Understanding Caregivers' Accuracy in Facial Expressions of Pain in Children: An Eye Tracking Study

by

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Abstract

Facial expressions of pain indicate that you are in need of attention. Previous studies have shown that caregivers have difficulty distinguishing genuine, suppressed, and fake pain in children. The current study examined parents' and nurses' ability to recognize pain expressions in children while their eye-movements were tracked, to understand their accuracy and identify strategies to improve. Results did not show differences between caregiver groups, however there was an effect of expression type. Participants were more accurate for suppressed than genuine expressions and more for genuine than fake expressions. Results from eye movement patterns offer information on how to improve on recognition accuracy. For genuine and suppressed expressions, participants must attend to the eye zone longer and faster to increase accuracy. For fake expressions, the mouth zone needs more attention to increase accuracy, also the faster participants looked at the mouth, the higher their accuracy for fake expressions.

Key words: Pain expressions, caregivers, children, eye-tracking

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Understanding Health Professionals' Accuracy in Detecting Deception in Facial Expressions of Pain in Children: An Eye Tracking Study

The human face reveals important information to others in social communication. Amongst other things, it displays our identity, gender, and emotional facial expressions (Ekman, 1993). In effect, facial expressions provide communicative social cues to other people, in order to allow them to react appropriately to a given situation (Williams, 2002). For instance, expressions of pain signify to others that you are in need of attention or care (Craig, Versloot, Goubert, Vervoort, & Crombez, 2010; Goubert, 2005). If this expression results in receiving help when in pain, then the production of this expression is an adaptive function that is valuable. Consequently, the ability to express and recognize pain would be beneficial since we are unable to directly know when another person is experiencing pain. The current study will analyze parents' and nurses' ability to accurately recognize genuine, fake, and suppressed facial expressions of pain in children. More precisely, the purpose of this study is to build on previous work (Larochette and colleagues, 2006) with the addition of eye-tracking technology in order to better understand perceptual and attentional processes involved when detecting pain expressions. Larochette et al. (2006) found that parents were able to correctly identify each of the pain conditions more frequently than expected by chance. The parents were successful at detecting fake pain, but had more difficulty differentiating the other conditions. However, doctors had the most difficulty at this task, whereas nurses were the most accurate and parents did not differ significantly from either. Although for each of the caregiver groups this task was difficult, all performed around chance level. There is little research on the underlying mechanisms understanding why this task is so difficult and what can be done to improve at this task. The current study will implement the use of eye-tracking technology which will allow to further

investigation how differences between caregiver groups abilities' in the processing of pain expressions in children occur and why this task is difficult overall. Finally, the current study uses eye-tracking to test the perceptual-attentional limitation hypothesis (Perron & Roy-Charland, 2013; Roy-Charland, Perron, Beaudry, & Eady, 2014; Roy-Charland, Perron, Young, Boulard, & Chamberland, 2015) in order to better understand errors in detecting pain expressions and why they occur. This hypothesis purposes that if there are errors in recognition of pain expressions, it could be due to difficulty in perceiving the subtle differences in pain expressions or a lack of attention to the cues on the face that lead to accurate recognition.

Production of Pain Expressions

Several researchers have induced pain in participants in order to record their facial expressions allowing for analysis of pain expressions as they naturally occur (Craig, & Patrick, 1985; Boerner, Chambers, Craig, Riddell, & Parker, 2013). Analyzed with the Facial Action Coding System (FACS) (Ekman, Friesen, & Hager, 2002), the genuine expression of pain has been found to typically involve the display of cheeks raised with lids tight, upper lip raised, corner lip pulled, lips part, jaw drooped with mouth stretched, and eyes closed-blinking (Craig, & Patrick, 1985; Williams, 2002). These findings are consistent across adults and children. Studies have found that the pain of surgery and immunizations in children has been associated with cheek raising, vertical mouth stretching, brow lowering, squinting, nose wrinkling and eye squeezing, which are consistent with expressions of adult pain (Gilbert, Lilley, Craig, McGrath, Bennett, & Montgomery, 1999; Breau, McGrath, Craig, Santor, Cassidy, Reid, 2001). However, not all of these expressions are displayed in each painful situation. The expression of pain is unique and varies in how it is displayed depending on the individual and the intensity of the pain (LeResche & Dworkin 1988; Prkachin & Mercer 1989). The current thesis focused on Ekman's

theories of emotions and his system to code facial expressions of emotions. However, we are conscious the fact the not all authors view emotions and facial expressions in this way and that other theories of emotions might explain the literature differently (e.g. Smith, A., C., & Scott, H., 1997).

As for facial expressions of other emotions, in response to pain, human expressions occur naturally and automatically, but we are also capable of masking them, neutralizing them, suppressing them, faking them, moderating them and simulating them (Ekman & Friesen, 2003; Larochette, Chambers, & Craig, 2006). For example, suppressing an expression would occur when the natural expression is controlled to be displayed less intense visually, whereas faking an expression would occur when an expression is displayed but not actually naturally felt. While there are various reasons why one would fake pain, such as for personal gain (for example a legal outcome or compensation) (Craig & Hill, 1999), research has shown that the authentic display of pain seems to differs from the display of fake pain. Fake facial expressions of pain have been found to have a delayed onset and appear for a longer duration than natural pain expressions (Ekman & Friesen, 1982). The movement of fake pain also appear separately in time, such as changes in brow movement followed by changes in eye tightening, as compared to natural pain expressions that are typically displayed at once, grouped together in time (Lee & Craig, 1986). Hill & Craig (2002) also found that fake pain expressions differ in their frequency and intensity compared to natural pain expressions. For example, they found that brow lowering and opening of the mouth occurred more frequently and for a longer duration in fake expressions than they did in natural pain expressions. Another aspect of fake pain expressions was that facial actions unrelated to pain expressions, such as brow raising, arise while we fake pain expressions (Hill & Craig, 2002). Research has also shown that fake pain expression may contain features of other

expressions along with them such as shame, or guilt (Hager & Ekman, 1985). This may suggest that people have a difficult time reconstructing the authentic expression of pain and suppressing the expressions from the felt ones.

Recognition of Pain Expressions

Being able to accurately recognize genuine pain expressions is necessary in order to be able to aid in the suffering of others (Prkachin, 1986). The ability to recognize pain accurately becomes an important skill for caregivers. Caregivers, like parents and nurses, consistently are met with situations in which they must interpret the pain of those for whom they care (Prkachin, Solomon, & Ross, 2007; Riddell, & Craig, 2007). When working with children, it might be important to be able to perceive pain expressions accurately due to the possibility that the child is unable to verbally state that they are in pain or because, like adults, they could be faking, masking or suppressing it (Singer, Gulla, & Thode, 2002; Boerner, Chambers, Craig, Riddell, & Parker, 2013).

