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

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Abstract

This study examined the influence of Virtual Humans' (VH) sex and race on participants' ratings of pain intensity, pain unpleasantness, pain-related negative mood, pain coping, and recommendations for medical help. Seventy-five undergraduates viewed a series of VHs and provided computerized visual analog scale (VAS) ratings for the five domains listed above. Mixed model ANOVA analyses showed that participants of both sexes and races viewed female VHs as experiencing greater pain intensity, greater pain unpleasantness, a greater number of pain-related negative moods, poorer coping skills, and a greater need to seek medical help for their pain. Participants of both races rated Caucasian VHs as experiencing more negative moods and poorer coping skills do deal with their pain. The novel computerized VH technology used herein allowed for the standardization of pain expression across sexes and races of VH stimuli, thus allowing us to remove the influence of biases when creating the study stimuli. This is a notable advantage over other research methodologies in this line of inquiry. Several future research and education applications of this VH technology are discussed.

Keywords

Pain Assessment; Virtual Technology; Mood; Coping; Medical Help

Introduction

Empirical investigations support the presence of sex differences in pain (Dao & LeResche, 2000; Ellemeier & Westphal, 1995; Frot, Feine, & Bushnell, 2004; Hawthorn & Redmond, 2000; Robinson, Riley, Myers, Papas, Wise, Waxenberg et al., 2001; Robinson & Wise, 2003; Robinson & Wise, 2004; Unruh, 1996; Vallerand & Polomano, 2000). Some studies have shown that females perceive and express higher levels of pain than males in clinical settings (Hawthorn & Redmond, 2000). Sex-related differences in pain perception have also been found in experimental pain settings (Frot, et al., 2004). These sex differences extend to the observation of pain in others, with one study finding that participants rated female subjects as experiencing greater pain intensity in an experimental pain task compared to males (Robinson & Wise, 2004).

Sex-specific relationships between pain and negative affect have been reported in both community and clinical samples (Riley, Robinson, Wade, Myers, & Price, 2001). In the National Health and Nutrition Examination Survey, pain and depression were more prevalent in females than in males (Magni, Caldieron, Rigatti-Luchini, & Merksey, 1990). In clinical pain samples, the prevalence of depression and anxiety is typically higher for females (Unruh, 1996). Although little is known about the differences between males and females in coping with pain, Unruh, Ritchie, & Merskey (1999) found that females use a wider range of coping strategies than men do. However, Keogh & Herdenfeldt (2002) suggested that the use of a wider range of strategies could reflect the failure of coping strategies to effectively reduce pain.

A number of studies have also suggested that there are racial differences in pain perception, pain-related negative affect, and pain coping. In one study, 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, & Liesen, 1998). 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. Moreover, research on pain-related mood has shown that African Americans with chronic pain had higher pain-related depression and disability when compared to Caucasians (Carmen, Green, Ndao-Brumblay, Nagrant, Baker, & Rothman, 2004). Riley, Wade, Myers, Sheffield, Pappas, & Price (2002) also found that African Americans experience greater emotional suffering compared to Caucasians with similar levels of pain intensity.

Most research studies investigating sex and race differences in pain perception and evaluation focused on how both sexes and different races perceive and evaluate their own pain. The current study focuses on the differences in perceiving and evaluating others' pain. Furthermore, studies investigating differences in perceiving and evaluating pain in others relied mainly on recorded videos and still pictures of actual pain patients expressing pain. This methodology, however, is not sensitive to the possible variance that might already exist amongst video-taped pain patients. The current study controls this possible variance through a novel computerized technology which reduces the variance to almost zero. The purpose of this study was to employ a novel computer-generated virtual human (VH) technology to investigate sex and racial differences in the observation of pain, pain coping, pain-related negative affect, and recommendations to seek treatment. The use of a VH technology allows for the standardization of the amount of pain expression independent of the sex and race characteristics that are of interest as dependent variables. This level of experimental control is not possible with traditional research methodologies, such as those that involve historical chart reviews. It was hypothesized that a VH stimulus would elicit the same sex and race differences previously published in traditional self-report and observational studies.

