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# JUDGEMENTS OF PAIN FOR GENUINE, MASKED, POSED AND BASELINE FACIAL EXPRESSIONS

by

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# ABSTRACT

Laboratory research has shown that people are capable of making reasonably accurate judgements of pain based on others' facial expressions. Clinical studies have produced less impressive results, however.

The present study tested untrained subjects' abilities to make accurate pain judgements after viewing genuine, masked, and posed facial expressions of pain. Subjects viewed a series of 6-second video segments featuring facial expressions of back pain patients undergoing range of motion tests, some of which were painful. Patients also attempted to mask facial expression during painful movements and pose a painful expression during movements that were not painful. After viewing each expression, subjects chose a phrase from the painfulness scale of the Gracely Verbal Descriptor Scales.

In addition to the video segment, subjects were given information, supposedly from the patient, which was either consistent or inconsistent with the facial expression. This information was correct half of the time.

Findings indicate that participants were able to reliably distinguish between the genuine pain faces and the baseline conditions, in which pain was neither experienced nor expressed. In terms of the false expressions, subjects tended to attribute more pain to the posed faces than to the genuine ones, and they attributed significantly less pain to the masked faces than they did to either the genuine or the posed expressions, though some pain was perceived on the masked faces.

The inability to distinguish masked and posed expressions from real expressions is unaffected by whether or not the participants are told in advance

that they are about to see these fake expressions. The difficulties the participants experienced identifying these expressions were found for all subject types, regardless of whether they were university students, or term 1, 3, or 5 nursing students.

When subjects were told that patients had said, "Yes, that movement was painful," judgements of pain were significantly higher than when participants were told that the patients had said, "No, it was not painful." When subjects received correct verbal information from the patient they were less fooled by the posed and masked faces. Though self report information affected pain judgements, the pattern of results suggests strongly that facial information was considered first and weighed more heavily by subjects.

It is suggested that judgements of pain in clinical settings are made considerably more difficult by false expressions such as poses and masks and that training in the identification of these expressions could yield more accurate assessment of patients' pain.

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# CHAPTER I

# INTRODUCTION

> Your face, my thane, is as a book where men
> May read strange matters. (*Macbeth*, 1.v)

Lady Macbeth's observation, made to her famous husband, acknowledges a long-standing fascination of philosophers, psychologists and neurophysiologists alike. It is not surprising, since the physiology of the face allows it to be one of the most expressive parts of our anatomy. This expressive ability is the result of an intricate system of muscles, sub-cutaneous fibres, and neural pathways whose sole purpose is to control this graphic form of social display. Yet, there is considerable debate regarding the nature and precision of that control. Can we voluntarily present facial expressions that look spontaneous? Can we mask expressions and successfully hide our emotions or other internal states? It will be the aim of this research to explore this debate, specifically, the communication of pain via facial expression.

Put most simply, research concerning the face focuses on what the face is *doing* and what it is *saying*. Experimental designs used in investigations of the latter typically use videotaped or photographed subjects who are put through an emotionally evocative experience, often by viewing slides or film. The subject is asked to describe the emotion experienced in kind and intensity. Then, observers view the videotapes of the subjects' expressions and provide emotional labels for them. Thus, concordance rates are measured between sender and receiver.

Painstaking research is required to determine what the face is doing when we imply or infer various internal states. We will begin with a review of common methods used in the description and measurement of facial movements considered by sender and receiver to be meaningful.

## Charting Facial Expressions

Attempts at objective measurement of facial expression tend to start by dividing the face into a series of discernable regions and then having the rater describe, using one of a number of criteria, the activity of that region associated with a given expression. For example, Blurton-Jones (1971) divided the face into nine anatomical components. He gave raters a list of descriptors varying from "wide" to "narrow," referring to the amount of contraction or movement in that area. The rater then had to use the appropriate descriptor for each component of the face.

More rigorous techniques analyse the specific muscle groups involved in an expression. In this way, neurological processes can also be traced. This approach has led to the discovery that facial expressions are the result of groups of facial muscles working in concert, however inharmonious that concert might be (Darwin, 1872[1965; Ekman, 1971). For example, a smile is more than the mere upturn of the lips. This upturn, caused by the contraction of a muscle called the zygomatic major, is usually accompanied by a contraction of the orbicularis oculi, the muscle around the eye that causes us to squint. We can smile using the zygomatic only, but most people will consider it posed or insincere if it is not accompanied by orbicularis oculi contraction (Ekman & Friesen, 1982).

Similarly, smiles that are forced in spite of depression may result in distinctive, less-than-happy shapes of the mouth because the zygomatic, which is being voluntarily contracted, is working in opposition to the depressor anguli oris, which is responding involuntarily to our internal state, pulling our mouth downward. The implied direction of causality in this analysis is from emotion to expression, rather than the reverse, which is the contention of facial feedback theory (Izard, 1971; 1977). Even facial expressions that are the result of imagined emotional states are somewhat different from those purely posed. For example, imagined sad events produce stronger brow activity than when we simply try to "look sad" (Smith, McHugo, & Lanzetta, 1986).

The measurement of specific muscle activity during facial expression may be accomplished by raters using procedures that are similar to, but considerably more exhaustive than, that of Blurton-Jones. Izard (1979) identified muscle groups that contracted during certain facial expressions and then he trained raters to identify the extent of this contraction in photographs and videotapes. This is called the *Maximally Discriminative Facial Movement Coding System* (*Max*). Izard also devised a system for charting movement as it changes over time (Izard & Dougherty, 1982). The *affectogram*, as it is called, provides a graph of the duration and nature of facial expressions, represented by various patterns of shading.

The most rigorous method, however, is the *Facial Action Coding System* (*FACS*) (Ekman & Friesen, 1978). This system is used to analyse 44 discrete actions of the facial muscles and an additional 22 descriptors of eye and head positions. Collectively, these 66 actions and descriptors are called *action units* (*AU's*). The *FACS* procedure requires the trained rater to look carefully at still photographs or slow motion and stop-action video and identify the *AUs* for that expression. Training takes approximately 100 hours. The coding of a few minutes of dynamic facial expression can be quite laborious.

Researchers looking for an even more objective measure of expression-related muscle activity have turned to electromyography (EMG). In this procedure, electrical activity associated with muscle contraction is measured using electrodes that are either attached to the surface of the skin or imbedded under the skin via tiny needles. The attached electrodes are less invasive than the needles, and therefore less likely to disrupt normal facial expression. However, unlike the needle EMG, they are not able to measure the activity of a single muscle. As such, they may be more objective than *FACS*, but no more specific in identifying muscle activity associated with a given expression.

Nevertheless, this technique may help measure non-observable, covert activity. Schwartz (1974) used electrical recordings of four facial muscles of subjects who were asked to think of experiences that would make them happy, sad, or angry. No expressions were visible during these imaginings, but the electrical readings distinguished among the types of thinking.

## The Origin of Human Facial Expressions

It is all well and good to be able to accurately describe what the face is doing at times when a given state is inferred, but why have specific patterns of facial movement become associated with an emotion or sensation in the first place? Why, when we are feeling happy, does the zygomatic major contract to bring the corners of the mouth upward? Why does the corrugator contract to furrow the brow when we are puzzled? And why do we associate these movements with happiness and puzzlement when we see them?

One of the first people to address this question was Charles Darwin (1872|1965). Consistent with his emphasis on biology and evolutionary processes, Darwin began by looking at other animals having sufficient musculature to be capable of a variety of facial displays. He noted that monkeys pull back their lips and bare their teeth when confronted by an unfamiliar member of the same species. This expression is also found in some monkeys when greeting familiar others. This display, when anthropomorphized, becomes a human grin.

The general principle implied here is that expressions originally served biological functions. Others come to appreciate the communicative significance of these expressions due to their relationship with environment and context. Andrew (1963) has noted that animals will squint and pull back their ears when threatened. It is believed that this movement serves to protect the sense organs in times of danger. Though humans do not have the neural capability for fine motor control of ear movement, remnants of the squint still can be found on the human face in times of stress or danger. From an evolutionary perspective, then, facial expressions began as adaptive, perhaps directly protective functions. Through time, these adaptive movements, when perceived in a given context, took on communicative significance quite apart from their original purpose.

Support for an evolutionary explanation can be found in the apparent universality of some basic facial expressions. For example, Ekman and Friesen (1986) have recently discovered that a facial expression unique to contempt was recognized by people in Estonia, West Germany, Greece, Hong Kong, Italy, Japan, Scotland, Turkey, the United States, and West Sumatra. Paul Ekman was first struck by the possibility that some facial expressions may be universal when he was analysing film footage of New Guinea natives (Ekman, 1971). It is of some interest to note that, at this time, Ekman was more concerned with body posture than facial expression, and he was looking for evidence of cultural specificity rather than universality. Nonetheless, it was his identification of six basic emotion-related facial displays, and the fact people the world over could read these regardless of their cultural origin, that started Ekman on an extensive investigation of the face, an investigation that he still actively pursues today.

There is another possible theory to explore that may further clarify the role played by the face in emotional experience. The *vascular theory of emotion*, as outlined by Zajonc (1985), is based on early observations of a physiologist by the name of Israel Waynbaum. Fundamental to this theory is the notion that the term facial *expression* of emotion is misleading because it implies this is a terminal step of a process that is internally initiated and trying to surface. Zajonc suggested that *emotional efference* is a more useful term. Seeing facial movement as being an integral part of a process rather than the result of it allows us to entertain the possibility that such movement helps to control that process. That control stems from the fact that facial activity affects cerebral blood flow (CBF). Waynbaum (1907) observed that the blood supply to the brain and the face comes from the same source - the carotid artery. (Today we know that this is an oversimplification and that blood circulates to and from the head via the circle of Willis. Still, this does not discredit Waynbaum's theory.)

Also, blood supply to the brain must be stable. Since the facial artery is rich in an inordinate amount of muscle tissue; contraction of this tissue acts as tourniquets by pressing against bony structures and can thus counteract the "circulatory perturbations" (Zajonc, 1985, p. 17) that result from emotional reactions and help maintain stable CBF.

Today we know that the vascular system has its own controls in the form of vasodilators and vasoconstrictors and that blood drains from the brain via facial veins. Still, it is the case that facial musculature can control blood flow to a certain extent by increasing flow to the muscles and to the motor strip of the brain. Zajonc postulated that CBF in and of itself may not be as important as the brain temperature that it helps to regulate. The brain has a "cooling system" such that increased CBF will lower the brain's temperature. He suggests further that brain function, such as neurotransmitter production, may be affected by brain temperature. All of this means that regulation of CBF is important and can be affected by facial movement.

Blushing is an example of this process. Increased blood flow is routed safely to the face rather than to the brain. In the absence of appropriate efference for this emotion, the blood vessels dilate to relieve CBF. In the case of euphoria, contraction of the zygomatic muscle causes blood and oxygen to be held and this facilitates the euphoric feeling. Then tears are released after strong laughter, thus relieving that rising pressure of cerebral blood by demanding flow to the lachrymal gland.

A number of questions remain unanswered by Zajonc's "theory reclaimed" (1985, p. 15). First of all, is there proof that brain temperature does influence brain function? Zajonc admitted that the answer to this question is "no." Also, there is, as yet, no proof that facial activity directly affects brain temperature. Another set of questions concerns the order of events in this theoretical process. Is there room for facial feedback? Is the emotion already experienced and labeled before CBF must be stabilized via facial efference? Zajonc provided a careful non-answer when he said, "A subjective state may exist immediately before what came to be known as expressive movements, or these movements could also be executed automatically and without a prior subjectively felt experience" (1985, p. 19). Still, it seems clear that facial movement cannot be an *instigator* of that subjective state. This theory does not discount the possibility, though, that the movement of the face, intended primarily to stabilize CBF, may provide important neural feedback that affects the cognitive component of the emotional experience. This feedback may conceivably provide information about both *dimension* and *category*. Facial expression, then, may be a *result* of emotional experience, or a *modifier* of it. Still, the inescapable fact that there are some clear universals in facial expression suggests that there is some purpose to such movement, whether it be a product of evolution, as Darwin stated, or an attempt to control cerebral blood flow, as was Zajonc's contention.

When human beings are surprised, their brows are pulled upward by the frontalis muscle. When we are puzzled, the brows knit in a furrowed position caused by contraction of the corrugator. This is true even for people who have been blind since birth (Baker-Shenk, 1985). Such evidence leads to the conclusion that there are a number of species-specific facial displays that tend to be exhibited during certain fundamental emotional states such as anger, fear, surprise, happiness, sorrow, and disgust (Ekman, 1971). These displays are not learned. They are culturally invariant and they emerge at a very early age (Clark & Clark, 1977).

We are not slaves to our faces, however. Indeed, if we had no conscious control over our facial expressions there likely would be a much greater demand for masks. Instead, our culture teaches us to create our own "masks" in the form of posed or suppressed facial expressions. Through enculturation, we learn that some of the muscle movements innately associated with emotional states must be overridden by volitional movements. Our culture provides us with norms, called *display rules*, that dictate the social appropriateness of facial expressions. As mentioned at the outset of this paper, psychologists are still trying to ascertain the extent to which we are successful at replacing spontaneous, innate facial expressions with consciously controlled, perhaps more socially appropriate ones. Ekman and Friesen (1982) have used *FACS* analysis to show that genuine facial expressions are different from posed ones in terms of the muscles used. Still, these same researchers routinely train actors to emulate the muscle movement of genuine expressions such that naive raters cannot distinguish these expressions from those that are genuine. So it might not be the case that we are unable to convincingly override innate expressions, rather we need considerable training and practice to do so.

Genuine facial expressions actually originate from different locations in the brain and take different neural paths to the face than do those that are posed (Rinn, 1984). Involuntary, emotion-related facial movement tends to originate in subcortical centres, whereas voluntary facial activity is controlled by the more recently evolved motor strip. The face, therefore, comes prepared to communicate certain basic emotional states via universally consistent patterns. This relatively simple association between internal state and facial expression is clouded, however, by the nuances provided by culture's display rules which are manifest in conscious movement that is regulated, like hand gestures, by the motor strip. From this perspective, it can be seen that a more detailed understanding of the neurophysiology of facial expression would be helpful in understanding the origins of that expression and the extent to which humans are able to control it.

## The Neurophysiology of Facial Expression

We can shed considerable light on the nature of facial expression by tracing the neurological pathways that innervate the muscles of the face. The logical starting point is not with the face itself, but with a collection of nuclei found in the brainstem, near the pons (Rinn, 1984). This collection is called the *lower motor neuron tract (LMN)*. These nuclei are clustered in six groups, three arranged vertically on the lateral side and another three similarly arranged on the medial side of the brainstem.

The processes of these nuclei reach the face via the seventh cranial nerve that emanates from a tiny opening in the skull just behind each ear. From there, the nerve separates into five distinct branches: two *temporofacial branches* innervating the upper portion of the face, and three *cervicofacial branches* innervating the lower portion. These branches are related to the brainstem nuclei such that dorsolateral nuclei send impulses to the temporofacial branches and lateral and ventrolateral nuclei to the cervicofacial branches.

As mentioned earlier, neural impulses that cause facial movement originate either in the motor strip, or in subcortical nuclei, called *extrapyramidal cells.* The point of origin depends upon whether the movement is spontaneous or voluntarily controlled. Impulses from the motor strip result in contralateral control of the body, whereas extrapyramidal impulses are bilateral in nature. Further tracing of these pathways reveals that impulses from the motor strip synapse most often with lateral and ventrolateral brainstem nuclei which travel down the cervicofacial branches of the eighth cranial nerve and thus end up having a greater impact on the lower portions of the face. In contrast, involuntary, bilateral impulses from subcortical centres synapse with dorsolateral nuclei more often and thus have more bilateral control over the face.

It must also be noted that muscles featuring contralateral control are capable of more finely coordinated unilateral movement that is independent of its homologous counterpart. Bilaterally controlled muscles, on the other hand, such as those of the stomach, tend to be closely "yoked", such that it is difficult to move one side while keeping the other side still. Thus, if we journey carefully through this maze of neural pathways, we find that muscles innervated by the temporofacial branches, especially the uppermost *frontal branch*, receive approximately 75 percent of their impulses from bilateral sources. As a result, it is difficult to lift one eyebrow independent of the other (the result of contraction of the frontalis muscle).

By contrast, muscles stimulated by the lower cervicofacial branches receive most of their stimulation from contralateral sources. So it is not difficult to raise one corner of the mouth or sneer with one side of the lower face. Furthermore, since these contralateral sources, housed in the motor strip, are also voluntarily controlled, it should be the case that voluntary expressions are more asymmetrical than are spontaneous displays that come from subcortical, bilateral sources. Ekman, Hager, and Friesen, (1981) have, in fact, found this to be the case.

A number of questions are raised by the existence of this asymmetry. For example, is the asymmetry pronounced enough to be perceived, either consciously or subconsciously, by the receiver? And is it consistent in nature? That is to say, is it also *lateralized*? Is there evidence of hemispheric specialization when it comes to our ability to "put on faces" and, perhaps, in our ability to read faces? The questions concerning both cerebral and facial lateralization have been addressed by a considerable body of literature.

*Specialized functions of the hemispheres in facial expression*

The notion that the right hemisphere of the brain dominates the left in the interpretation and expression of emotion has numerous supporters (e.g., Heilman, Watson, & Bowers, 1983; Milner, 1974; Strauss & Moscovitch 1981). Consistent with this notion is the finding that cognitive reaction times for affect-related stimuli are faster when presented to the right hemisphere (Heilman & Van den Abel, 1979). It is also possible that the right hemisphere is more actively involved in the processing of other people's facial expressions because of its superiority in visuo-spatial tasks (Benton & Van Allen, 1968; Bowers, Bauer, Coslett, & Heilman, 1985).

Strauss and Moscovitch (1981) tested the possibility of right hemisphere superiority in the perception of facial expressions. Also, they were looking for evidence that recognition of facial identity and of facial expression were different functions, both conceptually and anatomically. Subjects were exposed to vertically positioned pairs of faces. These faces portrayed either the same or different emotions. In addition, the two pictures were either of different people or of the same person shown twice. Essentially, then, Strauss and Moscovitch created a 2 x 2 x 2 design with visual field of presentation being one variable, emotion (same vs. different) being another, and person (same vs. different) being the third. The subjects were asked to make same/different judgements and the reaction times for these constituted the dependent variable.

It was discovered that face pairs presented in the left visual field (LVF) (and thus to the right hemisphere) were judged more quickly only when both faces featured the same expression. Furthermore, Strauss and Moscovitch found that right hemisphere superiority was most pronounced when subjects judged different faces portraying the same emotion. This was consistent with the researchers' prediction, since they hypothesized that judgements involving different faces were more demanding than those comparing two pictures of the same face. They argued that the latter task tapped primarily visuo-spatial, template matching skills, whereas the former involved a more complex, abstract cognition — a generalized representation of what a given emotion looks like on the human face. In the language of this paper, it tested knowledge of what the face was *saying* in addition to what the face was *doing*.

Strauss and Moscovitch went on to conclude that recognition of identity and perception of expression rely on different mechanisms. This conclusion was based, in part, on their finding that subjects who were asked to make same/different judgements regarding identity took less time than subjects asked to make those judgements regarding expression. Support for differences in identity and expression recognition functions was also presented by the finding that the right hemisphere's superiority differed depending upon whether the subject was judging identity or expression sameness. Evidence for a general right hemisphere superiority was scant, however. In emotion recognition tasks, females were generally faster for LVF faces. Males, though, showed this effect only when judging faces portraying the same expression. The robustness of this finding depended further on whether subjects were judging different or same faces.

Bowers et al. (1985) tested subjects with damage to the right or left hemisphere on their ability to identify faces and the emotions they were portraying. Even when non-facial, visuo-spatially based identity skills were controlled for, right hemisphere damaged subjects did worse on three of the seven tasks than did the left hemisphere damaged subjects or intact controls. Further attempts to localize right hemisphere lesions to posterior or anterior regions provided nonsignificant results. On the basis of their findings, the authors concluded that emotion recognition exists independent of identity recognition and is in the right hemisphere. This conclusion is further supported by the finding that amount of familiarity with a face will affect the speed with which someone can determine its identity, but familiarity does not affect how quickly we process its expression (Young, McWeeny, Hay, & Ellis, 1986).

If one believes that the right hemisphere dominates in the recognition and interpretation of facial activity, then one might also believe that this hemisphere *controls* such activity since it is all part and parcel of the emotional experience. Evidence for this extention is non-conclusive, however. Some researchers (Buck & Duffy, 1980; Moscovitch & Olds, 1982; Sackeim, Gur,

& Saucy, 1978) have found the left side of the face to be more active in emotional and nonemotional expression. Others (Davidson & Fox, 1982; Sackeim & Gur, 1978; Schwartz, Ahern & Brown, 1979) have asserted that left side dominance applies to the expression of negative emotional states only. In fact, these researchers have discovered that positive emotions are more actively expressed by the right side of the face.

Though these inconsistencies are difficult to reconcile, it should be noted that the nature and extent of facial lateralization discovered in each of these studies is in keeping with the assumptions of the respective researchers concerning the nature of emotion-related brain activity. For example, Sackeim and Gur (1978) have asserted that the hemispheric location of such brain activity differs depending upon whether the emotional experience is positive or negative, in other words, pleasant or unpleasant.

