SEX AND RACE DIFFERENCES IN RATING OTHERS' PAIN, PAIN-RELATED NEGATIVE MOOD, PAIN COPING, AND RECOMMENDING MEDICAL HELP

By

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A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

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To my parents who provided me with endless love. To my brothers Abdulghafour and Mohammad who planted gardens in the deserted land of my dreams. To my daughter Sarah who is the candle of my life and the meaning of my smile.

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Sex and race influence pain ratings. We studied these influences in ratings of pain intensity, pain unpleasantness, pain-related negative mood, pain coping, and recommending medical help. Seventy-five undergraduates viewed virtual human virtual humans expressing pain, and provided computerized ratings via VASs. A series of Mixed ANOVAs was performed. Male and female participants rated female virtual humans higher than male virtual humans on pain intensity, ($p < 0.05$), pain unpleasantness, ($p < 0.01$), pain-related negative mood, ($p < 0.05$), poor pain coping, ($p < 0.05$), and recommending medical help, ($p < 0.05$). Male and female virtual humans' need for medical help was rated higher by male participants compared to female participants, ($p < 0.05$). Males also rated African American and Caucasian virtual humans' need for medical help higher than females' ratings, ($p < 0.05$). African Americans and Caucasians rated female virtual humans higher on pain intensity, ($p < 0.05$) and pain unpleasantness, ($p < 0.05$). Caucasians and African Americans viewed Caucasian virtual humans' pain-related negative mood as higher than African Americans', ($p < 0.05$). Caucasians' ratings of male and female virtual humans' pain-related negative mood were higher than African Americans' ratings, ($p < 0.05$). Caucasians rated females' pain-related negative mood higher

than males', ($p < 0.05$). Caucasians' and African Americans' ratings for poor coping were higher for Caucasian virtual humans compared to African American virtual humans, ($p < 0.05$). African Americans' ratings for African American virtual humans' pain intensity were higher than for Caucasian virtual humans. In summary, both sexes and races had higher ratings for females' pain. Both races rated female virtual humans higher on each variable. Both races rated Caucasians as having more negative mood and poorer coping than African Americans. Females' higher negative mood and poorer coping might be explained the relationship between pain, mood, and coping. Results show that races may differ in sensitivity to pain expressions. Males' tendency to seek more pain medications may explain their high levels of recommending virtual humans to seek medical help. Technology used in this study (virtual humans) is discussed along with its possible future use and applicability.

CHAPTER 1
INTRODUCTION

Pain is an individual subjective experience that is known to have psychological components. Almost a fifth of American adults experience chronic pain (a total of 50 million). Persistent pain is experienced by 17% of patients in the United States seen by primary care physicians. And people who seek treatment for chronic pain each year are estimated to be about 4.9 million. Significant pain accompanies the majority of more than 23 million surgical procedures that are performed each year in the United States. Direct and indirect costs for the treatment of pain and the pain-related losses are estimated to be more than $125 billion per year (Turk & Melzack, 2001).

Sex Differences in Pain Perception and Rating

Empirical investigations support the presence of sex differences in pain (Robinson, Riley, Myers, Papas, Wise, Waxenberg, & Fillingim, 2001; Frot, Feine, & Bushnell, 2004; Robinson & Wise, 2003; Ellermeier & Westphal, 1995; Vallerand & Polomano, 2000; Hawthorn & Redmond, 1998; Unruh, 1996; Dao & LeResche, 2000; Robinson & Wise, 2004). However, the degree to which sex influences pain perception is not completely clear. Although a number of studies have shown that females perceive and express higher levels of pain than males, other studies have found no differences between the sexes (Hawthorn & Redmond 1998). A number of researches have shown that females are more likely to experience pain in a range of medical conditions compared to males. For example, females report more frequent tension and migraine headaches than males (Unruh, 1996), and have higher prevalence rates for orofacial (Dao et al, 2000) and musculoskeletal pain (Unruh, 1996). Sex-related differences in pain perception have also been found in experimental pain settings (Frot et al. 2004).

The presence of sex differences in the appraisal of pain might arise for two reasons. First, males and females have differences in their pain experience over the lifespan, suggesting the presence of meaning constructs of pain and related coping styles. Second, sex-based social role expectations are different for males and females. Subsequently, the interference of the pain experience differs with the roles and responsibilities for females and males. Pain-related emotional and affective responses might also be affected by differences in social role expectations (Unruh, 1996).

It is relatively well established that differences do exist between the sexes. However, the underlying mechanisms are not clear yet. It has been suggested that sex differences in pain perception are driven by both biological and socially learned factors, and also by the possible interaction between them. Different expectations were found between males and females in terms of the typical male's and female's pain responding. Males are viewed as less willing to report their pain and more able to endure it. A manipulation of sex- related pain expectancy in experimental setting eliminated the sex differences in cold pressor pain (Robinson et al., 2004).

Males and females endorse different predispositions to willingness to report their pain significantly (Robinson et al. 2001). That is, males are less willing to report pain. Robinson, Riley, & Myers (2000) have argued that the differences reported in many laboratory investigations could largely be explained by the sex-related expectations of pain. Robinson, Gagnon, Riley, & Price (2003) attempted to explicitly manipulate the sex role stereotypes for males and females to further determine the effects of these stereotypes and related expectations on different psychophysical responses to experimental pain. One of their hypotheses was that manipulating the expected performance for males and females would influence their subsequent pain report and reduce or eliminate the documented sex differences in pain. They hypothesized

that in standard instructional sets, pain report would differ between males and females. And these differences would decrease when females and males were given similar sex role expectations for pain tolerance. Their work was the first to show that sex differences in pain report decrease when sex role is experimentally manipulated. Results also supported the notion that assessments of sex differences in pain responding, in laboratory settings, are influenced by sex role–related expectations of pain. That is, pain tolerance can be manipulated by altering sex role–based expectations for pain.

There are few studies examining how individuals view others in pain, either experimentally or clinically. Robinson et al. (2001) have found that males and females differ significantly in their pain expectations for self and others. Investigators examined how both sexes observe experimentally induced pain in male and female participants. They found that, regarding virtual humans' sex, viewers rated male virtual humans as having less pain than female virtual humans. Regarding sex of the observer, however, female viewers rated observed pain intensity significantly higher than did male viewers. In a more recent study, Robinson & Wise (2004) found that participants rated female subjects as experiencing greater pain intensity when undergoing a cold pressor task compared to males. Parental observation, sociocultural norms, acuity in observing overt behaviors, and beliefs regarding roles were suggested by the investigators to play a part in the explanation of how one perceives another in pain.

Sex Differences in Pain-Related Negative Mood

The current definition of pain by the International Association for the Study of Pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage." reflects the subjective, multidimensional nature of pain. A better understanding of the experience of clinical pain highlights the importance of

understanding the negative emotional experiences that accompany and contribute to the overall pain experience (Robinson & Riley, 1998).

Previous research shows that pain is associated with negative mood (Gaskin, Green, Robinson, & Geisser, 1992). Chronic pain patients show high psychological distress, including depressed mood, anxiety, and anger (Feldman, Downey, & Schaffer-Neitz, 1999). Wade, Dougherty, Hart, Rafii, & Price (1992); Wade, Dougherty, Archer, & Price (1996); and Price (1999) proposed a sequential stage model of pain processing. The Perceived intensity of the pain sensation was suggested to be the first stage. The second stage is the immediate pain unpleasantness, which reflects an individual's immediate affective response to the pain sensation and to the context of its occurrence. The immediate pain unpleasantness dimension involves limited cognitive processing and is often linked to the physical sensation of pain. The third stage involves long-term reflective or cognitive processing related to the meanings and implications of pain on the individual's life (Price, 1999). Therefore, negative emotions such as depression, anxiety, and anger, are thought to be characteristics of this third stage. The fourth and final stage of the model is the apparent behavioral expression of pain.

