

The Influence of Emotional Context Scenes on the Interpretation of Masking Smiles

by

Zacharie Gagné

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### Thesis Examiners/Examinateurs de thèse:

Dr. Mélanie Perron  
(Superviseur/Directeur(trice) de thèse)

Dr. Annie-Roy-Charland  
(Committee member/Membre du comité)

Dr. Michael Emond  
(Committee member/Membre du comité)

Approved for the Office of Graduate Studies  
Approuvé pour le Bureau des études supérieures  
Tammy Eger, PhD  
Vice-President, Research (Office of Graduate Studies)  
Vice-rectrice à la recherche (Bureau des études  
supérieures)

Dr. Mathieu Gagnon  
(External Examiner/Examinateur externe)

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## Abstract

The current study investigated the effects of emotional context scenes on the interpretation of masking smiles. The study was conducted using 3 groups, a control group (29 participants) and 2 experimental groups (30 and 25 participants respectively). The control group was shown the name of one of 4 emotions (Anger, Disgust, Fear or Sadness), followed by masking smiles with traces of negative emotions. They were then asked to identify the masking smiles that corresponded to the emotion. The first experimental group was shown an emotional context scene meant to convey one of the same 4 emotions in the control group, followed by pictures of the same masking smiles with traces of negative emotions. Finally, the second experimental group followed the same procedure as the first but were presented with an emotional context scene with the name of the emotion that it was meant to convey at the bottom of the screen. Participants in the experimental groups were asked to identify the masking smile that best corresponds to an individual trying to mask the emotion that was previously presented to them. The results showed that the context images did not have any major effects on the interpretation of masking smiles, with anger only being recognized at a below chance level in the first experimental group.

Keywords: emotion recognition, masking smiles, context images

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## 1. Introduction

Smiles are one of the most common facial expressions in everyday interactions (Chartrand & Gosselin, 2005). Although smiles can be expressed as a result of felt happiness, many of the smiles we observe every day are fake, that is, the person who exhibits them does not feel happiness, pleasure, or excitement while smiling. Fake smiles may be expressed to mask negative emotions, to deceive individuals, or to be polite in certain social situations (Ekman, 1985; Ekman & O'Sullivan, 2006). Smiles that are expressed to mask another emotion are also known as masking smiles. These smiles can be used in a variety of different situations, such as to hide an individual's true feelings regarding a specific situation or person. Thus, it would be advantageous to be able to identify when a person exhibits a fake smile to better respond to the presentation of the smile and adapt to the situation (Perron & Roy-Charland, 2013).

Several studies have indicated that adults, adolescents, and children as young as 5 and 6 are sensitive to certain characteristics that distinguish real and fake smiles; and can discriminate between these types of smiles (Soppe, 1988; Frank et al., 1993, Gosselin, Beaupré & Boissonneault, 2002; Thibault, Gosselin, Brunel, & Hess, 2009). However, the accurate identification of smile authenticity for adults as well as children remains a challenge, with performance being only slightly above chance (Gosselin et al., 2002, Chartrand & Gosselin, 2005, Del Giudice & Colle, 2007). One hypothesis that researchers have proposed to explain this phenomenon is that observers do not see the relevant clues of smiles on the face or that they do not pay enough attention to these clues (Perron & Roy-Charland, 2013, Perron, Roy-Charland, Chamberland, Bleach & Pelot, 2016). This hypothesis, which is called the Perceptual-Attentional limitation hypothesis, is plausible since the indices distinguishing authentic smiles and false smiles

are often subtle and infrequent (Krumhuber & Manstead, 2009; Perron & Roy-Charland, 2013, Perron et al., 2016).

However, using eye-tracking technology, Perron *et al.* (2016) have cast doubt on the perceptual and attentional limits hypothesis by showing that there was no significant relationship between the accurate recognition of a smile and the areas of the face used to reach this conclusion. This has led to researchers turning their attention to other factors that might influence how individuals interpret the authenticity of masking smiles. One of these factors is the context in which the smiles are presented. Previous research has shown that different forms of context can have an influence on how masking smiles are interpreted. The presence of different context scenes could provide clues to the participants that might aid in the correct identification of masking smiles. More specifically, this research project will be looking at emotional context scenes, which are images that arouse a certain emotion among individuals who view them. The goal of this thesis is to examine how the presence of an emotional context scene influences the interpretation of smiles masking negative emotions.

### 1.1. Interpretation of Emotional Facial Expressions

While research has shown that individuals are not that accurate when it comes to identifying different types of smiles, it has shown that individuals are effective, for the most part, at recognizing and identifying full emotional expressions or macro-expressions (Beaudry, Roy-Charland, Perron, Cormier, & Tapp, 2014, Calvo & Lundqvist, 2008; Matsumoto & Sung Hwang, 2011; Palermo & Coltheart, 2004). Numerous studies have shown that individuals can recognize and identify different facial expressions conveying basic emotions at above chance rates (Beaudry *et al.*, 2014; Calvo & Lundqvist, 2008; Matsumoto & Sung Hwang, 2011; Palermo & Coltheart,

2004). Happiness has been shown to be the emotional expression that is most accurately recognized, followed by anger, surprise, sadness, disgust, and fear being typically the least accurately recognized emotional expression (Calvo & Lundqvist, 2008; Ekman & Friesen, 1971; Gosselin, 2005; Matsumoto & Sung Hwang, 2011; Palermo & Coltheart, 2004). Throughout these studies, different recognition patterns have also emerged. The emotional expression of disgust has been found in many studies to be mistaken for the expression of anger, but surprisingly, anger is not often mistaken for disgust (Calvo & Lundqvist, 2008; Matsumoto & Sung Hwang, 2011; Palermo & Coltheart, 2004). Another pattern that is consistently seen is that of fear often being confused with surprise, but as with anger and disgust, the opposite effect is not often found (Calvo & Lundqvist, 2008; Gosselin & Simard, 1999; Matsumoto & Sung Hwang, 2011; Palermo & Coltheart, 2004, Roy-Charland, Perron, Young, Boulard & Chamberland, 2015).

The expression of fear is an interesting one, as almost all studies conducted on the matter have shown that it is the most poorly recognized of all emotional facial expressions (Calvo & Lundqvist, 2008; Ekman & Friesen, 1971; Gosselin, 2005; Matsumoto & Sung Hwang, 2011; Palermo & Coltheart, 2004). Some studies have even reported that fear is only correctly identified at a level slightly higher than chance, or in some instances, even lower than chance (Ekman & Friesen, 1971; Gosselin, 2005; Palermo & Coltheart, 2004). These results are very difficult to understand, as psycho-evolutionist assumptions state that emotion recognition is adaptive, which would therefore allow individuals to avoid certain dangerous or uncomfortable situations based on the interpretation of these facial expressions (Perron *et al.*, 2016; Ohman, Lundqvist, & Esteves, 2001). While the recognition of full emotional expressions or macro-expressions is done with a high degree of accuracy, the same cannot be said with masking smiles and micro-expressions.

## 1.2. Masking Smiles and Micro Expressions

When a person is attempting to mask a negative emotion, they face two challenges. The first is activating the muscles to produce the smile that mask the negative emotion, and the second is to inhibit the muscles that would otherwise show the true negative emotion that is being felt (Ekman & O'Sullivan, 2006). Previous research has shown that certain facial muscles are more easily activated than others, while other muscles are very hard to voluntarily activate, and are therefore only activated when the true corresponding emotion is felt (Duchenne, 1862; Ekman et al. 1980; Gosselin, Perron & Beaupré, 2010, Gosselin, Peretz, Hasboun, Baulac, & Samson, 2011).

Charles Darwin proposed a theory called The *Inhibition Hypothesis* to explain this concept. This hypothesis states that individuals who cannot make certain facial actions voluntarily will not be able to prevent these facial actions from manifesting when involuntary processes such as emotions instigate them (Ekman & O'Sullivan, 2006). Therefore, if certain facial muscles are difficult to activate voluntarily, then individuals who are unable to control these facial muscles will be unable to voluntarily inhibit these facial actions when spontaneous facial expressions occur. Ekman & Friesen (1974) call this phenomenon *leakage* of felt emotions (Ekman & O'Sullivan, 2006). Ekman, Roper & Hager (1980) found that fewer than 25% of people were able to deliberately produce the following facial movements: *Lip Corner Depressor (AU15)*, *Lower Lip Depressor (AU16)*; *Inner Brow Raiser (AU1)*; *Outer Brow Raiser (AU2)*; *Lip Stretcher (AU20)*, and *Cheek Raiser and Lid Compressor (AU6)*. These hard to activate action units (AU) are often found when expressing negative emotions, which render them important when individuals attempt to mask these negative emotions. Furthermore, muscles that are difficult to voluntarily control will therefore be harder to activate or to prevent from being activated when the individual is attempting to conceal a negative emotion, which in turn leads to the leakage of micro-expressions.

Micro-expressions were originally thought to be very distinct muscular movements in the face or full flashes of an emotion that lasted no longer than 1/5 of a second, with some being as short as 1/25 of a second (Ekman, 2003). However, an analysis of over 400,000 frames of genuine and deceptive emotions by Porter & Brinke (2008) found two distinct patterns concerning micro-expressions. The first is that micro-expressions are rarely full displays of emotional expressions. Instead, they were found to be very distinct muscular movements isolated to either the top or bottom of the face, with the top of the face being more common than the bottom. The second is that micro-expressions do not occur as fast as originally thought, with most approaching a duration of close to a second. The study further found that individuals experiencing strong emotional reactions were more likely to leak micro-expressions as opposed to those experiencing weak emotional reactions.

### 1.3. Judgment of Masking Smiles

Research has shown that masking smiles are not judged with the same level of accuracy as full emotional expressions (Ekman & Friesen, 1974; Ekman & O'Sullivan, 1991, Ekman, O'Sullivan & Frank, 1999; Gosselin et al., 2002; Perron et al., 2016). Ekman and Friesen (1974) examined the accuracy of detecting deception by having participants examine videos of female nursing students watching positive and negative videos. There was a total of 4 sessions used for the creation of the videos. In sessions 1 and 2, the nurses watched pleasant videos and described their feelings honestly. In sessions 3 and 4, the nurses watched negative videos. Nurses in session 3 were told to hide their true feelings about the videos whereas nurses in session 4 were told to describe their feelings honestly about the video. These videos were then shown to participants who were tasked with determining whether they felt the nurses were telling the truth about the video

they were watching or lying about the content and their feelings. The results showed that only half of the participants accurately judged the faces as being honest or deceptive at a rate above chance level. However, one limitation of this research project was that the authors did not code the videos of the nurses either lying or telling the truth to ensure that there did exist a discernible difference between the liars and the truth-tellers. Therefore, there was no way to properly ensure that the videos of liars and truth-tellers were significantly different from one another.

Ekman & O'Sullivan (1991) built on this work using the same videotapes from Ekman & Friesen (1974), however, this time, the videos were coded to ensure that there existed a clear difference between the liars and the truth-tellers. The authors also showed the videos to a larger set of participants which included U.S. Secret Service agents, federal polygraphers, judges, police officers, psychiatrists, a special interest group, as well as students. Each group was shown 10 videotapes of individuals describing positive feelings they were experiencing while watching a film. The participants had to indicate whether they believed the individuals were telling the truth about the film they were watching. The results showed that only the group of U.S. Secret Service agents was able to detect whether the individuals were lying at an above-chance rate. Ekman & O'Sullivan (1991) argued that the higher than chance accuracy could be associated with their duty of protecting high-profile political figures, which often relies on interpreting nonverbal cues such as body language and facial expressions (e.g., scanning crowds). Every other group performed at either chance or below chance level which is consistent with previous research showing that individuals cannot accurately detect deception in masking smiles.