Hager and Ekman (1985) have forwarded a number of possible reasons why hemispheric specialization in the processing of emotion may result in asymmetry of facial expression. One possibility stems from the fact that verbal skills are localized, usually in the left hemisphere. According to a cognitive labeling theory of emotion (Schachter & Singer, 1962), an important part of the emotional experience is verbal in nature; namely, the labeling of non-specific arousal. If it is the case that this activity "overflows" to other areas and degrades when crossing to the other hemisphere, then there should be a left hemisphere bias in emotion-related cognition. Alternatively, it may be that language centres are accessed when we consciously attempt to *inhibit* emotion, in the form of defence mechanisms. Perhaps this is why less support can be found for left than right hemisphere bias. In fact, these same researchers

(Ekman, Hager, & Friesen, 1981) found that deliberate, requested actions typically featured more *AU* activity on the left side of the face, implying right hemisphere dominance. It must be noted, though, that such activity may have very little to do with emotion at all. Instead, it may indicate patterns in "facedness."

In their 1985 study, Hager and Ekman attempted to compare spontaneous, posed, and startle-induced facial expressions in terms of their laterality or asymmetry. They operationally defined lateralization as asymmetry with a consistent one-side bias. Subjects were 33 right-handed caucasian women. They were asked to simulate six full-face emotional expressions and specific *AU's* as stipulated by *FACS*. Then they were induced to smile spontaneously. (This was done after a considerable period of difficult posing. The experimenter said, "Aren't you glad that's over?" Part of a subject's response to that question was what Hager and Ekman considered to be a spontaneous smile.) Finally, the subjects were startled by an unexpected noise from behind them.

All of these facial expressions were videotaped and analysed using *FACS*. Hager and Ekman discovered that asymmetry was more common in the deliberately posed faces, whether emotion-related or not. They also found that laterality, the consistent bias for one side of the face was rare and, at that, found only for certain *AU's*. In fact, only 5 of the 33 subjects showed consistent laterality and neither side of the face was favoured by all five. On the basis of their work, which is perhaps the most careful and comprehensive to date, the researchers concluded that theories of hemispheric specialization in emotional expression are not supported, since such specialization would result in consistent lateralization and that simply cannot be reliably produced. This does not discount the possibility that the right hemisphere is responsible for some control over emotion. It may oversee emotion-related *cognition* but not *movement*. Or perhaps it may work to *inhibit* or *modulate* emotion rather than to *generate* it.

Hager and Ekman suggested that a closer look at facial motor neural pathways may be helpful in explaining why posed expressions are asymmetrical rather than lateralized. That suggestion is best followed by returning to Rinn's (1984) explanation of the neuropsychology of facial expression. Specifically, we must look closely at evidence for the theory that posed and spontaneous facial expressions are controlled by different parts of the brain. Then we can identify reasons why each location might be more or less likely to produce expressions that are asymmetrical in nature.

Earlier in this paper, it was noted that voluntary control of facial movement originates in the motor strip of the cerebral cortex. It was also noted that impulses originating from this area result in contralateral control over the face and that this control is most evident in the lower half of the face. To be more specific, about 75 percent of the neurons innervating the muscles around the eye are contralateral in origin, compared to only about 50 percent of those in the brow and forehead region.

This being the case, we should be able to find clear evidence from brain damaged patients that lesions affect the face in particular ways depending upon their location. People who suffer massive damage to one hemisphere of the brain due to stroke should show more hemiplegia in the lower portions of the face, since those muscles are contralaterally controlled. This is, indeed, the case (Rinn, 1984). Furthermore, there are symptoms of certain brain dysfunctions that affect voluntary facial movement, but not spontaneous expression. And the reverse is also found for other dysfunctions.

For example, the hemiparalysis caused by tumors in one hemisphere of the motor strip is evident when patients are asked to smile. Only one corner of the mouth, on the side ipsilateral to the lesion, is retracted. However, the same patients' genuine smiles are clearly bilateral in nature. Of course, the same muscles are used for volitional and spontaneous smiles, but their neurological origin is quite obviously different. Conversely, many patients with Parkinson's disease are quite capable of moving facial muscles on command, but they lose the ability to display emotion spontaneously. Rinn pointed out that the cause of this "masked face" syndrome is lesions that affect the functioning of various nuclei in the extrapyramidal motor system, especially the basal ganglia.

Taken collectively, this evidence supports the hypothesis that voluntary facial expressions are more asymmetrical because the part of the brain responsible for such movement exerts distinct, contralateral control. This allows for left side facial movements that are independent of those on the right and are, therefore, more likely to be asymmetrical. Furthermore, this asymmetry is more pronounced in the lower half of the face because pathways from the motor strip synapse with lateral LMN nuclei that innervate that facial area.

This is not to ignore studies that show significantly greater deficits in right brain damaged subjects when it comes to emotional processing and expression. In addition to the Bowers et al. (1985) finding that right brain damaged subjects were poorer perceivers of facial expression and identity, others (Borod, Koff, Lorch, & Nicholas, 1986) have found that subjects with right-brain cerebrovascular pathology were significantly worse at producing both posed and spontaneous facial expressions. That both types of expression were affected suggests that the damage was both cortical and subcortical in nature.

To summarize then, evidence presented here does not entirely refute the claim that the right hemisphere is dominant in the processing of emotion-related stimuli. However, when those stimuli take the form of facial expressions, the extent of that dominance must be questioned since it appears to depend on the nature of the processing. It also is concluded here that attempts to prove this dominance to be manifest in lateralized facial expressions have failed. There is, nonetheless, strong empirical support suggesting that posed facial expressions are more asymmetrical than their spontaneous counterparts. This asymmetry does not demonstrate hemispheric specialization, though. Instead, it can be best explained via *vertical*, rather than *lateral* differences in brain function. Specifically, voluntary facial action is controlled by the motor strip which exerts contralateral, and thus more asymmetrical, control over the face, especially in its lower portions. These conclusions are corroborated in reviews of the literature (Dane & Thompson, 1985; Thompson, 1985).

## Facial Expressions of Pain

Though there is variation in the way individuals portray pain on their faces, it has been discovered that certain movements are considerably more common than others (Craig & Patrick, 1985; LeResche, 1982; LeResche & Dworkin, 1984). A *FACS* analysis of expressions in response to the cold pressor test revealed that subjects tended to raise their cheeks and upper lip, tighten their eyelids, pull back the corners of their mouth, and part their lips. Also common was a drop of the jaw and a stretching of the mouth, accompanied by closed or blinking eyes. It is interesting to note that these descriptions do not match those of Hjortsjo (1969), the key difference being that Hjortsjo's subjects were actors who posed *painful* expressions.

*FACS* analysis has also been conducted using a clinical population (Hyde, 1986, unpublished doctoral dissertation). Susan Hyde videotaped patients with low back pain as they underwent range of motion tests at the Shaughnessy Hospital Back Pain Clinic. Segments of tape were coded by three individuals trained in the use of *FACS*. Of the 14 action units (*AU's*) consistently identified by the raters to be associated with pain, nine were the same as those reported by Craig and Patrick (1985).

Hyde's patients were also asked to mask pain when they performed a movement previously identified as being painful, and to pose a pain expression during a movement that was not painful. In this way, she was able to make *FACS* comparisons between genuine, masked, posed, and baseline expressions. These comparisons yielded some interesting results.

Are posed pain expressions similar to the real thing? For Hyde's subjects, average *FACS* ratings for posed expressions were higher for 10 of the 14 *AUs*. Four of these differences were statistically significant. Posing, it appears, produces more of a caricature than a faithful reproduction of a genuine pain expression.

Are masked expressions similar to baseline measures? Hyde's findings suggest this to be the case. Only one *AU* differed significantly from the baseline condition. Patients blink less often when masking pain. This may be a comment on people's masking skills. However, it might be an artifact of the nature of the expressions being investigated here because even the genuine pain expression was not radically different from baseline when compared across *AUs*. Only two comparisons differed significantly. And so, though the masked expression was similar to baseline, it was also similar to genuine pain. The only difference being that the lips were more likely to be parted in the genuine expression.

In terms of *AUs* then, patients came closer to simulating the pain expression when they were trying to mask it than when they were trying to pose it. Of course, such a nomethetic analysis tells us little about individual faces. Also, this analysis is not sensitive to patterns of movement that might be created by a combination of *AUs* that, taken individually do not differ significantly from condition to condition. Support for this "gestalt" approach is provided by the finding that female patients were judged to be more expressive, yet no single *AU* showed significant male-female differences.

A fundamental question yet to be answered is whether or not the conditions Hyde employed (genuine, masked, posed, and baseline) yielded differences that practitioners and others could *detect* and ascribe to those conditions. Experimentation has been conducted on the detection and judgement of pain in others, but only recently using genuine and posed expressions (Prkachin, in press). For much of the work using genuine expressions only, subjects are first put through a controlled pain experience to tolerance, for example a series of ascending electric shocks. They are then put through the procedure again, but with two important additions. First, there is a confederate who is also supposedly receiving the shocks with the subject. This confederate, or model, displays either higher or lower than average tolerance. Second, the subjects are videotaped.

In the next phase of the procedure, observers view the videotapes and estimate, based on the subjects' facial expressions, how much pain they are experiencing. Independent variables include the intensity of the shock, the subjects' self-reports of discomfort, and the presence of a model (tolerant or intolerant).

In this way, Prkachin and Craig (1985) showed that observers could discriminate between low and high intensity shocks, based on the subjects' facial expressions, with significantly better-than-chance accuracy. This discriminability varied monotonically with the intensity of the high level shock. However, observers were less accurate when judging subjects who had been filmed in the presence of a tolerant model.

This latter finding has at least two explanations. It could be that subjects were masking their pain when in the presence of the tolerant model. It could also be, though, that subjects were actually experiencing less pain.

Patrick, Craig, and Prkachin (1986) did find, in fact, that subjects tended to tolerate greater intensity shocks and give reduced reports of discomfort when in the presence of the tolerant model. In this study, observers' ratings of the subjects' pain were correlated with shock intensity, independent of model condition. In other words, the observers did not agree with the subjects' own ratings of discomfort in the tolerant model condition. Instead, they "saw" the shock level on the subjects' faces. This suggests strongly that subjects were not getting pain cues from their own faces. Perhaps even more interesting is the implication here that the subjects were not in total control of their faces either. Observers attributed the most pain to subjects in the tolerant model condition, and the least pain to subjects with the intolerant model.

This brings us back to a distinction made at the outset of this thesis. We have some very accurate descriptions of what the face is *doing* when we are experiencing pain (or pretending to), but what is it *saying*? Do we attribute more pain as the movement becomes more exaggerated? Prkachin (in press) has shown that exaggerated poses are more likely to be considered false. And is there a subtle face showing attempts at tolerance and stoicism that we consider to be indicative of even more pain?

We do know that laboratory observers are able to link facial expressions with pain experience at significantly better-than-chance levels when the task is not complicated by attempts at deception. Subjects are also able to distinguish between pain expressions and simulations of those expressions for high intensity shocks (Prkachin, in press). Studies measuring the extent to which clinical observers' judgements match the self-reports of their patients' pain have produced mixed, predominantly unimpressive results, however.

Early indications that assessment of pain in clinical settings was less than accurate came from the work of Marie Johnson (1976; 1977). In one study, patients and their nurses filled out the Recovery Inventory, a measure of physical distress. The correlation between the nurses' and their patients' responses to the intensity of pain dimension of the inventory was .08, significantly lower than chance. Only 17 percent of the nurses' estimates agreed with those of their patients, though most of the nurses' estimates were close to the *average* of the patients' pain responses. It would seem from these results that experience plays a part in their estimates. Perhaps the nurses were drawing on their more global impressions of pain tendencies in the gynaecology ward, rather than the specific impressions conveyed by a particular patient. It is also possible, of course, that the patients in question were trying, for various reasons, not to convey pain.

Johnson's findings reinforce the commonsense notion that clinical judgements are more difficult than controlled laboratory ones. Distractions are numerous, and there are the agendas of both patient and practitioner to consider. Still, practitioners are experienced judges of pain. One might hypothesize that this experience, and other characteristics of the practitioner, would be related to their judgements of pain.

The effects of nurses' characteristics on their estimates of pain were investigated by Dudley and Holm (1984). The researchers looked at nurses' years in practice, age, relative job satisfaction, education, clinical area, cultural background, and shift assignment. The dependent measure was the amount of pain attributed to certain patients on their wards. It turned out that none of the characteristics measured yielded significant differences in the amount of pain attributed. In fact, when patient characteristics were also included, the only significant one was the nature of the illness or injury. Not surprisingly, nurses attributed more pain to trauma and infection and least to psychiatric problems.

Though the Dudley and Holm study tells us that nurses do not appear to become more or less sympathetic as they progress through their careers, it tells us little about how *accurate* they are. Since the nurses in Johnson's (1976) study tended to underestimate pain and Dudley and Holm's subjects attributed less physical pain than psychological distress, perhaps we can infer that higher estimates of pain are more accurate. But this is a tenuous inference at best. Thus, when Dudley and Holm talked about the consequences of poor pain assessment in terms of inappropriate care, they actually were talking beyond the bounds of their study, which made no attempt to match nurses' estimates with patients' self-reports. Nevertheless, there is nothing in this work to lead us to believe that nurses get any *more* accurate in their assessments of pain with years of practice.

Missing also from the Dudley and Holm work is any description of how the nurses derived their judgements of patient pain. Specifically, did they look at their patients faces? Teske, Daut, and Cleeland (1983) provided an answer to this question, as well as data on the accuracy of nurses' judgements. They were interested in the inter-rater reliability of pain judgements, as well as what they called the validity of those judgements — the extent to which they corroborated with patients' self-reports.

Two nurses were trained in the observation of a number of non-verbal indicators of pain, including such things as restlessness, muscle tenseness in various parts of the body, paralinguistic cues, and certain facial expressions. They then used a rating system designed by the authors to indicate activity in each of these areas. It was found that the correlation between nurses for 21 patients was 0.78, compared to 0.69 when they used a Visual Analogue Scale. The nurses also tended to agree as to whether a given movement was indicative of physical pain. This was particularly true of facial expressions, for which the inter-rater reliability was 0.73.

The correlations between patients' self-reports and observers' global judgements were significant. This was the case for sufferers of both chronic and acute pain, though the correlation was higher for the latter (0.28 vs. 0.32). The authors call these correlations "modest, though significant" (Teske et al., 1983, p. 289) Certainly, they are better than those obtained by Johnson. It must be remembered, though, that only two nurses were used by Teske et al., and the training could account for high inter-rater reliability scores. In fact, the validity scores were derived from the judgements of only one of the nurses.

Though the nurses agreed that certain facial expressions were indicative of pain, they did not agree very well at all regarding whether or not they had seen a particular facial expression when simultaneously observing a patient. In fact, of the 11 non-verbal categories that they were rating, four yielded non-significant inter-rater correlations, and three of those were face related. This is somewhat surprising, since they were looking for such overt expressions as frowning and grimacing. Are these low correlations caused by the rapidity with which these expressions occur, or is there a reluctance on the part of the nurses to focus their attention on the faces of people in pain? Though facial expressions of pain can be brief, they are not likely to be any more so than grunts, which received much higher reliability coefficients (.99 for grunts, as opposed to .50 for squinting). Support for the reluctance explanation may be inferred from reports by my student nurses at BCIT that patients in pain often have curtains drawn around their beds, even when they are in the room by themselves.

So it appears that clinicians have a harder time using facial information than do the subjects in laboratory settings. It has not been ascertained, though, whether or not this is a result of the practitioners' reluctance or inability to use facial information, or the patients' unwillingness to display it truthfully. Either way, we should not be surprised to find that patients are better predictors of the painfulness of an impending procedure than are their doctors, especially when the patients are experienced with the procedure (Hodgkins, Albert & Daltroy, 1985).

*Malingering*

In clinical settings, not all expressions of pain have organic or psychogenic origins. In some cases, patients simulate pain behaviour in a conscious attempt to receive medical attention and treatment (Stevens, 1986). This is called malingering, a form of deception intended to create an impression of physical illness or psychological disorder (Lees-Haley, 1986). It is this conscious motivation that distinguishes malingering from other forms of factitious illness, such as hysteria (Stevens, 1986; Swanson, 1984). Travin and Protter (1984) place malingering phenomena on a continuum of deceptiveness, with other-deceptive, mixed-deceptive, and self-deceptive categories. A patient's position on this continuum is defined by his or her conscious self-awareness of the deception process.

In addition to simulation or exaggeration of pain behaviour, malingerers also simulate deafness, blindness, weakness, diminished sensation, and even coma (Gorman, 1984). Malingering is more common among sociopaths, drug abusers, and alcoholics than other individuals (Sierles, 1984).

One of the most graphic forms of malingering is Munchausen syndrome. In these cases, patients attempt to convince practitioners of a nonexistent medical problem that requires urgent medical intervention (Prasad & Oswald, 1985). Many researchers continue to puzzle over the reasons behind this apparently self-destructive behaviour pattern (Folks & Freeman, 1985); however, Fisch and Zimran (1984) used the case study of a 24-year-old man to illustrate some of the potential gains of adopting Munchausen behaviours. These include the satisfaction of passive and dependent needs, the receiving of attention, and an increase in self-esteem.

It might stand to reason that malingering is more common in litigation or compensation cases in which the individual stands to make tangible gain from a positive diagnosis of illness or other condition. After a review of the literature, however, Mendelson (1986) concluded that there was not evidence to support the belief that litigants commonly exaggerate their pain experience. In fact, there is evidence that the overall rate of malingering in the form of simulation of pain symptoms might be quite low.

Leavitt and Sweet (1986) surveyed over 100 orthopedic surgeons and neurosurgeons across the United States to determine both their estimates of the frequency of malingering among patients with low back pain, and the extent of agreement regarding what constitutes malingering. The authors found that there was considerable agreement (70 percent) regarding the symptoms of malingering in this context, specifically exaggeration and incongruous behaviour. Sixty percent agreed that malingering is relatively infrequent, occurring in five percent or less of patients with low back pain.

Of course, it is not usually advisable or ethical for neurosurgeons or other physicians to be guided by suspicion in their practice. Instructors in clinical programs, such as nurse and pain specialist Margo McCaffery cite work such as that of Leavitt and Sweet in their teaching to guide practitioners when assessing the pain of their patients. In clinical practice then, pain is "whatever the experiencing person says it is, existing whenever he (or she) says it does" (McCaffery, 1979, p. 11). This same definition of pain is echoed by the American Pain Society (1987) and the World Health Organization (1986). This advice makes patient verbal report a prime criterion in pain judgement.

As social beings, however, we may place more weight on what we consider to be clear non-verbal information than on a person's self-report when making judgements about others because we have an implicit theory stating that verbal information is easier to control and falsify. Keefe, Bradley and Crisson (1990) follow Fordyce's (1976) analysis to suggest that self-report is operant behaviour. As such, it can be controlled by environmental and social reinforcement, as well as by the administration of pain medication. Other pain behaviour, such as facial expression, is considered to be "respondent" (Keefe, et al., 1990, p. 158). It is elicited by nociceptive influences such as tissue damage and will increase with activities that increase nociceptive input. The implication here is that nonverbal pain behaviour is more likely to covary with pain experience and, thus, be a better indicator than will verbal report.

Consistent with the notion that verbal report can be environmentally controlled independent of pain stimulation, Linton and Gotestam (1985) found that pain reports could be influenced by operant conditioning. In their study, Linton and Gotestam presented two groups of subjects with pain stimulation. The difference was that the experimental group had their pain reports reinforced verbally. As a result, their reports increased, even when the intensity of the pain stimulation was reduced.

Just because verbal report can be controlled and falsified does not necessarily mean that it will be. It is the contention of McCaffery and others that, in clinical settings, it is unlikely patients will falsify verbal report information such that they claim to be in pain when they are not. Because of this, they contend that patients' verbal reports of pain must be given primary consideration.

We are left in doubt, then, as to which general source of information, verbal or nonverbal, will be of best use when making judgements about others' pain experiences. The implicit theory that the face is less controllable than verbal report makes intuitive sense, but research has yet to accurately determine just how well people can control their facial expression where pain is concerned (Craig & Hyde, in preparation). It is possible, therefore, that we are quite susceptible to deception from facial expression because we do not *expect* that information to be false.

Still, there is research suggesting that people in general could be expected to have difficulty posing symptoms believably. Aubrey, Dobbs and Rule (1989) found that people did not have good awareness of the range of symptoms common to whiplash from an auto accident, presumably making simulation difficult.

As previously mentioned, practitioners estimate that malingering in the form of pain behaviour simulation is relatively infrequent. These estimates are based on the assumption that it is *not* difficult to identify such malingering in the first place. Medical tests can determine the existence of most organic causes of pain, and so it might be assumed that complaints that are not supported by positive evidence of organic cause are indicative of malingering. Such an assumption would be ill-advised, however, given the number of ways genuine pain complaints can exist without discernable tissue damage or other organic etiology (for example: psychogenic pain, hysteria, and stress-induced headaches). It can also be the case that patients with definite organic bases for their pain complaints might display symptoms that are "medically incongruent" (Main & Waddell, 1987; Reesor & Craig, 1988).

Weintraub (1988) defined hysteria as regional pain without a neurological link to an injury site. He went on to say that it was "exaggerated pain behaviour designed to attract attention" (p. 914). This is a simple enough criterion on the surface, yet it introduces the subjective process of internal attribution. The practitioner must make an *inference* regarding the reason for the pain behaviour.

Merskey (1988) provides somewhat more specific criteria. First, the occurrence of a symptom must correspond to an implicit theory the patient holds regarding the condition. Second, there must be the presence of other hysterical signs. Third, the existence of the symptom must solve some problem for the patient. In other words, it must be operant.