Gaskin et al (1992) analyzed the ability of anxiety, anger, and depression to predict self-report of clinical pain as indicated by the McGill Pain Questionnaire (MPQ). Researchers found support for the hypothesis that chronic pain has a predisposing factor in the development of negative mood. Feldman et al. (1999) investigated the relationship between daily pain, negative mood, and social support in 109 participants with reflex sympathetic dystrophy syndrome and found that pain led to increased depressed, anxiety, and anger. Slocumb, Kellner, Rosenfeld and Pathak (1989) matched gynecologic patients with the abdominal pelvic pain syndrome with other gynecologic patients. They administered to both groups self-rating scales of anxiety, depression,

and anger-hostility, and found that pain patients rated themselves significantly more anxious, depressed, and hostile. Another study investigated the associations between a chronic pain condition and common mood and anxiety disorders in a sample representative of the general US civilian population utilizing the National Comorbidity Survey. Researchers found significant positive associations between chronic pain and individual 12-month mood and anxiety disorders (McWilliams, Cox, & Enns, 2003).

Individuals experiencing chronic pain have higher incidences of depression, lower levels of physical functioning, and a poorer response to treatment (Geisser, Robinson, Keefe, & Weiner, 1994). Depression is a significant issue among pain patients. Prevalence rates for depression of 30% to 60% in clinic-based chronic pain samples highlight the significance of depression among pain patients (Robinson & Riley, 1998). Romano & Turner (1985) reviewed the literature on the relationship between pain and depression and concluded that research support can be found for almost all hypotheses about the nature of the relationship between the two constructs: "depression leads to pain by increasing pain sensitivity and decreasing pain threshold; pain becomes a virtual equivalent of depression among patients with certain dispositions; pain serves as a stressor that leads to subsequent depression; and that pain and depression occur simultaneously, but are related only due to coincidentally similar psychological and/or biological mechanisms". This highlights the importance of further investigation of the relationship between pain and depression, and to include factors that are expected to have variant contributions to that relationship such as the person's sex, how well the person is coping with his/her pain, the level of pain the person is reporting, and sex differences in perceiving the person's mood, coping, pain level, and his/her expected sex role.

Several studies indicate that patients with a variety of chronic pain conditions report anxiety levels significantly greater than published norms and that a significant amount of the variance in pain report can be explained by anxiety (Gaskin, Greene, Robinson, & Geisser, 1992; Brown, Robinson, Riley, & Gremillion, 1996; Holzberg, Robinson, Geisser, & Gremillion, 1996). Gaskin et al. (1992) used regression methodology to ascertain relationships between clinical pain measured by the McGill Pain Questionnaire and measures of depression, anxiety, and anger and found that 33% of the McGill affective dimension of pain was associated with state anger and state anxiety, and 19% of the McGill sensory dimension was associated with state anxiety. Anger is considered as an affective state that may be related to pain and styles of inhibiting anger have been found to be the strongest predictor of pain intensity (Kerns, Rosenberg, & Jacob, 1994). The development of depression in general has been linked to the suppression of anger in general, as well as specifically among pain patients (Beutler, Engle, Oro'-Beutler, Daldrup, & Meredith, 1986).

Sex-specific relationships between pain and negative affect have been evidenced in both community and clinical samples (Riley, Robinson, Wade, Myers, & Price, 2001). In the National Health and Nutrition Examination Survey, pain and depressive symptoms tended to be more evident in females than in males (Magni, Caldieron, Rigatti-Luchini, & Merksey, 1990). In pain clinic patient samples, prevalence of depression and anxiety is typically higher for females (Unruh, 1996), although at least one study reported more depression and anxiety in males (Buckelew, Shutty, Hewitt, Landon, Morrow, & Frank, 1990). In within-day assessments of pain, pain coping, and mood in males and females having Osteoarthritis, a study aimed to analyze sex differences in dynamic relations between pain, mood, and pain coping. Participants rated their pain, pain coping, and mood two times each day for 30 days using a booklet format. One finding

was that males were more likely than females to experience an increase in negative mood and a decrease in positive mood in the morning after an evening of increased pain (Keefe, Affleck, Emery, Waters, Caldwell, Stainbrook, Hackshaw, Fox, & Wilson, 2004). Riley et al. (2001) proposed a sequential model of pain processing with pain intensity as stage 1, pain unpleasantness as stage 2, pain-related emotions (depression, anxiety, frustration, anger, fear) as stage 3, and overt behavioral expression of pain as stage 4. Investigators tested hypotheses about relationships between sex and the first 3 stages of pain processing in both sexes participants with chronic pain and one of the findings was that pain-related emotions were more strongly related to pain for males. Anxiety was one of the emotions most highly related to pain. Recent research results highlight sex differences in the experience of pain and the importance of assessing pain-related negative mood and sex differences.

Sex Differences in Coping with Pain

Lazarus & Folkman (1984) define coping as "constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person". They also identified the person's health status and energy as one of the most pervasive coping resources in that they are relevant to coping in many, if not all, stressful encounters. They suggest that a person who is weak, ill, tired or otherwise debilitated has less energy to apply to coping than a healthy person and that it is easier to cope when one is feeling well than when one is not. This notion implies that people who are in pain will cope differently than people who are not and that pain would only be considered as a stressor when, and if, a person believes or appraises the pain as taxing or exceeding his/her recourses and abilities to manage it. Coping is a construct that many of the variables that influence pain and disability fall under, and many models of pain and illness give coping

responses an important, if not central, role in understanding and predicting adjustment to pain and illness (Boothby, Thorn, Stroud, & Jensen, 1999).

Given that individuals develop their own strategies for coping with painful experiences, and since males and females differ in the experience of pain, it is likely that males and females will develop different coping styles (Jensen, Turner, Romano, & Lawler, 1994; Weir, Browne, Tunks, Gafni, & Roberts, 1996; Robinson et al, 2000). Unfortunately, little research has investigated whether sex moderates or mediates the effectiveness of pain coping strategies (Sullivan, Tripp, & Santor, 2000; Keefe, Lefebvre, Egert, Affleck, Sullivan, & Caldwell, 2000). Unruh, Ritchie, & Merskey (1999), for example, presented results from a community based telephone survey of people who reported pain in the two weeks before the interview. Researchers found that females reported significantly more intense pain, as well as used a greater range of coping strategies, i.e. greater social support seeking, problem-solving, positive self-statements and palliative behaviors compared to males.

Another study aimed to determine whether sex differences would be found in the effect that sensory-focused and emotion-focused coping instructions have on cold pressor pain experiences. In this study, participants consisted of healthy adults, all of whom reported no current pain. Compared to females, males showed less negative pain responses when focusing on the sensory component of the pain experience, and compared to sensory focusing, emotional focusing was found to increase the affective pain experience of females (Keogh & Herdenfeldt, 2002). Keefe et al. (2004) found that females used more problem focused coping than males, and females who catastrophized were less likely than males to report negative mood. They also found that males were more likely than females to use emotion-focused coping when their mood was more negative.

Affleck, Tennen, Keefe, Lefebvre, Kashikar-Zuck, Wright, Starr, & Caldwell (1999) found that females reported more problem solving, social support, positive self-statements, and palliative behaviors than males. When the effects of disease and sex on daily pain, mood, and coping were compared in 71 patients with Osteoarthritis and 76 patients with rheumatoid arthritis, females had daily pain levels of 72% higher than the daily pain levels of males. Females used more problem-focused and emotion-focused strategies every day than males. This suggests the female participants endorsed more coping strategies than males.

The perceived seriousness of the pain experience may increase by the anticipated and actual interference of pain on one's perceived responsibilities. Multiple primary role responsibilities of females such as childcare or care for elderly parents, household management, and paid employment may contribute to the appraisal of pain as threatening. They may attend to pain earlier in an effort to minimize its' intrusiveness. Females may also be more worried and irritated about pain. Role interference and perceived effectiveness or ineffectiveness of coping strategies may contribute to the emotional response to pain. Normal biological processes that result in troublesome pain experiences, recurrent pains with little or no pathological significance, and pain experiences that are symptomatic of pathological, increase the complexity of female's pain experience and may lead to some frustration with self-management and assessment of pain. Risks of depression and disability associated with pain may be increased due to irritability and worry. Paid work remains the dominant occupational role for males although their involvement in childcare and household responsibilities is slowly increasing. Risk of work disability may be partially reduced by the greater opportunity to recover from pain if responsibilities for childcare, household management and relationships are considered secondary and possibly assumed by a partner. For males, unless the pain experience is interfering with work, they may perceive that

experience as having limited importance. While females may be more irritated and worried about pain, males may be more embarrassed by pain. Embarrassment may cause males to minimize pain unless pain increases in severity or interferes with work. Social and cultural norms that accept insensitivity to pain and pain endurance as measures of virility may minimize the pain expression or reporting (Unruh, 1996). Klonoff, Landrine, & Brown (1993) found that male undergraduate students were significantly more likely than females to rate their emotional response to common pain problems as embarrassment regardless of the location of the pain. Participants of both sexes identified the greatest threats to be the overall interference of pain and the emotional distress when asked about their appraisal of pain (Unruh et al., 1999).