Ekman, O'Sullivan & Frank (1999) further built on this, but this time, they created a more realistic scenario that was more applicable to everyday life. In this study, participants were first asked about the strength of their opinion on current controversial social issues. The issues in which

the participants felt most strongly were the ones that they were asked to discuss with an interrogator. Some participants were told to tell the truth about their opinions while others were told to falsely claim that they held positions opposite of their view. All the videos were then coded to ensure that there existed a difference between the participants telling the truth and those lying. These videos were then shown to different groups of people with a similar methodology as Ekman and O'Sullivan (1991). The only difference in this research project was that they wanted to look at the difference between groups that have an interest in being able to correctly identify liars, and those who do not have an interest in doing so. The study looked at seven groups, four of which were law-enforcement groups and the other three were groups of psychologists. Among the law enforcement groups, two of them had special interest or expertise in the area of deception, those groups being federal officers and LA sheriffs. The other two groups, the federal judges and mixed law-enforcement officers had no such expertise. Among the psychologist groups, the first group consisted of clinic psychologists with a special interest in the area of deception, the second group consisted of clinical psychologists with no such interest, and the third group consisted of academic psychologists with no special interest in deception. The results showed that the two groups related to law enforcement with a special interest or expertise in deception did significantly better in accurately judging the videos than the two groups with no expertise. The same results were seen between the groups of psychologists. Those who had a special interest in deception showed more accurate performance than the other groups of psychologists. Another finding of this study was that the individuals with a special interest in deception were more accurate in detecting lies than they were at detecting truthfulness. This finding was consistent for both law enforcement groups and psychologist groups, but no such difference was seen in the groups with no special interest in deception. These results seem to indicate that while the accurate judgment of truthfulness is

possible, not everyone is capable of making these judgments, as most of the unselected groups studied did poorly.

Another study conducted by Gosselin et al. (2002) looked at the judgment of smiles containing a trace of anger among groups of 6-7-year-olds, 11-12-year-olds, and adults. Three types of video clips of individuals smiling were created for this experiment to study the judgment of the authenticity of smiles containing micro-expressions associated with anger. The first was a Duchenne smile which contained the action units *Lip corner puller* (AU12) and *Cheek raiser* (AU6). The second and third smile also contained *Lip corner puller* (AU12) and *Cheek raiser* (AU6), but the coders were also instructed to add the action unit *Lip tightener* (AU23), to simulate a trace of anger in the mouth. The second group was instructed to activate the action unit *Lip tightener* (AU23) at a low intensity (A or B intensity levels), whereas the third group was instructed to activate it at a higher intensity (C or D intensity levels). The participants were first asked to determine if the person smiling was “really happy” or “not really happy”. If they judged the person to be “not really happy”, they were asked if there was another hidden emotion in the smile. The results showed that smile 1, the genuine smile of happiness, was judged to be more genuine by older children and adults than by younger children. Smile 2, which contained a slight trace of anger, was also shown to be judged as less genuine by adults compared to younger children. The researchers also found that among the group of 6-7-year-olds, 29% correctly identified the hidden emotion as anger, among the group of 11-12-year-olds, 31% correctly identified the emotion as anger, and among the group of adults, 50% of them correctly identified the emotion as anger. The researchers found that only the adult group correctly identified anger at an above chance level.

Research conducted by Perron et al. 2016 looked at the accuracy of judging a variety of different smiles containing traces of negative emotions. The goal of this study was to contribute to

the literature regarding the micro-expressions associated with negative emotions. All the smiles used in the study contained the characteristics of an authentic smile, that is containing the Duchenne marker (*Cheek raiser* (AU6)), along with micro-expressions which are characteristics of negative emotions. The masking smiles used included smiles containing traces of fear and disgust as well as two different smiles containing traces of anger and sadness both in the mouth and in the brow. In total, 7 different smiles (Enjoyment, Fear, Disgust, Angry Mouth, Angry Brow, Sad Mouth, and Sad Brow) were used in this study. The study also used eye-tracking technology to investigate the perceptual-attentional limitations hypothesis. It was hypothesized that the reason individuals had difficulty judging masking smiles was that they had difficulty locating or paying attention to the areas of the face that contain micro-expressions. It is for this reason that the participant's gaze was tracked when they were interpreting the masking smiles. Participants first had to determine if the person smiling was "really happy" or "not really happy". They were then asked if they thought another emotion was present in the face, and if they thought that another emotion was present, they were asked to identify this emotion.

The results showed that individuals responded "really happy" more often for enjoyment smiles than all other smile types, with Angry Brow smiles also being identified as "really happy" more than all other smiles, excluding enjoyment. The results also showed that participants responded "really happy" less often for fear smiles than any other smile type and that participants were more likely to indicate the presence of another emotion for smiles containing traces of fear than any of the other masking smiles. Finally, the results showed that when participants identified the presence of another emotion in the smile, they were only able to correctly identify the emotion in question under 50% of the time, with fear and sadness only being correctly identified less than 20% of the time, which did not exceed chance level (Perron et al., 2016). The researchers also

analyzed the eye movements to determine if where participants gazed during the judgment of the masking smiles influenced their judgment accuracy. There were no significant results between the location of the participant's gaze and their judgment accuracy. Therefore, these results do not support the perceptual limitations hypothesis which means that other factors need to be explored. Furthermore, this research project will attempt to not only get a better understanding of the judgment of masking smiles but will also attempt to determine if the presence of emotional context scene will increase the accuracy of detecting the masked emotion present in the masking smile.

#### 1.4. The Effect of Context on the Interpretation of Smiles and Emotions

When it comes to the interpretation of emotions, there exist different views to explain this process. However, two views have been proposed to explain the interpretation of facial expressions and the effect of context. The secrete-category view (Ekman, 1992) proposes that facial expressions convey very specific emotions. According to this view, context plays no role in the interpretation of emotions because each facial expression directly corresponds to a specific emotional state. Therefore, according to this view, a person smiling is happy, a person frowning is angry, and a person crying is sad regardless of the context in which these emotions are exhibited. The other dominant view is the dimensional view (Russell 1980, 1997), which states that facial expressions are not directly categorized into emotional categories, but instead, convey values on the dimensions of valence and arousal. Moreover, the context can have an influence on the interpretation of facial expressions. However, the definition of context is not always clear in research and has suffered from an overly broad definition using the term to "denote any cue that is external to the face" (Hassin, Aviezer, & Bentin, 2013, p. 61).

Knudsen and Muzekari (1983) conducted a study in which they combined verbal statements of context with emotional facial expressions to determine if there was an effect on the interpretation of the emotional facial expressions. Participants rated still images of emotional facial expressions, shown either alone, with a congruent context description, or with an incongruent context description. The results showed that there was a greater agreement regarding the meaning of facial expressions when they were accompanied by a congruent verbal statement, and conversely, there was a greater disagreement on the meaning of facial expressions when they were accompanied by an incongruent verbal statement. Therefore, verbal statements of context did influence the interpretation of facial expressions.

Studies have also shown that bodily contextual cues can have an influence on the interpretation of facial expressions (Aviezer, Hassin, Ryan, Grady, Susskind, Anderson & Bentin, 2008, Aviezer, Bentin, Dudarev, & Hassin, 2011; Aviezer, Trope, & Todorov, 2012; Van den Stock, Right, & de Gelder, 2007). A study conducted by Aviezer et al. (2008) used face-context composites, in which different facial expressions were integrated with different bodily context scenes. In experiment 1, a facial expression of disgust was imposed over 4 different bodily context scenes (Anger, Disgust, Fear, or Sadness). These stimuli were created to exhibit four different levels of perceptual similarity between the target face and the bodily context. The disgusted facial expression with a context of disgust (full similarity), anger (high similarity), sadness (medium similarity), and fear (low similarity). Participants were asked to choose the emotion that best describes the facial expression. The results showed that the higher the perceptual similarity between the disgust facial expression and the bodily context, the higher the accuracy of the participants. Furthermore, when the disgusted facial expression were presented with a bodily context of anger (high similarity), participants were equally likely to categorize the facial

expressions as anger. The results also showed that sad faces presented in a context of fear were more likely to be categorized as fearful than when they appeared in a sad context. Overall, these results seem to indicate that bodily context scenes can have an influence on the interpretation of facial expressions.

More recent work by Lecker, Dotsch, Bijlstra & Aviezer (2019) also showed that there might be a bidirectional influence of context between faces and bodies. In the study, participants were asked to classify face-body composites made up of individuals expressing the facial expressions of anger, disgust, fear, or happiness, combined with body expressions of individuals posing in a stance meant to convey happiness, anger, disgust, or fear. In the first condition, participants were asked to classify the facial expression only, in the second condition they were asked to classify the bodily context only, and in the third condition, they were asked to classify the entire face-body composite. The results showed that there was a clear bidirectional contextual effect of faces and bodies. While the isolated faces were more accurately recognized than the isolated bodies, the results showed that the facial expressions were more influenced by bodily context than the reverse. Therefore, while there is a bidirectional influence of context, the results are still in line with the notion that facial expressions are more influenced by different types of bodily contexts. These are only a few of the studies that have shown that different types of contexts can have an influence on the interpretation of emotional facial expressions. However, in Russell and Fernandez-Dols' book, *The Psychology of Facial Expressions*, they present multiple other studies that show that results in the field of context and facial expressions are often mixed and inconsistent (Fernandez-Dols, Wallbott & Sanchez, 1991; Fernandez-Dols, Sierra & Ruiz-Belda, 1993; Nakamuru, Buck & Kenny, 1990; Wallbott, 1988). Overall, all these mixed findings indicate

that there is no definitive answer about how context influences or interacts with the perception of emotions, and to what degree this interaction plays a role.

One theory that is thought to explain how non-facial cues can influence the interpretation of facial expressions is centered around the notion of emotion seeds (Aviezer *et al.*, 2008). Emotion seeds can be thought of as the perceived information that is given out by facial expressions. These seeds generally lie dormant in the face, but they can be activated by the appropriate context. When a context is presented with a facial expression that shares many emotion seeds, these seeds are then thought to “sprout”, which may override the original facial expressions. However, when an equally powerful context image does not share the same emotion seeds as the facial expression, then the context will have little to no impact on the original facial expression (Aviezer *et al.*, 2008). This theory might have some bearing, as studies have shown that facial expressions that are similar to each other are more likely to be confused when presented in the same context. For example, a facial expression of disgust presented in an angry context is more likely to be classified as angry than disgust because of the large similarity between the two facial expressions. However, when a facial expression of disgust is presented in a fear context, it is more likely to be categorized as disgust because of the low perceptual similarity between the two facial expressions (Aviezer *et al.*, 2008; Reschke *et al.*, 2018). Therefore, according to the theory of emotion seeds, the angry context activates many of the same seeds as the disgust facial expression and can therefore override the original facial expression of disgust. When it comes to a disgust facial expression presented in a fear context, the fear context does not activate the same emotion seeds as the disgust facial expression would, and therefore cannot override the disgust facial expression. Similarly, when facial expressions and the context they are presented in are congruent, they are more likely to be correctly identified than when the facial expression and the context are incongruent.

The theory of emotion seeds has not been directly applied to the interpretation of masking smiles in different contexts. Based on previous research done with emotional facial expressions and different types of contexts, it is reasonable to assume that the theory of emotion seeds could apply to the interpretation of masking smiles. The basis behind this assumption is that previous research has shown that the theory of emotion seeds has been successfully applied to emotional context images and full emotion expressions (Aviezer et al., 2008). Furthermore, since masking smiles contain traces of the cues that are found in full emotional expressions, such as similar micro-expressions, a context image could activate these same cues in masking smiles in the way they activate them in full emotional expressions. If the emotional context scene can activate the emotion seeds in the face, then we expect the context will help the individual correctly identify the masking smile containing micro-expressions that are congruent with the context.

