	19	Female	White	2
X099	24	Female	Black	2
X100	19	Female	White	1 & 2*
X102	31	Female	White	2
X104	22	Male	White	2
X105	35	Male	White	2
X107	41	Female	White	1 & 2*
X108	23	Male	White	1
X112	29	Female	White	2
X114	24	Male	Black	1
X115	25	Male	West Asian	2
X117	26	Male	White	1 & 2*
X118	22	Female	White	2
X119	39	Male	East Asian	2
X120	37	Female	White	2
X121	34	Male	White	1
X122	23	Female	White	2
X123	18	Male	White	1
X124	28	Female	White	1 & 2*
X125	32	Male	White	1
X126	25	Female	Black	2
X127	28	Female	East Asian	2
X128	20	Male	White	2
X129	21	Female	Black	2
X130	19	Male	White	2

X131	34	Male	White	1
X132	25	Male	White	2
X134	21	Female	White	2
X135	N/A	Female	West Asian	2
X136	54	Female	White	2
X137	21	Male	Black	2
X139	25	Female	White	2
X141	23	Male	White	1 & 2*
X142	26	Male	West Asian	2
X144	27	Female	White	1
X172	40	Male	White	2
X173	34	Male	White	1

Table B2
Proportion of face stimuli by ethnicity for the test phase used for Experiments 1 and 2 from the Face Research Lab London Set (DeBruine & Jones, 2017; https://doi.org/10.6084/m9.figshare.5047666.v5).

Ethnicity	*M*
White	0.53
Black	0.18
East Asian	0.13
East Asian/White	0.02
West Asian	0.13

Table B3
Comprehensive list of scene stimuli selected from Konkle et al. (2010; https://bradylab.ucsd.edu/stimuli.html) for both phases in Experiments 1 and 2.

Scene Name	Experimental Phase
Airplane	1
Airport	1
Amphitheater	2
Amusement Park	1
Aquarium	1
Arcade	1
Arch	2
ATM	2
Attic	2
Bakery	1
Balcony	2
Bar	1

Barn	2
Baseball Game	2
Basketball Court	2
Beauty Salon	2
Bee House	2
Boardroom	1
Boutique	2
Bowling Alley	2
Bridge	2
Buffet	2
Bus	2
Bus Stop	2
Café	1
Campsite	2
Canal	2
Casino	1
Cellar	1
Church	2
Circus	2
Classroom	1
Climbing Wall	2
Concert Hall	2
Courtroom	2
Dentist	1
Driveway	2
Elevator	2
Escalator	2
Fire Station	1
Florist	2
Game Room	2
Garage	2
Garbage Dump	2
Garden	2
Gas Station	2
Golf Course	2
Greenhouse	2
Grocery Store	1
Gym	2

Hallway	2
Heliport	2
Hospital	2
Ice Rink	1
Jewelry Store	2
Kennels	2
Kitchen	1
Laboratory	1
Laundry Room	2
Library	2
Living Room	2
Lobby	2
Locker Room	1
Mall	1
Market	1
Monster Truck Rally	2
Museum	2
Music Studio	2
Office	2
Parking	1
Patio	2
Phone Booth	1
Playground	2
Pond	2
Pool	1
Post Office	2
Prison	2
Racing	1
Ranch	2
Restaurant	1
Restroom	1
Sauna	2
Seaport	2
Shoe Store	2
Skate Park	1
Sports Field	2
Staircase	2
Street	2

Subway	2
Swamp	2
Tennis Court	1
Theatre	2
Train	2
Treehouse	2
Tunnel	1
Volleyball Court	2
Warehouse	2
Woods	2

Appendix C

Experiment 1

Welcome and Phase 1 Instructions

“Welcome to this study on human memory!

In this study, you will view people's faces one at a time. Each person will be wearing a medical face mask, and each face will appear in a different scene context. Be sure to pay attention to each face as well as the name of the scene that they are in, as these will be important for the later memory test.

Once you have completed the first phase (in which you viewed people wearing medical masks), you will complete a second phase. In the second phase, you will again see people's faces; however, this time, they will not be wearing a medical mask, and they will appear in new scene contexts. For each face, you will be asked to rate how familiar the face seems using a scale of 0 to 10 where 0 means ‘not at all familiar-seeming’ and 10 means ‘extremely familiar-seeming.’ You must provide a familiarity rating between 0 and 10.