Practitioners' confidence in their identification of malingering is made questionable by research demonstrating how easily they can be fooled. In one study (Faust, Hart, Guilmette & Arkes, 1988), teenagers were instructed to "fake bad" on neuropsychological tests. When neuropsychologists were presented with these test results, about three-quarters of them judged the cases to be abnormal and attributed results to cortical dysfunction. In a second study reported in the same paper, Faust et al. combined an equal number of malingerers' cases with actual cases. They then primed the neuropsychologists by telling them that 50 percent of the cases were malingerers. Even after such priming, their detection rates were no better than chance. Of note is the fact that the practitioners were quite confident of their case appraisals, despite their poor accuracy rates.

In another study, Faust and his colleagues (Faust, Hart, & Guilmette, 1988) asked children to "fake bad" on comprehensive neurological tests. The children were given little guidance regarding how this should be accomplished. When presented with the test results, 93 percent of the 42 neuropsychologists who participated diagnosed abnormality. Not one attributed the test results to malingering.

How skilled must a patient be in order to fool a practitioner? Certainly the children and teenagers in the Faust studies were not trained actors or experienced malingerers. They did have the "innocence of youth" in their favour, though. In other words, it might not have been their skill as malingerers as much as the practitioners' implicit theories about the veridicality of children's test results that were responsible for the practitioners' errors.

*The Utility of Language in Pain Assessment*

Thus far, the discussion of the value of self-report has focused solely on the truthfulness of that source of information. Another possibility exists, however. The information might be truthful, but inarticulate. Self-report is only as useful as the words the patient chooses. Such information would be of best use of words or phrases that were within the patient's vocabulary were more common to some physical or psychological conditions than others; that is, if the words had specific, objective meaning.

Tearnan and Dar (1986) presented a large sample of physicians from various specialties with 10 pain descriptors and asked them to rate, using a 10-point scale, the extent to which each applied to four pain syndromes: neurogenic, joint, bone, and myofacial. It was found that physicians discriminated among pain syndromes in their ratings of all but two descriptors. Most descriptors were also used differently for chronic as opposed to acute pain, with physicians reporting that the descriptors were more useful for acute pain.

Brattberg, Thorslund and Wikman (1988) suggested that objective language might be derived by having the patient compare the sensation to other common pain experiences for which there is reasonable consensus regarding intensity. A survey by these authors identified five ordered experiences that were sufficiently discriminating: tight clothes, stiffness after exercise, recently sprained ankle, intense dull toothache, and fractured leg.

One of the simplest applications of language in pain assessment is the Visual Analogue Scale (VAS) which features a phrase at either end of a 10-centimetre line. At one end is a phrase like, "I have no pain"; at the other, "My pain is as bad as I can possibly imagine." The VAS has proven valid and reliable as a measure of pain with such groups as severely ill cancer patients (Ahles, Ruckdeschel & Blanchard, 1984).

Ekblom and Hansson (1988) asked dental patients to use a number of scales to describe their current pain. They found that the words "light",

"light-moderate", "moderate", "moderate-severe", and "severe" were highly correlated with VAS ratings supplied for the same pain. When mean VAS ratings were calculated for each word, however, there was considerable overlap in the 95 percent confidence intervals. This supports the observation made by Chapman, Casy, Dubner, Foley, Gracely and Reading (1985) that pain scales featuring verbal descriptors do not necessarily feature equal intervals of magnitude between those descriptors.

Tamburini, Selmi, De Conno and Ventrafridda (1987) asked advanced cancer patients to rate the intensity of five key words (in this case, presented in Italian) by marking a 10-centimetre line as used in the VAS. Of 83 patients tested, all but one showed agreement regarding the order of the key words in terms of intensity. The words were: slight, troublesome, exhausting, terrible, and excruciating.

Such an ordered five-point word scale, or event scale in the case of Brattberg et al. (1988), is useful in terms of its simplicity and ability to reliably allow patients to place their experience on a continuum. However, they treat pain as a unidimensional phenomenon. Other pain scales using word checklists divided into three or more dimensions have provided even greater diagnostic and experimental utility.

Perhaps the most widely used of these is the McGill Pain Questionnaire (MPQ; Melzack, 1975). The MPQ consists of 20 groups of words, from which the patient is instructed to select only those that best describe the pain in question. The words represent three dimensions of pain: affective, sensory, and evaluative. Another relevant measure derived from the MPQ is the number of words chosen.

It has been argued that the MPQ measures more than three dimensions (Crockett, D.J., Prkachin, K.M., Craig, K.D. & Greenstein, H., 1986). After using the MPQ to assess pain under conditions of social influence (tolerant and intolerant models), Crockett et al. identified additional dimensions, including affective-arousal, sensory-pressure, perception of harm, somesthetic pressure, and cutaneous sensitivity.

The diagnostic power of the MPQ has been widely documented for a variety of conditions from psychological to physiological disorders (e.g. Brennan, Barrett & Garretson, 1987; Melzack, Terrence, Fromm & Amsel, 1986). It has been translated into a number of foreign languages, including, most recently, German (Stein & Mendl, 1988), Dutch (Vanderiet, Adriaensen, Carton & Vertommen, 1987), and Italian (Maiani & Sanavio, 1985).

Despite the wide and successful use of the MPQ, Nehemkis and Charter (1984) have cautioned against drawing the conclusion that verbal descriptor scales such as the MPQ produce unique constellations of word groupings for given pain syndromes. They point out that there is considerable overlap among these syndromes on most of the sensory and affective dimensions of verbal descriptor scales, as well as less-than-universal agreement among studies regarding just which words are most commonly chosen by cancer and arthritis patients.

Melzack has designed a short form of the MPQ (SF-MPQ, Melzack, 1987). In this version, patients are presented with 15 words and asked to rate the intensity of their current pain in terms of those words using a 0-3 scale.

Melzack reported that tests with postsurgical, obstetrical, physiotherapy, and dental patients yielded high correlations between the SF-MPQ and the standard MPQ.

The scales designed by Gracely and his colleagues (Gracely, 1979; Gracely, McGrath & Dubner, 1978) also feature three dimensions: sensory intensity, unpleasantness, and painfulness. In addition to these three dimensions, the Gracely scales have the advantage of numerical equivalents for the painfulness dimension that are ratio-scaled. Since the painfulness scale is the one chosen for the present study, a more detailed description of its properties will be presented in the Method section under Materials.

In summary, patient verbal self-report has been used extensively in the assessment of pain. These reports range from those solicited by the highly structured, formalized questionnaire or scale, to "Tell me where it hurts and how bad it is." Regardless of the way self-report information is collected, it must be seen as a form of pain behaviour, especially when offered by the patient without invitation from the practitioner. As such, it can be motivated by a set of factors that are quite independent from other pain behaviours, and be indicative of specific dimensions of pain, rather than a global sensation.

## Rationale for the Present Study

*The face as a source of information regarding the experience of pain*

One hardly needs to forward a case for the importance of accurate pain assessment in clinical settings. In non-clinical settings, recognition of another's pain or distress may provide impetus for valuable helping behaviours (Craig, 1986; Krebs, 1975; Piliavan, Dovidio, Gaertner & Clark, 1981). Pain, more than any other symptom, sends people to their physician (Taylor, 1986), and though the patient often sees the pain as being the problem, the practitioner sees it as being *indicative* of a problem. It is informative. So much so that analgesics may be withheld in order to get a true measure of pain.

But what is a true measure of pain? Verbal report is easy to quantify, as are Visual Analogue Scales. However, these measures are subject to situational demands as interpreted by the patient. They are also easily influenced by the motives of the patient (Craig & Prkachin, 1983; Prkachin, Currie & Craig, 1983).

Though it is the case that verbal report can be manipulated by the patient in either subtle or obvious ways (eg. the Munchausen syndrome; Ireland, Sapira & Templeton, 1967), it is still arguably the single best indicator of patient discomfort (Wolff, 1986). As an indicator, however, it is only as good as the truthfulness of the patient.

What about those times when verbal report and nonverbal behaviours contradict one another? Prkachin (1986) has argued convincingly that pain behaviours are not unitary in nature. Though various pain behaviours are correlated, they are not perfectly so. Anciano (1986) found three distinct factors underlying the Pain Behavior Checklist (Philips & Hunter, 1981) — avoidance, verbal complaint, and palliative behaviour. Each factor correlated well with headache sufferers' overall pain ratings, but correlations among the factors were low.

Different pain behaviours are regulated by different factors. Prkachin has compared grimacing and guarded posture. The former might be regulated by social factors, the latter less likely so.

By viewing pain behaviours as being somewhat independent of one another and multifactorial, we can see how contradictions between such forms as self-report and facial expression might arise. Such "mixed messages" might be the result of attempts at deception; however, they might also be two behaviours responding to different eliciting factors.

Research has yet to be conducted that investigates people's pain judgements under conditions in which contradictory information from two or more pain behaviours is presented. It might very well be that people put more faith in nonverbal measures because they believe such behaviours are more difficult for the patient to control.

*Differences among genuine, masked, and posed facial expressions*

People are not likely to "put faith" in a source they do not think they can read. In other words, if we turn to facial expression as a means of verifying verbal reports of pain, we must have some knowledge of the veridicality of that expression. We must be able to distinguish fakes from the real thing. There must exist discernable differences between genuine (involuntary) and faked (voluntary) expressions. This is not to say that all voluntary expressions are fake, but that all faked expressions are, to some extent, voluntary.

Neurophysiological evidence cited earlier in this thesis indicates that involuntary and voluntary facial expressions are controlled by different neural mechanisms (Craig & Prkachin, 1983; Rinn, 1984). It was also pointed out that those differences increased the likelihood that voluntary expressions would be more asymmetrical, and that subjects asked to pose expressions featured more activity on the left side of the face (Ekman, Hager & Friesen, 1981) and that asymmetry was more common for posed expressions (Hager & Ekman, 1985). What remains to be seen is whether or not untrained observers are able to perceive these asymmetries.

Asymmetry is not the only way in which posed and genuine faces differ. Hyde (1986) discovered that posed expressions of pain featured more movement than their genuine counterparts. These differences were apparent to the trained *FACS* coders, but we do not know if untrained observers would interpret them as poses or as "super-normal" examples of pain. Prkachin (in press) has found that the greater the exaggeration of a pained expression the greater the likelihood that it will be identified as a pose.

*From description of the expression to the meaning of the expression*

Regarding facial expressions of pain, research has provided us with detailed descriptions of such expressions in both laboratory (Craig & Patrick, 1985; LeResche, 1982) and clinical (Hyde, 1986; Prkachin & Mercer, 1989) settings. Hyde has also described masked and posed expressions of pain. We know, as well, that subjects making judgements of genuine pain expressions in a relatively distraction-free lab can match expression to stimulus intensity with better-than-chance accuracy (Patrick, Craig & Prkachin, 1986). By contrast, practitioners in clinical settings are less accurate, and at times worse than chance (Johnson, 1976; 1977).

Of the many factors that are introduced when we move from laboratory to clinical settings, masking and posing on the part of the patient could have considerable impact on pain judgement. We now know what the face is *doing* during these dramas, but we must still ascertain what it *means* to the perceiver. With this knowledge, we would gain insight into the problems encountered when assessing pain in more realistic settings. Are people fooled by masks and poses? If so, future research could investigate the possibility of training them to be become better judges.

Of course it must be acknowledged that pain judgements are like any other social judgement tasks in that they depend greatly on the context of that judgement. The present study attempts to do what many experiments in social psychology attempt — to isolate a manageable number of factors within that context and measure their impact. The present study is primarily interested in the potential effects of posing and masking on the part of the "sender", who in this case is the patient.

The literature reviewed here could lead us to one of two potentially contradictory general hypotheses regarding people's abilities to read facial expressions. Physiological analysis of facial expression and related laboratory research suggest strongly that posed and genuine faces are different, both in neurology and in physical display. As such, we should be able to distinguish between false and real expressions. However, when nurses and doctors are asked to make pain judgements in clinical settings the results are unimpressive. This work yields the prediction that people are fooled by false expressions.

In the next section, a series of hypotheses will be introduced and explained. In the main, these hypotheses are consistent with clinical data, rather than physiological implications that false and real expressions are distinguishable.

## Hypotheses

### *Null and Alternate Hypotheses*

The primary objective of the present study was to determine if people are able to discriminate between genuine, masked, posed, and baseline facial expressions of pain. The hypotheses reflect this objective by starting with statements regarding the facial expression variable, predicting essentially that people will be fooled by masked and posed expressions.

The remaining hypotheses address the robustness of the effects of masking and posing. They state that these effects *will not change*, regardless of subject type, or when subjects are given self-report information regarding the patients' pain experiences, or when told that some of the faces are posed and masked. Research reviewed earlier in this thesis provides the rationale for these predictions: Nursing experience does not appear to affect magnitude of pain judgements; self-report is not as salient as facial expression in the judgement process; and priming physicians did not make them better detectors of malingering. As such, these remaining hypotheses appear to be expressed in null form, because by predicting that the judgements regarding masked and posed expressions will be found regardless of these conditions, they predict no effect for subject type, self-report, or priming.

There are, of course, methodological difficulties associated with attempting to prove null hypotheses. Also, though they are supported by clinical findings, some of these hypotheses appear to contradict common sense. For these reasons, the hypotheses will be stated in both the null and alternate forms. Each will be followed by a description of the hypothesis in statistical terms. As well, Hypotheses 2 through 4 will be discussed in terms of common sense support for the alternate hypothesis and clinical research support for the null.

*Hypothesis 1*

***Null hypothesis:*** *Subjects' judgements of pain will be unrelated to patients' facial expressions.*

***Alternate hypothesis:*** *Subjects' judgements of pain will differ according to patients' facial expression.*

The alternate form of Hypothesis 1 predicts that subjects will be fooled by false facial expression. This means that their ratings souldbe higher for genuine than for masked expressions, and higher for posed than for baseline expressions. No other differences should be found.

In total, four patterns of results are possible regarding the facial expression variable, assuming a main effect. Each of these patterns is presented graphically in Figures 1 through 4. The graphs describe hypothetical results if the subjects are fooled by both fake expressions (masked and posed; Figure 1), not fooled and therefore able to accurately distinguish real from fake expressions (Figure 2), or fooled by only one of the fake expressions (Figures 3 and 4).

The hypothesis that subjects will be fooled is consistent with clinical research demonstrating that clinicians have been unable to detect and use different facial expressions to make accurate pain judgements (Johnson, 1976; 1977; Teske et al., 1983).

Evidence for neurological differences between posed and genuine expressions has been documented, however, (Rinn, 1984), and differences in symmetry demonstrated by Hager and Ekman (1985). Also, the analysis provided by Hyde (1986) showed posed faces to be significantly more active across four *AUs*. If subjects are able to detect these differences, a main effect would still be found for facial expression, but the planned comparisons would yield different results. Specifically, the genuine and posed expressions would differ, as would the masked and baseline expressions (see Figure 2).

Though common sense does not suggest the null hypothesis in this case, it does not have to be that subjects are either entirely fooled or entirely sensitive to masking and posing. It could be, for example, that patients mask pain well but do not pose it well. If this were the case, then judgements for masked expressions would not differ from baseline *or posed* expressions (see Figure 3). Planned comparisons, therefore, will allow for an assessment of the relative effectiveness of these two forms of false expression.

*Hypothesis 2*

***Null hypothesis:*** *The pattern of results predicted in Hypothesis 1 will be found regardless of subject type.*

***Alternate hypothesis:*** *Judgements of pain for genuine and masked expressions* *will not differ for subjects with two or more terms of clinical nursing experience. The same will be true for judgements of posed and baseline expressions. However, for subjects with this experience, judgements will differ between genuine and posed expressions, and between masked and baseline.*

The alternate hypothesis says simply that subjects are less likely to be fooled by false expression as they gain more clinical experience (thus the pattern of results would resemble Figure 2 for subjects in term 3 or 5 of the nursing program). This represents the "common sense" prediction. However, research to date does not support common sense in this regard. Dudley and Holm (1984) found that years in nursing practice were unrelated to amount of pain attributed in clinical settings.

*Hypothesis 3*

***Null hypothesis:*** *The pattern of results predicted in Hypothesis 1 will be found regardless of whether or not subjects are presented with patients' self-reports of pain.*

***Alternate hypothesis:*** *Self-report information that is consistent with facial expression will polarize the subjects' judgements of pain. Self-report information that is inconsistent with facial expression will eliminate differences between genuine and masked expressions, and between posed and baseline expressions.*

The alternate hypothesis predicts that subjects will use both facial expression and patient self-report information when making their judgements. Specifically, the effect of self-report will differ depending upon whether it is consistent or inconsistent with facial expression. Consistent information will intensify the differences predicted in Hypothesis 1 and shown in Figure 1. Inconsistent information will change those differences since subjects will no longer be fooled by the fake expressions, so that the pattern resembles Figure 2.

*Hypothesis 4*

***Null hypothesis:*** *The pattern of results predicted in Hypothesis 1 will be found regardless of whether or not subjects are told in advance that some of the expressions are posed and some are masked.*

***Alternate hypothesis:*** *When told in advance that some of the patients' expressions are posed and some are masked, subjects will not be fooled by fake expressions.*

The alternate hypothesis predicts that high ratings of pain for posed expressions and low ratings for masked expressions, as predicted in Hypothesis 1, will be reversed to more accurately reflect the patients' actual pain experiences (as shown in Figure 2). The null hypothesis predicts no such reversal.

Common sense might suggest that when subjects are made explicitly aware of the "rules of the game," that fake expressions exist in the sample, they will become more sensitized to that possibility and, thus, more accurate in their judgements. Still, the null hypothesis is supported by clinical studies mentioned earlier that have yielded unimpressive accuracy ratings for pain judgements. Ratings of this nature are made by practitioners who are not naive to the possibility that patients will pose and mask expressions of pain.

Figure 1: Pattern of results if subjects are fooled by fake expressions.

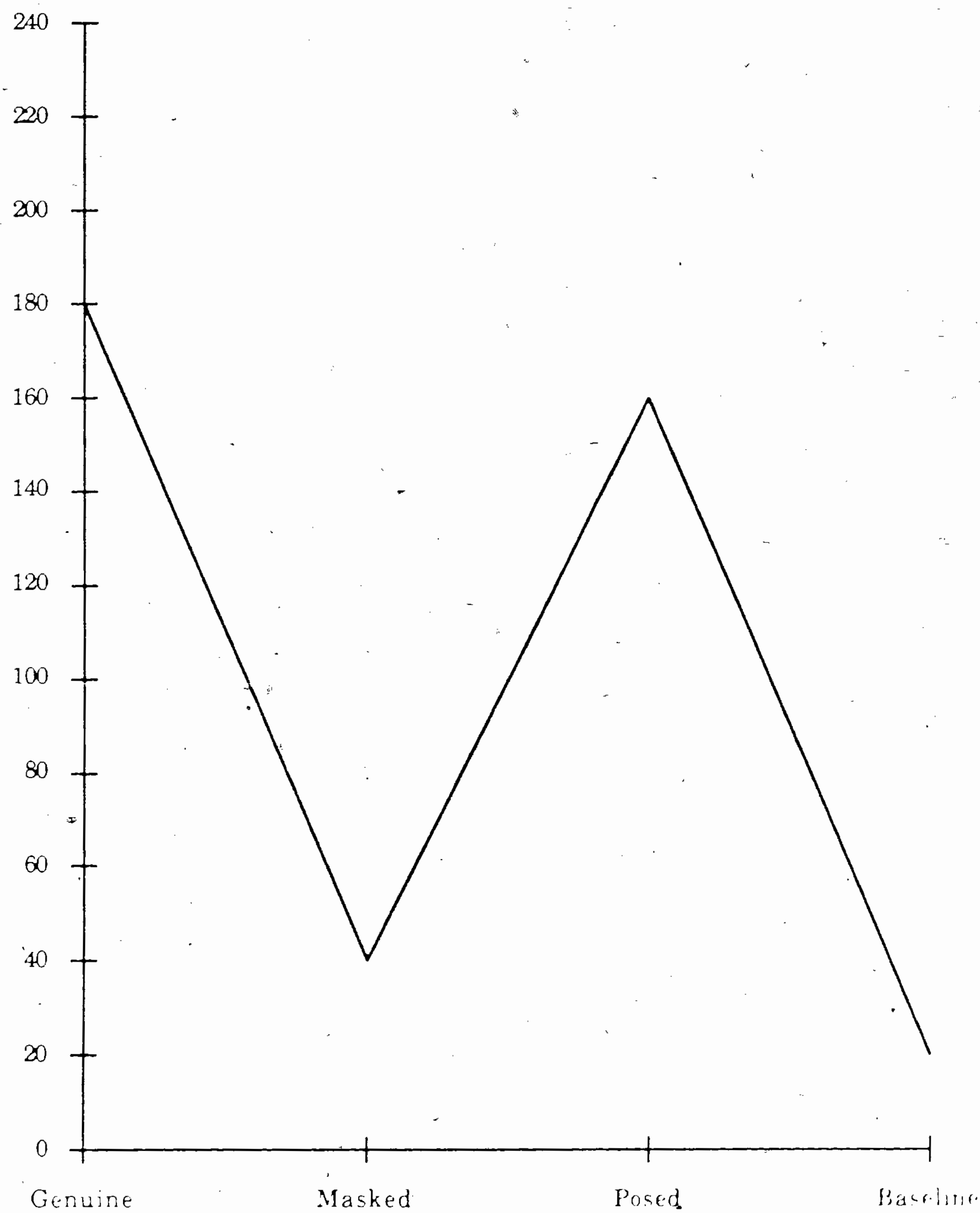


Figure 2: Pattern of results if subjects are not fooled by fake expressions.