Racial Differences in Coping with Pain

The literature concerning chronic pain has shown that active coping, such as problem-focused coping, tends to be associated with better physical and psychological functioning. And passive coping, such as emotion-focused coping, tends to be associated with poorer physical and psychological functioning (Jensen, Turner, Romano, & Karoly, 1991; Boothby et al., 1999). Furthermore, patients who used problem-focused coping were better in adapting to chronic disease than those who used emotion-focused strategies (Bombardier, D'Amico, & Jordan, 1990; Maes, Leventhal, & de Ridder, 1996).

Little is known about racial differences in coping with pain as well as racial differences in perceiving others' coping strategies when experiencing pain. It is possible that different coping styles used by African Americans and Caucasians may impact the pain experience. For example, in a study of pain coping among patients with rheumatoid arthritis, racial differences were present in the use of pain coping strategies although no racial differences in pain were noted. African Americans with rheumatoid arthritis reported significantly higher use of distraction and

praying/hoping as coping strategies, whereas, Caucasians reported greater use of ignoring pain and coping statements (Jordan, Lumley, & Leisen, 1998).

Many researchers concluded that race is an important predictor of pain-related symptomatology and pain coping (Edwards & Fillingim, 1999; Greenwald, 1991; Novy, Nelson, Hetzel, Squitieru, & Kennington, 1998; Sheffield, Biles, Orom, Maixne, & Sheps, 2000; Zatzick & Dimsdale, 1990). Others such as Edwards, Doleys, Fillingim, & Lowery (2001) highlighted that future investigations may benefit from assessment of coping strategies as a potential mediator or moderator of relationships between race and pain responses. Previous research has suggested that coping, social learning, and attitudes might play an important role that is yet unstudied in racial differences in health conditions, particularly pain (Folkman & Moskowitz, 2000; Moore & Brodsgaard I, 1999). Jordan et al (1998) compared racial groups on pain coping strategies and control beliefs and the relationships of these variables to health status among women with rheumatoid arthritis. They found that Racial groups did not differ in pain severity or negative affect, but African-Americans used more coping techniques involving diverting attention and praying/hoping. And that Caucasians used more coping techniques involving ignoring pain. The relationships of praying/hoping and reinterpreting pain to RA adjustment differed by racial group. Whereas, ignoring pain, coping statements, and stronger control beliefs predicted better health status, diverting attention predicted more pain for all patients. These findings suggest that there are racial differences in the use of coping strategies that should be acknowledged when helping patients cope with their pain.

Campbell, Edwards, & Fillingim (2005), Examined racial differences in responses to multiple experimental pain stimuli, including heat pain, cold pressor pain, and ischemic pain and found that African Americans reported greater use of passive pain coping strategies.

Racial differences in pain related coping were also found between African Americans and Whites on every Coping Strategies Questionnaire-Revised scale dimensions after including sex and age as covariates in the model (Hastie, Riley, & Fillingim, 2004).

Pain coping strategies generally vary widely between cultures. Cultural differences in pain coping strategies might be as important as the differences in the prevalence pain or its reported severity (Brodsgaard, 1999). Racial differences in pain coping within clinical samples might not be the result of a long chronic pain experience, but might be present even in the absence of chronic pain. So, racial differences in pain coping might indicate an exacerbation of stress management styles that are inherited, such as pain. Coping is not individualistic but is folded in the influences of the person's ethno-cultural environment and sub-cultural context (Hastie et al., 2004).

Racial Differences in Pain-Related Negative Mood

Race may have a major influence on the emotional and behavioral responses to pain and pain appraisal (Edwards, Fillingim & Keefe, 2001). Socio-cultural factors related to racial background may influence the meaning of the pain experience (Bates, 1996). Consequently, pain appraisals can have a major influence on pain-related emotional responses such as depression and anxiety, as well as behavioral responses such as the decision to seek treatment, adherence to treatment regimens (Edwards et al., 2001).

Associations have also been reported between depression and emotion-focused coping strategies in chronic pain (Weickgenant, Slater, Patterson, Atkinson, Grant, & Garfin, 1993; de Ridder, & Schreurs, 2001; Endler, Corace, Summerfeldt, Johnson, & Rothbart, 2003). Studies on patients coming to pain centers for initial assessment found that higher pain intensity and depression were associated with being African American, younger, and having a pain duration of more than 30 months (Anderson, Palos, Gning, Mendoza, Sanchez, Valero, Richman, Nazaria,

Hurley, Payne, & Cleeland, 2003; Green, Anderson, Baker, Campbell, Decker, Fillingim, Kaloukalani, Lasch, Myers, Tait, Todd, & Vallerand, 2003; Green, Baker, Sato, Washington, & Smith, 2003; and Green, Baker, Sato, Washington, & Smith, 2003). One study aimed to explore relationships between chronic pain and race. The researchers asked the participants to rate the degree to which their chronic pain interferes with their lives, and found that African Americans had significantly higher rating than Caucasians on irritability, disturbed sleep, inability to participate in pleasurable activities, and loss of appetite due to their pain condition (Portenoy, Ugarte, Fuller, & Haas, 2004). Research on pain related mood has shown that African Americans with chronic pain had higher pain severity, depression, and disability when compared to whites with chronic pain (Carmen, Green, Ndao-Brumblay, Nagrant, Baker, & Rothman, 2004).

Riley, Wade, Myers, Sheffield, Papas, & Price (2002) found that African Americans experience greater emotional suffering compared to white participants on similar levels of pain intensity. The researchers identified depression, anxiety, frustration, anger, and fear as the components of the emotional factor in their study. Researchers used VASs to assess for the components of the emotional factor. In a retrospective analysis of persons younger than 50 years of age presenting for chronic pain management in a multidisciplinary pain center, Green et al. (2003) found that African American participants were more depressed, anxious, and irritable compared to white participants.

Facial Expression of Emotions

Charles Darwin was one of the first who talked about facial expressions of emotion. In his 1872 book, Expression of the Emotions in Man and Animals, he suggested that humans' expressive movements are remnants of earlier ones. Taking the expression of grief in adult as an example, it is a toned down version of crying in the infants (Woodworth, 1938). The wide-open mouth of crying involves muscles of the corner of the mouth, and the slight movement of these

stays as a sign of grief after vocal crying has decreased as a response. Darwin described the facial expression of disgust as a combination of closing off the nose to keep out unpleasant odor and opening the mouth as if to spit out the contents (Woodworth & Schlosberg, 1954).

Having people judge facial expressions of emotions from photographs was introduced by Darwin. Because the muscles and skin of the face are very mobile, the face was a logical choice. In addition, the face is visible to others and is an important source of information in both verbal and nonverbal social communications (Woodworth & Schlosberg, 1954).

Piderit also talked about the facial expressions of emotions in the 19th century. He argued that mental images of objects should produce the same facial response as when the object was actually viewed. Therefore, when unpleasant thoughts exist, the mouth moves as if to avoid a bitter taste, the eye region as if to avoid an unpleasant sight, the nose as to react to an unpleasant odor. Piderit mentioned also the open mouth of attention and the appraising mouth, with lips protruding. Piderit illustrated his arguments with simple line drawings. Boring and Titchener in the 1920s used his drawings in studying judgments of emotional expressions by participants (Woodworth & Schlosberg, 1954).