Regardless of caregiver role, all caregivers deal with situations in which they must analyze and react to pain expressions in children. Although it is important for caregivers to recognize pain expressions, research on caregiver's ability to accurately assess pain has found that they are not particularly successful at recognizing authentic pain expressions (Prkachin & Craig, 1994). However, research also suggests that caregivers may show different patterns of results based on the different relationships with the children they are surrounded by, as well as varying time spent with those children. These variables may influence how accurate they are in recognizing pain expressions in children (Boerner et al. 2013). For instance, parents, unlike health care professionals, do not receive any training on how to recognize pain expressions in their children (Pillai, Lilley, & Craig, 2004). Parents must learn to recognize pain in their

children by consistently having time to interact with their children, learn how their children react in a variety of different contexts and understand their children's character. This amount of personal time with their child allows for a deeper understanding of the expressions that their infant would use to communicate pain (Emde, 1993).

Unlike parents, health care professionals do receive training on pain recognition but are accessing multiple patients a day, which may lead to differences in how they perceive pain in comparison to parents (Riddell, & Craig, 2007). Their training and medical knowledge might lead to different approaches in assessing children's pain. Moreover, differences between health professionals and parents pain recognition may also emerge as a function of their experience. For example, a parent only is assessing the pain and care of their children when they experience pain whereas a nurse will be surrounded by multiple children a day who could be experiencing various levels of pain. Furthermore, in comparing nurses and doctors, the demands of a doctor typically consist of spending less time with an individual child than a nurse or parent would, but in turn would deal with the more children in comparison to nurses and parents (Huth & More, 1998). Whereas, nurses would fall in between parents and doctors in terms of time spent with an individual child and how that relates to their ability to recognize pain in children. Nurses would have to react and assess more instances of pain expressions in children than parents, but not more than doctors. Nurses would also spend more one-on-one time with a child than doctors, but not more than parents (Huth & More, 1998). Also, doctors typically prescribe pain medication leaving the responsibility to nurses to monitor pain levels accordingly (Broome, & Slack, 1990; Jacob & Puntillo, 1999)

Riddell and Craig (2007) examined whether infant pain displayed during their immunizations would be recognized and identified differently based on caregiver groups. They

found that pediatricians accurately recognized pain significantly less than parents. They also discovered that nurses' ability to recognize pain expressions in children fell between parents and doctors, but were not significantly different than either of the groups. Thus, parents recognize pain more accurately than nurses, and nurses more than doctors. However, unlike Riddell and Craig's (2007) results on nurse's accuracy in pain recognition, Boerner et al. (2013) found that nurses were the only caregiver group to perform significantly better at recognizing genuine pain expressions. This study examined parents, nurses' and doctors' ability to assess genuine pain, fake pain, and suppressed pain. Nurses had the highest accuracy in their overall scores in comparison to parents and doctors, who did not differ from each other. However, nurses' recognized genuine pain better than parents, which is contrary to previous studies that found parents to be more accurate at detecting children's genuine pain expressions than health care professionals (Schneider, & LoBiondo-Wood, 1992; Singer, Gulla, & Thode, 2002). Thus, research has found differing results as to who better recognizes pain in children most accurately, parents or nurses. Although nurses did recognize genuine pain more accurately than parents or doctors, all caregivers were able to accurately recognize fake and suppressed pain expressions slightly above chance level (Boerner et al. 2013). This finding is consistent with previous research that has found children's fake pain expressions to be exaggerated causing them to be more accurately detected as fake by all caregiver groups (Larochette, Chambers, & Craig, 2006).

Boerner et al. (2013) found that all caregivers, parents, nurses, and doctors, had a difficult time distinguishing genuine expressions of pain from fake, or suppressed pain expressions. However, differences in pain recognition ability were found to vary across caregiver roles. For instance, research has found that when parents do not accurately recognize genuine pain, they typically underestimate children's pain (Chambers et al.1998). Parents were also more likely to

estimate children's pain when more action units of pain were displayed as well as when the parent's catastrophized more about their child's pain (Goubert, Vervoort, Sullivan, Verhoeven, & Crombez, 2008; Goubert, Vervoort, Cano, & Crombez, 2009). Thus, children's pain estimation may be harder to recognize and react appropriately to if they display less action units of pain and if their parents rationalize or underestimate their child's pain.

Although there are differences in caregivers' ability to recognize pain in children, none of the groups discussed are very accurate in recognizing pain. Kappesser & Williams (2002) found that health care professional's recognition of pain was only somewhat above chance at 58% accuracy. The Boerner, et. al. (2013) study found that all caregiver's underestimated pain in approximately half of the situations when viewing genuine and suppressed expressions. Thus, children who are experiencing pain are at risk for having their pain underestimated by those who are caring for them, whether a parent, nurse or doctor. The goal of the current study is to better understand why caregivers perform poorly at this type of task. By examining the perceptual and attentional mechanisms involved in recognizing pain expressions in children it will be possible to further understand this difficulty and begin to develop strategies for improvement.

Perceptual-Attentional Limitation Hypothesis

In order to determine why there are errors in recognition of pain expressions, the current study will be using eye-tracking to test the perceptual-attentional limitation hypothesis. This hypothesis proposes that the difficulties in recognition of different pain expressions could be due to difficulties perceiving subtle changes in facial expressions or a lack of attention to the areas of the face that cue in the genuineness, or lack thereof of, in pain expressions. The perceptual-attentional limitation hypothesis is a plausible explanation as to why there are difficulties in recognizing authentic from non-authentic pain expressions due to their similarity in how they are

displayed. For example, Hill and Craig (2002) observed that real and fake pain expressions were very similar, with pain expressions differing due to additional pain and non-pain related activation of muscles, and longer peak intensities as well as duration than authentic expressions of pain. Thus, eye-tracking will allow the observation of scanning patterns of the authentic and non-authentic pain expressions to document whether participants focus their attention on the relevant cues or not, and whether scanning pattern can predict accuracy.

Current Study

The goal of the current study is to examine parents' and nurses' abilities in recognizing genuine, faked and suppressed pain expression in children, similarly as Larochette et al. (2006) and Boerner et. al. (2013), but with the additional element of eye-tracking, in order to understand the mechanisms behind accuracy and errors in judgement. Since the current study will focus on the mechanisms related to accuracy and inaccuracy in pain recognition, the two most successful caregiver groups will have their eye-movements analyzed to determine where they are viewing on the face when making correct and incorrect decisions. This study will also assess their confidence in their answers as well as where they are looking on the children's faces through the use of eye-tracking. The purpose of this study is to (a) create stimuli of a younger group of children who are experiencing genuine, suppressed, and faked pain through a cold pressor task (b) further understand how accurate parents and nurses are at detecting pain when children are genuinely experiencing pain, faking, and suppressing expressions of pain, based on their facial expressions, (c) how parents and nurses differ from each other in pain recognition, (d) whether confidence in their judgments of facial expressions are related to their accuracy, and (e) what specific facial expressions parents and nurses use when judging between genuine and deceptive facial expressions of pain (f) the link between facial exploration and accuracy.