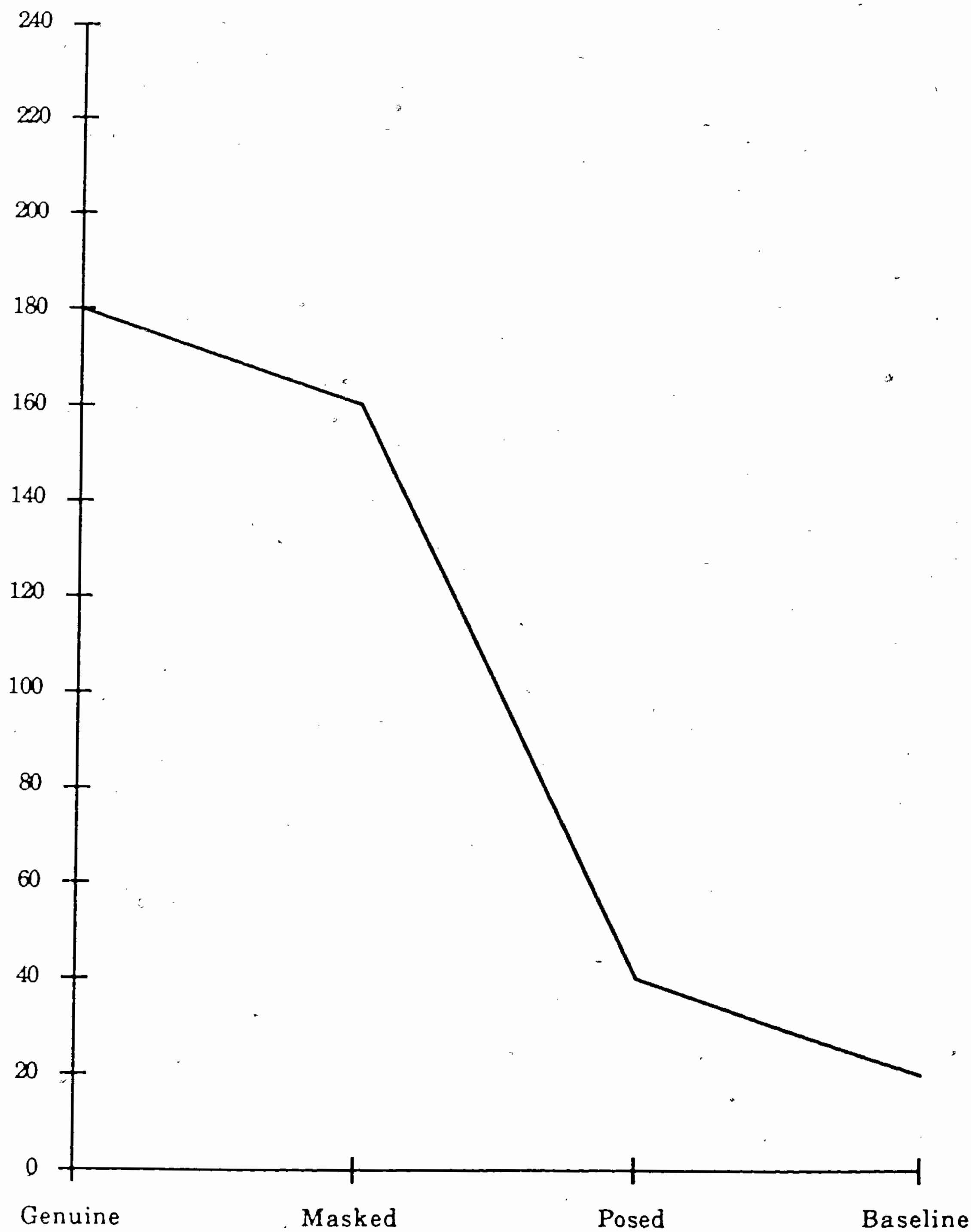


Figure 3: Pattern of results if subjects are fooled by masked expression only.

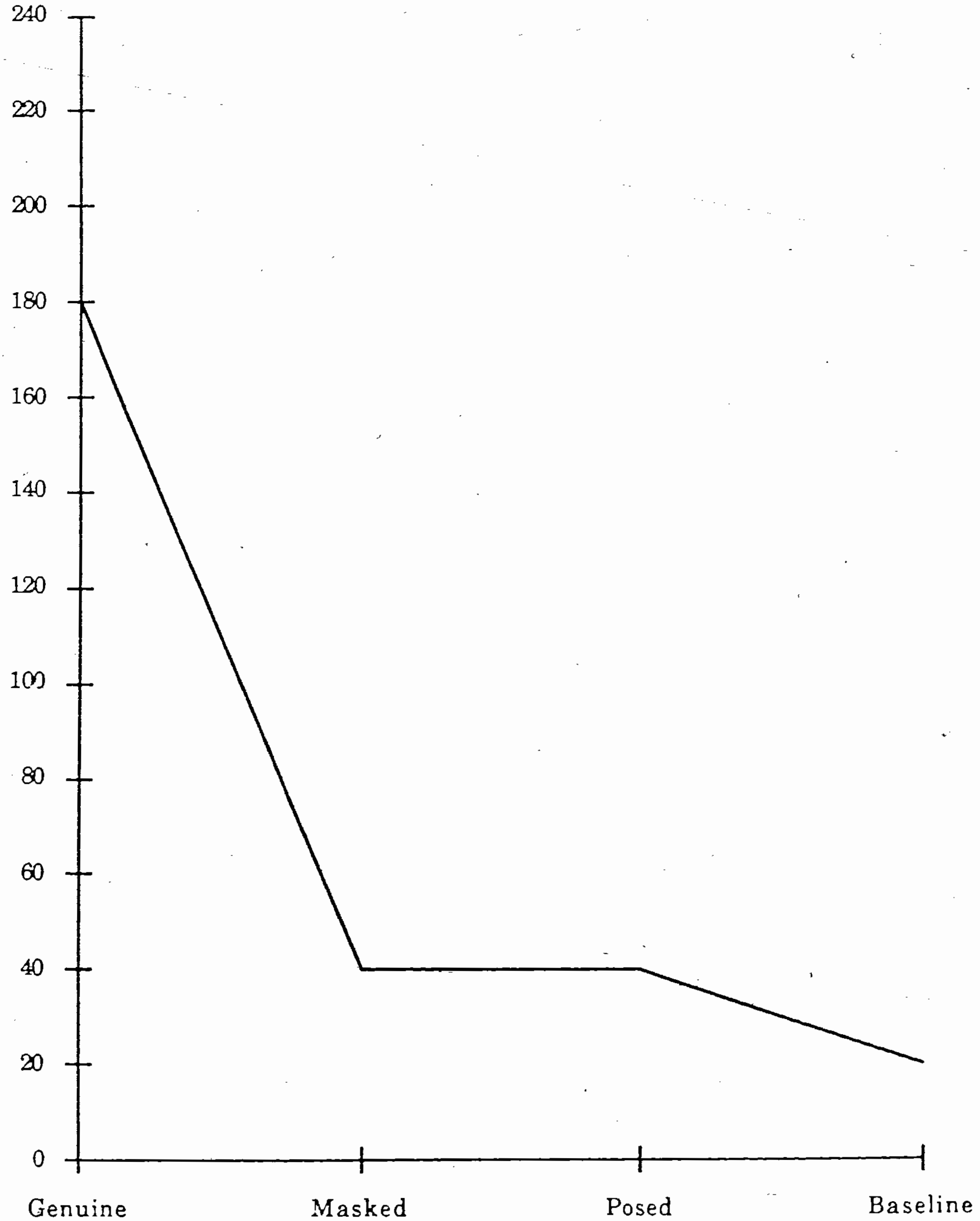
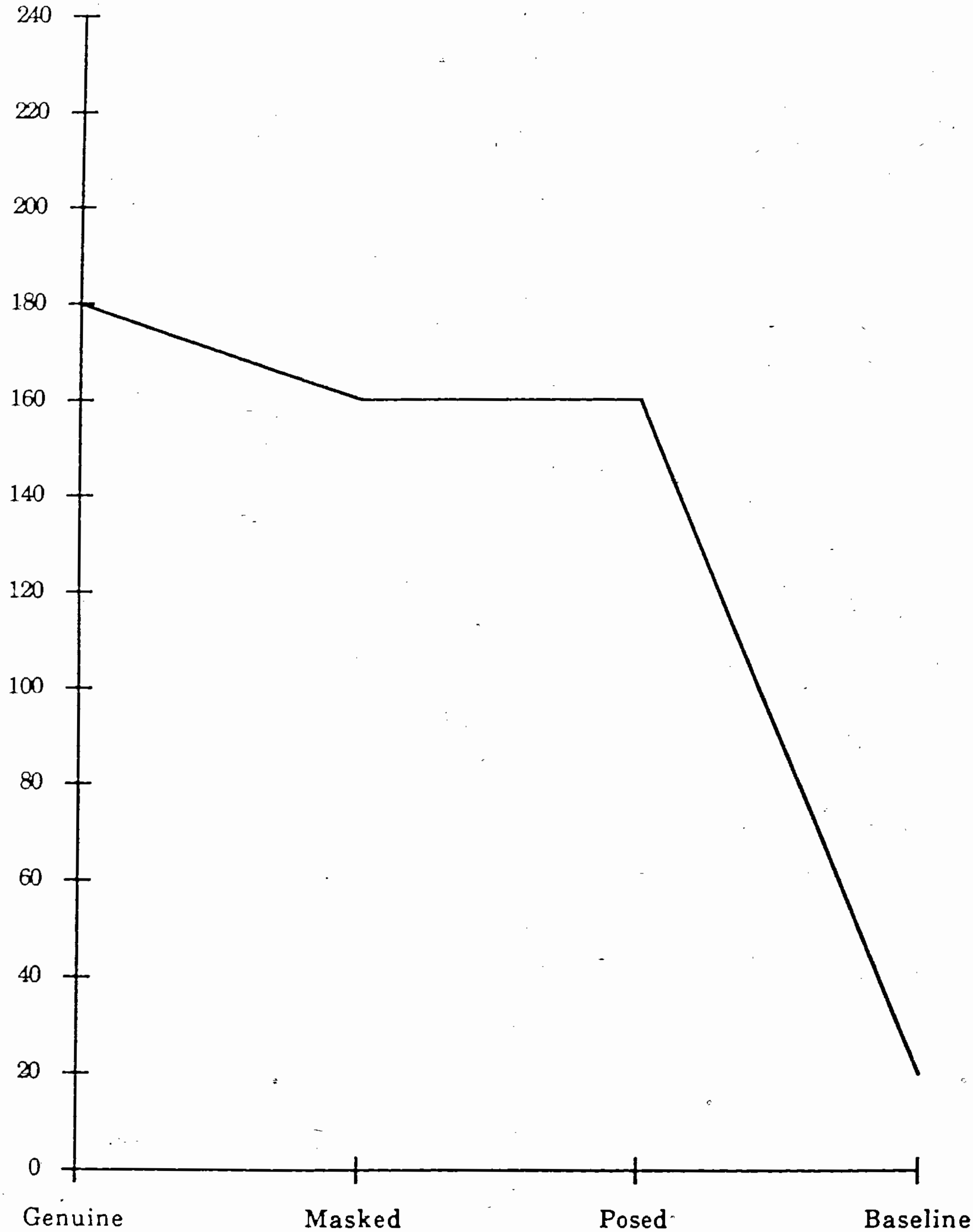


Figure 4: Pattern of results if subjects are fooled by posed expression only.



# CHAPTER II

# METHOD

## Subjects

The subjects for the present study were recruited from introductory psychology classes at Simon Fraser University (SFU) and from the nursing program at the British Columbia Institute of Technology (BCIT). For the Simon Fraser students, instructors gave their classes a brief description of the study and then students were invited to volunteer by signing a sheet that was circulated afterwards. Similarly, most of the BCIT subjects were approached at the beginning of one of their classes. Some of the BCIT nursing students who took part were taking a course through Health Part Time Studies. This is a correspondence program, and so they were solicited via telephone. Before deciding to take part, students were assured that their participation would in no way affect their standing at SFU or BCIT.

The BCIT nursing program spans five terms. Subjects for the present study were drawn from the first, third, and fifth terms of that program. Combined with the SFU sample, these comprised the four subject groups used in the study, three from BCIT and one from SFU. A summary of subjects' demographic data by group is presented in Table 1.

These groups differed primarily in terms of their clinical training experience. Each of the first four terms of the nursing program features two days a week of hospital training, starting in the second week, and each term is sixteen weeks long. Nursing students in term one were tested during the third week of their term. Term three students were tested during the fourteenth, fifteenth, and sixteenth weeks of their term. Term five students were tested during their first week of term. Estimates of days of clinical training experience, as presented in Table 1, were calculated by assuming two days per week for weeks two through sixteen of each term the students had been in the program.

Term five students actually go through a full-time, five day per week training period from their second to sixteenth week. It would have been advantageous to test them after this intensive training period. Unfortunately, once they started their full-time hospital experience, their participation in the study became untenable, and so they had to be tested during their first week, which is spent at the BCIT campus.

None of the nursing students from Health Part Time Studies had received hospital training at the time of the study. One subject from this group, however, did have experience working in extended care facilities and with patients as an in-home companion.

All subjects participated between November 23, 1989 and March 6, 1990.

**Table 1**

Subjects' Background Data by Subject Type

| | SFU | BCIT 1 | BCIT 3 | BCIT 5 | OVERALL |
|---|---|---|---|---|---|
| n | 44 | 18 | 20 | 22 | 104 |
| Mean age | 24.07 | 24.39 | 30.05 | 27.91 | 26.09 |
| Years of post secondary education | 1.09 | 1.39 | 3.35 | 3.27 | 2.03 |
| Number of males | 9 | 2 | 1 | 2 | 14 |
| Number of females | 35 | 16 | 19 | 20 | 90 |
| Number who have experienced back pain | 9 | 8 | 5 | 7 | 29 |
| Estimated days of clinical training | 0 | 2 | 88 | 120 | --- |

## Materials

*The videotapes*

The stimulus materials of central importance were black and white videotapes of the facial displays of patients undergoing range of motion tests at the Shaughnessy Hospital Back Pain Clinic. These patients all had a history of low back and/or hip pain that had lasted at least six months prior to taping.

The videotapes were produced as part of Susan Hyde's research (1986) in which she analysed facial action associated with pain in this clinical population. As a result, she has collected videotaped facial displays that include genuine, masked, and posed pain, as well as a no pain/no expression baseline. Each display is coded according to the *Facial Action Coding System (FACS)* (Ekman & Friesen, 1978). The patients completed the McGill Pain Questionnaire (Melzack, 1975) and the Gracely verbal descriptor scales (Gracely, 1979) to describe the most painful movement in the test. Each of these provides a reasonably detailed description of subjective pain experience. These were accompanied by pain estimates from the attending physiotherapist and Susan Hyde, a doctoral student in Clinical Psychology at the time.

The facial expressions were videotaped during a range of motion test conducted by a physiotherapist. The test consisted of a series of leg movements, some of which were likely to induce either low back or hip joint discomfort. For example, for some patients, straightening and lifting the right leg while lying at a 45-degree angle was very painful. However, the same action with the left leg produced no pain. Once the most painful movement had been identified, patients were asked to repeat that movement twice. The second time they were asked to suppress (or mask) their facial expression of pain. Finally, the patient was asked to repeat a movement that did not cause pain, but to pose a "pain face." During the taping, all subjects began with the genuine expression. Then the posing and masking instructions were counterbalanced randomly across subjects.

For the purposes of the present study, the videotapes of 48 patients were used — 24 males and 24 females. This yielded a total of 192 expressions (48 patients x 4 expressions) for each subject to judge.

The patients were chosen randomly (other than the male/female ratio consideration) from a collection of 120 patients, as videotaped by Hyde.

There are numerous potential order effects that could emerge in a study of this nature, especially concerning the order of presentation of the expressions. For example, a posed expression might be more effective if it followed a series of genuine pain expressions. Or a masked expression might be less effective if it followed a series of baseline expressions. Also, if two or three expressions by the same patient were shown in succession then the subject could make comparisons that would not be possible if the expressions were shuffled.

Since it was not possible to control for all possible order effects, it was important for the present study to randomize the presentation of facial expressions. This randomization process was performed in four steps as follows:

1. A computer program (Minitab) was used to randomly select 48 faces (24 male and 24 female) from the original 120 on Hyde's videotapes.
2. The numbers 1 to 4 were randomized 48 times. The number 1 corresponded to genuine expressions, 2 to masked, 3 to posed, and 4 to baseline expressions. Each of these randomized sets of four was assigned to a patient selected in step 1, so that each patient now had a randomized order of expressions.
3. The patients were randomly divided into three groups of 16 (8 male and 8 female), so they could be edited onto three videotapes. For each subject,

the first facial expression, as dictated by the randomizing procedure in step 2, was assigned. This procedure was repeated for each of the remaining sets of 16 expressions obtained from step 2.

For example, patient number 54 might be the first to be shown on tape one. This patient's randomized order of expressions might be masked, posed, genuine, baseline. So the first face on tape one would be patient 54's masked expression. After each of the 16 faces had appeared once, they appeared again, this time in a different order, showing the second expression in their randomized set of expressions. On each of the tapes, then, a patient appeared four times. The videotapes did not, therefore, feature only the most expressive patients, or the best or worst posers and maskers.

4. Self-report was randomly paired with facial expression so that one-third of the 192 expressions were paired with "yes," one-third "no," and one-third "not asked." These particular pairings were shown to approximately one-third of the subjects. Another third of the subjects were presented with pairings that resulted from permuting the self-report so that a report of "yes" for the first group of subjects became "no" for the second group. "No" became "not asked," and "not asked" became "yes." For the final group of subjects, the order was permuted once more. In this way, each expression was paired with each self-report level an equal number of times.

*The Gracely verbal descriptor scales*

The Gracely scales (Gracely, 1979; Gracely et al., 1978) ask subjects to rate their pain on three dimensions. These are sensory intensity, unpleasantness, and painfulness. The first two scales are divided into 15 points each, ranging from maximal to minimal intensity. Each point has a corresponding verbal descriptor. The third scale is divided into 12 points. Each of the videotaped patients completed these scales to describe the most painful movement in the test. For the purpose of the present study, only the painfulness scale was used (see Appendix A).

The scale was chosen for the present study for a number of reasons. First, the scales are considered to be reliable measures of the pain experience (Gracely et al., 1978). Second, the Gracely scales are the measure of choice in much of the work currently being conducted in Craig's lab (personal communication with Ken Craig, March 13, 1989) and using the same measure may facilitate future comparisons. Third, the scale provides sufficient detail without the disadvantage of requiring time consuming judgement on the part of the subject, who will be making 192 judgements.

Perhaps the most appealing feature of the verbal descriptor scales is that Gracely et al. (1978) have used cross-modality matching techniques to derive a ratio scale of numerical equivalents for the verbal descriptors used in the painfulness scale. To do this, Gracely and Dubner had students match both handgrip force and tone duration, rather than numbers, to each verbal descriptor. Correlations among the resulting ratio scales were strong, both within subjects (r=0.92) and between subjects (r=.93). The numerical equivalents

(Gracely & Dubner, 1987) can be found in Table 2.

**Table 2**

Ratio-scaled Relative Magnitude for Each Painfulness Descriptor (Gracely & Dubner, 1987)

| | |
|---|---|
| Extremely Painful | 38.80 |
| Unusually Painful | 30.20 |
| Very Painful | 27.30 |
| Quite Painful | 20.50 |
| Pretty Painful | 12.80 |
| Decidedly Painful | 12.20 |
| Rather Painful | 11.30 |
| Moderately Painful | 8.14 |
| Somewhat Painful | 6.87 |
| Mildly Painful | 4.27 |
| Slightly Painful | 2.63 |
| Faintly Painful | 1.37 |
| Not Painful | 0.00 |

Though the use of cross-modality matching in this context has been questioned by Hall (1981), Gracely and Dubner (1981) have provided a thorough defence of the procedure. Hall disagreed with Gracely and Dubner regarding the reliability, validity, and objectivity of their sensory and affective scales. He also claimed that cross-modality matching procedures do not produce bias-free scales, any more than category scaling methods do. Another problem, according to Hall, was that the cross-modality matching task presupposes that subjects can judge ratios because they start with a base judgement that compares, say, line length to the intensity of another stimulus, then are asked to judge other intensities by picking line lengths in relation to their first judgement.

Gracely and Dubner counter that ratio scales are less biased than category scales in that the former places fewer constraints on the person doing the judging. For ratio scales, as created by cross-modality matching, responses are made on a continuous scale, typically with a high ceiling. This is considered less restricting, and thus less susceptible to bias, than category scaling. The consistency of subjects' responses, as indicated by correlations between and within subjects in Gracely's work, provides convincing evidence that people can indeed judge ratios. It also suggests that the scales and their corresponding numerical values are reliable and objective.

*Subject background information*

Each subject was given a brief questionnaire (see Appendix B) to measure demographic variables, as well as the extent to which he or she had experience with pain similar to that experienced by the patients in the videotapes.

These background variables included:

1. Age of subject
2. Sex of subject
3. Subject's experience with back pain
4. Years of post-secondary education

Procedure

Subjects for the present study participated in small groups, ranging in size from two to six members, with two subjects being tested individually. SFU subjects were run in three different settings on campus, as were the BCIT subjects on their campus, based on room availability at each institution. In each room, subjects sat at tables in front of an RCA television monitor (either 21- or 28-inch screen). Group size was limited, therefore, by the number of viable viewing positions in front of the monitor.