## 1.5. Limitations of Past Research

Previous research conducted in the field of facial expressions and the effect of context on their judgment has been limited. Most studies conducted have looked at the effect of context on the interpretation of full emotional expressions and very few have looked at how masking smiles are interpreted differently in regard to the context they are presented (Aviezer *et al.*, 2008; Barrett, Mesquita & Gendron, 2011; Maringer, Krumhuber, Fischer, & Niedenthal, 2011; Meeren, Van Heijnsbergen & Gelder, 2005; Wieser & Brosch, 2012). Furthermore, many previous research projects conducted using masking smiles have used videos of individuals hiding their true feelings while watching a short film (Ekman & Friesen, 1974; Ekman & O'Sullivan, 1991; Ekman *et al.*, 1999). While these do make the masking smiles genuine, previous studies have not permitted us to study the judgment of authenticity with regards to specific facial cues. In this research project,

we used smiles that were created in a laboratory setting which allowed us to control for the specific facial muscles that are associated with each type of masking smile, as well as symmetry and intensity for all action units present (Perron et al, 2016). Previous research on micro-expressions has also focused very little on the presence of these in the upper or the lower face. In this experiment, we will be presenting masking smiles containing both fear and sadness in the brow area as well as fear and sadness in the mouth area. This is a limitation that is being addressed in this research project to allow for a better generalization of the results, as Porter et al. (2008) demonstrated that micro-expressions most often manifest themselves in either the upper area or the lower area of the face. Finally, no study to this date has examined the effect of emotional context scenes on the interpretation of masking smiles (Hess & Hareli, 2018; Wieser & Brosch, 2012).

## 1.6. Goals of This Current Research

The goal of this research is to examine how emotional context scenes can influence the judgment of masking smiles. Masking smiles have not been researched as much as full emotional facial expressions; therefore, our goal is to get a better understanding of how these smiles are judged and interpreted in different contexts. The study will include a pilot project in which participants will rate how certain emotional context scenes make them feel. This will be used to select emotional context scenes that properly represent each of the 4 emotional facial expressions used (Anger, Disgust, Fear, and Sadness). Once the selection of these images has been completed, they will be used in the first and second experimental groups to determine if they have an effect on how individuals interpret the masking smiles that precede them. The first experimental group will be shown the images alone prior to being shown the images of the masking smiles. The second

experimental group will be shown the images accompanied by the name of the emotion that the image is meant to elicit. Finally, the main study will also include a control group that will not be shown emotional context scenes, but instead will simply be shown the name of an emotion. The identification accuracy, that is to say, the number of masking smiles that are correctly identified as corresponding with the emotional context scene will be calculated for the two experimental groups. For the control group, the identification accuracy will be calculated as the number of masking smiles correctly identified as corresponding with the emotion on the slide presented beforehand. This will be done to get a better understanding of the true effect that the emotional context scenes have on the interpretation of the masking smiles.

### 1.7. Hypothesis

Based on previous research conducted, it is expected that the emotional context scenes could influence how the masking smiles are interpreted (Barret *et al.*, 2011; Hess & Hareli, 2018). The judgment accuracy of the masking smiles should increase when presented with an emotional context scene congruent with the micro-expression, in comparison to the results to the control group, in which no emotional context scene was provided with the masking smiles. Therefore, we expect that the emotional context scenes should also help in the judgment of the masking smiles by supplying the participant with emotion seeds, which in turn could help them better associate the context image with the corresponding masking smile, compared to the control group which will receive no such seeds from the name of the emotion alone.

Regarding a possible effect of macro-expressions, previous research has also shown that fear is the emotional expression that is the least accurately recognized (Beaudry *et al.* 2014; Calvo & Lundvist 2008; Gosselin & Kirouac 19995; Gross & Ballif, 1991; Matsuomoto & Ekman 1989;

Matsuomoto & Hwang 2011; Smith & Schyns 2009; Tracy & Robins 2008). Furthermore, previous research has also shown that the emotional expression of anger is typically one of the most accurately recognized emotions (Beaudry et al. 2014; Gosselin & Kirouac 1995; Gross & Ballif 1991; Matsumoto & Ekman 1989; Matsumoto & Hwang 2011; Smith & Schyns 2009; Tracy & Robins 2008). However, a study by Perron et al. (2016) has demonstrated that masking smiles do not have the same response pattern as those of macro-expressions. In their study, masking smiles concealing traces of fear were recognized as being the least happy of all the masking smiles. However, participants still had difficulty identifying fear as the emotion being masked. Given that this research will be examining the effect of context on the interpretation of masking smiles, it is difficult to predict the recognition pattern that will be present since there is little research that has been conducted using masking smiles. However, based on the results of Perron et al. (2016), we do expect that the recognition pattern of the masking smiles in this study will differ from the results of research conducted with macro-expressions.

## 1.8. Implications of the Research

The interpretation of smiles can have several implications since smiles are abundant in everyday life. Having the ability to determine whether a person is truly smiling, or simply faking a smile, can influence an individual's social life, such as comforting a friend in need (Gosselin, 2002). False smiles are often emitted in social situations and can be expressed to mask negative emotions, deceive individuals, or be polite in certain situations (Ekman, 1985). Thus, having the ability to differentiate between these smiles could better enable individuals to respond in these types of social situations (Perron & Roy-Charland, 2013). In addition, the identification of smiles can play a large role in the judicial system, even if it is not a perfect or acceptable tool in court.

Deception is often used in police investigations and police often have difficulty distinguishing between what is true and what is not true (Ekman, 1990). A better understanding of the judgment of the authenticity of smiles might help with this aspect of police investigations since facial actions are clues that can be used to determine whether a person is telling the truth or not (Ekman, 1990). This research also has the benefit of including context scenes in the equation when interpreting facial expressions. Knowing how an individual reached his emotional state, how he felt in that moment, his body language during the expression of the emotion, or his surrounding environment at the time can all be important clues to help correctly interpret emotional facial expressions and determine their authenticity. For all this to be possible, one must first better understand how an individual identifies and interprets different types of emotional facial expressions, and how effectively they can do so. Research like this will provide a better understanding of how emotional expressions are interpreted as well as how the context in which they are presented can affect people's judgment of these expressions.

## 2. Methods

### 2.1. Pilot study

The goal of the pilot study was to select the context images that were going to be used in the first and second experimental groups of the main research project. All the images were obtained from the International Affective Picture System (IAPS, Bradley & Lang, 2007). These images were then sorted into 4 separate categories which corresponded with the 4 different types of masking smiles that were presented to the participants, "Anger", "Disgust", "Fear", and "Sadness". Images with a valence rating of over 6 were classified as happy images whereas those with a valence rating of under 3 were classified as sad images. As for the images of disgust, fear, and anger, only images with an arousal rating of over 4 and judged to be relevant to the emotion in question by the researcher were selected. From there, the images were sorted, and between 22-25 images from each emotional category (Anger, Disgust, Fear, Sadness, and Joy) were selected and presented to the participants of the pilot study. All these images were randomly added to a PowerPoint presentation and shown to the participants for them to rate their emotional valence. In total, 121 different context images were shown to the participants in the pilot study. For a context image to get selected to be shown to the experimental group, they must have had an average score of 3 or higher in one emotion (Anger, Disgust, Fear, or Sadness) and a score of less than 2 in every other emotion. This general design was based on a study conducted by Hess & Hareli (2018). The images with the highest mean scores that respected the above criteria were chosen for the research project. In total 24 images were selected, 6 from each emotional category (Anger, Disgust, Fear, and Sadness) to be shown to participants.

### 2.1.1. Participants

The sample consisted of 73 participants, including men and women. Participants were not asked to fill out a demographic's questionnaire, therefore, the age and gender of the population are unknown. The accessible population consisted only of Laurentian University students. There were two exclusion criteria for this research project: age and vision. Participants had to be over 17 years old. Since this research project required participants to observe and then analyze different context images, participants also had to have the ability to see the faces and context scenes that were presented to them.

### 2.1.2. Materials

The images for this experiment were obtained from the International Affective Picture System (IAPS, Bradley & Lang, 2007). All the images in the IAPS were classified by three primary dimensions, affective valence (ranging from pleasant to unpleasant), arousal (ranging from calm to excited) and the third dimension was "dominance" or "control". However, only the first two dimensions were used for the selection of images because the third dimension had nothing to do with the emotions associated with the images. The context scenes for this experiment were selected directly from the bank of images provided by the IAPS and divided into 4 categories based on the emotion that the context was meant to exhibit. These 4 categories correspond with the 4 different types of masking smiles that were presented to the participants, which were "Anger", "Disgust", "Fear", and "Sadness". Happy and sad context images were first selected for the pilot project by using their valence rating. Images with a valence rating of over 6 were classified as happy images

whereas those with a valence rating of under 3 were classified as sad images. The context images for disgust, fear, and anger were chosen by using the arousal rating. Images with an arousal rating of over 4 and judged to be relevant to the emotion in question by two separate researchers were classified as disgust, fear, and anger context images. An arousal rating of over 4 was chosen as disgust, fear and anger have been shown to be high arousal emotions (Russel, 1980). Once all the images were identified, they were put into a PowerPoint presentation in a random order to facilitate the presentation of the stimulus to a large group of participants. An answer sheet was created to allow participants to indicate which emotions were present as well as to which extent the images were able to arouse them (Appendix A). For a context image to be selected and shown to the experimental group, they must have had an average score of 3 or higher in one emotion (Anger, Fear, Happiness, Sadness, or Disgust) and a score of less than 2 in every other emotion (Anger, Fear, Happiness, Sadness, Disgust and Other). This general design was based on a study conducted by Hess & Hareli (2018). A total of 24 images were taken from the pilot project (6 images from each of the 4 different emotions) and used for the experimental group. The emotion of happiness was omitted from the experimental group as happiness is not considered a masking smile.

### 2.1.3. Procedure

Participants were first handed a consent form that they had to read and sign to participate in the study (Appendix B). They were then given a brief introduction to the task they were about to perform (Appendix C). The PowerPoint presentation containing all the context images was installed on a large screen in front of the classroom. Students were read a script informing them that they were going to view 121 images that were meant to stimulate an emotional reaction. Participants were handed an answer sheet on which there was a number that corresponded to each

image that was going to be presented to them. Each number contained 6 Likert scales from 0-5, each of which corresponded to an emotion (Happiness, Sadness, Anger, Fear, Disgust, and Other). Participants were informed that they were to fill out each scale with the emotional response that they were feeling when a context image was presented to them. If the image did not arouse a certain emotion, participants were informed to circle the 0 on the Likert scale. If the image did arouse a certain emotion, participants were asked to indicate to which extent on the scale, with 1 being very little arousal and 5 indicating a high level of arousal. Participants were informed that they were able to mark more than one emotion as being aroused by the image. If an image aroused more than emotion, they could indicate so on the Likert scale. Once the participants had viewed all the context images in the PowerPoint presentation, the answer sheets were collected, and they were debriefed before leaving the classroom.

#### 2.1.4. Results

A one-way ANOVA was conducted to determine whether the mean score of the target emotion differed significantly from the mean of the other emotions that participants were asked to evaluate in the pilot study. For example, context scenes meant to invoke anger had to have a mean score for the emotion of anger that was significantly higher than the rest of the emotions that participants in the pilot study were asked to evaluate (Anger, Disgust, Fear, Sadness, Joy and Other). Table 1 indicates the average score and standard deviations of the context images selected to be used in the research project for all the 6 emotion categories (Anger, Disgust, Fear, Sadness, Joy and Other) that participants were asked to rate.

**Table 1: Means and Standard Deviations Table of Participant Answers on the Likert Scale for the Pilot Study.**

	Emotions listed on answer sheet											
	Anger		Disgust		Fear		Sadness		Joy		Other	
Context Scenes	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Anger	2.65	0.64	1.46	1.18	1.32	0.65	1.15	0.70	0.13	0.09	0.71	0.11
Disgust	0.78	0.33	3.86	0.58	0.73	0.41	0.80	0.56	0.25	0.31	0.61	0.11
Fear	0.55	0.54	0.42	0.32	2.17	0.27	0.44	0.32	0.48	0.39	0.79	0.26
Sadness	1.04	0.37	0.95	0.62	1.28	0.5	3.29	0.21	0.13	0.08	0.61	0.08

Note: M and SD stand for mean and standard deviation respectively.