It is hypothesized that there will be significant differences between parents and nurses' judgements of pain expressions, with nurses being more accurate than parents. Parents and nurses have been found to have different assessments of infant pain (Riddell & Craig, 2007; Riddell et al. 2008). It is expected that both caregivers will be capable of recognizing fake expressions of pain (Boerner et al. 2013; Larochette, Chambers, & Craig, 2006). It is hypothesized that parents' ratings of pain will be higher than the nurses, as parents have been shown to have greater sensitivity to expressions of children's pain than health professionals, yet they will be less accurate at detecting the pain conditions than the nurses arhat Riddell and Craig (2007) supports this difference even in parents that were observing children that were not their own. The accuracy will be consistent with their ratings of confidence in their decisions to detect pain in each of three conditions (for genuine, suppressed and fake), as seen in previous literature (Hadjistavropoulos et al. 1996; Kappesser & Williams, 2002). Also, it is hypothesized that all participants will perform slightly better than chance in accurately recognizing all conditions combined (Hadjistavropoulos et al. 1996).

As for eye-tracking, to the best of our knowledge, no studies have looked at recognition of pain expressions with the use of this technology. Roy-Charland et al. (2014; 2015) found support for the perceptual-attentional hypothesis in the confusion between fear and surprise. Fear and surprise are commonly mistaken for each other when individuals are asked to identify which emotion is present. The confusion between fear and surprise occurs as a result of their many similarities in muscle activations. More precisely, participants were more accurate in distinguishing expressions of fear from those of surprise when appearance changes between them were greater and when participants spent time in the appropriate location of distinct cues. Thus, the current study hypothesizes that errors in recognizing facial expressions of pain could be

accounted for by difficulties in noticing subtle changes in expressions or the lack of attention to these cues while viewing authentic or unauthentic pain. If there are differences in caregiver groups' eye-tracking, observations will allow for a better understanding of groups differences in accuracy.

Methods

Participants

A total of 31 individuals were recruited to participate in this study. There were 15 parents and 16 nurses, whom completed the same task. Only participants with normal or corrected to normal vision were able to take part due to the visual nature of the task, in addition to the use of eye-tracking technology, which cannot be used correctly otherwise.

Recruitment of parents and nurses was conducted through public advertising and the gathering of lab members through word of mouth. Eligibility for participation was determined on the basis of their children's age, familiarity (or lack thereof) with the cold pressor task, as well as professional and educational background. More specifically, only parents with at least one child aged 4 to 10 years were used for participation in order to guarantee sufficient experience with the age group of those children appearing in the video stimuli. Finally, to maintain a clear distinction between groups of caregivers, parents were only considered eligible if they have never received medical training and do not currently work as healthcare professionals (Boerner et al. 2013). Additionally, only individuals currently working as nurses were asked to take part in the study.

Materials

Dynamic facial expressions of pain.

The dynamic facial expressions of pain used in this study were created following similar procedure as the stimuli used by Boerner and colleagues (2013) and Larochette and collegues

(2006), through the use of a cold pressor task to induce pain, however with younger children (ages 4-10 years old). The video stimuli consisted of 21 video clips that were displayed 3 times each, totaling to sixty-three video trials that each participant viewed. The clips consisted of 7 different children, four girls (*M*= 6.75 years old) and three boys (*M*= 8.6 years old) who each displayed expressions of genuine, suppressed and fake pain. Each child produced three distinct expressions constituting the three corresponding experimental conditions under consideration.

Cold pressor task.

Cold pressor apparatus.

The study used one 5-gallon fish tank as the cold pressor tank and one 2-gallon fish tank as the room temperature tank. Both of the tanks were equipped with a pump to circulate the water in to maintain a constant temperature. Both tanks were also equipped with a thermometer to further ensure that the cold tank was consistently at 7 °C (+/- 1°C) and the room temperature tank at 30 °C (+/- 1 °C). The cold water tank was used for both the genuine and suppressed conditions while the room temperature tank was used for the fake condition. The cold pressor task has been found to be a valid and ethically appropriate experimental stimulus for inducing clinically significant levels of pain in children across a number of pediatric studies (von Baeyer et al. 2005).

Digital video equipment.

Recording was done using a Sony HD Video Recording Handycam Camcorder set up on a stand directly in front of the child. Apple iMovie software was used to edit and trim each of the video clips to begin at the onset of the expression and be 20 seconds each in length.

Recording procedure.

Parents and children provided verbal and written consent before participating in the encoding study. The purpose of the study was explained to both the parent and child, describing that the child would be asked to display genuine, fake, and suppressed facial expressions while their hand was submerged in their cold or room temperature water. Children were told that they would video taped throughout the session and asked to hide their pain from their parents when in the suppressed pain condition.

The children were separated from their parents for the cold pressor task and video recordings. The children were asked to submerge their arm into the tank of cold water twice and the room temperature water once for a maximum of 30 seconds each time. During the cold water conditions, the water was at approximately 7 °C, whereas the room temperature tank was at approximately 30 °C. The order of hand submergence was counterbalanced, yet always consisted of the genuine condition first in order to capture the child's initial response (Larcohette et al. 2006). When recording the genuine condition, the children were asked to show their pain openly. When recording the suppressed condition, the children were asked to hide their pain from their parents. When recording the fake pain condition, the children were told in advance that the water would not be cold like the previous tank but that they were to simulate a believable facial expression of pain. A research assistant was present throughout all cold pressor recordings in order to manipulate the camera and stopwatch. Children were given a short 20 second break in between each recording.

All videos were then trimmed to be 20 seconds in length and correspond to the initial onset of each facial expression, as these have been shown to be most prominent in terms of pain-indicative facial activity (Craig & Patrick, 1985). In addition, the audio component was removed

from the presented clips to minimize possible influence of verbal and auditory information (Boerner et al. 2013).

Measures

A measure of the participant's confidence after each video was obtained by rating each video on a 10 point Likert scale from 0 (not very confident) to 10 (very confident) similarly as used in (Boerner et al. 2013). A measure of how much pain the participant thought the child was in after each video was rated on the Facial Pain Scale-Revised (FPS-R) (Hicks et al. 2001), which presents a 6-point scale of faces ranging from "no pain" to "very much pain". The scale represents each level of pain on the scale with a picture of a drawn face displaying increasing levels of pain expressions. Both of the measures were displayed on the screen after immediately each video the participant views. The participants are asked to state their ratings on each scale verbally while the experimenter took notes.