After entering the room, subjects chose a seat and were asked to read and complete the consent form that was the first page of their response package (see Appendix C for consent form). Upon completion of the consent form, subjects were instructed to tear that top sheet from the package and hand it in separately so that the pain judgements they recorded in the rest of the package would remain anonymous.

Subjects were then looking at page two of the package, which contained the instructions for the task. Subjects were presented with one of two sets of instructions, depending upon condition (prime, no prime). Instructions for the "no prime" condition can be found in Appendix D, and those for the "prime" condition in Appendix E.

The experimenter read the instructions aloud while the subjects followed along on their own sheets. As previously mentioned, it was at this point that the priming variable was introduced. Subjects in the "prime" condition were told that they were about to see four kinds of faces — genuine, masked, posed, and baseline. Subjects in the "no prime" condition were not told that there were masked and posed expressions on the tapes.

After reading the instructions and answering any questions regarding the task, the experimenter told subjects to turn to the next page and provide background information as requested (see Appendix B). When this was completed, subjects turned to the next page, which was titled "PRACTICE SHEET" (see Appendix F). On this sheet were four blanks for subjects' responses to the four practice expressions. At this time, the practice expressions were shown, with patient self-report information provided either before or after each, depending upon condition, 54 subjects being given the information before the expression, 50 after. These practice expressions were the same for all subjects, and were always presented in the same order. In every case, subjects were told that the first patient said yes when asked if the movement was painful. The second patient said no, the third was not asked, and the fourth said yes.

In addition to the written instructions, subjects were also given other verbal instructions after the practice expressions and before beginning the task in which their responses would be used as data. They were told that though they were doing the study in a group, it was not a group task, and they should keep their responses to themselves. They were told at this time that if they had any comments about the faces or the task itself, the experimenters would be very interested in hearing them, but not until after the procedure was finished. They were reminded that any comments they made during the procedure may very well influence other people's judgements.

They were also told that if they had any skill at all in lip reading they would be able to discern the words "Yes" and "No" coming from some of the patients on the videotape, even though there was no sound accompanying the video. Subjects were advised not to be distracted by these "Yes" and "No" patient responses because they might be responding to questions from the physiotherapist other than "Are you in pain?" or "Does that hurt?" For example, they might be answering the question, "Do you understand?" or "Can I lift your leg further?"

A final comment was made to subjects regarding the pace of the ensuing procedure. They were told that, at first, the 6-second facial expressions would be presented rather slowly, with a considerable gap between faces, so that they would have time to familiarize themselves with the list of descriptors and also to make their judgement. They were then told that, because there were a large number of judgements to make (192), the experimenter would then pick up the pace so that the task didn't take too long. Subjects could ask the experimenter to slow down if the pace got too fast, or to repeat a face if they missed one. None of the 104 subjects asked for the pace to be slowed, though on two occasions, subjects asked to see a face again.

Subjects were then instructed to turn to the first page of the response sheets. This page looked identical to the practice sheet, but for having more blanks and a space for subject number to be filled in by the experimenters afterwards (see Appendix G). Before beginning, subjects were asked if they had any final questions regarding the task. Based on their experience with the practice faces, a number of subjects asked if the patients' self-reports were, in fact, true. The experimenter answered this question by advising the subjects to use the information, whether it be verbal or facial, as they saw fit in making their judgements of pain.

Now, with the response sheets in front of the subjects, the task began. During this phase of the procedure, 54 subjects received patient self-report information prior to viewing each expression whereas the other 50 viewed the expression first and then were given the self-report information. For those given the information beforehand, they were first told the number of the expression (from 1 to 192), then told what the patient supposedly said when asked if the movement was painful (or if the patient was not asked), and then the facial expression was shown. The videotape was then stopped while the the subjects used the Gracely scale to make their judgements.

This self-report information was arranged so that patients said "yes" a third of the time, "no" a third of the time, and were supposedly not asked for another third of the expressions. The self-report information was scripted with the facial expressions to form a complete 3 x 4 factorial. In other words, a third of the time, any given expression was accompanied by a yes self-report, a third of the time a no self-report, and a third of the time the subject was told the patient had not been asked. Therefore, the yes and no reports were correct half the time.

And so, a typical sequence for those receiving self-report information before a given expression would have gone like this: "Number 15 said no" – facial expression shown – tape stopped – judgement made. "Number 16 said yes" facial expression shown – tape stopped – judgement made. For patients who received patient self-report information *after* viewing the expression, a typical sequence would have gone like this: "Number 15" – facial expression shown "said no" – tape stopped – judgement made. "Number 16" – facial expression shown – "said yes" – tape stopped – judgement made.

In each of the rooms used at SFU and BCIT, lighting was purposely subdued. This was done for two reasons: first, to make it easier for subjects to see the black and white facial expressions on the monitor and, second, to make it easier for them to focus their attention on the monitor rather than on the experimenter. When possible, the experimenter used a remote control device to stop and start the videotape. For these sessions, the experimenter sat behind the subjects, completely out of their view.

Given that the room was dimly lit, it was quite unlikely that subjects used the experimenters' facial expressions as cues for making their pain judgement. With the use of the remote control device, this possibility was eliminated altogether.

The 192 facial expressions were arranged on three videotapes. So, after every 64 expressions, there was a brief break while the experimenter changed tapes. As mentioned previously in the Materials section, each of these tapes featured 16 patients displaying all of the four expressions (genuine, masked, posed, and baseline). Therefore, with the introduction of a new tape came the introduction of new faces. The order of the tapes was counterbalanced such that each of the six possible combinations was used an equal number of times.

Two experimenters were used in the present study, one male and one female. Because of the logistics of scheduling, some subjects were run by the female and others by the male, while still another set of subjects had both experimenters take turns within their session, changing when the tape was changed. Experimenters found that they could control the pace of presentations quite easily by monitoring the slowest member of the group and timing the presentation of faces accordingly. There was, in fact, little variability among groups in the time taken to complete the task: the slowest taking 70 minutes, and the fastest taking 55 minutes.

After subjects made their last judgement, the experimenter thanked them for their participation, acknowledging that the task is a potentially fatiguing one. They were then asked if they had any questions or comments about the task. After a discussion in which the questions were answered and comments explored, subjects were asked how they had used the facial and verbal information to make their judgements. Finally, subjects were again thanked for taking the time to participate and allowed to leave.

# CHAPTER III

# RESULTS

## The Design

The present study featured a mixed factorial design combining between-subject and within-subject variables. The between-subject variables included subject type (4 levels – SFU, BCIT first term, BCIT third term, and BCIT fifth term), priming (2 levels – prime and no prime), and order of self-report information (2 levels – before and after). The within-subject variables included facial expression (4 levels – genuine, masked, posed, and baseline), and patient self-report (3 levels – yes, no, and not asked).

The dependent measure was the subjects' judgements which were made using the Gracely painfulness scale. See Tables 14 through 17 for cell means, sorted by subject type, for the entire 4 x 2 x 2 x 4 x 3 design. Note also that selected cell means adjusted to match Gracely's ratio-scale values (as shown in Table 2) are presented in Appendix H.

The effects of these variables were tested using analyses of variance (ANOVA) at the .05 level of significance. Comparisons, both planned and post hoc, were tested using tailored error terms where appropriate. Post hoc comparisons were tested at using Bonferroni-corrected levels significance. All of these analyses were computed using BMDP program P2V. The effects of other between-subject variables (subject's age, education level, and experience with pain) were also assessed, using the same method.

The results of the present study are summarized herein by hypothesis, with appropriate ANOVA summary tables, along with figures that graphically represent significant differences.

Hypothesis 1

**Null hypothesis:** *Subjects' judgements of pain will be unrelated to patients' facial expressions.*

**Alternate hypothesis:** *Subjects' judgements of pain will differ according to patients' facial expression.*

A main effect was found for facial expression, ($F(3,294)=620.78$, $p<.001$ (genuine M=529.39, SD=186.45; masked M=345.32, SD=153.44; posed M=567.44, SD=204.85; baseline M=194.92, SD=115.26; see Table 3 and Figure 5). A planned comparison between judgements based on genuine and masked expressions was also significant, $F(1,88)=480.85$, $p<.001$ (see Table 4 and Figure 5) as was the planned comparison between posed and baseline expressions, $F(1,88)=826.24$, $p<.001$ (see Table 5 and Figure 5).

In the proposal for the present study, Hypothesis 1 originally predicted that no other comparisons should yield significance. However, Figure 5 suggests that significant differences might exist between posed and genuine, as well as between masked and baseline expressions. This was, in fact, the case: genuine vs. posed, $F(1,88)=24.61$, $p<.001$ (see Table 6 and Figure 5), masked vs. baseline, $F(1,88)=395.99$, $p<.001$ (see Table 7 and Figure 5).

**Table 3**

Mixed ANOVA for Overall Design

| SOURCE | SS | DF | MS | F | *p* | $R^2$ |
|---|---|---|---|---|---|---|
| MEAN | 21160362.93 | 1 | 21160362.93 | 708.78 | 0.0000 | .7276 |
| Subject type | 145454.01 | 3 | 48484.67 | 1.62 | 0.1895 | .0050 |
| Prime | 159046.19 | 1 | 159046.19 | 5.33 | 0.0233 | .0055 |
| Report order | 36166.64 | 1 | 36166.64 | 1.21 | 0.2741 | .0012 |
| Subject type x prime | 23968.77 | 3 | 7989.59 | 0.27 | 0.8486 | .0008 |
| Subject type x order | 219765.63 | 3 | 73255.21 | 2.45 | 0.0685 | .0076 |
| Prime x order | 13677.54 | 1 | 13677.54 | 0.46 | 0.5003 | .0005 |
| Subject type x prime x order | 27346.76 | 3 | 9115.59 | 0.31 | 0.8215 | .0009 |
| ERROR | 2627205.88 | 88 | 29854.61 | | | |
| Expression | 2783738.21 | 3 | 927912.74 | 620.78 | 0.0000 | .0957 |
| Expression x subject type | 5771.91 | 9 | 641.32 | 0.43 | 0.9189 | .0002 |
| Expression x prime | 51330.63 | 3 | 17110.21 | 11.45 | 0.0000 | .0018 |
| Expression x order | 6854.08 | 3 | 2284.69 | 1.53 | 0.2075 | .0002 |

**Table 3** (continued)

| SOURCE | SS | DF | MS | F | $p$ | $R^2$ |
|---|---|---|---|---|---|---|
| Expression x subject type x prime | 16402.92 | 9 | 1822.55 | 1.22 | 0.2831 | .0006 |
| Expression x subject type x order | 26423.66 | 9 | 2935.96 | 1.96 | 0.0437 | .0009 |
| Expression x prime x order | 5118.35 | 3 | 1706.12 | 1.14 | 0.3328 | .0002 |
| Expression x subject type x prime x order | 24930.66 | 9 | 2770.07 | 1.85 | 0.0593 | .0009 |
| ERROR | 394614.32 | 264 | 1494.75 | | | |
| Report | 466476.18 | 2 | 233238.09 | 117.98 | 0.0000 | .0160 |
| Report x subject type | 36565.88 | 6 | 6094.31 | 3.08 | 0.0068 | .0013 |
| Report x prime | 50267.16 | 2 | 25133.58 | 12.71 | 0.0000 | .0017 |
| Report x order | 23663.80 | 2 | 11831.90 | 5.98 | 0.0031 | .0008 |
| Report x subject type x prime | 14545.17 | 6 | 2424.19 | 1.23 | 0.2950 | .0005 |
| Report x subject type x order | 33943.54 | 6 | 5657.26 | 2.86 | 0.0110 | .0012 |
| Report x prime x order | 9044.04 | 2 | 4522.02 | 2.29 | 0.1046 | .0003 |

**Table 3** (continued)

| SOURCE | SS | DF | MS | F | $p$ | $R^2$ |
|---|---|---|---|---|---|---|
| Report x subject type x prime x order | 21293.03 | 6 | 3548.84 | 1.80 | 0.1026 | .0007 |
| ERROR | 347954.18 | 176 | 1977.01 | | | |
| Expression x report | 38648.96 | 6 | 6441.49 | 8.09 | 0.0000 | .0013 |
| Expression x report x subject type | 64688.96 | 18 | 3593.83 | 4.51 | 0.0000 | .0022 |
| Expression x report x prime | 30845.17 | 6 | 5140.86 | 6.45 | 0.0000 | .0010 |
| Expression x report x order | 45333.56 | 6 | 7555.59 | 9.48 | 0.0000 | .0016 |
| Expression x report x subject type x prime | 28676.96 | 18 | 1593.16 | 2.00 | 0.0085 | .0010 |
| Expression x report x subject type x order | 42593.29 | 18 | 2366.29 | 2.97 | 0.0000 | .0014 |

Table 3 (continued)

| SOURCE | SS | DF | MS | F | $p$ | $R^2$ |
|---|---|---|---|---|---|---|
| Expression x report x prime x order | 16005.42 | 6 | 2667.57 | 3.35 | 0.0030 | .0006 |
| Expression x report x subject type x prime x order | 31488.19 | 18 | 1749.34 | 2.20 | 0.0031 | .0011 |
| ERROR | 420600.93 | 528 | 796.59 | | | |

**Table 4**

Planned Comparison Between Pain Judgements for Genuine and Masked Facial Expressions

| SOURCE | SS | DF | MS | F | $p$ |
|---|---|---|---|---|---|
| Expression | 537792.74 | 1 | 537792.74 | 480.85 | 0.0000 |
| Error | 98421.79 | 88 | 1118.43 | | |

**Table 5**

Planned Comparison Between Pain Judgements for Posed and Baseline Facial Expressions

| SOURCE | SS | DF | MS | F | $p$ |
|---|---|---|---|---|---|
| Expression | 2152539.18 | 1 | 2152539.18 | 826.24 | 0.0000 |
| Error | 229258.24 | 88 | 2605.21 | | |

**Table 6**

Planned Comparison Between Pain Judgements for Genuine and Posed Facial Expressions

| SOURCE | SS | DF | MS | F | $p$ |
|---|---|---|---|---|---|
| Expression | 22739.38 | 1 | 22739.38 | 24.61 | 0.0000 |
| Error | 81318.98 | 88 | 924.08 | | |

**Table 7**

Planned Comparison Between Pain Judgements for Masked and Baseline Facial Expressions

| SOURCE | SS | DF | MS | F | *p* |
|---|---|---|---|---|---|
| Expression | 339905.40 | 1 | 339905.40 | 395.99 | 0.0000 |
| Error | 75535.95 | 88 | 858.36 | | |

Hypothesis 2

***Null hypothesis:*** *The pattern of results predicted in Hypothesis 1 will be found regardless of subject type.*

***Alternate hypothesis:*** *Judgements of pain for genuine and masked expressions will not differ for subjects with two or more terms of clinical nursing experience. The same will be true for judgements of posed and baseline expressions. However, for subjects with this experience, judgements will differ between genuine and posed expressions, and between masked and baseline expressions.*

The alternate hypothesis predicts an interaction between facial expression and subject type; however, this interaction did not prove to be statistically significant, $F(9,264) = .43$, $p = 0.9189$. Nor was there a main effect for subject type, $F(3,88) = 1.62$, $p = 0.1895$. (SFU M=126.17, SD=43.48; BCIT1 M=133.50, SD=58.75;, BCIT3 M=157.31 SD=66.83; BCIT5 M=140.34 SD=51.65).

Hypothesis 3

***Null hypothesis:*** *The pattern of results predicted in Hypothesis 1 will be found regardless of whether or not subjects are presented with patients' self-reports of pain.*

***Alternate hypothesis:*** *Self-report information that is consistent with facial expression will polarize the subjects judgements of pain. Self-report information that is inconsistent with facial expression will eliminate differences between genuine and masked expressions, and between posed and baseline expressions.*

The alternate hypothesis predicts an interaction between self-report and facial expression. This interaction did prove to be statistically significant, $F(6,528)=8.09$, $p<.001$ (see Table 3 and Figure 6).

The interaction between self-report and self-report order was also significant, $F(2,176)=5.98$, $p<.01$ (yes-before $M=154.17$, $SD=58.72$; yes-after $M=162.42$, $SD=60.6$; no-before $M=111.92$, $SD=49.6$; no-after $M=99.16$, $SD=48.8$ not asked-before $M=156.31$, $SD=77.15$; not asked-after $M=129.49$, $SD=57.05$; see Table 3).

To test the possible "polarizing" effect of self-report information that was consistent with facial expression, a number of planned comparisons were conducted: genuine-not asked vs. genuine-yes, $F(1,36)=11.36$, $p<.01$ (genuine-not asked $M=187.32$, $SD=78.57$; genuine-yes $M=197.42$, $SD=77.28$; see Table 8 and Figure 6); masked-not asked vs. masked-no, $F(1,36)=44.30$, $p<.001$ (masked-not asked $M=118.68$, $SD=53.80$; masked-no $M=91.99$ and $SD=52.85$; see Table 9, Figure 6); posed-not asked vs. posed-yes, $F(1,88)=1.94$, $p=.1726$ (posed-not asked $M=202.85$, $SD=76.55$; posed-yes $M=214.61$, $SD=80.60$; see

Table 10 and Figure 6): baseline-not asked vs. baseline-no, $F(1,36)=16.07$, $p<.001$ (baseline-not asked M=62.91, SD=42.36; baseline-no M=46.12 SD=35.56; see Table 11 and Figure 6).

To assess the relative influence of facial expression vs. patient self-report, post hoc comparisons were made for baseline-inconsistent (i.e., yes) vs. posed-inconsistent (i.e., no) and genuine-inconsistent (i.e., no) vs. masked-inconsistent (i.e., yes). When Bonferroni corrections were applied, the former comparison was statistically significant, $F(1,36)=378.02$, $p<.001$ (baseline-inconsistent M=85.89, SD=51.02; posed-inconsistent M=149.98, SD=71.01; see Table 12 and Figure 7), the latter was not, $F(1,36)=.28$, $p=.6022$ (genuine-inconsistent M=~~144.67~~, SD=69.29; masked-inconsistent M=134.65, SD=59.82; see Table 13 and Figure 7).

**Table 8**

Planned Comparison Between Pain Judgements for Genuine-not asked and Genuine-yes Facial Expressions

| SOURCE | SS | DF | MS | F | $p$ |
|---|---|---|---|---|---|
| Report | 16813.28 | 1 | 16813.28 | 11.36 | 0.0018 |
| Error | 53273.65 | 36 | 1479.82 | | |

**Table 9**

Planned Comparison Between Pain Judgements for Masked-not asked and Masked-no Facial Expressions

| SOURCE | SS | DF | MS | F | $p$ |
|---|---|---|---|---|---|
| Report | 22761.57 | 1 | 22761.57 | 44.30 | 0.0000 |
| Error | 18496.89 | 36 | 513.80 | | |

**Table 10**

Planned Comparison Between Pain Judgements for Posed-not asked and Posed-yes Facial Expressions

| SOURCE | SS | DF | MS | F | $p$ |
|---|---|---|---|---|---|
| Report | 1781.49 | 1 | 1781.49 | 1.94 | 0.1726 |
| Error | 33122.77 | 36 | 920.08 | | |

**Table 11**

Planned Comparison Between Pain Judgements for Baseline-not asked and Baseline-no Facial Expressions

| SOURCE | SS | DF | MS | F | $p$ |
|---|---|---|---|---|---|
| Report | 7570.38 | 1 | 7570.38 | 16.07 | 0.0000 |
| Error | 16958.16 | 36 | 471.06 | | |

## Table 12

Post Hoc Comparison Between Pain Judgements for Baseline-inconsistent (yes) and Posed-inconsistent (no) Facial Expressions

| SOURCE | SS | DF | MS | F | *p* |
|---|---|---|---|---|---|
| Expression | 596748.87 | 1 | 596748.87 | 378.02 | 0.0000 |
| Error | 56829.72 | 36 | 1578.60 | | |

## Table 13

Post Hoc Comparison Between Pain Judgements for Genuine-inconsistent and Masked-inconsistent Facial Expressions

| SOURCE | SS | DF | MS | F | *p* |
|---|---|---|---|---|---|
| Expression | 432.02 | 1 | 432.02 | .28 | 0.6022 |
| Error | 56234.03 | 36 | 1562.06 | | |

<u>Hypothesis 4</u>

***Null hypothesis:*** *The pattern of results predicted in Hypothesis 1 will be found regardless of whether or not subjects are told in advance that some of the expressions are posed and some are masked.*

***Alternate hypothesis:*** *When told in advance that some of the patients' expressions are posed and some are masked, subjects will not be fooled by fake expressions.*

Again, the alternate hypothesis predicts an interaction, this time between facial expression and priming. A significant interaction was found, $F(3,264)=11.45$, $p<.001$ (see Table 3, Figure 8). However, Figure 8 reveals that the nature of this interaction is not consistent with the predictions of the alternate hypothesis. Figure 8 also suggests a main effect for priming. This was, in fact, significant, $F(1,88)=5.33$, $p<.05$ (prime $M=122.39$, $SD=56.57$; no prime $M=149.93$, $SD=63.67$).