One way facial expressions were viewed is that it represents a psychobiological phenomenon influenced by the humans' evolutionary heritage along with current circumstances. This helped developing an evolutionary perspective on emotions. A perspective that would suggest that emotion-specific changes in autonomic physiology have evolved to help that adaptation processes that are presented as emotions, such as anger and fear. Ekman (1992) proposed that each emotion state (emotion family) constitutes a family of affective states that share commonalities in the way they are expressed. These commonalities between emotion families are characteristic of that specific family and distinguishes it from other emotion

families. Research on facial expressions yielded the possibility of separate discrete emotional states such as fear and anger. Contraction of specific facial muscles provides the information as to whether the expression represents anger, fear, sadness, disgust, enjoyment, or surprise (Ekman, 1993).

Some research has argued that the dynamic facial expressions are necessary for complete emotional information extraction derived from faces (Caron, Caron, & Myers, 1985). The dynamics of expression is a factor that facilitates recognition of expressions. Researchers used different stimuli such as computer generated schematic movies (Wehrle, Kaiser, Schmidt, & Scherer, 2000), Natural movies (Harwood, Hall, & Shinkfield, 1999), subtle displays of emotion (Ambadar, Schooler, & Cohn, 2005), and point-light displays (Bassili, J, 1979) argued for the importance of dynamics in the perception of facial expressions of emotions.

Sex differences in recognition of facial expressions and facial pain expressions

Males and females show differences in perception of facial expressions. The majority of the literature shows that females are better in identifying different affects expressed through face (Hall, 1978., Kirrouac & Dore, 1985., Nowicki & Hartigan, 1988., and Tylor & Johnsen, 2000). However, some research suggest that sex differences depend on the type of facial expression being observed. Nowicki et al. 1988 found that females are better in recognizing expressions such as fear and sadness. Whereas, Wagner, McDonald, Manstead, 2986., Mandal & Palchoudhury, 1985., and Rotter & Rotter, 1988, found that males are better in identifying displays of anger. The sex differences in recognizing facial expressions seem to hold true even at an early age. Boyatzis, Cazan, & Ting, 1993, found that 3.5 year-old girls accuracy in recognizing facial expression matched 5-year-old boys' accuracy.

The most prominent nonverbal pain behavior has been considered to be the facial expressions of pain (Craig & Patrick, 1985). In general, sex differences in facial expressions have hardly been studied. And sex was rarely included as a factor in facial pain expressions limited research (Kunz, Gruber, & Lautenbacher, 2006). Some research found no differences between males and females in pain facial expressions (Craig, Hyde, & Patrick, 1991., and Prkachin, 1992). However, Guinsburg, Peres, de Almeida, Balda, Bereguel, Tonelotto, &Kopelman (2000) found increased facial pain responses in female neonates compared to male neonates. Robinson et al. (2001) have found that males and females differ significantly in their pain expectations for self and others. Viewers rated male virtual humans as having less pain than female virtual humans and female viewers rated observed pain intensity significantly higher than did male viewers. Robinson et al. (2004) found that participants rated female subjects as experiencing greater pain intensity when undergoing a cold pressor task compared to males.

Vignettes Research

This study used vignettes and virtual humans of virtual humans experiencing pain. Vignettes, pioneered by Peter Rossi (Leahey, 2004) combine forms of survey research and experimental designs. The vignette technique is applied to studies of problems in which participants make evaluations regarding complicated objects. Desirable features included an avoidance of real world multi-collinearity and the ability to isolate the independent variable of interest. The vignette format is particularly appropriate for studying norms, attitudes, and beliefs (Leahey, 2004). Jasso & Webster (1997); Jasso & Opp (1997); and Morrill, Snyderman, & Dawson (1997) used the vignette format to explore normative judgments, sexed double standards, and moral gaps in business settings.

Other researchers also used vignette formats in medical and health settings. Green, Wheeler, & LaPorte (2003) used nine clinical vignettes to examine potential differences in the

physician's pain management based on the type of pain and patient demographic characteristics, and found that that the preparation of adequate pain management may be influenced by patient characteristics and physician variability. In another study, Hassenbusch & Portenoy (2000) investigated practice patterns via an internet-based survey distributed to physicians who manage implantable infusion pumps for pain management. The survey used a standard questionnaire format and two clinical vignettes to assess decision-making practices and found evidence of wide variations in clinical practice among physicians. Goubert, Crombez, & Danneels (2004) investigated whether pain catastrophizing and pain-related fear is related to a reluctance to generalize an experience of lesser pain than expected to other similar situations. Researchers used a series of vignettes to assess catastrophizing, overgeneralization, personalization and selective abstraction related to general life experiences and to low back pain (LBP) experiences. They also used three vignettes to assess the lack of generalization of corrective experiences related to LBP. Researchers found that dysfunctional cognitions related to general life experiences were the strongest predictor of the self-denigration subscale of the Beck Depression Inventory (BDI). However only dysfunctional cognitions related to LBP accounted for a unique contribution in predicting the somatic and physical function subscale of the BDI. Moreover, dysfunctional cognitions related to LBP were significantly correlated with interference with daily life due to pain.

In a study aimed to determine what factors influence emergency physicians' decisions to prescribe an opioid analgesic for three common painful conditions, Tamayo-Sarver, Dawson, Cydulka, Wigton, & Baker (2004) developed a baseline vignette, and items expected to influence the decision for each of the three pain conditions: migraine, back pain, and ankle fracture, and found that Physicians' likelihood of prescribing an opioid showed marked variability. Many

other studies have used vignette format in medical and health settings (Mitchell and Owens, 2004; Weisse, Sorum, & Dominguez, 2003; Adamson, Ben-Shlomo, Chaturvedi, & Donovan, 2003; Hazelett, Powell, & Androulakakis, 2002; Hamer, van den Hout, Halfens, Abu-Saad, & Heijltjes, 1997; Tait & Chibnall, 1997; Carey, Hadler, Gillings, Stinnett, & Wallsten, 1988; and Cohen, 1980).

In terms of medication practices, research using vignettes that were identical, except for the sex of the patient indicates that different amounts of analgesic medication were chosen based on the patients' sex, with nurses' choosing less pain medication for female patients experiencing pain than when compared to males (Cohen, 1980; McDonald & bridge, 1991). Campbell (2002) found that in prospective vignette studies, some nurses have indicated the intention to spend less time engaged in pharmacological pain management of female patients, and to select less pain medication for female patients. She also found, using lens model and vignette format, that patient pain report appears to play an early predispositional role in the clinical decision making process. She also found that patient sex, age, and race play smaller predispositional roles in the clinical decision making process (Campbell, 2002).

Study Rationale

Relatively little is known about how males and females of different races vary in respect to perceiving and rating pain, pain-related negative mood, pain coping, and the extent to which each would recommend seeking medical help for males, females, Caucasians, and African Americans when experiencing pain. Some research has been done on sex differences in rating other individual's pain. Previous research has shown that differences in perceiving and rating other's pain lead to differences in judgments and decisions relative to pain management, drug prescriptions and health care providing (Tamayo-Sarver et al, 2004; Campbell, 2002; Cohen, 1980; McDonald et al, 1991; Holm, Cohen, Dudas, Medema, & Allen 1989; Green et al, 2003; &

Hassenbusch et al, 2000). Since research has shown that sex and race differences in pain-related negative mood and pain coping exist, the importance of investigating how males and females of different races differ in perceiving other's pain-related negative mood and pain coping may in turn lead to better understanding of the differences in the way males and females of different races perceive, rate and respond to others' pain coping, pain-related negative mood, and better pain management strategies.

This study adds to the determination of whether differences between males and females, and differences between races exist in terms of perceiving and rating other peoples' pain. In addition, this study contributes to the investigation of whether sex differences and/ or race differences exist in perceiving and rating other's pain-related negative mood, pain coping, and the extent of recommending seeking pain-related medical help.

Study Aims

The initial aim of this study is to determine whether sex and/or racial differences exist in regard to rating other people's pain, pain-related negative mood, pain coping, and the extent of recommending medical help for pain. Second, in this study, the sex role expectations of pain are investigated as a possible mediator to the relationship between sex and the perceived others' pain.

Hypotheses

- There will be significant differences in participants' ratings for male and female virtual humans' pain intensity, pain unpleasantness, pain-related negative mood, coping with pain, and the extent in which virtual humans will be recommended to seek medical help for their pain. Ratings made by male, female, Caucasian, and African American participants for female virtual humans will be higher than their ratings for male virtual humans.