Eye-tracking Apparatus

Participants' eye movements were recorded by the EyeLink 1000 system from SR Research Ltd. This apparatus consists of one camera and one infrared sensor, both positioned between the participant and the computer screen where the task was presented. This location allowed for the tracking of each participant's right eye. The data produced within the context of the experiment was transferred in real time by an Ethernet connection linking the apparatus and the display computer that faced the subject (Roy-Charland et al. 2007). While the apparatus did not come into direct contact with any part of the participant's body, it was asked that each participant placed their head onto a chinrest in order to keep their face stable and steady throughout the duration of the experiment.

Procedure

Caregivers' participation in the study required one 45 to 60 minutes testing session. All testing took place in a research laboratory. Upon arrival, participants were asked to take a seat directly in front of a computer monitor on which the video stimuli will later appear. They were invited to carefully review and sign a consent form, following which they completed a demographics questionnaire. The eye-tracking technology was then installed and calibrated, and after participants received instructions pertaining to the task at hand. Participants were informed that they would viewing 63 video clips showing children expressing either genuine, suppressed, or fake pain. Explanations with regards to the manner in how pain was induced in these children (i.e. the cold pressor task) was provided, and an opportunity for questions or concerns was given. Each experimental condition was clearly defined as: the genuine condition, in which the child is expressing the pain felt from the cold water; the suppressed condition, in which the child is hiding the pain felt in reaction to the cold water; the fake condition, in which the child is merely pretending to be in pain, while his or her hand is in warm water. A reference screen with this information was prompted after each video presented to be used as necessary during the judgement task. The reference screen reminded the participants of what each each of the scales were as well as what each of the conditions were (Boerner et al. 2013).

Participants viewed each of the 63 video clips one at a time while their eye movements were recorded. The presentation of these clips was presented in a randomized order. After each clip was presented is was immediately followed by three questions on screen relating to the video just viewed as well as the reference sheet. Participants were required to answer verbally and the experimenter took note of their answers on paper.

Participants were first asked to identify which of the three experimental conditions was presented. It should be noted that participants were not be informed that they will be seeing all three conditions for each child. Next, participants were asked to rate the level to which they are confident in their judgement using a Likert scale of 0 (not at all confident) to 10 (extremely confident). Following, caregivers were asked to estimate the pain intensity felt by the child in question. For this task, participants used the Facial Pain Scale-Revised (FPS-R) (Hicks et al. 2001). The participants were noted that the goal is not to match the child's facial expression to those presented on the scale, but rather to select the face that corresponds best to the level of pain felt by the child as estimated by the participant (Boerner et al. 2013). Participants repeated this procedure until all video clips were viewed and analyzed

Data analysis

Proportion of accurate responses was computed by dividing the number of correct responses by the number of trials for each type of expression, 21 trials of each genuine pain, fake pain suppressed pain; average scores for each expression were used in all analyses. Confidence levels were rated on a Likert scale from 0-10 and pain level was rated on the FPS-R (Hicks et al. 2001), which is also on a scale from 0-10 For each of these measures, a series of 2 (nurse vs. parent) X 3 (genuine, fake and suppressed) mixed-design ANOVA analyses were conducted using type of participant (nurse or parent) and types of pain (genuine, fake and suppressed) as between- and within-subject factors respectively.

For eye movements, proportion of time in each zone (eyes vs. mouth) was examined. A 2 (eyes vs. mouth) X 2 (nurse vs. parent) X 3 (genuine, fake and suppressed) X 2 (accurate vs. inaccurate) mixed-design ANOVA was conducted to examine in attention to the zones, expressions and accuracy. Proportion of time was computed by dividing the time spent in the eye

or mouth zone by the total time spent on the video. Analyses were also computed for the timing of initial orientation to zone using a 2 (eyes vs. mouth) X 2 (nurse vs. parent) X 3 (genuine, fake and suppressed) X 2 (accurate vs. inaccurate) mixed-design ANOVA.

Timing of initial orientation for the mouth and eyes zone is measured from the onset of the stimulus until the participant's first fixation in the area (see Roy-Charland, Plamondon, Homeniuk, Flesch, Klein & Stewart, in press, for same definition). In order to compute this measure at least one fixation had to occur in the eyes or mouth zone, without which an empty cell was recorded. In addition to zone (eyes and mouth), type of pain (genuine, fake and suppressed) and type of participant (nurse and parent) was again used as an independent variable. While for the first series of analysis accuracy was used as a dependent variable, for the eye-tracking data, accuracy was used as in independent variable (see Roy-Charland, Saint-Aubin, Klein & Lawrence, 2007, as an example of this procedure).

Last, Pearson correlation analyses were conducted between accuracy, level of confidence and pain level for each type of expressions (genuine, fake and suppressed).

Results

Accuracy

The proportion of accurate responses was examined as a function of participant type (nurse vs. parent) and expression type (genuine, fake, and suppressed). Means and standard deviations are presented in Table 1. The 2 (nurse vs. parent) X 3 (genuine, fake and suppressed) mixed-design ANOVA revealed a main effect for expression type, ($F(2,58) = 18.95$, $p < .001$, $\eta 2p = .40$), but neither the main effect of participant type ($F(1,29) = 1.37$, $p = .25$, $\eta 2p = .05$), or the interaction between expression and participant ($F(2,58) = 0.66$, $p = .52$, $\eta 2p = .02$) reached significance. Post hoc tests (LSD) revealed that participants were more accurate for suppressed

expressions than the other two types of expression; and were better at detecting genuine than fake expressions.

An analysis was also computed for each of the three types of expressions (genuine, fake and suppressed) to compare obtained accuracy of recognition with chance level. Since three options were available to participants, chance level (alpha) was set at .33. For all expression types combined, genuine, fake and suppressed, accuracy was better than chance ($t(33) = 3.98$, $p < .001$, $t(33) = 4.03$, $p < .001$, $t(33) = 8.71$, $p < .001$).

An analysis was also computed of frequency of given responses the three possible responses (genuine, fake and suppressed) as a function of the three types of expressions shown to participants (genuine, fake and suppressed). For instance, it was explored in order to examine if higher accuracy for suppressed expressions were the result of a response bias. Results revealed no main effect of types of expressions shown ($F(2,60) = 0.46$, $p = .64$) but there was a main effect of response type ($F(2,60) = 13.65$, $p < .001$, $\eta 2p = .31$) and an interaction ($F(4,120) = 44.94$, $p < .001$, $\eta 2p = .60$. Simple main effects were computed for each of types of expressions shown and all were significant, respectively for genuine, fake and supressed ($F(2,60) = 16.96$, $p < .001$, $\eta 2p = .36$, $F(2,60) = 8.56$, $p = .001$, $\eta 2p = .22$, $F(2,60) = 49.54$, $p < .001$, $\eta 2p = .62$). Post hoc tests (LSD) revealed that for genuine expressions, participants answer genuine more than fake but there is no difference between genuine and suppressed. For fake expressions, they answer fake more than the other two who do not differ between each other. For suppressed, they answer suppressed more than the other two that did not differ. Thus, there is no clear indication of bias.