Methods

Participants

Seventy-five University of Florida undergraduate students (53 females, 22 males) were recruited through fliers and posters requesting volunteers to participate in this study. The participant sample was 83% Caucasian and 17% African American.

Inclusion/Exclusion Criteria

Eligibility requirements for participation were being at least 18 years old, English speaking, and of African American or Caucasian background. 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 signed 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, they completed a brief demographic questionnaire that collected participants' age, race, and sex. Participants then 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.

A series of 16 vignettes were produced using computerized VH technology via a commercially available software package (People Putty™). A novel feature of this approach was the ability to standardize the amount of pain expressed in the VH face across different sexes and races of VHs. This was accomplished by employing the Facial Action Coding System (FACS). The FACS is based on an anatomic analysis of facial muscle movements and distinguishes 44 different action units (AUs). An abbreviated version of the FACS was used in this study focusing on the four primary action units that are involved in the facial expression of pain and produced validated facial expressions showing pain—brow lowering, tightening of the orbital muscles surrounding the eye, nose wrinkling/upper lip raising, and eye closure.

Each stimulus the participants observed consisted of a vignette and a VH patient. Each VH contained three cues—sex (two levels: male or female), race (two levels: Caucasian or African American), and pain (two levels: low amount or high amount of pain) which was reflected on the VHs facial expressions.

Participants were instructed to completely respond to VHs in the order presented, complete the ratings for one VH before going on to the next, and they were not allowed to revisit a previously viewed VH. For each VH, participants used computerized VASs to rate the level of pain intensity observed, the level of pain unpleasantness observed, the level of pain-related negative mood observed, how well the observed VH was coping with the pain experience, and the extent to which they would recommend the observed VH to seek pain-related medical help. Participants also completed a computerized version of the Gender Role Expectations of Pain questionnaire (GREP) (see appendix A) using computerized VASs to assess the degree to which gender role expectations of pain may contribute to their ratings.

The Gender Role Expectations of Pain questionnaire (GREP) consists of visual analog scales to assess 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. Wise, Price, Myers, Heft and Robinson 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 by gender role expectations.

Task duration for the current study was approximately one hour. Following the completion of the task, participants were asked to respond, in writing, to a task validity probe, in which they were asked to guess the study hypotheses. 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 VHs served as independent variables, and ratings of pain intensity, pain unpleasantness, pain-related negative mood, pain coping, and the extent to which the VHs were recommended to seek medical help for their pain served as dependent variables. We had no a priori hypotheses regarding a number of the interaction terms (e.g. sex of participant, by race of participant, by sex of video, by race of video), therefore, we approached the analyses by looking at only the main effects and specified two-way interactions for which a priori hypotheses were available.

Willingness to report pain and pain endurance, taken from the GREP, were investigated to determine whether they met the criteria to serve as covariates in the analyses involving participants' ratings of pain intensity and pain unpleasantness.

Results

Covariance Analysis

Willingness to report pain and pain endurance are two factors of the GREP that were considered for inclusion in the models as covariates. Correlation analyses were conducted on these two factors as well as male and female participants' ratings of pain intensity and pain unpleasantness for male and female VHs. Results of the correlation analyses were not significant, thereby indicating that the two GREP factors did not meet the assumptions of covariance analysis. Therefore, willingness to report pain and pain endurance were not included in the following models.

Associations among the Dependent Variables

A correlation analysis was conducted between the 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 significantly correlated. The magnitude of the correlations ranged from 0.35 (pain coping and recommending medical help) to 0.87 (pain intensity and pain unpleasantness.) See Table 1 below.

Analysis of Pain Intensity Ratings

Sex Effects—Both male and female participants rated pain intensity for female VHs as significantly higher than that for male VHs, $F(1, 73) = 4.92, p < 0.05$. Both Caucasian and African American participants rated pain intensity for female VHs significantly higher than that for male VHs, $F(1, 73) = 6.93, p < 0.05$.