## Table 14

Cell Means (and Standard Deviations) for SFU Students

| Expression | Report | no prime before | no prime after | prime before | prime after |
|---|---|---|---|---|---|
| | prime = / order = | no prime / before | no prime / after | prime / before | prime / after |
| Genuine | Yes | 187.73 (80.42) | 199.37 (71.55) | 125.46 (53.18) | 195.99 (104.81) |
| | No | 150.91 (85.49) | 114.94 (70.41) | 103.87 (41.51) | 121.52 (67.33) |
| | Not asked | 216.54 (87.52) | 260.61 (86.81) | 120.02 (38.07) | 190.58 (72.16) |
| Masked | Yes | 127.44 (65.44) | 148.85 (58.04) | 88.61 (41.09) | 133.06 (56.69) |
| | No | 91.81 (60.79) | 81.74 (54.94) | 69.06 (33.72) | 93.99 (49.96) |
| | Not asked | 127.18 (66.12) | 137.09 (59.06) | 76.10 (31.13) | 123.21 (48.91) |
| Posed | Yes | 250.10 (97.25) | 265.21 (84.68) | 140.90 (49.30) | 205.93 (76.67) |
| | No | 163.43 (78.88) | 125.86 (60.60) | 84.72 (25.71) | 142.56 (66.86) |
| | Not asked | 209.14 (93.18) | 231.25 (80.77) | 135.66 (64.81) | 186.34 (60.34) |
| Baseline | Yes | 86.02 (61.89) | 86.06 (48.47) | 51.00 (34.96) | 86.64 (59.86) |
| | No | 38.15 (27.44) | 35.89 (27.21) | 30.36 (18.96) | 42.76 (30.22) |
| | Not asked | 56.87 (41.14) | 70.93 (46.50) | 36.41 (19.74) | 76.11 (58.03) |
| | MARGINAL | 142.11 | 146.48 | 88.51 | 133.22 |
| | n | 15 | 7 | 12 | 10 |

## Table 15

Cell Means and (Standard Deviations) for First Term BCIT Students

| Expression | prime = / order = | noprime before | noprime after | prime before | prime after |
|---|---|---|---|---|---|
| | Report | | | | |
| Genuine | Yes | 222.29 (74.91) | 225.39 (34.77) | 197.95 (64.68) | 186.06 (48.78) |
| | No | 135.07 (73.49) | 91.63 (51.33) | 210.86 (30.25) | 115.39 (50.75) |
| | Not asked | 268.71 (78.60) | 142.60 (91.89) | 203.67 (51.19) | 126.22 (33.55) |
| Masked | Yes | 157.51 (92.34) | 123.95 (49.40) | 168.40 (72.67) | 104.84 (39.75) |
| | No | 101.01 (36.76) | 52.66 (43.19) | 127.85 (40.51) | 63.97 (21.11) |
| | Not asked | 143.37 (59.68) | 90.75 (41.92) | 123.77 (23.32) | 106.49 (34.02) |
| Posed | Yes | 286.83 (79.54) | 218.92 (67.25) | 176.05 (67.40) | 162.23 (62.61) |
| | No | 150.24 (72.06) | 130.63 (68.53) | 168.52 (82.48) | 142.46 (81.85) |
| | Not asked | 276.62 (72.73) | 180.58 (50.63) | 241.63 (61.68) | 151.94 (59.53) |
| Baseline | Yes | 124.30 (85.98) | 77.45 (34.07) | 79.60 (61.25) | 62.52 (13.63) |
| | No | 65.40 (48.84) | 21.34 (19.20) | 67.54 (23.37) | 31.23 (25.88) |
| | Not asked | 78.67 (32.12) | 38.49 (38.99) | 61.82 (46.20) | 49.43 (28.54) |
| | MARGINAL | 167.50 | 116.20 | 152.31 | 108.56 |
| | n | 4 | 5 | 4 | 5 |

## Table 16

Cell Means and (Standard Deviations) for Third Term BCIT Students

| | prime = <br> order = | noprime <br> before | noprime <br> after | prime <br> before | prime <br> after |
|---|---|---|---|---|---|
| Expression | Report | | | | |
| Genuine | Yes | 235.99 | 322.32 | 190.53 | 233.19 |
| | | (64.68) | (80.95) | (80.09) | (97.19) |
| | No | 179.74 | 172.53 | 180.09 | 143.62 |
| | | (62.52) | (75.47) | (62.21) | (58.42) |
| | Not asked | 217.57 | 200.22 | 159.14 | 164.09 |
| | | (78.38) | (73.38) | (79.30) | (56.61) |
| Masked | Yes | 182.21 | 169.82 | 154.05 | 153.31 |
| | | (93.13) | (36.62) | (43.21) | (63.14) |
| | No | 119.06 | 113.05 | 87.37 | 104.27 |
| | | (99.40) | (37.36) | (54.39) | (67.51) |
| | Not asked | 154.18 | 130.20 | 103.82 | 126.70 |
| | | (71.96) | (29.51) | (59.99) | (73.05) |
| Posed | Yes | 225.96 | 254.82 | 235.65 | 179.43 |
| | | (69.78) | (68.86) | (96.82) | (99.53) |
| | No | 174.59 | 247.15 | 154.88 | 147.87 |
| | | (91.19) | (99.48) | (48.97) | (55.76) |
| | Not asked | 307.69 | 40.49 | 219.61 | 154.22 |
| | | (78.15) | (70.80) | (67.95) | (38.43) |
| Baseline | Yes | 103.13 | 131.19 | 109.83 | 95.60 |
| | | (47.97) | (28.68) | (62.48) | (49.29) |
| | No | 89.52 | 43.18 | 55.34 | 61.47 |
| | | (81.88) | (23.16) | (35.71) | (44.27) |
| | Not asked | 86.45 | 81.00 | 83.01 | 87.92 |
| | | (55.33) | (22.37) | (56.21) | (66.99) |
| | MARGINAL | 173.01 | 175.50 | 144.44 | 137.64 |
| | n | 5 | 5 | 4 | 6 |

## Table 17

Cell Means and (Standard Deviations) for Fifth Term BCIT Students

| Expression | prime = / order = / Report | noprime before | noprime after | prime before | prime after |
|---|---|---|---|---|---|
| Genuine | Yes | 215.59 | 176.00 | 165.84 | 191.81 |
| | | (25.15) | (61.78) | (60.68) | (30.23) |
| | No | 159.03 | 179.17 | 223.47 | 138.28 |
| | | (60.34) | (70.65) | (99.61) | (32.88) |
| | Not asked | 271.28 | 169.12 | 164.75 | 136.20 |
| | | (41.72) | (56.97) | (58.41) | (31.31) |
| Masked | Yes | 150.32 | 130.93 | 116.13 | 126.67 |
| | | (49.30) | (36.73) | (25.18) | (81.64) |
| | No | 116.63 | 92.76 | 100.86 | 92.61 |
| | | (37.32) | (44.38) | (45.29) | (65.52) |
| | Not asked | 172.94 | 98.73 | 94.32 | 111.73 |
| | | (36.51) | (43.69) | (47.72) | (47.98) |
| Posed | Yes | 260.17 | 217.47 | 202.64 | 184.05 |
| | | (25.28) | (58.20) | (54.48) | (65.68) |
| | No | 176.16 | 152.28 | 177.43 | 147.92 |
| | | (17.79) | (85.14) | (67.46) | (43.96) |
| | Not asked | 236.34 | 208.27 | 233.41 | 161.30 |
| | | (40.80) | (48.39) | (63.16) | (44.39) |
| Baseline | Yes | 85.32 | 89.86 | 76.22 | 84.22 |
| | | (47.44) | (40.65) | (31.89) | (60.23) |
| | No | 62.30 | 50.84 | 33.02 | 53.70 |
| | | (36.78) | (34.32) | (14.20) | (40.14) |
| | Not asked | 72.85 | 47.30 | 48.51 | 63.64 |
| | | (25.58) | (34.86) | (17.66) | (43.76) |
| | MARGINAL | 164.91 | 134.39 | 136.38 | 124.35 |
| | n | 6 | 6 | 4 | 6 |

Subject Background Variables

The following background variables did not have a significant effect on pain judgements: subjects' pain experiences, $F(1,102)=2.04$, $p=.1559$; years of post-secondary education, $F(7,96)=1.74$, $p=.1081$; or sex of subject, $F(1,102)=.35$, $p=.5576$.

The one background variable that did yield significance was subject's age, $F(3,100)=2.89$ $p<.05$ (under 20 years M=134.16, SD=67.14; between 20 and 25 M=153.17, SD=62.48; between 26 and 35 M=113.09, SD=49.69; over 35 M=138.26, SD=58.93). None of the background variables produced significant interactions.

Figure 5: Mean pain judgements for each facial expression

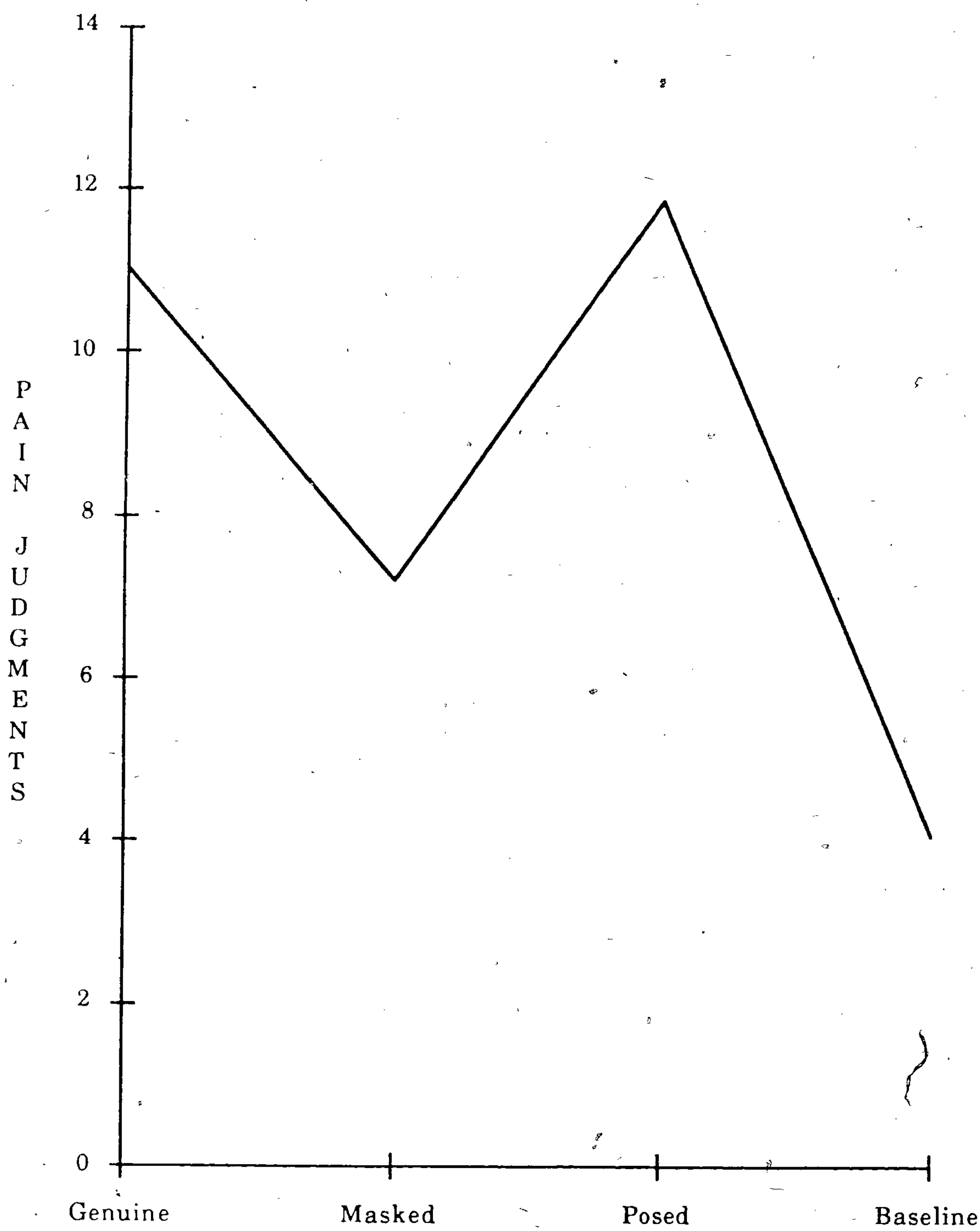


**Figure 6: Mean pain judgements for each facial expression according to self-report information**

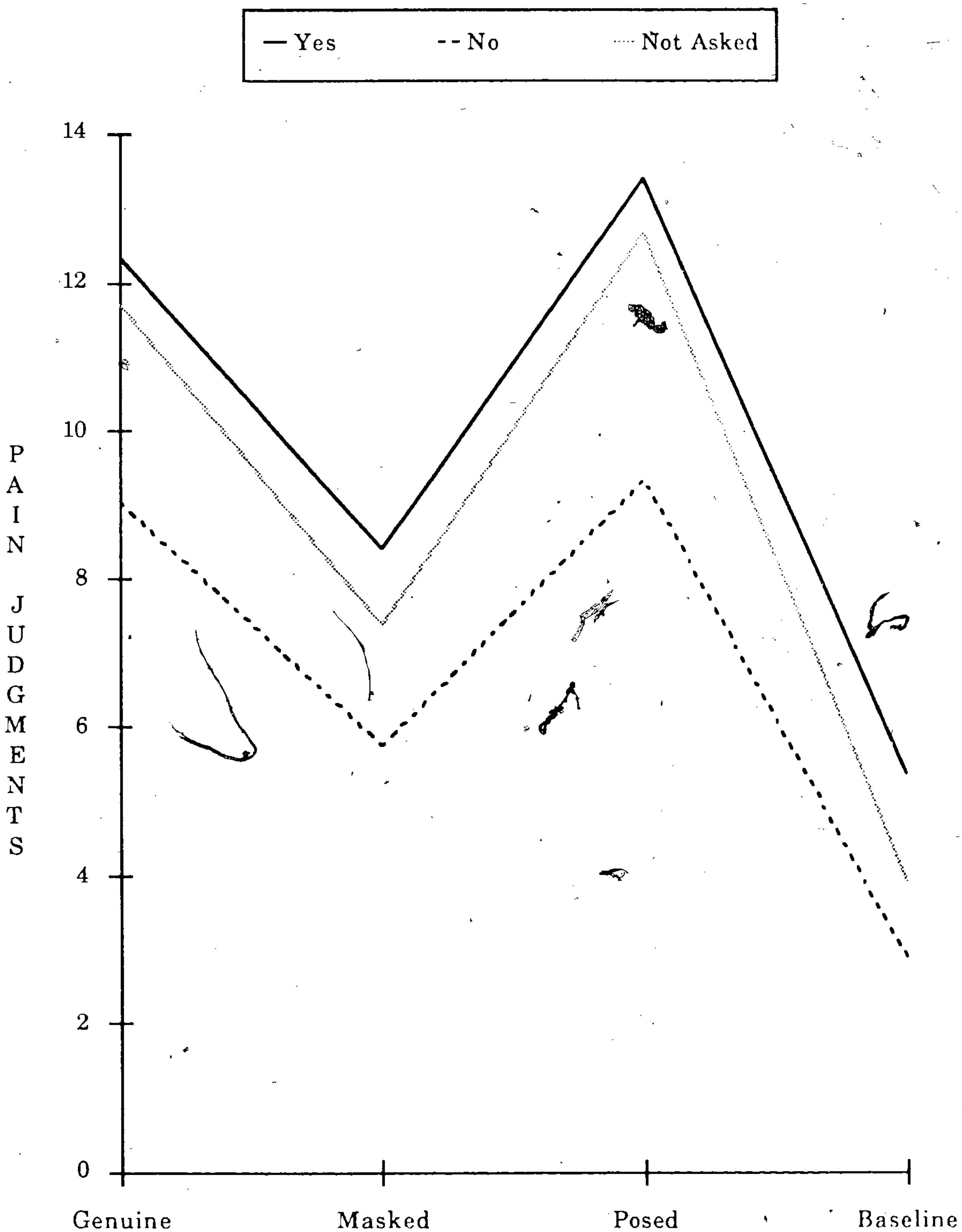


Figure 7: Mean pain judgements for each facial expression when presented with consistent and inconsistent self-report information

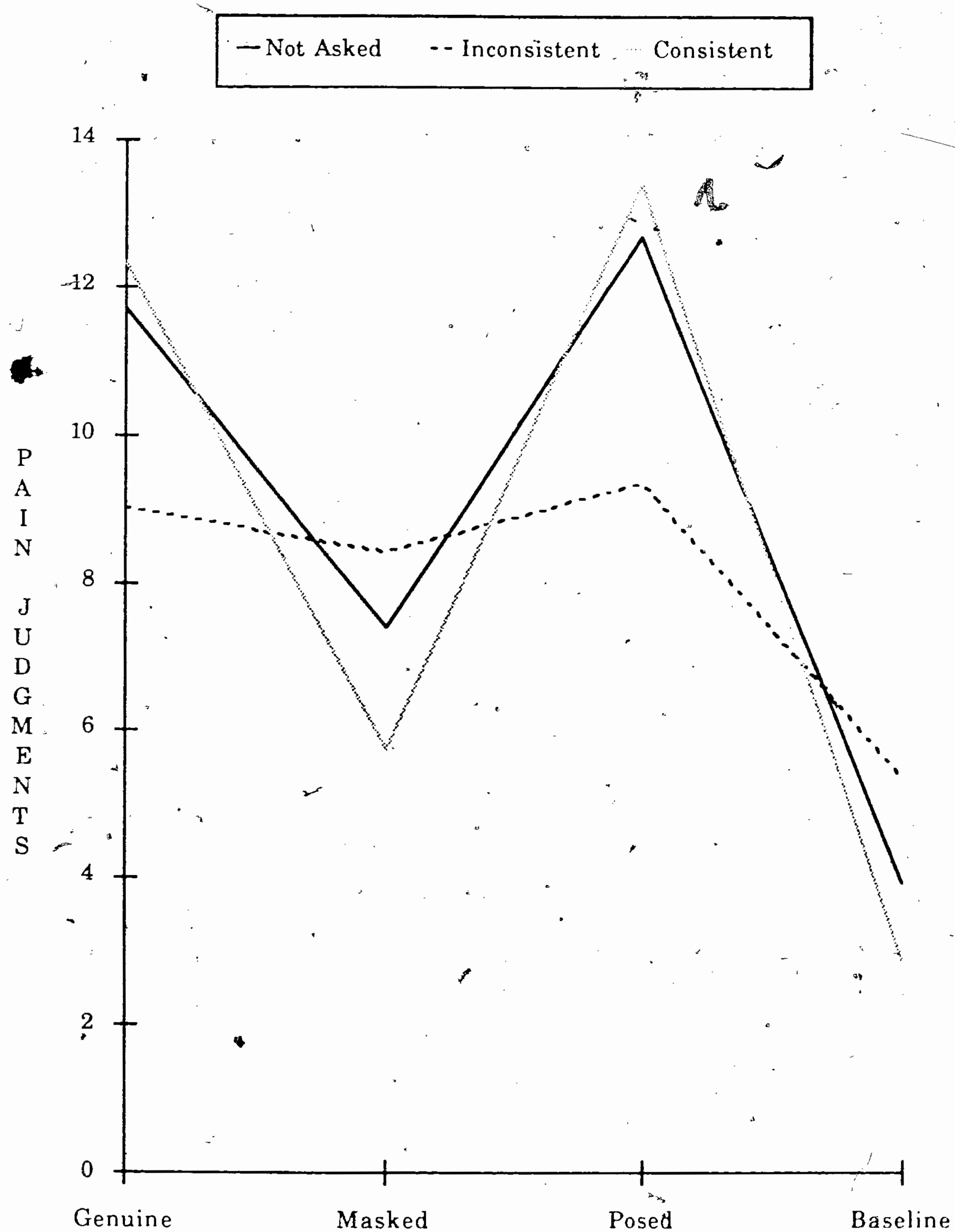
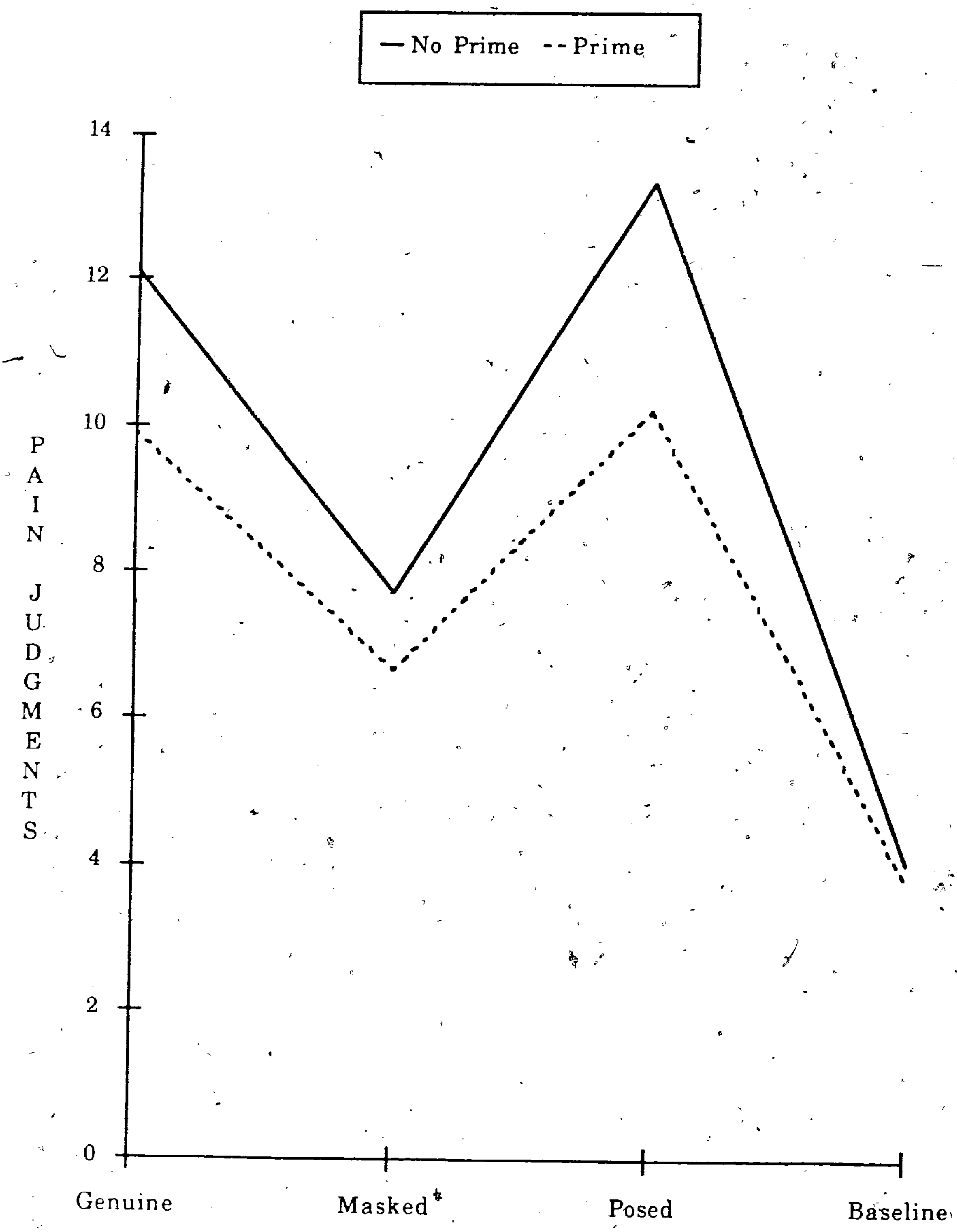


Figure 8: Mean pain judgements for each facial expression according to presence of priming



# CHAPTER IV

# DISCUSSION

## Distinguishing Between Genuine and Fake Facial Expressions of Pain

It is important to note that, in some ways, the present study represents an attempt to create a laboratory analogue to clinical judgement. Actual patients videotaped in a real clinical setting were the targets of subjects' judgements. Subjects had to make a large number of these judgements, the latter ones often under conditions of fatigue that could have made concentration difficult, and thus analogous to clinical conditions.