Level of confidence

As for accuracy, the level of confidence was analyzed as a function of participant type (nurse vs. parent) and expression type (genuine, fake and suppressed). Means and standard deviations are presented in Table 2. The 2 (nurse vs. parent) X 3 (genuine, fake and suppressed) mixed-design ANOVA revealed a main effect of expression type ($F(2,58) = 7.03$, $p = .002$, $\eta^2_p = .20$), but neither the main effect of participant type, ($F(1,29) = 1.31$, $p = .26$, $\eta^2_p = .04$), or the interaction, ($F(2,58) = 1.86$, $p = .17$, $\eta^2_p = .06$), reached significant. Post hoc tests (LSD) revealed that participants were more confident in detecting fake expressions than genuine or suppressed expressions. No other difference was significant.

Level of pain

The level of pain was examined as a function of participant type (nurse vs. parent) and expression type (genuine, fake and suppressed). Means and standard deviations are presented in Table 3. The 2 (nurse vs. parent) X 3 (genuine, fake and suppressed) mixed-design ANOVA revealed a main effect of expression type, ($F(2,58) = 9.05$, $p < .001$, $\eta^2_p = .24$), and a main effect of participant type, ($F(1,29) = 4.87$, $p < .001$, $\eta^2_p = .14$. However, the interaction between expression and participant type was statistically non-significant ($F(2,58) = 0.68$, $p = .51$, $\eta^2_p = .02$). Results showed that nurses rated the level of pain higher than parents regardless of expression type. Furthermore, post hoc (LSD) analyses showed that participants rated level of pain higher for genuine expressions than for suppressed and fake expressions; while there was no difference in ratings between these latter two expressions

Eye movements

Proportion of time in zones. The proportion of time spent in each zone (eyes vs. mouth) was examined as a function of participant type (nurse vs. parent), expression type (genuine, fake

and suppressed), as well as accuracy (accurate vs. inaccurate). Means and standard deviations are presented in Table 4. The 2 (eyes vs. mouth) X 2 (nurse vs. parent) X 3 (genuine, fake and suppressed) X 2 (accurate vs. inaccurate) mixed-design ANOVA revealed a main effect of zone, 9F(1,28) = 6.01, p = .02, η^2_p = .18), a main effect of expression type, (F(2,56) = 10.60, p < .001, η^2_p = .28), but neither the main effect of accuracy, (F(1,28) = 0.36, p = .55, η^2_p = .01), or the main effect of participant type, (F(1,28) = 3.55, p = .07, η^2_p = .11), was significant. There were two-way interactions between zone and expression type, (F(2,56) = 26.62, p < .001, η^2_p = .49), and between zone and accuracy, (F(1,28) = 10.45, p = .003, η^2_p = .27). None of the other interactions were significant (all Fs < 2.18, ps > .12).

Simple main effects tests were computed to examine the interactions. For the interaction between zone and expression type, Dunn-corrected pairwise comparisons was applied with alpha level set at .03. For the eyes zone, there was a significant effect of expression type, (F(2,60) = 21.52, p < .001, η^2_p = .42). revealed that less time was spent in the eyes for fake expressions than the other two, which did not differ significantly for each other. For the mouth zone, there was also a significant effect of expression type, revealed that less time was spent in the mouth for suppressed expressions than the other two and less time was spent in the mouth for genuine than for fake. For genuine and suppressed expressions, respectively, participants spent less time in the mouth than in the eyes, (F(1,30) = 7.21, p = .01, η^2_p = .19); (F(1,30) = 10.47, p = .003, η^2_p = .26). For fake expressions, there was no significant difference in the time spent in the mouth or in the eyes, (F(1,30) = 3.06, p = .09, η^2_p = .09).

Second for the interaction between zone and accuracy, Dunn's correction was also applied to alpha level (*p* < .04). For accurate and inaccurate responses, respectively, participants spent less time in the mouth than the eyes, (F(1,30) = 5.29, p = .029, η^2_p = .15); (F(1,30) = 8.73,

$p = .006$, $\eta^2_p = .23$). For the eyes zone, participants spent less time for inaccurate than accurate response, ($F(1,30) = 4.71$, $p = .038$, $\eta^2_p = .14$). However, for the mouth zone, there was no significant difference between accurate and inaccurate responses, ($F(1,30) = 2.91$, $p = .098$, $\eta^2_p = .09$).

Timing of initial orientation to zone. The timing of the initial orientation to each zone (eyes vs. mouth) was computed as a function of participant type (nurse vs. parent), expression type (genuine, fake and suppressed) as well as accuracy (accurate vs. inaccurate). Means and standard deviations are presented in Table 5. The 2 (eyes vs. mouth) X 2 (nurse vs. parent) X 3 (genuine, fake and suppressed) X 2 (accurate vs. inaccurate) mixed-design ANOVA revealed a main effect of zone, ($F(1,28) = 9.76$, $p = .004$, $\eta^2_p = .26$), and none of the other main effects were significant, all $Fs < 2.03$, $ps > .17$. There was a two-way interactions between zone and expression, ($F(2,56) = 4.85$, $p < .011$, $\eta^2_p = .15$), and a three-way interaction between zone, expression type and accuracy, ($F(2,56) = 5.26$, $p = .008$, $\eta^2_p = .16$). None of the other interactions were significant, all $Fs < 2.26$, $ps > .14$.

Because of the three-way interaction, for each expression type, a 2 X 2 repeated measures ANOVA was computed to compare the timing of initial orientation as a function of zone (eyes vs. mouth) and accuracy (accurate vs. inaccurate). For genuine and suppressed expressions, respectively, results revealed a main effect of zone, ($F(1,30) = 15.08$, $p = .001$, $\eta^2_p = .36$); ($F(1,29) = 7.54$, $p = .01$, $\eta^2_p = .21$), but neither the main effect of accuracy, ($F(1,30) = 1.97$, $p = .17$, $\eta^2_p = .06$); ($F(1,29) = 0.25$, $p = .62$, $\eta^2_p = .009$), or the interaction, ($F(1,30) = 0.07$, $p = .80$, $\eta^2_p = .002$); ($F(1,29) = 1.91$, $p = .18$, $\eta^2_p = .06$), were significant. For genuine and suppressed expressions, participants were faster to look at the eyes than the mouth. For fake expressions, results revealed a main effect of zone, ($F(1,30) = 5.14$, $p = .03$, $\eta^2_p = .15$), a significant

interaction, ($F(1,30) = 10.11$, $p = .003$, $\eta^2_p = .25$), but the main effect of accuracy was not significant, ($F(1,30) = 0.03$, $p = .86$, $\eta^2_p = .001$). Simple main effects tests were computed to explore the interaction (Dunn's correction $p < .04$). For the eyes zone, participants were faster to look at the eyes for inaccurate than accurate responses, ($F(1,30) = 5.71$, $p = .02$, $\eta^2_p = .16$). For the mouth, participants were faster to look at the mouth for accurate than inaccurate responses, ($F(1,30) = 5.08$, $p = .03$, $\eta^2_p = .15$). For inaccurate response, participants were faster to look at the eyes than the mouth, ($F(1,30) = 15.77$, $p < .001$, $\eta^2_p = .34$). For accurate responses, there was no significant difference in the timing of initial orientation in the eyes and mouth, ($F(1,30) = 0.64$, $p = .43$, $\eta^2_p = .02$).