For the context scenes meant to invoke the emotion of anger, the one-way ANOVA determined that there existed a significant difference between the mean scores of the 6 different emotions ( $F_{(5, 30)} = 9.45, p < .001$ ). A post hoc LSD test was conducted to determine whether these context scenes had a significantly higher score for the emotion of anger compared to the other 5 emotions that were rated by participants. The post hoc LSD test revealed that the mean rating for the emotion of anger was significantly higher than the mean rating for the emotions of disgust ( $p < .01$ ), fear ( $p < .01$ ), sadness ( $p < .01$ ), joy ( $p < .001$ ) and other ( $p < .001$ ). The same analysis was conducted for context scenes meant to invoke the emotions of disgust, fear, and sadness. For context scenes meant to invoke the emotion of disgust, the one-way ANOVA revealed that there existed a significant difference between the mean scores of the 6 different emotions ( $F_{(5, 30)} =$

61.88,  $p < .001$ ). The post hoc LSD test revealed that the mean rating for the emotion of disgust was significantly higher than the mean rating for the emotions of anger ( $p < .001$ ), fear ( $p < .001$ ), sadness ( $p < .001$ ), joy ( $p < .001$ ) and other ( $p < .001$ ). For context scenes meant to invoke the emotion of fear, the one-way ANOVA revealed that there existed a significant difference between the mean scores of the 6 different emotions ( $F_{(5, 30)} = 20.90, p < .001$ ). The post hoc LSD test revealed that the mean rating for the emotion of fear was significantly higher than the mean rating for the emotions of anger ( $p < .001$ ), disgust ( $p < .001$ ), sadness ( $p < .001$ ), joy ( $p < .001$ ) and other ( $p < .001$ ). Finally, for context scenes meant to invoke the emotion of sadness, the one-way ANOVA revealed that there existed a significant difference between the mean scores of the 6 different emotions ( $F_{(5, 30)} = 51.65, p < .001$ ). The post hoc LSD test revealed that the mean rating for the emotion of sadness was significantly higher than the mean rating for the emotions of anger ( $p < .001$ ), disgust ( $p < .001$ ), fear ( $p < .001$ ), joy ( $p < .001$ ) and other ( $p < .001$ ).

## 2.2. Main research project

### 2.2.1. Participants

The sample consisted of 29 participants (7 males, 19 females, 3 unknown,  $M = 20.15$  years old) in the control group, 30 participants (7 males, 22 females, 1 unknown,  $M = 23.41$  years old) in the first experimental group and 25 participants (9 males, 14 females, 2 unknown,  $M = 23.17$  years old) in the second experimental group. The accessible population consisted primarily of Laurentian University students. There were three exclusion criteria for this research project: age, vision skill and FACS training (Facial Action Coding System) (Ekman, Friesen & Hager, 2002). Participants had to be over 17 years old. The cutoff age of 17 was chosen to allow first-year university students to participate in the study. Since this research project requires participants to

observe and then analyze different types of smiles, participants also had to have the ability to see the faces that are presented to them. In addition, participants with FACS training were excluded from this research as they would have had an advantage in analyzing smiles and are not representative of the general population.

## 2.2.2. Materials

### 2.2.2.1. Masking Smiles

The masking smiles were obtained from Perron et al. (2016) (Appendix D). A total of 21 smiles (7 different smiles X 3 encoders each) were created by Perron et al. and all of them, except for the genuine smile of happiness were used for this experiment. The first smile is not a masking smile as it was simulated to represent the characteristics of a true enjoyment smile. This smile contained the facial characteristics of Cheek Raiser (AU6) and Lip Corner Puller (AU 12) with the intensity of the activation being at a C level for both. This smile was excluded from the research, because, as previously mentioned, it is not masking any negative emotions. Each of the 6 other smiles also contained the facial characteristics of Cheek Raiser (AU6) and Lip Corner Puller (AU 12) with the intensity of the activation being at a C level. However, they also contained traces of other action units to represent traces of the different negative emotions used for the experiment (Anger, Sadness, Disgust, and Fear) (Perron *et al.*, 2016). Two types of smiles were used to display anger, one had traces of anger in the brow and the other in the mouth. The masking smile with an angry brow contained the additional activation of “Brow Lower” (AU 4); whereas the masking smile with an angry mouth contained the additional activation of “Lip Presser” (AU 24) (Perron *et al.*, 2016). Two smiles were also used to display sadness. One of the smiles contained traces of sadness in the brow, which included the additional activation of “Brow Lower” (AU 4) and “Inner

Brow Raiser” (AU 1) (Perron *et al.*, 2016). The other masking smile contained traces of sadness in the mouth, with the additional activation of the “Lip Corner Depressor” (AU15) (Perron *et al.*, 2016). The smile containing traces of disgust contained the additional activation of “Nose Wrinkler” (AU9), and the smile containing traces of fear contained the additional activations of “Brow Lower” (AU 4), “Inner Brow Raiser” (AU 1), and “Outer Brow Raiser” (AU 2) (Perron *et al.*, 2016). All the traces of negative emotions in the masking smiles were produced at a B intensity level to represent the subtleness of micro-expressions (Ekman *et al.*, 2002).

#### 2.2.2.2. Context Scenes

The context images were obtained from the International Affective Picture System. The images were first selected by the researcher as relevant to each emotion and then classified in the pilot project to determine their validity for the experimental portion of the experiment. Their validity was determined by using the average Likert scale scores for each emotion to determine what emotions were most prominent in each context image. A total of 24 context scenes were chosen for the study, 6 from each of the four context scene categories (Anger, Disgust, Fear, and Sadness).

#### 2.2.2.3. General Procedure

Each participant started by reading and signing the consent form presented to them (Appendix E). Once the participant read and signed the consent form, they were asked to fill out a demographic questionnaire (Appendix F). Upon entering the laboratory, participants were seated in front of a computer monitor. The participants were then given an overview of the task they were about to perform. The researcher read the participants a script outlining the task (Appendix G).

They were informed that the name of different emotions would be appearing on the screen in front of them. After the emotion was presented, it was followed by a screen containing 4 different masking smiles (Anger, Disgust, Fear, and Sadness). Participants were then asked to indicate which masking smile they felt best corresponded to an individual who would be trying to mask the emotion that was presented to them on the previous screen. Once the participant indicated which masking smile they felt corresponded to an individual masking the previous emotion, they were instructed to click on the smile in question with the mouse located in front of them. Once the smile had been chosen, the name of a new emotion appeared on the screen, and the process started over. There were 4 different types of emotions, and each emotion was presented to the participants 6 times, making for a combined 24 trials. The position of the smiles on the screen, as well as the position of the correct answer, was randomized, using a computer-generated randomizer, throughout all 24 trials. The type of smile was also swapped in and out at random as each smile had multiple encoders to ensure that the same smile for each emotion was not seen throughout the entire experiment. Upon completing all 24 trials, participants were debriefed and informed of the true motives behind the experiment before leaving the laboratory.

#### 2.2.2.4. Procedure for experimental groups

For the first experimental group, the researcher read the participants a slightly different script outlining the task (Appendix H). In this task, participants were asked to identify the masking smile that best corresponded to an individual trying to conceal their true emotions towards the context image that was presented to them. Once participants were given their instructions, the researcher set up the program and the participants began by viewing a context image on the screen in front of them. Participants were able to observe and analyze the context image for as long as

they wanted. Once they felt ready, they were instructed to hit the space bar on the keyboard located in front of them in order to move on to the next screen. As with the control group, pictures of the 4 different types of smiles appeared on the screen. Afterward, a control question appeared on the screen asking the participants to identify which emotion they thought the context image was meant to represent. This question was presented following the participant identifying the masking smile presented to them. The question was meant to determine how the participant interpreted the emotional context scene that was presented prior to the masking smiles. Once the participant answered the question by identifying which emotion they felt was represented in the context scene, a new context image appeared on the screen, and the process was repeated for each emotional context scene.

The procedure for the second experimental group, unfortunately, could not be completed in the same manner as the control group and the first experimental group as a result of health and safety protocols implemented during the COVID 19 pandemic. Therefore, to satisfy these protocols, a PowerPoint presentation was created, which permitted the study to be done over zoom, as doing it in person was no longer a possibility. Participants were sent the demographics questionnaire and consent form by email prior to completing the study. Once the researcher received these documents, participants were read a script outlining the task (Appendix I). Once participants were given their instructions, the researcher set up the program and the participants began by viewing a context image accompanied by the name of the emotion that the image was meant to elicit on the screen in front of them. Participants were able to observe and analyze the context image with the name of the emotion for as long as they wanted. Once they felt ready, they were instructed to hit the space bar on the keyboard located in front of them in order to move on to the next screen. As with the other groups, pictures of the 4 different types of smiles appeared on

the screen. The PowerPoint presentation was formatted in the same manner as the program created for the control group and the first experimental group. Once completed, participants were debriefed over zoom. This experimental group was done to see if participants would have a higher accuracy identifying masking smiles if the emotion that the context scene was trying to convey was identified to them.

### 3. Results

#### 3.1. Main study

A one-way ANOVA was conducted to determine whether there existed a significant difference between groups regarding the average age of participants. The results showed that there was no significant differences between the control group ( $M = 20.15$ ,  $SD = 1.38$ ), the first experimental group ( $M = 23.41$ ,  $SD = 9.25$ ) and the second experimental group ( $M = 23.17$ ,  $SD = 2.73$ ) regarding average age ( $F_{(2, 76)} = 2.52$ ,  $p = .087$ ).

A mixed-designed analysis of variance (ANOVA) was conducted with the groups (control, experimental 1 and experimental 2) as a between-participants factor and emotion (fear, anger, disgust and sadness) as a within-participant factor. Means and standard deviations of the identification accuracy of participants for the three groups appear in Table 1. Results revealed a main effect of emotion ( $F_{(3, 234)} = 18.00$ ,  $p < .001$ ,  $\eta_p^2 = .68$ ), a main effect of group, ( $F_{(2,78)} = 10.17$ ,  $p < .001$ ,  $\eta_p^2 = .21$ ) and a significant interaction, ( $F_{(6, 234)} = 3.10$ ,  $p < .01$ ,  $\eta_p^2 = .07$ ).

**Table 2: Means and Standard Deviations Table of the Identification Accuracy of Participants**

Groups	Emotion							
	Anger		Disgust		Fear		Sadness	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Control	0.33	0.21	0.21	0.21	0.47	0.21	0.27	0.17
Experimental 1	0.11	0.11	0.22	0.25	0.42	0.23	0.21	0.16
Experimental 2	0.33	0.21	0.39	0.24	0.45	0.15	0.29	0.16

Note: M and SD stand for mean and standard deviation respectively.

Simple main effects tests were computed to explore the interaction. Dunn's correction was applied to the alpha level. Thus, to be considered significant *p-value* had to be smaller than .021. For the control group, the results showed that there was a significant difference between the recognition rate of the masking smiles ( $F_{(3, 75)} = 8.04, p < .001, \eta^2 = .32$ ). A post hoc LSD test was conducted to determine where the differences reside. The results of the post HOC test for the control group revealed that masking smiles containing traces of fear were the most accurately recognized facial expression, with participants identifying these smiles at a higher rate than those containing traces of anger ( $p < .05$ ), disgust ( $p < .001$ ) and sadness ( $p < .01$ ). The results also showed that participants were able to better recognize smiles containing traces of anger from those containing traces of disgust ( $p < .05$ ), but not from those containing traces of sadness ( $p = .253$ ). No other significant differences were present for the control group. For the first experimental group, the results showed that there was a significant difference between the recognition rate of masking smiles within the group, ( $F_{(3, 87)} = 12.98, p < .001, \eta^2 = .510$ ). A post hoc LSD test was conducted to determine where the differences reside. The results of the post hoc test, much like those of the control group, showed that masking smiles containing traces of fear were the most accurately recognized facial expression, with participants identifying these smiles at a higher rate than those containing traces of anger ( $p < .001$ ), disgust ( $p < .01$ ) and sadness ( $p < .001$ ). The results also showed that participants were better able to recognize masking smiles containing traces of sadness, compared to those containing traces of anger ( $p < 0.01$ ), but not those containing traces of disgust ( $p = .854$ ). No other significant differences were present for the first experimental group. Finally, for the second experimental group, the results showed that there was also a significant difference between the recognition rate of the masking smiles within the group ( $F_{(3, 72)} = 3.50, p$

$< .022$ ,  $\eta^2 = .12$ ). A post hoc LSD test was conducted to determine where the differences reside. The results showed that masking smiles containing traces of fear were more accurately recognized by participants than masking smiles containing traces of anger ( $p < .05$ ) and sadness ( $p < .01$ ), but not those containing traces of disgust ( $p = .249$ ). No other significant differences were present for the second experimental group.