Subjects were confronted with patients who presented facial expressions and verbal reports that were not always correct (in fact, correct only half the time). It is this combination of the use of actual patients and information varying in its truthfulness that makes the subject's task analogous to clinical judgement.

Like all laboratory simulations, however, there are a number of aspects of the present study that are quite unlike its clinical counterpart. Foremost of these is the fact that subjects were privy to only two sources of information — facial expression and self-report. Even the self-report information was not presented by the patients themselves. Subjects viewed silent videotapes and had the self-report information presented by the experimenter, so subjects did not have the advantage of assessing patients' voice tones.

In an informal survey, the present author discovered that student nurses who are only in the second term of their five-term BCIT program identified, on average, 24 different ways that they can tell if their patients are in pain. Many of these involve parts of the body that were not shown in the videotapes used in the present study, such as assuming fetal position and gripping the bedsheets. Keefe et al. (1990) were able to divide low back pain patients into four subgroups, based on their pain behaviours. These subgroups included varying degrees of guarding, bracing, and rubbing. None featured significant amounts of grimacing, the only facial behaviour measured. So it could be fairly said that subjects in the present study were asked to make judgements based on limited, albeit central, information.

In clinical settings, there is also the advantage of being able to establish rapport with a patient over time. Sensitive practitioners can detect subtle changes in their patient's behaviour that may be indicative of pain or distress. We must be careful not to make too much of this factor, however, since studies tend to show that improvement in pain judgement accuracy is positively related to familiarity with the *measurement tool* (e.g., Teske et al., 1983), but not with the *patient*. (see Johnson, 1977, in which nurses paired with patients in a post-operative recovery ward made judgements that were virtually uncorrelated with patient self-ratings).

The present study demonstrates that, when information is restricted to facial expression and verbal self-report, correctly identifying masked and posed expressions is a difficult task. It is even more difficult when the self-report information is consistent with faked expressions. This is evidenced by the significant differences between genuine vs. masked, and posed vs. baseline expressions. There were also other comparisons of interest in the pattern of differences among the four types of facial expressions that deserve particular attention.

*Genuine vs. Posed Expressions*

One of the first conclusions to be drawn from the pattern is that the patients featured in the videotapes were convincing posers. In fact, pain judgements for posed expressions were significantly higher than those for genuine expressions. A number of explanations are possible. First, the posed expressions involved more facial activity than did the genuine expressions (Craig & Hyde, in preparation; Hyde, 1986). As such, pain judgements covaried with facial activity. Rather than being seen as a false version of a "pain face," posed expressions were considered to be more "super-normal" than abnormal. Simulation of pain, therefore, might be best achieved via exaggeration, provided it remains plausible to the experienced clinician. Results from the present study also suggest that it would be advisable to augment the exaggeration with verbal reports of pain to further increase the likelihood of getting high pain ratings from others.

Another explanation for the higher ratings given to posed expressions can be found in the nature of the instructions to the patients. The posed expressions were preceded by distinct instructions to put on a "pain face" (Craig & Hyde, in preparation). In the genuine expressions condition, the only elicitor was the pain itself. The increased ratings could attest to the fact that some people simply do not naturally express pain on their faces (Keefe et al., 1990) *unless directly told to do so.* It is more likely, though, that the combination of being spontaneously unexpressive yet voluntarily expressive of pain is rare.

It must be remembered here that the patients used in this study were not hand picked for their posing ability. Rather, they were chosen randomly from an original set of 120 patients representing a continuous series of patients seen in a back pain clinic. In fact, it is worth noting parenthetically that the unedited videotapes of those 120 patients revealed many of them had considerable difficulty simply understanding the posing instructions. When given those instructions, patients would say, "But how can I show you that I am in pain, when I am *not* in pain?!" It was clear also that many had not given a moment's thought to what they looked like when they actually were in pain, and thus had no personal "template" in memory to use as a guide. These observations were corroborated by Susan Hyde, who did the original videotaping (personal communication, March, 1990).

It must be remembered also that there were virtually no incentives provided for the patients to be "good posers," aside from the possible desire to please the experimenter and the physiotherapist. In fact, Rogers and Cavanaugh (1983) cite this as a weakness of all studies that test malingering via simulation. When all of this is taken into consideration then, the high ratings for the posed faces are all the more remarkable. Most of the expressions came from patients with little understanding of the task, little or no experience at such posing, and little incentive to do it well. One can only speculate at the posing ability of experienced malingerers who have, in addition to their honed skills, incentives such as narcotic medication, attention from others, and control of their environments.

*Masked vs. Baseline Expressions*

It was hypothesized in the present study that judgements of pain based on masked expressions would be significantly lower than those made for genuine pain expressions. In other words, subjects would be fooled by the mask. Results show that this was, indeed, the case. However, it was also the case that judgements made for masked expressions were significantly *higher* than those made for baseline expressions. In fact, the difference between masked and baseline judgements was almost as great as that between masked and genuine expressions. A considerable amount of pain "leaked through" the suppressed expressions of the patients.

According to Hyde's (1986) analysis, the only action unit that differed significantly between masked and baseline expressions was AU 45, which is blinking. It would indeed be very perceptive of the subjects in the present study if they could find as much evidence of pain as they did based solely on the patients' reduced blinking.

In Hyde's *FACS* analysis of the patients used in the present study, there was no significant difference in blinking between baseline and genuine pain expressions. It did occur significantly less often in both the masked and posed expressions, however. In fact, it occurred less often in the posed than in the masked. So it is clear that subjects did not use blinking as their primary criterion when making pain judgements.

Writing about the similarity in facial activity between masked and baseline expressions as described by the *FACS* coding done on the patients used for the present study, Craig and Hyde (in preparation) state, "The patients were strikingly successful in their response to the instructions to inhibit their reactions to a repeat of the painful movement." When *AUs* are used as the criteria of comparison, the masked and baseline expressions do appear very similar. When the judgements of subjects in the present study are used as the criterion, however, the difference is considerable. We are left to explain why the subjects were able to detect differences that the trained *FACS* coders were not.

Perhaps the answer lies in the fact that the coders *were* able to detect a number of differences among many of the other 14 AUs, but taken as individual paired comparisons between masked and baseline versions of the same AU, these differences were not statistically significant. In light of the subjects ability to see pain leaking through the masked expressions, it might be instructive to look at two alternate ways of analysing the differences in these *FACS* scores.

First, given that the various actions of the face combine to form a gestalt-like pattern, it might be justified to look at *total* differences in *FACS* scores between masked and baseline expressions. An inspection of aggregate differences, as displayed in Table 18, reveals that 9 of the 14 *AUs* showed less activity in masked expressions than in baseline. It is possible that patients took the instruction to "mask" quite literally, holding all telling areas of the face as still as possible. The result is an unusual sort of static face that the subjects interpreted as being indicative of pain. Also, the total of the mean activity levels across the 14 *AUs* was also greater for the baseline (5.601) than for the masked expressions (4.217).

Secondly, the alpha level used by Hyde when assessing the significance of each paired comparison was a "conservative" .001. Even though the purpose of the study was to make such comparisons and, as such, they might be considered *planned*, it was presumably impossible to specify in advance how many comparisons would be made and precisely which action units would be involved. As a result, the comparisons had to be considered post hoc, and the alpha level corrected accordingly. Yet, 9 of the 14 action units that ended up being used by Hyde were consistent with the findings of Craig and Patrick (1985) and Patrick et al. (1986), so it might be argued that at least the comparisons between these *AUs* could have been considered planned.

## Table 18

Action Unit Categories: Frequency Means and Standard Deviations for Baseline and Masked Expressions (Hyde, 1986)

| AU | Baseline | | Masked | |
|---|---|---|---|---|
| | M | SD | M | SD |
| in-brow raise | .108 | .338 | .050 | .219 |
| out-brow raise | .117 | .371 | .050 | .219 |
| brow lower | .067 | .250 | .167 | .417 |
| cheek raise | .075 | .295 | .050 | .254 |
| lids tight | .008 | .091 | .100 | .328 |
| upper lip raise | .000 | .000 | .008 | .091 |
| lip corner pull | .133 | .258 | .117 | .371 |
| chin raise | .042 | .239 | .042 | .239 |
| lip pucker | .025 | .203 | .017 | .129 |
| lip stretch | .050 | .219 | .008 | .125 |
| lips part | .342 | .667 | .208 | .428 |
| jaw drop | .292 | .640 | .250 | .530 |
| eyes closed | .100 | .363 | .142 | .373 |
| blink | 4.242 | 2.948 | 3.008 | 2.627 |

The answer to the question regarding why subjects were able to detect pain on the masked faces might lie in the nature of the instructions given the patients. It could be that the instruction to mask pain is a form of paradoxical intervention (Cade, 1984; DeBord, 1989) — like telling someone to relax, or not think about their blinking. A pure baseline face, one that is free of any indication of pain, is, at least to some extent, relaxed. It is very difficult to achieve that facial relaxation voluntarily, especially when in pain. It could also be that the instruction constitutes a form of distraction (McCaul & Malott, 1984). Cognitive focus is shifted from the pain site to the face, and this shift causes the face to "freeze" somewhat. If the attempt at masking is truly distracting, then it would result in a reduced subjective pain experience. This would mean that an even greater percentage of the patient's pain was leaking through the masked expression.

As a final somewhat ironic note, it is quite clear from the original Hyde videotapes that patients had a much easier time understanding the masking instructions than those for posing, yet they were much more successful at fooling the subjects in the present study with their poses than with their masks.

It can be concluded, then, that the facial expressions subjects adopted when instructed to mask pain are different from genuine and baseline expressions and are perceived as expressing pain levels somewhere between those two expressions.

## The Effect of Subject Type

The difficulty subjects experienced identifying masked and posed expressions was found for all subject types. Increased clinical experience did not help subjects become better detectors of simulation. The clinically experienced subjects for the present study were nursing students taken from terms 1, 3, and 5 of the BCIT Nursing Program. As in most nursing programs, students are taught to be sensitive to their patients' needs, to be a "patient advocate." The reading of facial expression is not an explicit part of that training, though students are encouraged to be aware of patients' behaviours referred to generally as "non-verbals." In truth, researchers are divided in their opinions regarding just how informative or useful facial expression is in that collection of behaviours.

Keefe, Brantley, Manuel and Crisson (1985) discovered that patients with head and neck cancer displayed their pain primarily through facial expression in the form of grimacing. This form of communication becomes particularly important for these patients who, post-operatively, can have considerable difficulty communicating verbally. Yet it was also Keefe et al. (1990) who factored pain behaviours into four subgroups only to find that facial expression was not a component in any of the subgroups.

It does not appear to be a matter of whether or not pain can be read on the face. The very large differences between judgements based on genuine and baseline expressions in the present study, and the better-than-chance accuracy levels found in studies such as that by Prkachin and Craig (1985) demonstrate that the face does display pain very clearly. The questions, rather, are whether or not the face can be sufficiently controlled to fool judges, or if judges (in this case, aspiring clinicians) can be trained to detect deception, thus making the face a good source of dependable information regarding a patient's pain experience (see Jensen, Bradley, & Linton, 1989). Ekman (1985) contends quite strongly that such training is possible. The forms that this training could take will be discussed in some detail when we look at possibilities for future research.

At this point, it would be ill-advised to counsel nursing students (or any other practitioners) to make pain judgements based primarily on facial expression. However, this is not to say that practitioners should not be encouraged to assume that most expressions they encounter are genuine and, thus, informative. Still, it is not surprising that such explicit training is not part of a nursing school's curriculum.

So what does one say to nursing students when they ask what they should do when patients' facial expressions and self-reports appear to be contradictory (as a number of subjects did ask during the debriefing phase of the present study)? In medical practice, "false positives", or Type II errors, are usually less costly than Type I errors, in which bona fide conditions are not diagnosed. Because of this, the experimenters in the present study never advised their nursing student subjects to consider withholding medication or other intervention for patients who reported verbally that they were in pain but did not show accompanying facial expressions indicative of that pain. This is not to say that such discrepancies between verbal and non-verbal indicators should not be mentioned by the nurse to the attending physician, especially if such verbal complaints appear to be fit Merskey's (1988) criteria of being consistent with the patient's own theory regarding the condition, and being instrumental in the attainment of some reward or environmental control.

On the other hand, patients might deny pain verbally yet show it facially. When presented with just such a discrepancy in the present study, subjects relied on facial expression information and gave relatively high pain ratings (certainly much higher than baseline ratings). In such cases, it might be reasonable to press the patient further regarding the nature of pain, especially by explicating just what range of pain experience could be expected, given the patient's condition. It was Kinsey (Kinsey, Pomeroy & Martin, 1948; Kinsey, Pomeroy, Martin & Gebhard, 1953) who discovered that people were more likely to answer a question honestly (in this case, about their sexual behaviour) if they were given an indication of wide latitudes of normality for their responses. If patients are giving false self-reports regarding the nature and extent of their pain, therefore, practitioners might be able to encourage a more honest report if the patient is made to feel that the pain experience is normal or at least, accepted. This is extremely important for cases in which patients place themselves in potentially life-threatening positions by suppressing evidence of pain.

## The Effect of Self-report Information

The strong main effect for self-report information indicates that subjects did consider it when making their judgements. This finding also provides a clear manipulation check for the subject's acceptance of the validity of the self-reports, given that this information was presented by the experimenter rather than by the patient. Telling the subjects that the patients had answered "yes" or "no" when asked if a movement had been painful had the effect of increasing or decreasing judgements, regardless of the patient's expression. As well, for each type of expression, the judgements made when subjects were given no self-report information (i.e., told that the patient had not been asked if the movement was painful) always fell, on average, between the "yes" and "no" judgements.

The task given to subjects in the present study was one of social judgement. Information about others is collected and integrated in order to form an impression about those others. In this case, the impression involved pain assessment. It might be useful, therefore, to borrow from person perception theory when trying to explain how subjects used the facial expression and self-report information presented to them when making their judgements.

At least three models can be explored: those being additive, averaging (either weighted or non-weighted), and augmenting. The first, as originally forwarded by Bruner, Shapiro and Taguiri (1958), would predict that subjects added the value of both facial and verbal information to derive an aggregate judgement. This would explain why, for every type of facial expression, subjects judgements were higher when accompanied with a "yes" self-report. For example, subjects viewed 16 genuine pain expressions without any verbal information. The mean for these 16 judgements was 187.32. For the 16 judgements made when the genuine expression was accompanied by a "yes" report, the mean was 197.42, and with a "no" report, 144.67. According to an additive model, the "yes" report contributes only another 10.10 points to the rating.

The additive model assumes that each source of information contributes an absolute amount to the judgement, independent of the existence of the other source of information. In other words, if the subject was given only the self-report information without seeing the face, the total of 16 judgements using the Gracely scale would have been around 10, which is to say very little, if any, pain would have been attributed. Even when one considers the large proportion of the variance that is explained by expression (see Table 3), it is still unlikely that a "yes" report alone would be so blatantly disregarded. This, in turn, makes the additive model implausible.

According to the averaging model of information integration (Anderson, 1965; 1981), subjects would have added up the pain values for each of the sources of information, then divided by two in order to obtain an average. Using the genuine expressions again, if we start with the fact that the 16 expressions presented alone were given a rating of 187.32, then in order for genuine-yes expressions to receive a rating of 197.42, the self-report would have to contribute 207.52 points ([207.52 + 187.32]/2=197.42). This would mean that the self-report information carried greater weight than the facial expression information.

When we make the same calculations for the genuine-no faces, we find that the "no" self-report would contribute 102.02 points, even though it logically should not contribute any. Given the pattern of results obtained in the present study, an averaging model would fit only if all "yes" reports carried more weight than facial expression information, and all "no" reports carried less (see Table 19).

A weighted averaging model accounts for the possibility that some pieces of information are more influential than others in the judgement process. For example, it might not matter to a perceiver that someone is lazy, but it might be very important that the person be intelligent. In the context of the present study, a weighted averaging model would allow for the possibility that a given *source* of information could be more influential than another.

Unfortunately, this model is only useful if the weights assigned to a source remain at least proportionally constant. In other words, if the face is given greater consideration than self-report information, it should be consistently so. According to the pattern of data obtained in the present study, the weight of self-report information changes depending upon its relationship to corresponding facial expression information.

## Table 19

Contribution of Self-Report Information to Pain Judgements According to Additive and Averaging Models

| Expression | Additive | | Averaging | |
|---|---|---|---|---|
| | Yes | No | Yes | No |
| Genuine | 10.10 | -42.65[a] | 207.52 | 102.02 |
| Masked | 15.97[a] | -26.69 | 150.56 | 65.30 |
| Posed | 11.76 | -52.87[a] | 226.37 | 97.11 |
| Baseline | 22.98[a] | -16.75 | 108.87 | 29.33 |

[a] Self-report contradicts facial expression

Table 19 reveals that the additive or subtractive effect of each form of self-report information (yes and no) is greater when it contradicts facial expression. In other words, self-report information that is consistent with facial expression tends to confirm the expression, and therefore has less net effect on the judgement. Inconsistent information, on the other hand, causes problems for the subject. It casts some doubt on the validity of the facial expression information, and, as such, must be given greater consideration than consistent information. Consequently, it has a greater effect on judgement.

The pattern of results as shown in Table 19 and Figure 6 is best explained by an augmenting model. That is, the relative weight given self-report information in judgements of patients' pain varies according to its relationship with facial expression information. Subjects did not appear to make their judgements based on the assumption that the face is the only truthful source of information, thus disregarding self-report information when it contradicted the face. Self-report information that is consistent with facial expression confirms the facial expression, but does not add considerably to the pain rating. Self-report information that contradicts facial expression, however, must be given greater consideration and, as a result, has a greater influence on the judgement.

*The Use of Self-report Information Relative to Facial Expression Information*

The high pain ratings afforded the genuine expressions of pain when not accompanied by self-report information (genuine-not asked) suggest that facial expression information contributed the lion's share when subjects made their pain judgements. The augmenting model discussed previously implies an order to the cognitive processes involved in that judgement; namely, the facial expression was not only weighted heavily, it was also considered first, and then the self-report was compared.

In the present study, order of presentation of the information was counterbalanced, with self-report given before facial expression to half the subjects and after for the other half. The significant interaction between order of presentation and self-report was such that self-report information had a greater impact when it was presented after viewing the facial expression (see Table 3). This recency effect for self-report is consistent with the augmenting model and the order of cognitive events that the model implies.

The combinations of self-report and facial information that were inconsistent with one another provide the opportunity to assess which source of information is given the most weight by the subjects when those sources contradict. For example, when posed-inconsistent (no) and baseline-inconsistent (yes) are compared, three patterns of results are plausible.

First, the subjects could base their judgements on true information only. If this were the case, they would use self-report for the posed-inconsistent condition and facial expression for baseline-inconsistent. The pattern of results would be such that judgements would not differ significantly between posed-inconsistent and baseline-inconsistent, and both would be quite low. Another possibility is that they would base their judgements on the self-report information only. This would yield low ratings for the posed-inconsistent and high ratings for the baseline-inconsistent condition.

A final possibility (other than subjects basing their judgements on false information only) is that they would use the face as their primary source of information. For this strategy, judgements for the posed-inconsistent condition would be higher than for baseline-inconsistent. This was, in fact, the pattern that emerged in the present study (see Figure 7).