Correlations

Correlations were computed between accuracy, level of confidence and pain level for each type of expressions (genuine, fake and suppressed). Correlations are presented in Table 6. Inspection of Table 6 revealed that, for all three types of expression, there was no significant correlation between accuracy and level of confidence or between accuracy and level of pain. Furthermore, there was no correlation between accuracy for one type of expression and the others. However, the higher level of confidence for one type of expression, the higher the level for the others was. Similarly, the higher the level of pain for one type of expression, the higher the level for the others was.

Discussion

The current study examined parents' and nurses' ability to recognize facial expressions of genuine, suppressed, and fake pain in children while recording eye movements. Both parents' and nurses' accuracies in detecting each of the types of pain was examined in order to determine which pain expressions were detected most accurately, as well as whether parents' or nurses'

differed in their judgement of these expressions. Furthermore, the participants' confidence in detecting different types of pain expression and the level of pain rated were also examined. However, the main contribution of the current study was to examine parents' and nurses' eye movements while they were viewing the videos in order to determine where they were looking on the face of the children when making their decisions, and more importantly, whether their eye movement pattern differed based on their accuracy. Since the majority of the previous research on caregivers' ability to detect pain expressions in children has indicated that overall the task is preformed at about chance level (Kappesser & Williams, 2002; Boerner et al. 2013), results from the current study reveal the areas of the face that caregivers should focus on to increase the rate of accuracy. Hence, the goal of the current study was to further understand accuracies and errors in pain detection in order to allow for improvement in recognition.

Accuracy differences between parents and nurses.

Results revealed that the parents' and the nurses' did not differ on their accuracy in pain expression recognition. Previous research on caregivers' accuracies in detecting pain expressions in children has not shown consistent differences between groups, thus the results here are not surprising (Schneider, & LoBiondo-Wood, 1992; Kappesser & Williams, 2002; Singer, Gulla, & Thode, 2002; Larochette et al. 2006; Riddell & Craig, 2007; Boerner, et al. 2013). However, for instance, Boerner et al. (2013) observed that the nurses were significantly better at detecting genuine pain expressions than parents and doctors. A possible explanation for these differences could be due to differences in the training and experience of the nurse groups examined across each of these studies. The current study did not specifically examine paediatric nurses while Boerner et al. (2013) did, which may explain why the nurses in the current study do not perform significantly different than the parents. Paediatric nurses' would have specific training focused

on the assessment and recognition of young children's pain expressions in order to understand how to manage their pain properly. Furthermore, they would also have continuous, daily, one on one care with children that nurses who work in various other areas in the hospital would not. Nevertheless, although the parents and nurses did differ significantly in Boerner et al. (2013), their differences were about 10%. Thus, regardless of the group difference in the previous study, results remain modest and only slightly above chance level for all caregivers, explaining the lack of differences between these groups in the current study.

Accuracy differences across pain conditions

Accuracy was also examined across pain expression conditions to determine which expression was recognized most accurately. Results revealed that participants were most accurate at detecting suppressed pain expressions compared to genuine and fake. These results are somewhat consistent with Boerner et al. (2013) who observed that participants were most accurate at detecting suppressed and fake pain expressions. However, different from the previously mentioned study, the current study's results indicated that participants were better at detecting genuine expressions than fake expressions, resulting in fake expressions being the most difficult to detect accurately. These results do not support those of Boerner et al. (2013) or Larochette et al. (2006), who all observed that fake pain expressions were one of or the most accurately detected pain conditions, along with suppressed. However, the videos viewed in Boerner et al. (2013) and Larochette et al. (2006) were identical, whereas the current study used different stimuli. While stimuli were created using the same procedure as the other studies with a cold pressor task, this study used different children and subtle differences in the children's morphology, for instance, might account for these differences.

Along with the stimuli being different from Boerner et al. (2013) and Larochette et al. (2006), the ages of the children recorded in the current study differ from the previous studies. The children recorded here were on average younger than the children used in the Boerner et al. (2013) and Larochette et al. (2006) studies. The range of ages in the stimuli used in the previous studies was 8-12 years, whereas in the current study, the range of ages of the children in the video clips were 4-10 years. Thus, the differences in children's age may be a possible explanation for why suppressed expressions were the most accurately recognized condition for both parents and nurses. It may be possible that as they get older, children are better at controlling their pain expressions, and more specifically at suppressing the expression of their pain. Consequently, in the current study, since children are younger they might have had more difficulty hiding in their pain, making it less difficult for the parents and nurses to detect that the expression is suppressed pain.

To test this hypothesis, the videos used in the current study can be coded using the FACS (Ekman, Friesen, and Hager, 2002). This system is an anatomically based facial movement system in which muscle movements are coded based on the presence and intensities of their activation. In Larochette et al. (2006), they coded the above-mentioned stimuli from the previous studies by having a trained FACS coder coded each of the videos, and then, a second trained FACS coder coded 25% of the videos. With an identical procedure for the current stimuli, through examining the coding of facial movements, we would be able to compare activated muscles as well as intensity between the videos in the current study and those in the previous studies to see if young children do, in fact, have more difficulty suppressing their pain and if there is any possible leakage of other expressions from the felt emotions. This would be reflected

in more activations and more intensity of activation for the younger than older children in the suppressed pain expressions.

While age seems like a plausible factor that could explain the higher accuracy in detection suppressed pain expressions in the current study, this explanation seems less plausible for the fake pain expressions. In effect, the parents and nurses in the current study were significantly less accurate in detecting the fake pain expressions than the other types of pain, while in the previous studies (Boerner et al. 2013; Larochette et al. 2006), participants were as accurate for suppressed and fake expressions and less for genuine. If age was a factor, we would expect the younger children in the current study to be less effective in faking pain than the older children in the previous studies, making it easier to detect the fake expressions in the current study. Results do not support this explanation and, in fact, there is no developmental reason to expect that the younger children would be better at faking pain than older children. The coding of the facial expressions with the FACS might also help elucidate this question. Through coding, it is possible to examine the muscle movements that were activated in each of the expressions. After the coding is determined, it would be possible to compare the action units that were activated in the current study's stimuli while the children express genuine, faked and suppressed pain, to the stimuli used in prior research. The evaluation of the similarities and differences between the children's expressions can be made between the two studies to determine if any differences in action units could possibly result in the difference in accuracy between the types of expressions.