Race Effects—There was no main effect of race of VHs on ratings of pain intensity. Table 2 below summarizes the results of the pain intensity ratings.

Analysis of Pain Unpleasantness Ratings

Sex Effects—Both male and female participants rated pain unpleasantness for female VHS significantly higher than that for male VHS, $F(1, 73) = 7.61, p < 0.01$. Both Caucasian and African American participants rated pain unpleasantness for female VHS as significantly higher than that for male VHS, $F(1, 73) = 4.17, p < 0.05$. These results mirrored the pain intensity effects presented above.

Race Effects—There was no main effect of race of VHS on ratings of pain intensity. Table 3 below summarizes the results of the pain unpleasantness ratings.

Analysis of Pain-Related Negative Mood Ratings

Sex Effects—Both male and female participants rated pain-related negative mood for female VHS as significantly higher than that for male VHS, $F(1, 73) = 6.76, p < 0.05$. A main effect was found for race of participants where Caucasian participants' ratings for both male and female VHS pain-related negative mood ($M=40.59, SE=1.84$) were significantly higher than African American participants' ratings ($M=31.75, SE=4.02$), $F(1, 73) = 3.99, p = 0.05$. An interaction of the sex of the VHS by race of participants was also found—Caucasian participants' ratings for female VHS ($M=42.17, SD=14.28$) were significantly higher than African American participants' ratings for female VHS ($M=31.02, SD=16.16$), $F(1, 73) = 4.11, p < 0.05$.

Race Effects—Both Caucasian and African American participants viewed Caucasian VHS as having significantly higher levels of pain-related negative mood ($M=39.84, SD=14.97$) compared to African American VHS ($M=38.12, SD=16.02$), $F(1, 73) = 5.34, p < 0.05$. Table 4 above summarizes the results of the pain-related negative mood ratings.

Analysis of Pain-Coping Ratings

Sex Effects—Both male and female participants viewed female VHS as coping more poorly than male VHS, $F(1, 73) = 6.37, p < 0.05$. No significant main effect for sex of VHS on the race of participants was found.

Race Effects—Both Caucasian and African American participants viewed Caucasian VHS as coping more poorly with their pain ($M=34.47, SE=13.56$) than African American VHS ($M=32.79, SE=14.07$), $F(1, 73) = 6.86, p < 0.05$. Table 5 below summarizes the results of the pain-coping ratings.

Analysis of Recommending Medical Help Ratings

Sex Effects—A main effect for sex of VHS on sex of participants was found. Both male and female participants' ratings for recommending medical help were significantly higher for female VHS than that for male VHS, $F(1, 73) = 5.98, p < 0.05$. The sex of participants was also found as a main effect, indicating that male participants' ratings for recommending medical help ($M=52.86, SE=4.31$) were significantly higher than female participants' ratings ($M=42.50, SE=2.78$), $F(1, 73) = 4.02, p < 0.05$. Race of the participant did not have an effect on ratings of recommending medical help.

Race Effects—Male participants' ratings for both Caucasian and African American VHS ($M=52.86, SE=4.31$) were significantly higher than that of female participants ($M=42.50, SE=2.78$), $F(1, 73) = 4.06, p < 0.05$. Table 6 below summarizes the results of recommending medical help ratings.

Summary of Results

In summary, male and female participants both rated female VHs' pain intensity, pain unpleasantness, pain-related negative mood, and poorer pain coping, as higher than male VHs. Male and female participants were also more likely to recommend that female VHs seek medical help than male VHs. However, Caucasian and African American participants' ratings for female VHs were higher than that for male VHs only on pain intensity and pain unpleasantness. Caucasian VHs were viewed as having higher pain-related negative mood and as coping more poorly with their pain than African American VHs. African American VHs' 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.