- There will be significant differences in participants' ratings for Caucasian and African American virtual humans' pain intensity, pain uncleanness, pain-related negative mood, coping with pain, and the extent in which the virtual humans will be recommended to

seek medical help for their pain. Male, female, Caucasian, and African American participants will rate African American virtual humans higher.

- There will be significant differences between male and female participants' ratings of virtual humans' pain intensity, pain unpleasantness, pain-related negative mood, coping with pain, and the extent in which the virtual humans will be recommended to seek medical help for their pain. Female participants' ratings for male, female, Caucasian, and African American Virtual humans will be higher than the ratings made by male participants.

- There will be significant differences between Caucasian and African American participants' ratings for virtual humans' pain intensity, pain unpleasantness, pain-related negative mood, coping with pain, and the extent in which the virtual humans will be recommended to seek medical help for their pain. Caucasian participants' ratings for male, female, Caucasian, and African American virtual humans will be higher than the ratings made by African American Participants.

Sex and race differences on rating others' pain, pain-related negative mood, pain coping, and the extent of recommending medical help experiencing pain provides a broader range of variables that may affect the way males and females of both races perceive and rate others' pain, mood, and coping. This study provides baseline information regarding the role of the person's pain, mood, and coping taken together on decisions and judgments regarding people who are experiencing pain. It also provides initial data to explore sex and race differences on dealing with other people's pain from both sexes and races, and its expected effects on a wider range of behaviors including expected sex and race effects on health care behaviors toward pain patients.

CHAPTER 2
METHODS

Participants

Recruitment

75 University of Florida undergraduate students of both sexes (53 females, 22 males) and races (62 Caucasians, 13 African Americans) were recruited through flyers and posters requesting volunteers to participate in this study.

Inclusion/Exclusion Criteria

Eligibility for participation required being at least 18 years old and English speaking. Only males and females of African American or Caucasian background were included. Participation was also contingent upon ability to give consent.

Procedure

Each participant was asked to read a description of the study including the time required to complete the study and a reminder that the study is voluntary. After reading the study description, all participants read and sign a computerized consent form acknowledging that the study procedures were explained and that they could withdraw, without prejudice, from the study at any time. Next, the participants filled out a demographic questionnaire. The following demographic information was collected: sex, race, and age. After that, participants read a set of instructions that provided information on how to approach the task and how to use Visual Analogue Scales (VASs) to give ratings. Then, participants viewed the vignettes and the virtual humans of both sexes and races. The virtual humans participants observed expressed pain through facial expressions. These facial expressions of pain were digitally coded based on the Facial Action Coding System (FACS). The FACS is based on anatomic analysis of facial muscle movements and distinguishes 44 different action units (AUs). However, an abbreviated version

of FACS was used in this study focusing on 4 action units: brow lowering, tightening of the orbital muscles surrounding the eye, nose wrinkling/upper lip raising, and eye closure.

Each virtual human the participants observed consisted of a vignette and a virtual reality virtual human of the observed patient of each sex and race. Each virtual human contained three cues: sex (two levels: male or female), race (two levels: Caucasian or African American), and pain (two levels, and were manipulated only in the observed virtual human and was inferred by the participants based on the virtual humans' facial pain expressions). Pain-related negative mood, pain coping, and the virtual humans need to be recommended to seek medical help was also inferred by the participants based on and related to the pain facial expressions of the observed virtual human of both sexes and races.

In order to minimize the impact of social desirability on participants' ratings, participants were instructed to completely respond to virtual humans in the order presented, complete one virtual human before going to the next, and not to revisit a previously completed virtual human. For each virtual human (of both sexes and races), participants (of both sexes and races) used computerized VASs to (1) rate the level of pain intensity they think the observed virtual human is experiencing, (2) rate the level of pain unpleasantness they think the observed virtual human is experiencing, (3) rate the level of pain-related negative mood the observed virtual human is experiencing due to his/her observed pain, (4) rate how well they think that the observed virtual human is coping with the pain experience, and (5) rate the extent to which they would recommend the observed virtual human to seek pain-related medical help. Participants also completed a computerized version of the Sex Role Expectations of Pain questionnaire (GREP) (appendix A) using computerized VASs to assess for the degree to which sex role expectations of pain may contribute to their ratings.

The Gender Role Expectations of Pain questionnaire (GREP) consists of visual analog scales to assess for participants' view of the typical male and female regarding pain sensitivity, pain endurance, and willingness to report pain. It also assesses the participants' personal attribution of his/her pain sensitivity, pain endurance, and willingness to report pain relative to the typical male and female. The psychometric properties of the GREP factor structure are close to the theoretical formulation of the scales, accounting for 76% of the variance in scores. The questionnaire has good test–retest reliability with individual item correlations ranging from 0.53 to 0.93. The sex differences in the endorsement of items on the GREP were large, with the largest differences (46% of variance) shown for willingness to report pain items. (Robinson et al, 2001). Wise et al (2002) found that the GREP was a significant predictor of experimental pain ratings in undergraduate males and females, and that a significant proportion of sex differences in pain report was accounted for.

Task duration was approximately 1 hour. Following completion of the task, participants were asked to respond, in writing, to a task validity probe, in which they were asked to guess what the study hypotheses were. Then, participants were briefed regarding the variables of interest and the study hypotheses.

Analysis

All data analyses were performed using SPSS for windows (Version 15). Mixed model ANOVA analyses were performed where sex and race, of participants and virtual humans, served as independent variables, and ratings of pain intensity, pain unpleasantness, pain-related negative mood, pain coping, and the extent to which the virtual humans were recommended to seek medical help for their pain as dependent variables.

The 2 X 2 Mixed model ANOVAs were conducted as follows: ratings of pain intensity served as a dependent variable, and sex of virtual humans (male and female) and sex of

participants (male and female) served as independent variables. The same process was repeated for ratings of pain unpleasantness, pain-related negative mood, pain coping, and recommending medical help. Then, ratings of pain intensity served as a dependent variable, and race of virtual humans (Caucasian and African American), and sex of participants (male and female) served as independent variables. The same process was repeated for ratings of pain unpleasantness, pain-related negative mood, pain coping, and recommending medical help. After that, ratings of pain intensity served as a dependent variable, and race of virtual humans (Caucasian and African American), and race of participants (Caucasian and African American) served as independent variables. The same process was repeated for ratings of pain unpleasantness, pain-related negative mood, pain coping, and recommending medical help. Finally, ratings of pain intensity served as a dependent variable, and sex of virtual humans (male and female), and race of participants (Caucasian and African American) served as independent variables. The same process was repeated for ratings of pain unpleasantness, pain-related negative mood, pain coping, and recommending medical help.

Willingness to report pain and pain endurance (taken from the GREP), were investigated to determine whether they meet the criteria to serve as covariates in the analyses of sex of virtual humans and participants main effects on ratings of pain intensity and pain unpleasantness.

CHAPTER 3
RESULTS

A series of mixed model ANOVA models was performed where sex and race of participants and virtual humans served as independent variables, and ratings of pain intensity, pain unpleasantness, pain-related negative mood, pain coping, and the extent to which the [virtual humans] are recommended to seek medical help for their pain as dependent variables.

The willingness to report pain, and pain endurance are two factors of the GREP that are being considered to be included in the model as covariates. However, correlation analysis was conducted on these two factors as well as male and female participants' ratings of pain intensity and pain unpleasantness for male and female virtual humans. Results showed that correlations are not significant. Therefore, willingness to report pain, and pain endurance were dropped from the model because the assumptions of covariance analysis were not met.

Analysis of Pain Intensity Ratings

Sex Effects

Both male and female participants rated pain intensity for female virtual humans significantly higher than that for male virtual humans, F (1, 73) = 4.92, $p < 0.05$. Between participants main effects, and sex of virtual human by sex of participant interactions were non-significant (see table 3-1). Both Caucasian and African American participants rated pain intensity for female virtual humans significantly higher than that for male virtual humans, F (1, 73) = 6.93, $p < 0.05$. Between participants' main effects or the sex of virtual human by race of participant interaction effects were non-significant, (see table 3-2).