Then, you will be asked if you recall seeing that person's face in any of the earlier scene contexts. You will be able to indicate your answer by typing in the scene name(s) in which you think you saw that person previously.

Please press the arrow to begin the experiment.”

Phase 2 Test Instructions

“One at a time, you will now view people’s faces that are not wearing a medical mask. You may feel that some of these people appeared in the earlier phase wearing a medical mask and that some did not. For each face, you will first be asked to rate how familiar the face seems using a scale of 0 to 10, where 0 means ‘not at all familiar-seeming’ and 10 means ‘extremely familiar-seeming.’ You must provide a familiarity rating between 0 and 10.

Then, you will be asked if you recall seeing that face in the earlier phase. If you do, you should type in the name of the scene context in which you remember seeing that person. You may recall more than one context in which you saw the person; if so, you can type in the names of all the scenes in which you think you saw them before. If you do not recall seeing that person before, then just leave the prompt blank by pressing the arrow to move on to the next prompt.”

Experiment 2

Welcome and Phase 1 Instructions

"Welcome to this study on human memory!

In this study, you will view people's faces one at a time. Each person will be wearing a medical face mask, and each face will appear in a different scene context. Be sure to pay attention to each face as well as the name of the scene that they are in, as these will be important for the later memory test.

Once you have completed the first phase (in which you viewed people wearing medical masks), you will complete a second phase. In the second phase, you will again see people's faces; however, this time, they will not be wearing a medical mask, and they will appear in new scene contexts. For each face, you will be asked to rate how curious you feel about who that person is using a scale of 0 to 10, where 0 means 'not at all curious' and 10 means 'extremely curious.' You must provide a curiosity rating between 0 and 10.

Then, you will be asked if you recall seeing that person's face in any of the earlier scene contexts. You will be able to indicate your answer by typing in the scene name(s) in which you think you saw that person previously.

Please press the arrow to begin the experiment."

Phase 2 Test Instructions

"One at a time, you will now view people's faces that are not wearing a medical mask. You may feel that some of these people appeared in the earlier phase wearing a medical mask and that some did not. For each face, you will be asked to rate how curious you feel about who that person is using a scale of 0 to 10, where 0 means 'not at all curious' and 10 means 'extremely curious.' You must provide a curiosity rating between 0 and 10.

Then, you will be asked if you recall seeing that face in the earlier phase. If you do, you should type in the name of the scene context in which you remember seeing that person. You may recall more than one context in which you saw the person; if so, you can type in the names of all the scenes in which you think you saw them before. If you do not recall seeing that person before, then just leave the prompt blank by pressing the arrow to move on to the next prompt."

Appendix D

Demographics Instructions

"The experiment is not over. Please continue in order to receive credit for your time.

Now that you have completed the memory test, please answer the following demographic questions. Your responses are voluntary. If you choose not to answer a question, leave it blank and press the arrow to proceed to the next question. After completing these questions, you will proceed to the next set of instructions to receive credit for your participation."

Demographics Questions[8]

1. Please indicate your age

2. Please indicate your gender identity (select one)

female male non binary/third gender prefer not to say

prefer to self-identify ____

3. Please indicate your educational level (number of years) ________
(number of years; e.g. 12 if you're in your first year of college)

4. To what ethnic group do you belong? Please select (optional)

________ *Caucasian/White (non-Hispanic): Persons with origins in any of the original peoples of Europe, North Africa, or the Middle East.*

________ *Black (non-Hispanic): Persons with origins in any of the black racial groups of Africa.*

________ *Asian or Pacific Islander: Persons with origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands.*

________ *Native American or Alaskan Native: Persons with origins in any of the original peoples of North America, and who maintain cultural identification through tribal affiliation or community recognition.*

________ *Hispanic: Persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race.*

[8] All demographics questions were adapted for Qualtrics.

________ *Prefer not to say*

________ *Other (please clarify):*

5. Are you a native English speaker? _____ *YES* _____ *NO*

--If NO, approximately how many years have you spoken English? ____ *years*