A one-way analysis of variance (ANOVA) was conducted to determine whether there was a significant difference in the recognition accuracy of the masking smiles across the three groups. The goal of this analysis was to determine if participants were able to better recognize masking smiles in one group compared to the two other two groups. For masking smiles containing traces of anger, the analysis revealed that there was a significant difference in recognition rate between groups ( $F(2, 77) = 14.54$ ,  $p < .001$ ,  $\eta^2 = .27$ ). A post hoc LSD was conducted to identify where the differences lied between groups. The test revealed that participants in the first experimental group recognized masking smiles containing traces of anger at a significantly lower rate than those in the control group ( $p < .001$ ), and the second experimental group ( $p < .001$ ). No other significant differences were found for masking smiles containing traces of anger between groups. The same analysis was conducted for masking smiles containing traces of disgust. The analysis revealed that there was a significant difference in recognition rate between groups ( $F(2, 78) = 4.50$ ,  $p < .05$ ,  $\eta^2 = .10$ ). A post hoc LSD test was conducted and revealed that participants in the second experimental group had a higher recognition rate for masking smiles containing traces of disgust, compared to the control group ( $p < .05$ ), and the first experimental group ( $p < .05$ ). No other significant differences were found for masking smiles containing traces of disgust between groups. For masking smiles containing traces of fear, the analysis revealed no significant differences in the recognition rate between groups ( $p = .700$ ). Finally, for masking smiles containing traces of

sadness, the analysis revealed no significant differences in the recognition rate between groups ( $p = .200$ ).

### 3.2. Better than chance analysis

A one-sample *t-test* was conducted to determine whether participants were able to correctly identify the masking smile in question at a better rate than simple chance. Since participants had the option of choosing between 4 different masking smiles, the chance level for this condition is .25, as they had a 1 in 4 chance of getting the correct response. For the control group, the one-sample *t-test* revealed that participants were able to recognize masking smiles containing traces of anger ( $t(25) = 2.07, p < .05$ ) and masking smiles containing traces of fear ( $t(25) = 5.41, p < .001$ ) at a rate higher than chance. Masking smiles containing traces of disgust ( $t(25) = -.941, p = .356$ ) and masking smiles containing traces of sadness ( $t(25) = .575, p = .570$ ) were not identified at a higher rate than chance in the control group. For the first experimental group, the one-sample *t-test* revealed that participants were able to recognize masking smiles containing traces of fear ( $t(28) = 5.41, p < .001$ ) at a rate higher than chance. Participants in the first experimental group also recognized masking smiles containing traces of anger at a lower rate than chance ( $t(28) = -6.80, p < .001$ ). Masking smiles containing traces of disgust ( $t(28) = -.61, p = .546$ ) and masking smiles containing traces of sadness ( $t(28) = -1.30, p = .203$ ) were not identified at a higher rate than chance in the first experimental group. These results are very similar to what was observed in the control group. For the second experimental group, the one-sample *t-test* revealed that participants were able to recognize masking smiles containing traces of disgust ( $t(24) = 2.80, p < .05$ ) and masking smiles containing traces of fear ( $t(24) = 6.56, p < .001$ ) at a rate higher than chance. Masking

smiles containing traces of sadness ( $t(24) = 1.18$ ,  $p = .252$ ) were not identified at a higher rate than chance in the second experimental group while masking smiles containing traces of anger were close to significant ( $t(24) = 1.99$ ,  $p = .058$ ), but still not recognized at a rate higher than chance.

## 4. Discussion

### 4.1. Influence of context on interpretation of masking smiles

The current study investigated the role that context plays in the interpretation of smiles masking negative emotions. To the best of our knowledge, no other study has looked at the influence of context on the interpretation of masking smiles. It was hypothesized that the emotional context images presented to participants would aid in the interpretation of masking smiles by activating “emotion seeds”. The theory which was proposed by Aviezer et al. (2008), stipulates that emotion seeds are the perceptual information shared by different facial expressions. In other words, emotion seeds are the similarities that are shared by different facial expressions when an individual is interpreting them. These seeds generally lie dormant in isolated faces but can be activated in a different context. If the context shares many emotion seeds with the target facial expressions, or in other words, the two are congruent, these seeds can “sprout” and can override the original facial expression of the target face. For example, if a context image meant to invoke the emotion of disgust is presented with a target facial expression that shares many emotion seeds, such as a smile masking the emotion of disgust, or even a smile masking the emotion of anger, then these seeds can “sprout” and may override the original expression of the target face. However, if the context and target facial expression share very few emotion seeds, such as a context image meant to invoke sadness presented with a smile masking disgust, these seeds will lie dormant and will therefore have little impact on the interpretation of the masking smiles. Furthermore, previous research conducted in the field has shown that different types of contexts do have an influence on how macro-expressions are interpreted (Abramson, Petranker, Marom & Aviezer, 2021; Aviezer *et al.*, 2008, Aviezer *et al.*, 2011; Aviezer *et al.*, 2012; Aviezer *et al.*, 2017; Chen & Whitney, 2020; Hassin *et al.*, 2013; Knudsen & Muzekari, 1983; Lecker *et al.*, 2019; Van den Stock *et al.*,

2007). For this reason, it was hypothesized that the emotional context scenes would help participants by activating the “emotion seeds” located in the masking smiles, which in turn would lead to participants identifying the masking smiles at a higher rate than in the control group.

However, the results of this study seem to indicate that visual context scenes did not have a major impact on the interpretation of smiles masking negative emotions. These results were unexpected, as there is a growing body of research that indicates that context, whether it be body posture, verbal cues, or visual scenes, does play a significant role in the interpretation of facial expressions (Aviezer *et al.*, 2008; Aviezer *et al.*, 2011; Aviezer *et al.*, 2012; Aviezer *et al.*, 2017; Chen & Whitney, 2020; Hassin *et al.*, 2013; Knudsen & Muzekari, 1983; Lecker *et al.*, 2019; Van den Stock *et al.*, 2007). These results lead us to believe that the influence of different types of contexts does not manifest itself in the same way with masking smiles as it does with macro-expressions. There are a few possible explanations for the lack of any major significant findings regarding the influence of context.

The first possible explanation for these results lies in the fact that the current study used masking smiles, and not full facial expressions like previous studies conducted (Aviezer *et al.*, 2017; Blom *et al.*, 2020; Chen & Whitney, 2020). A full emotional facial expression is used to convey how an individual is feeling at a specific moment in time with no intention of concealing how they truly feel. Masking smiles on the other hand are used as a mechanism to conceal an individual's true feelings at a specific moment in time, and therefore do not display the full emotional expression. The only thing that differentiates masking smiles from one another is the micro-expressions that accompany them. Furthermore, since the goal of a masking smile is to conceal how an individual is feeling by smiling, these micro-expressions can be subtle, making it difficult for the average individual to identify them. Furthermore, when judging masking smiles,

participants also display different response patterns than when judging full facial expressions. For example, fear has been shown to have the lowest recognition accuracy among all full facial expressions, but a previous study by Perron et al. (2016) has shown that this pattern is not present for masking smiles containing traces of fear. Results from Perron et al. (2016) indicate that participants are more sensitive to masking smiles containing traces of fear as being “not happy” compared to all other masking smiles. However, even in this study, when participants were asked to identify the emotion present in the smile that was “not happy”, fear was the emotion that was the least accurately identified. Given that masking smiles are interpreted differently than full facial expressions, it is possible that different contexts also influence the interpretation of these smiles differently.

As previously mentioned, masking smiles not only seem to be interpreted differently than full facial expressions but they have also been shown to be more difficult to interpret (Ekman & Friesen, 1974; Ekman & O’Sullivan, 1991, Ekman, O’Sullivan & Frank, 1999; Gosselin et al., 2002; Perron et al., 2016), which could serve as a possible explanation for the low accuracy rates in this study. Previous research has indicated that masking smiles, or more specifically, false smiles, are more difficult to interpret for several different reasons. By definition, a false smile is any smile that is exhibited without the felt emotion of happiness, which includes masking smiles. When interpreting false smiles, the biggest difficulty for decoders is that the clues used to determine their authenticity are often subtle and inconsistent (Chartrand & Gosselin, 2005). For example, Ekman, Hager & Friesen (1981) found that false smiles are more asymmetrical than genuine smiles, however, this difference was only observed in 24% of false smiles. The same can be said about the action units activated for each type of smile. Ekman et al. (1988) found that the action unit *Cheek Raiser* (AU6) was less frequent in false smiles than authentic smiles.

Furthermore, the absence of *Cheek Raiser* (AU6) has been shown to be a good indicator for participants, as smiles with the presence of *Cheek Raiser* (AU6) are judged as more authentic than those in the absence of the action unit (Frank et al., 1993). Given that all the masking smiles used in this study included the addition of action unit 6, it is possible that the addition of the negative traces of emotions (Anger, Disgust, Fear, and Sadness) was not enough to make participants realize that the smiles were masking negative emotions.

Returning to the theory of “emotion seeds”, it is possible that in masking smiles, the “seeds” are too subtle for participants to notice, which could explain why they are interpreted differently than macro-expressions. An emotion is recognized at a higher rate if the context image and the target emotion share a larger number of “emotion seeds”. The more “emotion seeds” that are shared between the context image and the target emotional expression, the more “seeds” are activated. This theory has shown some merit when used to explain the interpretation of macro-expressions. If a context image is presented with an emotional expression that shares many emotion seeds, these seeds can “sprout” and override the original facial expressions. However, this does not seem to be the case with masking smiles in the current study. If participants were unable to determine whether there was a negative emotion present, then the theory of “emotion seeds” would not apply since the context images would be unable to activate the appropriate masking smile. If this were the case, a context image would be unable to override the target masking smile and would therefore have no effect on the interpretation of the facial expressions. Consequently, it is possible that in the context of masking smiles, that the micro-expressions present were not sufficient to activate the “emotion seeds”, which could explain the results seen in the first experimental group. Given that participants in the first experimental group were not significantly better at correctly identifying masking smiles compared to the participants in the control group,

this leads us to the conclusion that the context images did not have a significant effect on the interpretation of these smiles. There was however a significant effect of context images with the interpretation of smiles masking anger, but not in the predicted direction.

Participants in the first experimental group were shown an emotional context scene that they could view for as long as they liked. They were then shown four images of masking smiles and asked to identify which masking smile corresponds to an individual who is trying to mask the emotion portrayed in the emotional context scene. In the second experimental group, participants were asked to do the same task, with the only difference being that the name of the emotion was identified at the bottom of the emotional context scene. In the first experimental group, participants were found to be significantly worse at identifying masking smiles containing traces of anger, compared to the second experimental group, and the control group who were only shown the name of an emotion without the presence of an emotional context scene. These results were not expected as context images were hypothesized to increase the accuracy rate of classifying masking smiles, not lower it. Given that the first experimental group identified the target emotion at a significantly lower rate than the other two groups, the results seem to support the idea that the context images meant to invoke anger could be responsible for this response pattern. This hypothesis is plausible, as the accuracy of participants did not differ between the control group and the second experimental group, both of which identified the target emotion on the screen.

One possible explanation for these results might be found in a concept known as moral disgust. Previously, disgust was only considered a negative emotional reaction elicited by food, such as revulsion at the notion of eating contaminated food (Rozin & Fallon 1987). This reaction to physical materials is known as core disgust (Rozin, Haidt & McCauley, 2000). However, since then, several studies have found a strong link between immoral behavior and a disgust reaction.