Race Effects

There was no main effect of race of virtual human on ratings of pain intensity. However, African American participants rated African American virtual humans significantly higher than Caucasian virtual humans, F (1, 73) = 4.73, $p < 0.05$, (see table 3-3).

Analysis of Pain Unpleasantness Ratings

Sex Effects

Both male and female participants rated pain unpleasantness for female virtual humans significantly higher than that for male virtual humans, F (1, 73) = 7.61, $p < 0.01$. Main effect of sex of viewer, and main effect and sex of virtual human by sex of viewer interaction were non-significant, (see table 3-4). Both Caucasian and African American participants rated pain unpleasantness for female virtual humans significantly higher than that for male virtual humans, F (1, 73) = 4.17, $p < 0.05$. Between participants' main effect and sex of virtual human by race of participants' interaction were non- significant, (see table 3-5). These results mirrored the intensity effects.

Race Effects

Race of virtual human did not have an effect on ratings of pain unpleasantness. Sex of participant and race of participant did not have an effect on ratings of pain unpleasantness (see table 3-6).

Analysis of Pain-Related Negative Mood Ratings

Sex Effects

Both male and female participants rated pain-related negative mood for female virtual humans significantly higher than that for male virtual humans, F (1, 73) = 6.76, $p < 0.05$. No significant interactions or between participants' effects were found, (see table 3-7). However, a between participants main effect was found for race of participants; Caucasian participants'

ratings for both male and female virtual humans pain-related negative mood were significantly higher than African American participants' ratings, F (1, 73) = 3.99, p = 0.05. An interaction of sex of virtual human by race of participants was also found; Caucasian participants ratings for female virtual humans were significantly higher than African American participants ratings for female virtual humans, F (1, 73) = 4.11, $p < 0.05$, (see table 3-8).

Race Effects

Race of virtual human did not have an effect on ratings of pain-related negative mood made by male and female participants. (see table 3-9). However, both Caucasian and African American participants viewed Caucasian virtual humans as having significantly higher levels of pain-related negative mood, F (1, 73) = 5.34, $p < 0.05$. (see table 3-10).

Analysis of Pain-Coping Ratings

Sex Effects

Both male and female participants viewed female virtual humans as coping poorer than male virtual humans, F (1, 73) = 6.37, $p < 0.05$. No significant between participants effect, and sex of virtual human by sex of participant interactions were found, (see table 3-11). No significant main effect for sex of virtual human on race of participants was found. Also, no interaction or between race of participants effects were found (see table 3-12).

Race Effects

Both Caucasian and African American participants viewed Caucasian virtual humans as coping poorer with their pain than African American virtual humans, F (1, 73) = 6.86, $p < 0.05$. Race of participant did not have an effect on ratings of pain coping. (see table 3-13). Sex of participant did not have an effect on ratings of pain coping (see table 3-14).

Analysis of Recommending Medical Help Ratings

Sex effects

A main effect for sex of virtual humans on sex of participants was found; both male and female participants' ratings were significantly higher for female virtual humans than that for male virtual humans, F (1, 73) = 5.98, $p < 0.05$. A sex of participants' main effect was also found indicating that male participants' ratings were significantly higher than female participants' ratings, F (1, 73) = 4.02, $p < 0.05$, (see table 3-15). Race of participant did not have an effect on ratings of recommending medical help (See table 3-16).

Race effects

Sex of participant did not have an effect on ratings of recommending medical help. However, male participants' ratings for both Caucasian and African American virtual humans were significantly higher than that of female participants, F (1, 73) = 4.06, $p < 0.05$ (see table 3-17). Sex of participant did not have an effect on ratings of recommending medical help (see table 3-18).

In summary, male and female participants rated female virtual humans' pain intensity, pain unpleasantness, pain-related negative mood, poorer pain coping, and the need to seek medical help as higher than male virtual humans. However, Caucasian and African American participants' ratings for female virtual humans were higher than that for male virtual humans only on pain intensity and pain unpleasantness. Caucasian virtual humans were viewed as having higher pain-related negative mood and cope poorer with their pain than African American virtual humans. African American virtual humans' pain intensity was rated higher only by African American participants. Ratings made by male participants tended to be higher than ratings made by female participants.

A correlation analysis was conducted between dependent variables. All dependent variables in this study (ratings of pain intensity, pain unpleasantness, pain-related negative mood, pain coping, and recommending medical help) were intercorrelated. Correlations ranged between 0.35 (pain coping and recommending medical help) to 0.87 (pain intensity and pain unpleasantness (see table 3-19).

Table 3-1. Descriptive statistics and mixed model ANOVA results of the effect of sex of virtual humans on ratings of pain intensity made by male and female participants.

Virtual humans	Participants	*M*	*SD*	*F* (1, 73)	η^2	*P*
Male	Male	40.6	15.8	4.92	0.063	0.03
	Female	37.8	14			
Female	Male	41.6	14.7			
	Female	40.9	13.6			
Pain Intensity Ratings for sex of virtual human * sex of participants				1.23	0.017	0.27
Between Participants Effect				0.24	0.003	0.62

Table 3-2. Descriptive statistics and mixed model ANOVA results of the effect of sex of virtual humans on ratings of pain intensity made by Caucasian and African American participants.

Virtual humans	Participants	*M*	*SD*	*F* (1, 73)	η^2	*P*
Male	Caucasian	38.7	14.4	6.93	0.087	0.01
	African American	38.6	15.9			
Female	Caucasian	40.9	14.2			
	African American	42.3	12.8			
Pain Intensity Ratings for sex of virtual human * race of participants				0.41	0.006	0.52
Between Participants Effect				0.03	0.000	0.88

Table 3-3. Descriptive statistics and mixed model ANOVA results of the effect of race of virtual humans on ratings of pain intensity made by Caucasian and African American participants.

Virtual humans	Participants	*M*	*SD*	*F* (1, 73)	η^2	*P*
Caucasian	Caucasian	39.4	13.7	2.62	0.035	0.11
	African American	42.6	15.6			
African American	Caucasian	40	14.8			
	African American	38.3	12.9			
Pain Intensity Ratings for race of virtual human * race of participants				4.73	0.061	0.033
Between Participants Effect				0.03	0.000	0.86

Table 3-4. Descriptive statistics and mixed model ANOVA results of the effect of sex of virtual humans on ratings of pain unpleasantness made by male and female participants.

Virtual humans	Participants	*M*	*SD*	*F* (1, 73)	η^2	*P*
Male	Male	43.2	16.8	7.61	0.095	0.007
	Female	42	14.6			
Female	Male	46.9	16.9			
	Female	44	13.5			
Pain unpleasantness ratings for sex of virtual human * sex of participants				0.57	0.008	0.454
Between Participants Effect				0.32	0.004	0.575

Table 3-5. Descriptive statistics and mixed model ANOVA results of the effect of sex of virtual humans on ratings of pain unpleasantness made by Caucasian and African American participants.

Virtual humans	Participants	*M*	*SD*	*F* (1, 73)	η^2	*P*
Male	Caucasian	42.7	14.6	4.17	0.054	0.045
	African American	40.4	18.1			
Female	Caucasian	45.3	14.7			
	African American	43	14.2			
Pain unpleasantness ratings for sex of virtual human * race of participant				0.00	0.00	0.99
Between Participants Effect				0.267	0.00	0.61

Table 3-6. Descriptive statistics and mixed model ANOVA results the effect of race of virtual humans on ratings of pain unpleasantness made by male, female, Caucasian, and African American participants.

Virtual humans	Participants	*M*	*SD*	*F* (1, 73)	η^2	*P*
Caucasian	Males	45.15	16.7	1.17	0.02	0.28
	Females	44	13.3			
African American	Males	45	16.8			
	Females	42	14.7			
Pain unpleasantness ratings for race of virtual human * sex of participant				0.77	0.01	0.38
Between Participants Effect				0.32	0.00	0.58
Caucasian	Caucasian	44.58	14	2.55	0.03	0.11
	African American	43	16			
African American	Caucasian	43.4	15.4			
	African American	40.4	14.9			
Pain unpleasantness ratings for race of virtual human * race of participant				0.38	0.01	0.54
Between Participants Effect				0.268	0.00	0.61

Table 3-7. Descriptive statistics and mixed model ANOVA results of the effect of sex of virtual humans on ratings of pain-related negative mood made by male and female participants.