Using this same logic, we should find that judgements for the genuine-inconsistent condition are greater than those for the masked-inconsistent condition. This was not found, rather the difference was nonsignificant ($p = .6022$). Here, the lack of significant difference between the two conditions indicates that subjects were more likely to be using truthful information, regardless of whether it was self-report or expression. This, again, demonstrates the subjects' abilities to "see through the masks" put on by the patients to suppress pain expression.

Given that the difference between genuine and masked expressions is significant when consistent information (or no information) is presented, it could be that the inconsistent self-report of "yes" augmented or supported the suspicion subjects harboured regarding the message being presented by the masked face – that, because of decreased blinking or some other change in facial pattern, there is some indication of pain leaking through. Of course, it is also possible that the inconsistent "no" self-report presented with the genuine pain expressions reinforced any suspicions regarding the veracity of those expressions, however false those suspicions may have been.

This notion of contradictory self-report information confirming subjects' suspicions regarding the face brings us back to the subjects' implicit theories and researchers' explicit theories (Fordyce, 1976; Prkachin, in press) regarding which source of information is most susceptible to deliberate falsification by the patient. An observation made during the procedure of the present study and documented in the Method section bears relevance here. After the practice trials, a number of subjects asked if the self-report information could be false, yet none asked that question of the facial expressions, even though the design was such that the chances of facial information being false were the same as for self-report information (each was false half the time). This, of course, is only applicable for the subjects in the no prime condition, since the others were told explicitly that some of the expressions were false.

It appears doubtful, therefore, that the "no" self-reports accompanying genuine pain expressions served to reinforce suspicions about the truthfulness of the expression. The only type of expression patients could not control sufficiently to eliminate such suspicions was the mask. However, it must be remembered that, with the present design, we cannot say that subjects knew the patient was trying to mask but saw through it, in the strict sense of the word. It is just as possible that the subjects considered these masking attempts simply to be genuine-but-mild pain faces, especially those subjects in the no prime condition, in which they did not expect to find any masking attempts.

## The Effect of Priming

When subjects were told in advance that they would be seeing masked and posed faces in addition to genuine and baseline expressions, they did not get better at identifying false expressions, even though the priming instructions were quite blunt and to the point (see Appendix E). These instructions, which were read to the subjects as they read along on their copies, alerted subjects to the existence of masking and posing, and each was defined. Only one of the 104 subjects asked questions after the instructions regarding these definitions or any other aspect of the priming instructions.

What happens to subjects' perceptual sets when priming of this sort is presented? One possibility is that they will come to doubt the truthfulness of all expressions they see. In other words, they will be "primed for skepticism." This would presumably cause the subjects to attribute less pain to the genuine and posed expressions, and more pain to the masked and baseline faces. The result would be a flattening of the solid line presented in Figure 8. However, this did not occur.

Another possibility is that, once alerted to the existence of false expressions, they would be better at identifying masking and priming. This knowledge of "the rules of the game" would result in a crossing of the solid and dotted lines between the masked and posed points in Figure 8, indicating an interaction. Though there was a significant interaction obtained for expression x priming, it was not of this kind. Instead, the interaction was the result of judgements of primed subjects being somewhat lower for posed expressions. Still, the pattern of results is very similar for prime and no prime conditions. Priming did not make them appreciably better detectors of simulation.

A third possibility is that priming reduces the subjects' general willingness to attribute pain to the patients. The subjects became less "sympathetic" when they found that patients were putting on faces that were not always honest. This interpretation is supported by the findings as depicted in Figure 8. This explains the somewhat surprising pattern found for masked faces; subjects actually got *worse* at detecting masked expressions after being primed. In other words, they gave lower pain ratings.

We must be careful when attributing feelings such as sympathy to the subjects' pain judgements, given the somewhat artificial nature of the exercise. This is not to say that people are not capable of feeling sympathy for a stranger being viewed on a television monitor. One of our subjects who, herself, had for some time suffered from low back pain, said that she found some of the patients difficult to watch because they reminded her of her own pain and it made her feel sorry for them. The effects of feelings such as sympathy and empathy on subjects' judgements are not entirely predictable, though. For example, even though there was no main effect for subjects' own pain experiences, the tendency was for people who had experienced back pain to provide *lower* ratings than did subjects without such experience.

We can only speculate, therefore, as to whether or not the priming instructions caused subjects to be less sympathetic toward the patients and that this resulted in lower pain ratings. It must be remembered that subjects were told that patients put on masked and posed faces *at the request of the experimenter*, not because they were the "deceiving type." Still, there is classic evidence that presenting subjects with such information does not prevent them from making internal attributions (Jones & Harris, 1967), which might result in a reduced willingness to give higher pain ratings.

Whether or not sympathy or lack thereof was involved, it is still safe to say that priming did not make the subjects more accurate readers of the patients' faces. Faust, Hart, Guilmette and Arkes (1988) also discovered that telling neuropsychologists in advance that they were about to see a selection of test results taken from a collection with a 50 percent base rate for malingering did not improve their ability to identify the neurological test results that had been faked by children. Leavitt and Sweet (1986) found that orthopedic surgeons and neurosurgeons believed that the naturally occurring base-rate for malingering among their patients was five percent or less. One must be cautious when generalizing across different forms of medical practice, and so we cannot be sure that neuropsychologists have the same beliefs as neurosurgeons regarding the incidence of malingering. It is, nonetheless, interesting to speculate regarding how stubbornly practitioners will stick to their own implicit theories regarding incidence of malingering, even when told that the base rate, is high for a given sample. If this is so, then priming will have little or no influence on their judgements.

## Future Research Using Genuine and Fake Facial Expressions of Pain

There is not a great deal of research that has been designed to assess people's abilities to make pain judgements when presented with facial expressions that are genuine and false. The findings of the present study suggest a number of directions that such work could take. We will begin by looking at what can be learned in terms of methodology from the present study.

### *The Use of Stimulus Materials*

Subjects were shown relatively brief, 6-second segments of facial expressions. This was accompanied by supposed patient self-report information, as the experimenter told the subjects that the patient had said yes or no when asked if a given movement had been painful, or that the patient had not been asked for that particular movement. It is the obvious intention, therefore, that the subjects base their judgements on only these two sources of information: the facial expression on the monitor and the nature of the self-report.

To further ensure that this will be the case, the experimenter should become as transparent as possible in the process. One technique that decreased the experimenter's presence, and thus, potential influence in the present study was the use of the remote control device to operate the video recorder. This removed the experimenter from the subject's view, while still allowing precise control of the tapes.

Every effort was made to eliminate possible experimenter effects in the form of tone of voice as well. The experimenters practiced saying phrases like, "Number 74 said yes," in a neutral tone. This was important, because there were cases when the self-report information and facial expression were clearly discrepant, and so experimenters had to keep any "Believe it or not" expression from their voices. Experimenter voice effects could be eliminated entirely, of course, if the self-report information were prerecorded. To do this, each of the video scripts would have an accompanying audio tape that the experimenter could control, again from behind the subjects. For studies such as this one, this audio portion could not be dubbed onto the videotape, since tapes are presented in different orders, and every face is paired with each kind of self-report at some point in the experiment.

*Dependent Measures and Inferential Statistics*

In the current study, the ability to distinguish between genuine and false expressions of pain was assessed by asking subjects to use a 13-point verbal descriptor scale to make pain judgements. The four different types of facial expression — genuine, masked, posed, and baseline — were used as an independent variable. It was assumed that, if subjects' ratings followed the pattern outlined in Figure 1, then this would indicate that they were unable to detect the false expressions. In other words, this was not simply a sorting or labeling task for the subjects.

It could be argued that the task would be easier for the subjects if they were simply asked to identify the type of expression, given the four possibilities. There is evidence to suggest that this, in fact, is an easier task. Prkachin (in press) found that his subjects could discriminate between genuine and posed expressions when high intensity pain was being experienced or simulated. In that study, subjects were asked to label expressions. Their accuracy was determined by calculating an index of discriminability *P(A)*, based on a signal detection approach. For example, mistaking a posed face for a genuine could be construed as a "false positive."

This technique has its advantages, in that the task is laid out in straightforward fashion for the subject, and the experimenter cannot be accused of tricking the subject by withholding information that is relevant to the task. However, this approach does not allow for an assessment of the effects of priming, such as those featured in the present study. By telling subjects to identify posed expressions, they are alerted to the possibility that they exist. Another problem is that, though dichotomized decisions such as "He is posing," or "He is genuinely in pain" are likely made in clinical settings, pain judgements that result in careful interventions such as the prescribing of analgesics at correct dosages are more likely made on a more continuous scale – one such as the painfulness scale designed by Gracely and used in the present study.

It is suggested, therefore, that having subjects use a multi-point scale to make judgements, then analysing those judgements using ANOVA with the expressions as the independent variable provides a useful paradigm. It is analogous to clinical judgements and the pattern of results can be quickly analysed, both graphically and statistically, to determine whether or not subjects are being fooled by one or more of the false expression types.

In fact, this paradigm can be generalized beyond pain research to other forms of facial expression. All that is needed is a simple 2 x 2 in which the condition (or any internal state) is one factor (either present or not present), and the expression of that condition is the other (either shown or not shown). Then the four possible patterns of results as depicted in Figures 1 through 4 can be used to determine the extent to which people are able to detect real from false expressions. The difficulty comes in finding internal states that one can confirm and quantify. Few are as clear cut as pain in this regard.

*Weighing the Relative Contributions of Different Sources of Information to Pain Judgements*

In the present study, subjects were given two sources of information: facial expression and self-report. Also, that information was true half the time and false the other half. Factorial combinations of these variables allowed for an assessment of the relative weight that subjects placed on each when making their pain judgements. For example, when posed faces paired with inconsistent self-report (saying no) were compared with baseline faces paired with their corresponding inconsistent self-report (saying yes), it was possible to use the pattern of results to determine if face, self-report, or the truthfulness of the information was most influential in their judgements.

This same paradigm can be used to compare the relative weight of any two forms of information in the pain judgement process, provided the information can be manipulated such that it is true or false. For example, guarded posturing can be compared with Visual Analogue Scale reports, since both can be "posed" and "masked."

To do this, subjects making judgements on patients actually experiencing pain must be presented with two combinations of this information such that guarded posture is true (genuine) and VAS score is false (masked) in one instance, and guarded posture is false (masked) and VAS true (genuine) in the other. If the subject is using true information, then there will be no difference in the judgements based on the two pairs. High ratings of pain will be given, based on genuine posturing and genuine VAS scores, each of which is indicating true pain. If the subject is relying most heavily on the patient's posturing, then the genuine posture-masked VAS combination will receive higher pain ratings than the masked posture-genuine VAS combination will, since more pain is indicated by posture in the first pair than in the second. If, on the other hand, VAS scores are most influential, then the reverse will be true — the genuine posture-masked VAS combinations will receive *lower* ratings that the masked posture-genuine VAS scores. It must be remembered that this will be the case only if the patient is actually experiencing pain. Another set of combinations must be used if the patient is not in pain.

*Other Variables to be Tested*

A justifiable question to be asked after almost any research, and especially after research that demonstrates an inability or problem, is "So what?" In other words, can anything be done to rectify the problem? While it was not within the scope of the present study to answer this question empirically, it does deserve attention.

Zuckerman, Koestner and Colella (1985) presented deceptive messages to subjects via facial expressions only, speech only, and a combination of the two. They found that subjects who were given feedback regarding the accuracy of their judgements performed better than controls. Subjects in this "learning condition" group found their performance improved as they progressed through the task when detecting deception in speech only and face plus speech conditions. The face only condition did not improve with feedback, though. Zuckerman et al. discuss this in terms of difficulties people experience when looking at the face for cues to deception. Paul Ekman has argued that those cues are present and accessible, we only must know where to look.

In his book, *Telling Lies*, Paul Ekman (1985) outlined numerous techniques to help people detect deception in others. He suggested that we must look to forms of "leakage" in facial expressions that, in their contradiction with false verbal report, speak the truth.

One form of leakage that is difficult to pick up without training is the microexpression. Ekman has discovered that the face is capable of displaying a number of discernable expressions in a very short period of time. In fact, each expression is less that one-quarter second long. One might assume that such expressions were too brief to be perceived, but Ekman has trained people to detect expressions of only one-twenty-fifth and one-fiftieth of a second. The training involved the use of tachistiscopically presented expressions of decreasing duration.

Another sign of simulation is called "squelching." This occurs when antagonistic muscles try to hold back a spontaneous expression. The result is an unnatural face. An example would be the depressor anguli oris pulling the mouth down in sadness while the zigomatic major is used to put on a brave, yet unnatural smile.

Ekman contends that there are "reliable muscles" that we can look to when determining the authenticity of a facial expression. For example, it is very difficult to pull the corners of the lips down voluntarily without moving the chin muscle. Yet a spontaneous expression can do this. Also, consistent with Rinn's (1984) analysis of the neurophysiological origins of facial expression, Ekman points out that the forehead is a good source of reliable facial information. Another example of how reliable muscles can be used was presented by LeResche, Ehrlich and Dworkin (1990). They discovered that patients' smiles during genuine pain experiences were not often accompanied by obicularis oculi contraction (squinting). These "masked" smiles, as LeResche et al. called them, were rarely found in baseline conditions. The authors concluded that practitioners could be alerted to the nature of masked smiles as an indicator of pain. Using Ekman's terminology, the obicularis oculi should be considered more "reliable" muscles than those around the mouth when judging the genuineness of smiles when pain might be involved.

Microexpressions, squelching, and reliable muscles all can give away masked expressions. To detect posed expressions, Ekman has offered two pieces of advice. First, look for asymmetry. Posed expressions tend to be more asymmetical than the real thing (Hager & Ekman, 1985; Sackeim et al., 1978). Ekman (1985) found that judges were able to detect asymmetry in facial expressions *without* the need for training. Finally, the duration of an expression can be a clue to its truthfulness. Expressions lasting more than five seconds are usually false.

From Ekman's work, we can find a number of tangible focal points for training observers to detect false facial expressions. Future research could be conducted in order to measure the effectiveness of such training on people's abilities to make accurate judgements of patients' pain.

## Summary

When subjects are presented with videotaped facial expressions of patients in a real clinical setting, they find it difficult to make accurate pain judgements based on facial expressions that either mask or pose pain. This difficulty is compounded by patients' self-reports that corroborate those poses and masks. Subjects are more likely to be fooled by posing than masking, as indicated by the fact that masked expressions received pain ratings that were significantly higher than baseline, and posed expressions received ratings that were significantly higher than genuine expressions. In other words, pain "leaked through" some of the masked expressions; however, if any deception was evident in the posed expression, it was not detected by the majority of subjects in the present study.

The ability to detect posed and masked expressions did not improve as a function of subjects' clinical experience. Nursing students in their fifth and final term at BCIT with approximately 120 days of hospital training were no more accurate than SFU students. This might be because the reading of facial expressions is not an explicit part of that training or because there are social norms regarding privacy that discourage practitioners from overtly studying the faces of their patients in pain.

Subjects in the present study used self-report information as well as facial expression to make their judgements. The results suggest that self-report information was used to augment facial expression in the judgement process, and that facial expression information was considered first in the sequence of thoughts that led to those judgements. Also, subjects appeared to place more weight on facial expression, as evidenced by the pattern of results when subjects were given facial expressions and self-reports that contradicted one another.

When subjects were told in advance to expect some expressions that were masked and posed, they tended to give lower pain ratings, *regardless of expression*. So, rather than alerting them to deception, the priming instructions tended to make them less willing to attribute pain in general.

Future research in this area must take at least two directions. First, subjects with more clinical experience must be tested. Though clinical experience did not have an affect on the judgements of subjects in the present study, it must be remembered that the most experienced subjects had only about 120 days in the hospital. This falls well short of experienced nurses and doctors with patients in oncology, emergency, and post-operative care, in which pain is commonplace. Also, it would be interesting to test practitioners who routinely make pain judgements that can affect patients' lives in other-than-medical ways, such as in litigation and compensation cases.

Finally, it must be determined whether there are effective training methods that would improve people's abilities to detect simulation in facial expressions of pain. This training could range from simple accuracy feedback trials, to detailed practice at focusing on parts of the face that, theoretically, are more "telling" than others when it comes to deception (Ekman, 1985).

# APPENDIX A

## SHEET ONE

Not Painful (NP)

Faintly Painful (FP)

Slightly Painful (SlP)

Mildly Painful (MiP)

Somewhat Painful (SoP)

Moderately Painful (MoP)

Rather Painful (RP)

Decidedly Painful (DP)

Pretty Painful (PP)

Quite Painful (QP)

Very Painful (VP)

Unusually Painful (UP)

Extremely Painful (EP)

## APPENDIX B

## BACKGROUND INFORMATION

1. Circle: Female Male

2. Age in years _________

3. Years of post-secondary education completed _________

4. What post-secondary institution are you currently attending? _________

5. What is your major or program of study? _________________________

6. How many terms semesters have you completed? _________

7. Have you ever been treated for back pain or other chronic pain?

_________

8. If the answer to question 7 was yes, briefly describe the nature of the pain.

_______________________________________________________________

_______________________________________________________________

_______________________________________________________________

Turn the page now to the PRACTICE SHEET and wait for further instructions.

# APPENDIX C

## Simon Fraser University
## Informed Consent by Subjects to Participate in a Research Project

Please read the following document carefully, as your signature at the bottom of this form will signify that you have read it and have voluntarily agreed to participate in the project.

This is a research project conducted by Gary Poole, a graduate student at Simon Fraser University, as part of his Ph.D. thesis in psychology. It concerns people's judgements of pain based on facial expressions. You will be asked to view videotapes of people undergoing tests for back pain. Also, you will be asked to make judgements regarding how painful the procedure was for the person in the videotape.

Your participation in this project is strictly voluntary. Also, you may withdraw your participation in the experiment at any time. Your decision regarding participation will in no way affect your standing as a student at SFU or BCIT.

Name (please print):______________________________

Signature:______________________________

Date:______________________________

.................................................................................................................................

Thank you for your participation. A summary of the results of this study may be obtained from Gary Poole at Simon Fraser University (604) 291-3910.

Should you have any questions or complaints regarding this study, you may contact Dr. Roger Blackman, Chairman, Psychology Department, Simon Fraser University (phone: 604-291-3354).

# APPENDIX D

## INSTRUCTIONS (without priming)

In a moment, you will be shown a number of facial expressions and asked to judge how much pain, if any, the person on the monitor is experiencing. The people you will be seeing all suffer from lower back problems. They agreed to be videotaped for research purposes while they underwent "range of motion" tests. In these tests, patients are asked to perform a number of movements, some of which they find painful.

After viewing an expression, you are asked to pick a descriptive phrase from Sheet One and write its corresponding initials in the space provided on the Response Sheet (these are part of this package). Each video segment lasts approximately 6 seconds. So watch the entire segment carefully before making your judgement. Make your judgement based on *the most painful moment*, if any, during the 6-second segment. Remember, patients might vary considerably in the amount of pain they are experiencing.

You will see each patient more than once over the course of the tape. This is because each patient goes through a number of different movements, some of which might be painful.

For a number of the movements, the patients were asked if they were experiencing pain. We will tell you whether the patient answered "Yes," or "No," or was not asked.

Begin now by turning to the next page, which asks you for some background information.

## APPENDIX E

## INSTRUCTIONS (with priming)

In a moment, you will be shown a number of facial expressions and asked to judge how much pain, if any, the person on the monitor is experiencing. The people you will be seeing all suffer from lower back problems. They agreed to be videotaped for research purposes while they underwent "range of motion" tests. In these tests, patients are asked to perform a number of movements, some of which they find painful.

After viewing an expression, you are asked to pick a descriptive phrase from Sheet One and write its corresponding initials in the space provided on the Response Sheet (these are part of this package). Each video segment lasts approximately 6 seconds. So watch the entire segment carefully before making your judgement. Make your judgement based on *the most painful moment*, if any, during the 6-second segment. Remember, patients might vary considerably in the amount of pain they are experiencing.

You will see each patient more than once over the course of the tape. This is because each patient goes through a number of different movements, some of which might be painful.

For a number of the movements, the patients were asked if they were experiencing pain. We will tell you whether the patient answered "Yes," or "No," or was not asked.

The patients were also asked to do something else during that procedure. They were asked in some cases to pose an expression of pain even when they weren't in pain, and other times to mask pain; that is to try not to show pain on their faces even when they really were in pain.

So you will see 4 kinds of faces: some that are genuinely expressing pain, some that are posing pain, some that are masking pain, and others that are not showing pain because they aren't experiencing pain. Whether you think the patient is posing, masking, or being genuine, choose the phrase that best describes what you believe the patient is *actually experiencing*.

Begin now by turning to the next page, which asks you for some background information.

# APPENDIX F

## PRACTICE SHEET

1. ______________

2. ______________

3. ______________

4. ______________

## APPENDIX G

## RESPONSE SHEET

Subject number ______________________

1. __________

2. __________

3. __________

4. __________

5. __________

6. __________

7. __________

8. __________

9. __________

10. __________

11. __________

## APPENDIX H

**Cell Means Adjusted to Match Gracely's Ratio-scale Values**

| Expression | Self-report | | | |
|---|---|---|---|---|
| | Yes | No | Not Asked | Overall |
| Genuine | 12.34 | 9.04 | 11.71 | 11.03 |
| Masked | 8.42 | 5.75 | 7.40 | 7.19 |
| Posed | 13.41 | 9.37 | 12.68 | 11.82 |
| Baseline | 5.37 | 2.88 | 3.93 | 4.06 |

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