This reaction to immoral behavior is referred to as moral disgust (Chapman, Kim, Susskind & Anderson, 2009; Rozin *et al.* 2000). Many of the context images (3 of 6) used in this study to elicit an emotional reaction of anger could be considered immoral behaviors, and therefore could explain why participants in the first experimental group had a lower recognition rate than the control and second experimental group. For example, some of the images used to elicit an emotional reaction of anger contained scenes related to racism (Nazi's and the Ku Klux Klan) and physical violence towards women. Both themes are considered by many as immoral acts and could have elicited an emotional response of moral disgust, as opposed to anger which was the target emotion. Therefore, it is possible that participants in the first experimental group interpreted the emotional context scenes as eliciting the emotion of disgust, more specifically moral disgust, as opposed to anger, which could explain the low accuracy rate compared to the control and second experimental groups. An analysis was conducted to determine if participants answered with the emotion of disgust instead of anger at an above-chance rate. While the analysis conducted did not find a significant difference ( $t(29) = -1.53$ ,  $p = .14$ ), we do not believe that this discounts the possibility that participants interpreted some of the images as moral disgust as opposed to anger. As previously mentioned, only 3 of the 6 images shown to participants could be classified as meeting the criteria for moral disgust, therefore, this could explain why the analysis did not find a significant difference in the response pattern of the participants.

For masking smiles containing traces of disgust, the results showed that participants in the first experimental group did not identify these masking smiles at a higher rate than participants in the control group. Their results did however show that participants in the second experimental group were able to recognize masking smiles containing traces of disgust at a higher rate than participants in the first experimental group and participants in the control group. These results

indicate that when participants were presented with a context scene meant to elicit the emotion of disgust, and that when the target emotion was identified simultaneously, that participants were better able to identify the best corresponding masking smile. These results seem to indicate that participants had difficulty identifying the context images meant to elicit the emotion of disgust in the first experimental group. Participants in the control group were only shown the name of the emotion, whereas the participants in the first experimental group were only shown the context image meant to elicit the emotion of disgust. However, participants in the second experimental group were shown both the image and the name of the emotion identifying the image. Therefore, it seems that once the visual context scene was identified to the participants, such was the case in the second experimental group, these scenes aided in the participant's ability to identify the corresponding masking smile at a higher rate than both the control group and the first experimental group. A study conducted by Righart & Gelder (2008a) has shown that when a macro-expression of disgust is presented with a congruent context, they were correctly identified 95.4% of the time. Furthermore, Perron et al. (2016) demonstrated in their study on masking smiles, that when participants indicated the presence of another emotion, the emotion of disgust was identified at a higher rate than all other masking smiles with the exception of masking smiles containing traces of anger in the mouth. The results of these studies seem to indicate that the emotion of disgust should have been identified with a relatively high degree of accuracy when presented with a congruent context scene, however, such was only the case in the second experimental group when the context scene was identified to the participants.

The analysis also revealed that participants in the experimental groups did not identify masking smiles containing traces of fear at a higher rate than participants in the control group. Studies have demonstrated that fearful facial expressions can be identified with a relatively high

degree of accuracy (85.3% and 77% respectively) when presented with a congruent context scene (Righart & Gelder, 2008a; Righart & Gelder, 2008b). However, in Righart & Gelder (2008a) and Righart & Gelder (2008b), participants were only shown a single facial expression, as opposed to having to choose between 4, such was the case in this study. Furthermore, participants were shown full facial expressions whereas participants in the current study were asked to classify masking smiles, which have been shown to be much more difficult to accurately classify than full facial expressions. Participants in the control group were equally accurate than those in the first experimental group who were only shown the context scene, and those in the second experimental group who were shown a context scene with the emotion identified at the bottom of the screen. Therefore, a possible explanation for these results is that participants simply did not have the necessary skills to correctly identify the fearful masking smiles and therefore could not correctly associate these smiles with the fearful context scenes. While Perron et al. (2016) showed that participants were able to detect that fearful masking smiles were in absence of the emotion of happiness, the study also concluded that even when participants made this distinction, they had difficulty identifying fear as the emotion present in the masking smile. In fact, in their study, fear was the emotion that was the least recognized by participants (Perron et al., 2016). This further supports the theory that participants in this study were unable to identify which smile was masking the emotion of fear, and therefore could not make the correct association to the context scene that was presented beforehand.

Finally, for masking smiles containing traces of sadness, no significant effect was found between the experimental groups and the control group. To the best of our knowledge, no study has looked at the direct impact of a visual context scene on the classification of the emotional expression of sadness. Furthermore, there is very little context research that has focused on the

emotional expression of sadness, as it is a low arousal emotion. One research project that did look at sadness was conducted by Knudsen & Muzekari (1983), which determined that when photographs of sad facial expressions were paired with a congruent statement of context, they were recognized significantly more often than when the subjects viewed the photographs alone. However, once again, these were done with full facial expressions and not masking smiles. In their study, Perron et al. (2016) did not find any significant results regarding smiles masking sadness. In their study, participants did not answer “really happy” significantly more than any other masking smile. Furthermore, only smiles masking the emotion of fear were identified with a lower accuracy rate than smiles masking sadness. Therefore, the lack of significant results for the identification of masking smiles containing traces of sadness is not surprising in this study.

#### 4.2. Differences between emotions

Based on previous studies conducted, it was hypothesized that the recognition pattern of the masking smiles in this study would differ from the results of research conducted with macro-expressions. Results from research on macro-expressions have shown that anger is typically one of the most accurately recognized emotions, followed by disgust, sadness, and lastly fear (Beaudry et al. 2014; Calvo & Lundvist 2008; Gosselin & Kirouac 19995; Gross & Ballif 1991; Matsuomoto & Ekman 1989; Matsuomoto & Hwang 2011; Smith & Schyns 2009; Tracy & Robins 2008). In this study, an analysis of the first and second experimental groups revealed that masking smiles containing traces of anger were not recognized at a higher rate than any other masking smile.

Therefore, the hypothesis was not confirmed, as anger was not identified at a higher rate than any other emotion, as is normally the case in macro-expression research. For the control group, a within-group analysis revealed that masking smiles containing traces of anger were only

correctly identified at a higher rate than masking smiles containing traces of disgust. These results are consistent with previous research on macro-expressions as anger is typically always recognized with higher accuracy than facial expressions of disgust. However, the results also showed that there was no significant difference between masking smiles containing traces of anger and those containing traces of sadness. Furthermore, masking smiles containing traces of anger had a significantly lower recognition rate than those containing traces of fear. Similar results were observed for the two experimental groups. For the first experimental group, a similar pattern was observed as masking smiles containing traces of anger were recognized at a lower rate than both masking smiles containing traces of fear and those containing traces of sadness. And finally, for the second experimental group, masking smiles containing traces of anger were recognized at a lower rate than those containing traces of fear, with no other significant differences present.

These results were unexpected given that the emotion of anger has been shown in many studies to be one of the most accurately recognized of all the emotions, other than happiness (Beaudry et al. 2014; Gosselin & Kirouac 1995; Gross & Ballif 1991; Matsumoto & Ekman 1989; Matsumoto & Hwang 2011; Smith & Schyns 2009; Tracy & Robins 2008). Furthermore, research on micro-expressions conducted by Perron et al. (2016) has shown that much like macro-expressions, angry masking smiles are typically recognized at a higher rate than all other masking smiles. However, in their study, Perron et al. (2016), showed that this was only the case for masking smiles containing traces of anger in the mouth, whereas masking smiles containing traces of anger in the brow were recognized at a much lower rate. More specifically, participants recognized masking smiles containing traces of anger in the brow at almost half the rate of masking smiles containing traces of anger in the mouth. This disparity between the recognition accuracy of masking smiles with traces of anger in the mouth, and masking smiles containing traces of anger

in the brow could serve as a possible explanation for the results of this study. In this study, both masking smiles were used interchangeably for the condition of smiles masking the emotion of anger. Therefore, it is possible that during the study, participants were able to correctly identify the masking smiles with traces of anger in the mouth but had more difficulty doing so with masking smiles containing traces of anger in the brow, which could account for the lower than expected accuracy rate.

Further analysis of the results also showed a response pattern regarding masking smiles containing traces of fear previously never seen in macro-expression research. An analysis revealed that masking smiles containing traces of fear were identified with higher accuracy than those containing traces of anger, disgust, and sadness in both the control group and the first experimental group. In the second experimental group, masking smiles containing traces of fear were identified at a higher rate than masking smiles containing traces of anger and sadness, but not those containing traces of disgust. As previously mentioned, these results are not in line with previous research conducted with macro expressions, which show that fear is typically the least accurately recognized emotion (Beaudry et al. 2014; Calvo & Lundvist 2008; Gosselin & Kirouac 19995; Gross & Ballif 1991; Matsuomoto & Ekman 1989; Matsuomoto & Hwang 2011; Smith & Schyns 2009; Tracy & Robins 2008). However, these results are similar to research on masking smiles conducted by Perron et al. 2016. In their study, participants were shown masking smiles containing traces of anger, disgust, fear, and sadness, and were asked to judge the authenticity, so whether the smiles were displaying genuine happiness. If participants judge the smiles as not authentic, they were asked if the smiles contained a trace of another emotion and if so, to identify the emotion present. The results showed that masking smiles containing traces of fear were more likely to be judged as not happy than those comprising traces of other negative emotions. Their results also

showed that participants were more accurate at determining that there was another emotion present when presented with a masking smile containing traces of fear. However, even though participants were able to recognize that another emotion was present, they were less accurate at recognizing fear as the masked emotion, which is in line with previous research conducted on macro-expressions.

According to psycho-evolutionist assumptions, facial expressions such as fear would have an adaptive value as they would allow an individual to react to any threats or dangers (Ohman & Mineka, 2001). Therefore, facial expressions containing traces of fear should have a high recognition accuracy across all research as it would be beneficial for individuals to be able to recognize these facial expressions. Our research as well as Perron et al., (2016) are in line with psycho-evolutionist assumptions and the fear module proposed by Ohman & Mineka (2001). This module stipulates that the brain processes fear stimuli preferentially compared to other external stimuli, and that brain activation is more sensitive to fear stimuli, which does not require voluntary attention or conscious stimulus processing. The results from this research along with research conducted by Perron et al. (2016) seem to indicate when it comes to the interpretation of masking smiles containing traces of negative emotions, fear is recognized at a higher rate than smiles containing traces of negative emotions such as anger, disgust, and sadness. Masking smiles containing traces of fear were also the only masking smiles that were recognized at an above-chance rate in all three groups. These results provide further evidence that the recognition patterns of masking smiles differ significantly from those of full facial expressions, and therefore could be influenced differently by emotional context scenes. Future research could explore this topic further to identify the mechanisms responsible for this pattern.

### 4.3. Limitations

The current study is not without limitations. Since this study was conducted among university students, the majority of whom were in the psychology department, there was not an even distribution of men and women among the participants. The lack of male representation in the sample makes running a gender-based analysis impossible. With that being said, previous studies have not reported any gender effects in the interpretation and the judgment of the authenticity of smiles (Frank, *et al.* 1993; Thibault *et al.* 2009, Perron *et al.* 2016). Therefore, there was no reason to suspect any gender differences in this study.

Another possible limitation to the study has do to with the methodology of the second experimental group. As mentioned above, as a result of the COVID19 pandemic, the second experimental group was not able to conduct the research project in the laboratory, such was the case with the first experimental group and the control group. Therefore, a modified version of the study was created to allow the researchers to conduct the research project over zoom, as opposed to in person. While this modification did not change the contents of the study in anyway, it could still serve as a possible limitation, as the delivery method of the research project was drastically changed for the second experimental group.

There were also a few limitations regarding the stimulus used for this study. Firstly, the masking smiles used for this study were simulated, that is to say, they were created in a laboratory with the help of a FACS (Facial Action Coding System) coder. Using this method, coders were brought into the laboratory and were told to perform specific facial movements with the correct intensity to produce smiles masking specific emotions. For example, to create a smile masking disgust, the encoders were instructed to activate the muscles to produce *Cheek Raiser* (AU6), *Nose Wrinkle* (AU9), and *Lip Corner Puller* (AU12). All encoders were told to activate these muscles

at a B or C intensity level (A being the lowest and E being the highest). While this method does have its advantages, such as creating consistent and symmetrical smiles for all the encoders, they do also have the disadvantage of not being authentic masking smiles, as they were not produced in the presence of genuine felt emotions. Therefore, it is difficult to interpret and generalize these results, as the masking smiles seen in your everyday life will most likely not be perfect images such as the ones used during this study.