Virtual humans	Participants	*M*	*SD*	*F* (1, 73)	η^2	*P*
Male	Male	41.2	15.9	6.76	0.085	0.011
	Female	36.5	15.2			
Female	Male	44.2	15.3			
	Female	38.6	14.9			
Pain-related negative mood ratings for sex of virtual human * sex of participants				0.19	0.00	0.67
Between Participants Effect				1.89	0.03	0.17

Table 3-8. Descriptive statistics and mixed model ANOVA results of the effect of sex of virtual humans on ratings of pain pain-related negative mood made by Caucasian and African American participants.

Virtual humans	Participants	*M*	*SD*	*F* (1, 73)	η^2	*P*
Male	Caucasian	39	15.2	0.55	0.01	0.46
	African American	32.5	16.2			
Female	Caucasian	42.2	14.3			
	African American	31	16.2			
Pain-related negative mood ratings for virtual humans' sex * participants' race				4.11	0.05	0.05
Between Participants Effect				4	0.52	0.05

Table 3-9. Descriptive statistics and mixed model ANOVA results of the effect of race of virtual humans on ratings of pain pain-related negative mood made by male and female participants.

Virtual humans	Participants	*M*	*SD*	*F* (1, 73)	η^2	*P*
Caucasian	Male	42.8	15.8	1.29	0.02	0.26
	Female	38.6	14.6			
African American	Male	42.6	15.8			
	Female	36.3	15.9			
Pain-related negative mood ratings for virtual humans' race * participants' sex				0.9	0.01	0.35
Between Participants Effect				1.95	0.03	0.17

Table 3-10. Descriptive statistics and mixed model ANOVA results of the effect of race of virtual humans on ratings of pain pain-related negative mood made by Caucasian and African American participants.

Virtual humans	Participants	*M*	*SD*	*F* (1, 73)	η^2	*P*
Caucasian	African American	41	14.3	5.34	0.068	0.024
	Female	34.4	17.5			
African American	Caucasian	40	15.4			
	African American	29.2	16.6			
Pain-related negative mood ratings for virtual humans' race * participants' race				2.47	0.03	0.12
Between Participants Effect				3.87	0.05	0.053

Table 3-11. Descriptive statistics and mixed model ANOVA results of the effect of sex of virtual humans on ratings of pain coping made by male and female participants.

Virtual humans	Participants	*M*	*SD*	*F* (1, 73)	η^2	*P*
Male	Male	34.1	14.6	6.37	0.08	0.014
	Female	31.8	13.3			
Female	Male	36	15			
	Female	34.2	13.4			
Pain-coping ratings for virtual humans' sex * participants' sex				0.08	0.00	0.78
Between Participants Effect				0.35	0.01	0.56

Table 3-12. Descriptive statistics and mixed model ANOVA results of the effect of sex of virtual humans on ratings of pain coping made by Caucasian and African American participants.

Virtual humans	Participants	*M*	*SD*	*F* (1, 73)	η^2	*P*
Male	Caucasian	32.7	13.8	2.84	0.04	0.096
	African American	31.6	13.4			
Female	Caucasian	35.2	13.5			
	African American	32.5	15.5			
Pain-coping ratings for virtual humans' sex * participants' race				0.63	0.01	0.43
Between Participants Effect				0.21	0.00	0.65

Table 3-13. Descriptive statistics and mixed model ANOVA results of the effect of race of virtual humans on ratings of pain coping made by Caucasian and African American participants

Virtual humans	Participants'	*M*	*SD*	*F* (1, 73)	η^2	*P*
Caucasian	Caucasian	34.5	13.3	6.86	0.086	0.011
	African American	34.5	15.3			
African American	Caucasian	33.6	14			
	African American	28.9	14.5			
Pain-coping ratings for virtual humans' race * participants' race				3.7	0.05	0.058
Between Participants Effect				0.34	0.01	0.56

Table 3-14. Descriptive statistics and mixed model ANOVA results of the effect of race of virtual humans on ratings of pain coping made by male and female participants

Virtual humans	Participants'	*M*	*SD*	*F* (1, 73)	η^2	*P*
Caucasian	Male	34.6	14.6	0.79	0.01	0.38
	Female	34.4	13.3			
African American	Male	35.5	15			
	Female	31.7	13.8			
Pain-coping ratings for virtual humans' race * participants' sex				3.27	0.04	0.08
Between Participants Effect				0.35	0.01	0.56

Table 3-15. Descriptive statistics and mixed model ANOVA results of the effect of sex of virtual humans on ratings of recommending medical help made by male and female participants

Virtual humans	Participants	*M*	*SD*	*F* (1, 73)	η^2	*P*
Male	Male	51.9	25.1	5.98	0.076	0.017
	Female	40.8	18.6			
Female	Male	53.8	24.2			
	Female	44.4	19			
Recommending medical help ratings for sex of virtual human * sex of participants				0.64	0.01	0.43
Between Participants Effect				4.02	0.052	0.049

Table 3-16. Descriptive statistics and mixed model ANOVA results of the effect of sex of virtual humans on ratings of recommending medical help made by Caucasian and African American participants

Virtual humans	Participants	*M*	*SD*	*F* (1, 73)	η^2	*P*
Male	Caucasian	43.7	21.6	3.63	0.05	0.06
	African American	45.8	20			
Female	Caucasian	47.1	21.7			
	African American	47.6	17.5			
Recommending medical help ratings for virtual humans' sex * participants' race				0.37	0.01	0.54
Between Participants Effect				0.04	0.00	0.84

Table 3-17. Descriptive statistics and mixed model ANOVA results of the effect of race of virtual humans on ratings of recommending medical help made by male and female participants

Virtual humans	Participants	*M*	*SD*	*F* (1, 73)	η^2	*P*
Caucasian	Male	52.8	24.8	0.11	0.00	0.74
	Female	42.9	19.3			
African American	Male	52.9	24.2			
	Female	42.1	18.4			
Recommending medical help ratings for virtual humans' race * participants' sex				0.21	0.00	0.65
Between Participants Effect				4.06	0.53	0.048

Table 3-18. Descriptive statistics and mixed model ANOVA results of the effect of race of virtual humans on ratings of recommending medical help made by Caucasian and African American participants

Virtual humans	Participants	*M*	*SD*	*F* (1, 73)	η^2	*P*
Caucasian	Caucasian	45.3	21.7	1.44	0.02	0.24
	African American	48.1	20.1			
African American	Caucasian	45.3	21.5			
	African American	45.3	17.2			
Recommending medical help ratings for virtual humans' race * participants' race				1.36	0.02	0.25
Between Participants Effect				0.05	0.00	0.85

Table 3-19. Correlations between the dependent variables

	Pain Intensity	Pain Unpleasantness	Pain-related negative mood	Pain coping	Recommending medical help
Pain Intensity	1	0.87	0.72	0.68	0.53
Pain Unpleasantness	0.87	1	0.82	0.75	0.51
Pain-related negative mood	0.72	0.82	1	0.71	0.42
Pain coping	0.68	0.75	0.71	1	0.35
Recommending medical help	0.53	0.51	0.42	0.35	1

CHAPTER 4
DISCUSSION

Although pain levels were digitally controlled to be equal among male, female, Caucasian, and African American virtual humans, these data indicate that participants of both sexes and races still view females' pain, with both of its components, sensory (intensity) and affective (unpleasantness), as significantly higher than that for male virtual humans. This is consistent with other research findings. Robinson et al. (2001) found differences in participants' pain ratings for observed males and females experiencing experimentally induced pain. They found that viewers rated female virtual humans as having more pain than observed male virtual humans. One possible explanation for why female virtual humans were viewed as having higher pain levels than male virtual humans is the difference in pain expectations, that is, females are expected to report higher levels of pain than males in general. Although willingness to report pain, and pain endurance did not correlate significantly with pain ratings in this study, a sizable literature shows that both males and females expect females to experience higher levels of pain compared to males (Unrah, 1996, and Robinson et al, 2001). This study also suggests that differences in expecting females to experience higher levels of pain are also true across races (Caucasians and African Americans). Although between races rating did not differ, they both rated female virtual humans to have higher pain levels.