Nevertheless, while performance was modest, each of the expressions used was recognized accurately above chance levels, accuracy ranging from 40-68%. The current study hypothesized that the parents and nurses would preform above chance level but still make many

errors in judgment. This hypothesis was generated due to previous research by Kappesser & Williams (2002), Larochette et al. (2006), Riddell & Craig, (2007) and Boerner et al. (2013) who each found that their participants were able to perform above chance level but still not very well, causing them to make many errors in their detection of types of pain expressions. Thus, overall throughout previous research parents' and nurses' continuously are not very successful at detecting these pain expressions much above chance level.

Confidence ratings

In addition to accuracy, the participants' level of confidence in their decisions was recorded. As for accuracy, no difference between the parents and the nurses' levels of confidence was observed. However, overall participants were more confident than they were accurate, with accuracy levels between 40-60% and confidence levels between 60%-70%. As for reported confidence of pain expression detection, participants were significantly more confident in their recognition of fake pain expressions than genuine or suppressed, which did not differ from each other. The results that participants were more confident for fake pain expressions was surprising since they were least accurate in their recognition of fake pain compared to genuine and suppressed. Thus, participants were most confident in their decisions made for the condition for which they were the least accurate. This suggests that level of confidence is not a good indicator of the accuracy results in this task. In fact, there was no correlation between accuracy and confidence. However, the higher the level of confidence for one type of expression, the higher the level for the others was.

The results for pain judgement are similar to results obtained from other deception judgement research. Research has indicated that confidence levels are also not a good predictor for the judgement of deception of individuals' feelings (see e.g. Ekman & O'Sullivan, 1991).

More precisely, Ekman and O'Sullivan (1991) asked law enforcement personnel (e.g. police officer, FBI agents, judges and US secret service agents) to determine whether the person in a video is telling the truth or lying about their feelings. The results showed that not only did these individuals perform poorly on this task (except for secret service agents), but their accuracy was not linked to their confidence level. In sum, even if the judgement of a particular type of expression is strongly linked to our training and occupation, our confidence level may not match our accuracy.

Rating of Pain

Participants were also asked to rate each child's level of pain. Results revealed that nurses rated levels of pain higher than parents, regardless of the type of pain expression. This may be due to nurses rating pain more cautiously overall in comparison to parents due to their relationship with monitoring and managing pain in their day-to-day jobs. Furthermore, participants rated levels of pain higher for genuine expressions compared to suppressed and fake pain, which did not differ from each other. This result signifies that the genuine pain condition was perceived as more painful, whether or not the participants classified the condition correctly. However, the children are experiencing the same amount of pain in the genuine condition as the suppressed condition, thus it is problematic that both nurses and parents did not rate suppressed pain similarly. Nevertheless, it should be recalled that the suppressed pain was the most accurately recognized. Thus, the combination of these results might indicate that children who are suppressing their pain might have their pain noticed but not properly managed. This is especially possible since there was no correlation between accuracy and pain level ratings for all types of expressions.

Eye-movements

The current study sought to examine eye-movements to further understand how the areas on the face that the participants were at related to their accuracies in pain judgement. Proportion of time in the eyes and mouth was examined as well as timing of initial orientation to zone to determine where individuals were looking when making their decisions and for how long. Results revealed differences in the type and initial orientation in the eyes and mouth, being more quickly to look at the eyes than the mouth, and spent more time in the former zone than the latter. In examining the proportion of time spent in the eyes and the mouth zones, results revealed that participants spent less time in the mouth for genuine than fake expressions. Furthermore, for genuine expressions, participants spent less time and where slower at fixating in the mouth than the eyes. For fake expressions, participants did not differ in the time they spent in the eyes and mouth but more time was spent viewing the mouth than for the other types of expressions. The most interesting results, however, are related to the analyses integrating accuracy and eye movements, which was the main contribution of this paper. For proportion of time, there was no impact of the type of expression on the time spent in the mouth and eyes for inaccurate and accurate responses. Nevertheless, while participants spent more time in the eyes than in the mouth for both accurate and inaccurate responses, for the eye zone, they spent more time in it for accurate than inaccurate response but no difference was observed in the time spent in the mouth. For timing of initial orientation for fake expressions, a clear pattern emerged for accuracy. More precisely, participants looked at the eyes faster for inaccurate responses than accurate responses and faster at the mouth for accurate responses than inaccurate ones.

The results for eye movements, while complex, reveal interesting pattern to help understand both errors and provide information on how to improve accuracy. In general, results

seem to suggest that the faster participants look at the eyes and the more time they spend in that zone, the better their accuracy would be. However, results also suggest that this does not apply to all types of pain expressions. In effect, while this may be a good strategy to improve accuracy for the recognition of genuine and suppressed pain, and could explain the better performance on these two types of pain expressions, this strategy does not apply to fake pain expressions. Specifically, for fake expressions, the current study revealed the importance of attending to the mouth zone in order to be accurate in recognizing these expressions. Considering participants attended to the eye zone and mouth zone similarly, it is not surprising that fake expressions were judged the most inaccurately out of all of the expressions. Overall, participants had a bias towards the eye zone when viewing expressions, even though fake expressions require information from the mouth zone to be accurate. Therefore, fake expressions seem to require more attention to the mouth zone t than the eye zone, but in the current study participants viewed the eye and mouth zone similarly, which might explain why fake expressions were judged the least accurately. Additional support for this explanation comes from the timing of initial orientation that showed that for fake expressions specifically, the faster the participants looked at the mouth, the better their judgement; and the opposite was also observed, where the faster to the eyes led to fewer accurate responses. In other words, the participants' bias to the eye zone might have contributed to a negative effect on recognizing fake pain expressions. Once further examined with FACS coding it will also be possible to determine is there are actual differences in activation in the eyes and mouth that could be related to the current results. In sum, the current study provides important insight on how to improve on pain expression recognition based on training with regards to where to look for clues of the types of pain, and more importantly, that clues might not be in the same facial areas for each type of expression.

Limitations

A limitation of the current study is that the nurses who participated in the study were not specifically nurses who work with children between the ages of 4-10 years old. It is possible that if the nurses in this study were selected only based on the ages of the children they treat the current study's results may have indicated that nurses were more accurate than parents (e.g. as in Boerner et al. (2013)). However, although the parents and nurses did not differ significantly the current study has exemplified that very specific experience as a nurse might influence their ability to detect pain expressions in children. Future research could continue to examine how specific job experience influences participants' ability to detect pain in order to continue to understand how to improve difficulties on recognizing these expressions. Furthermore, the current study's results are limited to pain experienced from a cold pressor task, future research could observe pain resulting from a different procedure (for example immunizations) to examine any differences in recognition.