Additionally, to make this study even more generalizable, videos of masking smiles would have been a preferred method. While the images used in this study do provide accurate representations of what authentic masking smiles would look like, they do not represent what masking smiles would look like if viewed in a natural environment. Individuals in everyday situations do not have the ability to view still images of masking smiles, and therefore do not have an endless amount of time to analyze and interpret them, such was the case in this study. Masking smiles and the micro-expressions that form them appear and disappear very quickly when viewed authentically in everyday situations. In their study, Porter & Brinke (2008) found that micro-expressions generally last upwards of a second, which makes using images difficult to generalize as they do not provide an accurate representation of what would be viewed by individuals in everyday situations.

Lastly, the images used from the International Affective Picture System could have served as a limitation for this study. More specifically, the images that were used to convey the emotions of anger and fear. As mentioned in the methodology, participants in the pilot study had to classify the images on a Likert scale from 0-5. The answer sheet contained 6 Likert scales corresponding to the emotions of happiness, sadness, anger, fear, disgust, and other. For a context image to get selected to be shown to the experimental group, they must have had an average score of 3 or higher

in one emotion (Anger, Disgust, Fear, and Sadness) and a score of less than 2 in every other emotion. This general design was based on a study conducted by Hess & Hareli (2018). These conditions were met for all the images selected meant to convey the emotions of sadness and disgust. However, for the images meant to convey the emotions of anger and fear, not all the images selected were able to meet these criteria. In the pilot study, very few images meant to convey anger and fear had an average score of 3 or more. Furthermore, the ones that did have a score of 3 or higher did not always have a score of less than 2 in every other emotion. Therefore, the criteria for the images in these emotional categories had to be modified to be included in the study. For the context images of anger and fear to be selected for the experimental portion of the study, all the images had to have the highest score in the category of the emotion they were meant to convey, and the score in that category had to be at least 0.5 or higher than all the scores of the other emotions. For example, for a context image meant to convey anger, if the score in the anger category was 2.5, it had to be the highest of all the scores, and no score could be above 2. A one-way ANOVA was conducted to ensure that there was a significant difference between the mean score of the target emotion and all the other emotions that participants in the pilot study were asked to score. The results showed that for context images meant to invoke anger, the means score for the emotion of anger was significantly higher than all the other emotions (Disgust, Fear, Sadness, Joy and Other). For context images meant to invoke the emotion of fear, the results showed that the means score for the emotion of fear was significantly higher than all the other emotions (Anger, Disgust, Sadness, Joy and Other). However, another precautionary measure was taken to ensure that the context images used in the study were valid.

To assure that the modifications of the selection criteria for the context images conveying anger and fear did not affect the validity of this research, a second experimental group was added to the study. As mentioned, in the second experimental group, participants were shown the context image accompanied by the name of the emotion that the context image was meant to convey. By comparing the results of the second experimental group to the first experimental group, we were able to determine whether the results of the first experimental group were caused by the context images used. The results showed that for masking smiles containing traces of fear, there were no significant differences between the control group, the first experimental group, and the second experimental group. Based on these results, the context images of fear did not seem to have any effect on the interpretation of the masking smiles. For smiles masking anger, the results showed that participants in the first experimental group were significantly worst at identifying these smiles when only presented with the context image. Therefore, based on these results it is possible that the context images meant to convey anger were not adequate, and could have confused the participants of the study. One possible explanation for why context images meant to convey anger and fear had lower scores than those conveying disgust and sadness could lie in the subjective nature of how these emotions are interpreted. As previously discussed, the lack of high scores in the anger category could lie in the concept of moral disgust. Many of the context images meant to elicit an emotional reaction of anger could be considered immoral behaviors, such as violence towards women and anti-Semitism, and could therefore have been interpreted as moral disgust as opposed to anger. Therefore, the misinterpretation of the context images could have influenced the results of this research.

#### 4.4. Future Research

This research project has opened the door to several future possible research projects. The research in the field of masking smiles and micro-expressions is lacking, and research regarding the influence of context on these facial expressions is further lacking. Based on the results of the study, future research could further explore the effect of context on the interpretation of masking smiles by exploring different types of context scenes. Future research could explore the influence of contexts such as body language, tone of voice, and verbal context, or future research could further explore the use of context scenes. In future research projects, instead of using still images for context scenes, one could explore the effects of dynamic context scenes, such as short video clips or moving images. As mentioned in the limitations section, future research could also explore the use of authentic smiles as opposed to smiles that were created in the laboratory. Doing so would create authentic smiles that more closely resemble what participants would witness in their everyday lives. Using dynamic smiles, that is to say, videos of people exhibiting smiles would take this research project one step further by allowing the results to be generalized to individual's everyday lives. Furthermore, it would allow researchers to get a greater understanding of how different forms of context can have an influence on the interpretation of these smiles. Finally, given that research in this field is lacking, and many future projects will be conducting exploratory research, future projects could look at having gender-balanced groups, which would allow researchers to determine if there does, in fact, exist gender differences in the interpretation of masking smiles and how different forms of context can influence this process.

## 5. Conclusion

The goal of the present research project was to gain a better understanding of how visual context scenes can affect the interpretation of smiles masking negative emotions. Past research has shown that different types of contexts can have an influence on how macro-expressions are interpreted, but little research has been conducted on masking smiles and how different contexts can affect their interpretation. The theory of emotion seeds provided a good background for how context could have influenced the judgment of masking smiles, in the same way, that they affect the interpretation of macro-expressions. However, the results of the study indicate that the context scenes did not have a major effect on the accuracy rate of participants judging masking smiles. Furthermore, the response patterns of the participants differed significantly from the large body of research on macro-expressions and more closely resembled the results of Perron et al. (2016), whose research focused specifically on the interpretation of masking smiles. The main conclusion from this study is that context scenes do not seem to affect masking smiles in the same manner as they do macro-expressions. Future research should explore this area of study more in-depth to gain a better understanding of the processes that affect how masking smiles are interpreted, and more specifically, how different forms of context can have an effect on the judgment of smiles masking negative emotions.

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## **Appendices**

## Appendix A

Please rate the level of emotion that each image makes you feel on a scale of 0 to 5, with 0 being no emotion and 5 representing a very high level of emotion.

Image 1:

Anger 0 1 2 3 4 5

Sadness 0 1 2 3 4 5

Joy 0 1 2 3 4 5

Disgust 0 1 2 3 4 5

Fear 0 1 2 3 4 5

Other 0 1 2 3 4 5

Image 2:

Anger 0 1 2 3 4 5

Sadness 0 1 2 3 4 5

Joy 0 1 2 3 4 5

Disgust 0 1 2 3 4 5

Fear 0 1 2 3 4 5

Other 0 1 2 3 4 5

Image 3:

Anger 0 1 2 3 4 5

Sadness 0 1 2 3 4 5

Joy 0 1 2 3 4 5

Disgust 0 1 2 3 4 5

Fear 0 1 2 3 4 5

Other 0 1 2 3 4 5

Image 4:

Anger 0 1 2 3 4 5      Sadness 0 1 2 3 4 5      Joy 0 1 2 3 4 5

Disgust 0 1 2 3 4 5      Fear 0 1 2 3 4 5      Other 0 1 2 3 4 5

Image 5:

Anger 0 1 2 3 4 5      Sadness 0 1 2 3 4 5      Joy 0 1 2 3 4 5

Disgust 0 1 2 3 4 5      Fear 0 1 2 3 4 5      Other 0 1 2 3 4 5

.....  
Image 121:

Anger 0 1 2 3 4 5      Sadness 0 1 2 3 4 5      Joy 0 1 2 3 4 5

Disgust 0 1 2 3 4 5      Fear 0 1 2 3 4 5      Other 0 1 2 3 4 5

## Appendix B



### INFORMED CONSENT FORM FOR PARTICIPATION IN A RESEARCH PROJECT

Project title: Judgment of the authenticity of smiles

I, \_\_\_\_\_, (write your name in capital letters) consent to participate in this study.

I understand that:

1. This project aims to examine the perception of emotional scenes
2. I was clearly informed of the general conditions prevailing in this experiment. During this experiment, my task will be to watch slides with emotional scenes. I will have to choose the emotion that best represents the scene.
3. The experimental session will be approximately 45-60 minutes long and will take place in the cognitive health research laboratory.
4. I know that it is possible that I feel tired but I will be able to take breaks according to my needs.
5. I will be able to withdraw from the experiment at any time without any prejudice or punishment.
6. Any information obtained in this study will be treated strictly anonymously and confidentially. My identity will not be revealed. All electronic documents will be kept confidentially at the Cognitive Health Laboratory at (E-228 Alphonse-Raymond Building) at Laurentian University.
7. Each participant will be assigned a numeric code so that they can not be identified. The results will be kept in the cognitive health research laboratory. The documents allowing the identification of the participants will be destroyed after 5 years.
8. My participation is not associated with financial rewards or penalties. A bonus points will be rewarded for my psychology class if I need it.
9. Participation in this research project has potential benefits. In particular, it will make it possible to participate in scientific research. In addition, the information provided that will be provided following the study will help you better understand the judgment of the authenticity of smiles. The scientific community will also benefit from a better understanding of this type of judgment.

I understand the information related to this research project. I understand that I can ask questions in the future and that I can at any time end my participation without having to justify myself in any way whatsoever. I hereby consent to participate in this research project under the conditions just specified.

If I am concerned about the progress of my participation or would like to make a complaint, I can contact Mélanie Perron, Ph.D at (705) 675-1151 ext. 4010 ([mperron@laurentian.ca](mailto:mperron@laurentian.ca)).

You may also contact a person who is not associated with current research regarding possible ethical issues or complaints regarding this research at 705-675-1151 ext. 2436, or toll-free at 1-800-461-4030, or by email [psycrb@laurentian.ca](mailto:psycrb@laurentian.ca).

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Signature of the participant Date

I certify that I have explained to the signatory the terms of this form, the objectives and implications of the research project, have clearly answered his questions and have indicated to him that he or she remains at all times free to terminate the participation to the described project without having to justify any way whatsoever.

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Zacharie Gagné  
Student in Psychology

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Mélanie Perron, Ph.D  
Department of Psychology  
Laurentian University

## **Appendix C**

Hello, my name is \_\_\_\_\_ and I will be conducting the study today.

I would like to begin by having you read the consent form before you. Once you have read and feel comfortable, print your name and sign it.

So I'm going to start by explaining to you the study you're going to do today. Your task will be to evaluate emotional scenes that will be presented on the screen in front of you. In total, 121 different scenes will be presented on the screen. Each scene will be presented for a total of 20 seconds. During these 20 seconds, you have to fill the answer sheet that is in front of you. As you can see, the document contains 121 places where you can indicate to what extent each emotion corresponds to the emotional scene that will be presented on the screen. Each emotion is associated with a scale of 0 to 5. If the scene does not correspond to an emotion that you feel, a score of 0 should be indicated. If the emotion that you feel corresponds a lot to the emotional scene, a score of 5 should be given. It is important to circle one answer for each of the 6 answers on the page. For example, if you associate an emotional scene with joy and only with joy, you would indicate to what extent this scene makes you feel this emotion on a scale of 1 to 5, 1 being very little and 5 being a lot. But you would also indicate next to each other emotion that it does not match the emotional scene at all by circling 0. So you would give a score between 1 and 5 for joy and 0 for each other emotion. It is also possible that a scene corresponds to several emotions. For example, you can associate a scene with anger and sadness. In this case, you will give a score between 1 and 5 for anger and sadness and a score of 0 for each of the other emotions.

It is important to mention that some scenes that will be presented are very graphic. If someone has problems with scenes containing blood, serious injuries and mutilations, do not hesitate to leave immediately or at any time during the study.

Do you have questions about the document in front of you and the emotional scenes that will be presented?

Thank you for participating!

## Appendix D



## Appendix E



### CONSENT FORM FOR PARTICIPATION IN A RESEARCH PROJECT

**Project title:** The influence of emotional scenes on judging the authenticity of masking smiles.

I, \_\_\_\_\_, (write your name in capital letters) agree to participate in this study.