African American participants viewed African American virtual humans' pain intensity as significantly higher than Caucasian virtual humans' pain intensity. The ratings of African Americans as having higher pain intensity than Caucasians is consistent with previous studies; Walsh, Schoenfield, Ramamurthy, & Hoffman (1989) investigated pain tolerance to the cold pressor test in Anglo-Saxons, Hispanics, and African Americans and found that African Americans and Hispanics had lower pain tolerance. Sheffield, Biles, Orom, Maixner, & Sheps

(2000) Found that African Americans rated the thermal stimuli as more unpleasant and more intense than Caucasians. Edwards et al (1999) found that African Americans had a lower thermal pain tolerance and greater pain severity than Caucasians. Edwards et al (2001) also found that African Americans report significantly greater pain severity and pain-related disability than Caucasians. These studies investigated participants' ratings of their own pain conditions. The current study, however, investigated participants' ratings of others' pain. Since Caucasians did not rate African Americans' pain as high as African Americans did, results may indicate differences between race-related cultures in terms of sensitivity to facial pain expressions, that's is, African Americans might be more sensitive to African Americans' facial expressions of pain than Caucasians. Rahim-Williams, Riley III, Herrera, Campbell, Hastie & Fillingim (2007) studied ethnic identity to determine whether it associates with experimental pain intensity in three groups including African Americans. They found that African Americans scored the highest on the ethnic identity measure. Researchers suggested that higher scores on the ethnic identity measure would mean higher ethnic-specific socio-cultural influence on the pain experience. Since African Americans scored higher on the ethnic identity measure, and that means higher influence of their culture on pain experience, it is possible that they have rated African American virtual humans' pain intensity as higher than that for Caucasian virtual humans because they (the African American participants) are more sensitive to pain behaviors, including facial pain expressions, exhibited by individuals of the same race-related culture. In the Study mentioned above, Non-Hispanic Whites scored the lowest on the ethnic identity measure, suggesting that it is possible that Caucasians are not as influenced by their racial culture. This might suggest that Caucasians are less sensitive to pain behaviors, including facial pain expressions, exhibited by individuals of the same race. However, further investigation of this

finding is needed to further understand and explain the existence and the implications of between races differences in sensitivity to facial pain expressions.

The International Association for the Study of Pain defines pain in a way that highlights the importance of understanding of the negative emotional experiences of pain. Part of that emotional experience is the negative mood that accompanies pain experience. Although all facial expressions of pain were digitally controlled to be similar for males and females in this study, female virtual humans' pain-related negative mood was rated significantly higher than that for male virtual humans' by both male and female participants. These results might be explained by the positive relationship between pain and negative mood found and is consistent with the findings of the National Health and Nutrition Examination Survey, where pain and depressive symptoms tended to be more evident in females than in males (Magni et al, 1990). Turk & Okifuji (1999) also found that females were viewed as more depressed than males when in pain. These results also highlight the role of the expectations males have regarding the effects of females' high levels of pain on their moods. Current data also indicate that Caucasians and African Americans differ in their ratings of pain-related negative mood. Although Caucasian participants' ratings of pain-related negative mood for male and female virtual humans were significantly higher than African Americans' ratings, they even rated females' pain-related negative mood as significantly higher than males' pain-related negative mood. This highlights the role that culture might play in perceiving pain effects on the mood of females and males.

Caucasian virtual humans were rated by both African American and Caucasian participants as having higher pain-related negative mood. However, this is not consistent with the positive relationship between pain level and negative mood experiences. These results indicate that race might moderate the relationship between pain and pain-related negative mood.

Consistent with the pain-related negative mood results, male and female participants rated female virtual humans as coping poorer with their pain, and Caucasian virtual humans were rated by both Caucasian and African America participants as coping poorer with their pain. These results mirror the pain-related negative mood ratings. These results suggest that when females and Caucasians are viewed as having higher levels of pain than males and African Americans, they are more likely to be viewed as experiencing higher levels of pain-related negative mood and higher levels of poorer pain-related coping strategies.

When someone's pain level, pain-related negative mood, and pain-maladaptive coping is rated high, it is expected that he/she is more likely to be recommended to seek medical help for his/her pain. In this study, female virtual humans were rated higher on all of those variables than male virtual humans, they also were recommended to seek medical help for their pain significantly more than male virtual humans. However, it was not expected for male participants' recommendations to be higher than female participants'. Males recommended female virtual humans to seek medical help for their pain significantly more than the recommendation made by female participants. Male participants also recommended Caucasian and African American virtual humans to seek medical help for their pain significantly more than the recommendations made by female participants. One possible explanation to why males' recommendations are higher than females' recommendations is the difference between males and females in pain-related medication seeking behaviors. Males have been shown to request more drugs than females after surgery when given access to patient controlled analgesia (Macintyre & Jarvis, 1995. Burns, Hodsman, McLintock, Gillies, Kenny, & McArdle (1989) and Stinshoff, Lang, Berbaum, Lutgendorf, Logan & Berbaum (2004) also found that males tend to seek more medications for their pain compared to females.

The ratings of pain intensity, pain unpleasantness, pain-related negative mood, pain coping, and recommending medical help showed significant intercorrelations. Relationships between these dependent variables have a pattern that might add to the explanation of some of the current results. For example, the high correlation between pain intensity, pain unpleasantness, pain-related negative mood, and pain coping might add to the explanation as to why female virtual videos were rated high on all of them, if pain rating influenced the other ratings.

The results of this study have exciting implications, however, this study has some advantages and disadvantages worth noting. One limitation of this study is that only one African American male participated in it. Efforts to recruit more African Americans through study announcements to specifically target African American undergraduates were not successful.

The use of computerized virtual humans with digitally controlled facial expressions of pain based on the FACS, and digitally controlled pain levels across sexes and races of virtual humans, is innovative. This enables greater control over unifying facial pain expressions and levels of pain than if we had used human virtual humans. This technique, by the high control it provides over the ecology, also enables greater confidence in focusing on biases and variance brought to the ratings by participants.

Furthermore, the virtual human technology used in this study, has the potential to develop to be an educational assessment and intervention tool. Students, health care providers, and other individuals can use this technology to assess for their own biases regarding pain expressed by others and regarding specific variables of interest assigned to the observed virtual humans. This technology is also accessible from almost everywhere in the world via the Internet. One advantage of the easy access to this technology is that it makes, for example, cross-cultural studies much easier to conduct if same stimuli were to be used. Such an example provides wider

scope of races to be easily studied, as well as other cultures. Although the virtual human technology used in this study focused only on facial pain expressions without sound, future considerations might add other pain expressions to this technology, such as, verbal pain expressions, body gestures that are pain related, and adding background environments that determine context in which the pain is being experienced.

One other advantage of using virtual humans in this study is that it eliminates the biases in the making of the stimuli. These stimuli are basically made digitally identical except for the variables at interest in this study. One other advantage to this study is the focus on how others perceive and rate others' pain and other dependent variables in this study. Most research investigating pain perception focused on self-reports. Although self-reports of pain experience are an important component in the quest of understanding the nature of pain, it is also important to investigate how others perceive and view the experience of pain communicated to them by other individuals. This contributes significantly to the overall understanding of the nature of pain including how others appraise and respond to others' experiences of pain.

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BIOGRAPHICAL SKETCH

Ashraf Faris Alqudah was born on November 11, 1975 in Ajloun, Jordan. He grew up in Ajloun until he graduated from Ajouln High School in 1993. He moved to Amman, the capital city of Jordan, to study at the University of Jordan (JU). He earned his B. A. and M. A. in Psychology in 1997 and 2000, respectively. He worked as a teaching assistant for 1 year at JU upon receiving a scholarship to pursue his Ph. D. degree in Clinical Psychology.

Upon finishing the teaching assistant year at JU, he was admitted to the Graduate School at the University of Florida (UF) to work on his Ph. D. in Clinical Psychology at the UF Health Science Center, College of Public Health and Health Professions, Department of Clinical and Health Psychology. Upon completion of his Ph. D. program, Ashraf will join the faculty of the Department of Psychology at JU. He has a 4-year-old daughter whose name is Sarah.