Conclusion

The goal of the current study was to examine parents and nurses' ability to recognize genuine, fake and suppressed pain expressions while their eye-movements were tracked in order to understand accuracy at this task. Results did not show difference between the types of caregivers. However, participants were more accurate for suppressed than genuine expressions and more for genuine than fake expressions. More importantly, the results from eye movement patterns offer clues on how to improve on accuracy. For genuine and suppressed expressions, participants would need to attend to the eye zone longer and faster in order to be more accurate. For fake expressions, the mouth zone needs more attention in order to increase accuracy of recognition; the faster participants looked at the mouth, the higher their accuracy. With the

information obtained on how to improve accuracy at this task, training programs could begin to be tested in order to improve on this recognition deficit. The ability to recognize pain expressions has been found to be a difficult task (Larochette et al. 2006; Riddell and Craig, 2007; Boerner et al. 2013). Therefore, working towards improvement at this task is incredibly important and necessary in order to be able to respond to situations in which children are in pain accordingly.

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Table 1. Proportion of correct responses as a function of participant type and expression type.

Expression Type	Participant Type	M	S
Genuine	Parent	47.94	13.64
Genuine	Nurse	42.57	19.79
Fake	Parent	40.03	12.62
Fake	Nurse	41.07	8.32
Suppressed	Parent	68.11	17.89
2	Nurse	60.12	21.29

Table 2. Level of confidence as a function of participant type and expression type.

Expression Type	Participant Type	M	SD
Genuine	Parent	6.89	1.19
Genuine	Nurse	6.22	1.53
Fake	Parent	7.09	1.26
Fake	Nurse	6.41	1.51
Suppressed	Parent	6.54	1.33
Suppressed	Nurse	6.20	1.55

Table 3. Level of pain (FPS-R) as a function of participant type and expression type.

Expression Type	Participant Type	M	SD
Genuine	Parent	1.79	0.60
Genuine	Nurse	2.10	0.62
Fake	Parent	1.29	0.34
Fake	Nurse	1.80	0.64
Suppressed	Parent	1.46	0.49
Suppressed	Nurse	1.74	0.64

Table 4. Proportion of time spent in the eye zone and mouth zone as a function of participant type, expression type and accuracy.

Expression Type	Participant Type	Zone	Accuracy	M	SD
Genuine	Parent	Eyes	Inaccurate	58.17	23.55
Genuine	Nurse	Eyes	Inaccurate	41.57	19.05
Genuine	Parent	Eyes	Accurate	51.35	25.13
Genuine	Nurse	Eyes	Accurate	40.00	20.08
Fake	Parent	Eyes	Inaccurate	51.12	22.77
Fake	Nurse	Eyes	Inaccurate	36.01	18.00
Fake	Parent	Eyes	Accurate	48.27	25.74
Fake	Nurse	Eyes	Accurate	34.46	19.72
Suppressed	Parent	Eyes	Inaccurate	54.90	25.39
Suppressed	Nurse	Eyes	Inaccurate	42.63	20.37
Suppressed	Parent	Eyes	Accurate	56.03	21.85
Suppressed	Nurse	Eyes	Accurate	39.79	20.08
Genuine	Parent	Mouth	Inaccurate	24.40	19.30
Genuine	Nurse	Mouth	Inaccurate	30.20	18.00

Genuine	Parent	Mouth	Accurate	28.47	22.32
Genuine	Nurse	Mouth	Accurate	33.63	21.53
Fake	Parent	Mouth	Inaccurate	27.94	18.38
Fake	Nurse	Mouth	Inaccurate	32.50	18.49
Fake	Parent	Mouth	Accurate	28.58	23.57
Fake	Nurse	Mouth	Accurate	35.51	19.67
Suppressed	Parent	Mouth	Inaccurate	23.01	18.51
Suppressed	Nurse	Mouth	Inaccurate	29.31	19.07
Suppressed	Parent	Mouth	Accurate	22.86	19.57
Suppressed	Nurse	Mouth	Accurate	29.32	20.54

Table 5. Timing of the initial orientation to the eye zone and the mouth zone was as a function of participant type, expression type, and accuracy.

Expression Type	Participant Type	Zone	Accuracy	M	SD
Genuine	Parent	Eyes	Inaccurate	266.69	298.86
Genuine	Nurse	Eyes	Inaccurate	571.21	660.48
Genuine	Parent	Eyes	Accurate	579.57	736.16
Genuine	Nurse	Eyes	Accurate	746.86	891.81
Fake	Parent	Eyes	Inaccurate	491.09	861.98
Fake	Nurse	Eyes	Inaccurate	714.31	1060.05
Fake	Parent	Eyes	Accurate	920.03	1285.35
Fake	Nurse	Eyes	Accurate	1501.43	2172.20
Suppressed	Parent	Eyes	Inaccurate	1006.74	1250.87
Suppressed	Nurse	Eyes	Inaccurate	885.54	884.88
Suppressed	Parent	Eyes	Accurate	698.91	578.52
Suppressed	Nurse	Eyes	Accurate	922.04	768.44
Genuine	Parent	Mouth	Inaccurate	2556.54	2569.43
Genuine	Nurse	Mouth	Inaccurate	1498.45	1168.90

Genuine	Parent	Mouth	Accurate	3168.25	3612.84
Genuine	Nurse	Mouth	Accurate	1624.50	1356.84
Fake	Parent	Mouth	Inaccurate	2472.21	2238.71
Fake	Nurse	Mouth	Inaccurate	1824.82	1179.09
Fake	Parent	Mouth	Accurate	2084.72	2539.16
Fake	Nurse	Mouth	Accurate	1088.68	803.74
Suppressed	Parent	Mouth	Inaccurate	2243.44	2164.47
Suppressed	Nurse	Mouth	Inaccurate	1518.03	1079.77
Suppressed	Parent	Mouth	Accurate	2645.95	2467.82
Suppressed	Nurse	Mouth	Accurate	1704.13	1431.98

Table 6. Correlations between accuracy, level of confidence, level of pain and expression type

	Genuine Accuracy	Fake Accuracy	Suppressed Accuracy	Genuine Confidence Level	Fake Confidence Level	Suppressed Confidence Level	Genuine Pain Level	Fake Pain Level	Suppressed Pain Level
Genuine Accuracy									
Fake Accuracy	.172								
Suppressed Accuracy	-.112	.217							
Genuine Confidence Level	.096	-.034	.143						
Fake Confidence Level	.097	.006	.217	.971**					
Suppressed Confidence Level	.117	-.020	.141	.901**	.883**				
Genuine Pain Level	.118	.226	.148	.162	.202	.118			
Fake Pain Level	-.417*	-.251	-.182	.054	.049	.003	.499**		
Suppressed Pain Level	.028	.230	.285	-.036	-.012	.036	.766**	.326	

* correlation is significant at the 0.05 level (2-tailed).

** correlation is significant at the 0.01 level (2-tailed).