I understand that:

1. The purpose of this project is to examine the judgment of the authenticity of masking smiles. A masking smile is a smile used to hide a negative emotion. Therefore, a masking smile could be used to mask emotions such as anger, sadness, disgust and fear.
2. I was clearly informed of the general conditions prevailing in this experience. During this experience, my task will be to view slides containing the names of basic emotions accompanied by a context image. I should choose the smile that best represents that of someone trying to hide the emotion in question.
3. Some of the images shown depict some graphic content. I understand that these images might cause come discomfort, and that I can withdraw at any time as a result.
4. The experimentation session will last approximately 25-30 minutes and will take place over Zoom.
5. I know that I may feel tired, but I can take breaks as needed.
6. I can withdraw from the experience at any time without any prejudice or punishment.
7. All information obtained in this study will be treated in a strictly anonymous and confidential manner. My identity will not be revealed. All electronic documents will be kept confidential at the Cognitive Health Laboratory at Laurentian University (E-228 Alphonse-Raymond).
8. Each participant will be assigned a numeric code so that they cannot be identified. The results will be kept in the cognitive health research laboratory. The documents allowing the identification of the participants will be destroyed after 5 years.
9. My participation is not associated with financial rewards or penalties. A bonus point will be rewarded for my psychology class if I need it.
10. Participation in this research project has potential benefits. In particular, it will enable participation in scientific research. In addition, the information that will be provided at the end of

the study will allow you to better understand the judgment of the authenticity of smiles. The scientific community will also benefit from a better understanding of this type of judgment.

11.I understand that I have the right to withdraw from this study at any time, and if I chose to do so, all data collected will be deleted from the database and eliminated from the study.

**I understand the information relating to this research project. I understand that I can ask questions in the future and that I can end my participation at any time without having to justify myself in any way. I hereby consent to my participation in this research project under the conditions which have just been specified.**

**If I am worried about the progress of my participation or I wish to make a complaint, I can contact Mélanie Perron, Ph.D. at (705) 675-1151 ext. 4010 ([mperron@laurentienne.ca](mailto:mperron@laurentienne.ca)).**

**You can also contact a person who is not associated with the current research regarding possible ethical questions or complaints regarding this research at 705-675-1151 ext. 2436, or toll-free at 1-800-461-4030, or you can contact the Research Ethics Officer, Laurentian University Research Office at [ethics@laurentian.ca](mailto:ethics@laurentian.ca).**

---

Signature of participant

---

Date

**I certify that I have explained to the signatory the terms of this form, the objectives and the implications of the research project, that I have answered his questions clearly and that he has indicated that he or she remains free to terminate participation at any time. to the project described without having to justify himself in any way whatsoever.**

---

**Zacharie Gagné**  
Graduate student in Psychology  
[zgagne@laurentian.ca](mailto:zgagne@laurentian.ca)

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**Mélanie Perron, Ph.D**  
Department of Psychology  
Laurentian University  
Sudbury, ON  
P3E 2C6  
[mperron@laurentienne.ca](mailto:mperron@laurentienne.ca)

## Appendix E

### **Demographic and descriptive information**

Please complete the following document. You are under no obligation to answer questions that make you uncomfortable.

1) **Age:** \_\_\_\_\_ (years)

2) **Sex:** \_\_\_\_\_

3) **Your marital status (only chose one) :**

- |                       |                  |
|-----------------------|------------------|
| 1. Married            | 4. Widowed       |
| 2. Divorced/Seperated | 5. Never married |
| 3. Remarried          | 6. Other _____   |

4) **Your race/ethnicity (as defined by statistics Canada)**

Circle an option:

1. Asian
2. Arabe
3. Black
4. Latino
5. Indigenous/First Nations
6. White
7. Other

5) **What is your highest degree completed (circle one)**

BSc.            MA            MSc            PhD            MD

IA            BScI    MScI    Other: \_\_\_\_\_

## Appendix F



**Laurentian University**  
**Université Laurentienne**

### **PROCEDURAL SCRIPT**

**Project Title:** The Influence of Emotional Context Scenes on the Interpretation of Masking Smiles

#### **Introducing the Study & Consent Form**

We are going to start by reviewing the consent form with you, which will outline what we are doing today.

In this study, we are interested in your interpretation of smiles that aim to mask negative emotions. In everyday life we can smile if we really feel joy. For example, a person has just learned that they have landed the job they wanted. This person is really happy and expresses a smile.

However, in other contexts, we are exposed to situations that can make us feel rather negative emotions, but which we do not want to express in front of others. For example, a person may be sad to have lost their job but would still smile. They may express a smile in this situation so as not to show others how they are feeling and protect their vulnerabilities.

People may also feel angry at work because they have not received the promotion they thought they deserved. They could express a smile in this situation so as not to hurt the feelings of their colleague who had been promoted.

In this study, you will be exposed to the names of negative emotions. Your task will be, for each name of a negative emotion, to determine the type of smile that might be expressed by someone trying to conceal the negative emotion. In scientific work, it seems that when people smile to hide a negative emotion, there may be traces of the negative emotion that is expressed in their facial expression. Your task will therefore be to choose the smile that best represents the type of smile that a person could have if they wanted to conceal a negative emotion.

#### **Introducing the Task**

The study will begin with the presentation of the name of a negative emotion projected on the screen in front of you. You can view this screen for as long as you like. Then the next slide will show 4 images of smiles with traces of negative emotions. Your task will be to choose the smile that most closely matches the smile a person would express if they were to mask the negative emotion experienced on the screen previously presented. After making your choice, you can click on the smile that corresponds to your choice. After clicking on the smile of your choice, the name of another negative emotion will be presented to you. This will be repeated for a total of 24 trials.

### **Background & Demographic Questionnaire**

That is all the video clips, thank you for participating. Before you leave, we would like you to complete a background & demographic questionnaire. We are asking a few questions about you so we can better understand if certain characteristics influence accuracy in judging expressions of pain. All this information is kept private and anonymous. If you have any questions, please ask me at any point while completing the questionnaire.

*Participant completes demographic questionnaire.*

### **Debriefing Script**

As previously mentioned, the goal of this study was to determine the role of context on the interpretation of masking smiles. You were asked to view a variety of different emotion names and determine which masking smile corresponded best to the emotion presented to you. If you have any concerns regarding the study do not hesitate to contact 705-675-1151 ext. 2436, or toll-free at 1-800-461-4030, or by email [psycreb@laurentian.ca](mailto:psycreb@laurentian.ca).

Do you have any final questions or concerns?

Thank you for participating in our study, we really appreciate it. Have a great day!

### **End**

## Appendix H



### **PROCEDURAL SCRIPT**

**Project Title:** The Influence of Emotional Context Scenes on the Interpretation of Masking Smiles

#### **Introducing the Study & Consent Form**

We are going to start by reviewing the consent form with you, which will outline what we are doing today.

In this study, we are interested in your interpretation of emotional scenes and smiles that aim to mask negative emotions. In everyday life we can smile if we really feel joy. For example, a person has just learned that they have landed the job they wanted. This person is really happy and expresses a smile.

However, in other contexts, we are exposed to situations that can make us feel rather negative emotions, but which we do not want to express in front of others. For example, a person may be sad to have lost their job but would still smile. They may express a smile in this situation so as not to show others how they are feeling and protect their vulnerabilities.

People may also feel angry at work because they have not received the promotion they thought they deserved. They could express a smile in this situation so as not to hurt the feelings of their colleague who had been promoted.

In this study, you will be exposed to scenes that can arouse negative emotions. Your task will be, for each scene, to determine the type of smile that might be expressed by someone trying to conceal the negative emotion. In scientific work, it seems that when people smile to hide a negative emotion, there may be traces of the negative emotion that is expressed in their facial expression. Your task will therefore be to choose the smile that best represents the type of smile that a person could have if they wanted to conceal a negative emotion.

#### **Introducing the Task**

The study will begin with the presentation of emotional scenes projected on the screen in front of you. You can view this image for as long as you like. Then the next slide will show 4 images of smiles with traces of negative emotions. Your task will be to choose

the smile that most closely matches the smile a person would express if they were to mask the negative emotion experienced in the scene previously presented. After making your choice, you can click on the smile that corresponds to your choice. Then a question will appear on the next slide. You will be asked to identify the emotion evoked by the emotional scene you saw. You will have the opportunity to choose from the following emotions or to indicate another emotion of your choice: anger, fear, sadness, disgust, other (\_\_\_\_\_). After answering this question, a new emotional scene will be presented and the same questions will be asked for them 24 trials.

### **Background & Demographic Questionnaire**

That is all the video clips, thank you for participating. Before you leave, we would like you to complete a background & demographic questionnaire. We are asking a few questions about you so we can better understand if certain characteristics influence accuracy in judging expressions of pain. All this information is kept private and anonymous. If you have any questions, please ask me at any point while completing the questionnaire.

*Participant completes demographic questionnaire.*

### **Debriefing Script**

As previously mentioned, the goal of this study was the determine the role of context on the interpretation of masking smiles. You were asked to view a variety of different context images and determine which masking smile corresponded best to the emotion expressed in the scene. Some of the scenes you have just witnessed may have contained contents that some people might find disturbing. Therefore, if you have any concerns do not hesitate to contact 705-675-1151 ext. 2436, or toll-free at 1-800-461-4030, or by email [psycreb@laurentian.ca](mailto:psycreb@laurentian.ca).

Do you have any final questions or concerns?

Thank you for participating in our study, we really appreciate it. Have a great day!

**End**

## Appendix I



### **PROCEDURAL SCRIPT**

**Project Title:** The Influence of Emotional Context Scenes on the Interpretation of Masking Smiles

#### **Introducing the Study & Consent Form**

We are going to start by reviewing the consent form with you, which will outline what we are doing today.

In this study, we are interested in your interpretation of emotional scenes and smiles that aim to mask negative emotions. In everyday life we can smile if we really feel joy. For example, a person has just learned that they have landed the job they wanted. This person is really happy and expresses a smile.

However, in other contexts, we are exposed to situations that can make us feel rather negative emotions, but which we do not want to express in front of others. For example, a person may be sad to have lost their job but would still smile. They may express a smile in this situation so as not to show others how they are feeling and protect their vulnerabilities.

People may also feel angry at work because they have not received the promotion they thought they deserved. They could express a smile in this situation so as not to hurt the feelings of their colleague who had been promoted.

In this study, you will be exposed to scenes that can arouse negative emotions. Your task will be, for each scene, to determine the type of smile that might be expressed by someone trying to conceal the negative emotion. In scientific work, it seems that when people smile to hide a negative emotion, there may be traces of the negative emotion that is expressed in their facial expression. Your task will therefore be to choose the smile that best represents the type of smile that a person could have if they wanted to conceal a negative emotion.

#### **Introducing the Task**

The study will begin with the presentation of emotional scenes projected on the screen in front of you. These emotional scenes will be accompanied by the name of the emotion that the scene is meant to invoke. You can view this image for as long as you like. Once

you are ready to proceed, just inform the examiner and he will proceed to the next slide. Then the next slide will show 4 images of smiles with traces of negative emotions. Your task will be to choose the smile that most closely matches the smile a person would express if they were to mask the negative emotion experienced in the scene, and indicated below the image previously presented. After making your choice, you can verbalize your response (for example, top left, top right etc) of the smile that corresponds to your choice. Once you have chosen the smile, a new emotional scene will be presented and the same questions will be asked for them 24 trials.

### **Background & Demographic Questionnaire**

That is all the video clips, thank you for participating. Before you leave, we would like you to complete a background & demographic questionnaire. We are asking a few questions about you so we can better understand if certain characteristics influence accuracy in judging expressions of pain. All this information is kept private and anonymous. If you have any questions, please ask me at any point while completing the questionnaire.

*Participant completes demographic questionnaire.*

### **Debriefing Script**

As previously mentioned, the goal of this study was the determine the role of context on the interpretation of masking smiles. You were asked to view a variety of different context images and determine which masking smile corresponded best to the emotion expressed in the scene. Some of the scenes you have just witnessed may have contained contents that some people might find disturbing. Therefore, if you have any concerns do not hesitate to contact 705-675-1151 ext. 2436, or toll-free at 1-800-461-4030, or by email [psycreb@laurentian.ca](mailto:psycreb@laurentian.ca).

Do you have any final questions or concerns?

Thank you for participating in our study, we really appreciate it. Have a great day!

**End**