Discussion

Although pain levels—as expressed by the faces of the VHs—were digitally controlled to be equivalent across different sexes and races, results indicated that participants of both sexes and races still viewed female VHs' pain, both the sensory (intensity) and affective (unpleasantness) components, as significantly higher than that for male VHs. This is consistent with other research findings. In a study of experimentally-induced pain, Robinson et al. found that viewers rated females' pain as higher than males'. One explanation for why female VHs were viewed as having higher pain is the difference in pain expectations. Females are expected to report higher levels of pain than males in general. Although willingness to report pain and pain endurance (as measured by the GREP) did not correlate significantly with pain ratings in this study, a sizable literature shows that both males and females expect females to experience greater amounts of pain (Robinson et al., 2001; Unruh, 1996). Additional research is needed to determine whether such expectations are also elicited by computer-generated VH characters.

The International Association for the Study of Pain's definition of pain highlights the importance of understanding the emotional experiences of pain. It is important to note the effects of negative mood accompanying pain. Although all facial expressions of pain were digitally controlled to be similar for males and females in this study, female VHs' pain-related negative mood was rated as significantly higher than that for male VHs' by participants of both sexes. This result could be explained by the positive relationship between pain and negative mood and is consistent with the findings of the National Health and Nutrition Examination Survey, where pain and depressive symptoms were more evident in females than in males (Magni et al., 1990).

Caucasian VHs were rated by both African American and Caucasian participants as experiencing greater pain-related negative moods. These results suggest that assessment of the pain-related negative mood is, at least, partly determined by the race of the individual experiencing pain. Consistent with the pain-related negative mood results, participants of both sexes rated female VHs as coping more poorly with their pain, and participants of both races rated Caucasian VHs as coping more poorly with their pain. These results mirror those for pain-related negative mood, and suggest that when females and Caucasians are viewed as having higher pain than males and African Americans, respectively, they are also more likely to be viewed as experiencing higher levels of pain-related negative mood and poorer pain-related coping.

When an individual's pain level, pain-related negative mood, and maladaptive pain coping is rated as 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 VHs were rated higher on all these variables than male VHs. They were also recommended to seek medical help for their pain significantly more often than male VHs. However, it was not expected for male participants'

recommendations to be higher than female participants'. Male participants recommended that VHS of both sexes and races should seek medical help for their pain significantly more than female participants. This is consistent with studies showing sex differences in health-seeking behaviors. Males have been found 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 medication for their pain compared to females. Based on the current findings, it also appears that males are more likely to recommend that others seek care for their own pain complaints. Several other interpretations are possible. For example, perhaps males consider themselves to be less equipped than females to help others with their medical concerns. Males may also be less tolerant of expressions of distress from others, which results in them being more likely than females to encourage that medical care be sought. These speculations could be investigated in future studies.

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 of why female virtual videos were rated higher on all variables, if pain ratings influenced the other ratings.

The results of this study have several implications that are worth noting. First, the use of computerized VHS with digitally controlled facial expressions of pain across sexes and races is an innovative technique that enabled greater standardization of pain expression than real humans would allow. This standardization allows for greater confidence in interpreting the results as being determined by the sex and race biases that participants brought to the ratings. Furthermore, the VH technology used in this study has the potential to be an educational assessment and intervention tool. Students, healthcare providers, and other individuals can use this technology to assess their own biases in interpreting pain or other emotions expressed by others. This technology can also be accessible to almost anyone in the world via the Internet.

This study did have some limitations, however. First, there was only one African American male participant in the sample. Future investigations with more diverse samples would be necessary to provide additional evidence of the sex and race findings of the present study. Second, the participants in this study were undergraduate students and it would be important to replicate these findings in other populations. Finally, the VH characters only showed the head region and, thus, did not address the many other nonverbal expressions of pain that are communicated throughout the entire body. Future work could examine whether the sex and race effects observed herein are also found when full body characters are used and other nonverbal expressions are manipulated.

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Table 1

Correlations between the dependent variables

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

Table 2

Means and standard deviations of pain intensity ratings

VH	Pain Intensity
Male	38.65* (14.54)
Female	41.14* (13.87)
Caucasian	39.94 (13.98)
African American	39.72 (14.45)

*
< .05 significant difference between participants on pain intensity ratings

Table 3

Means and standard deviations of pain unpleasantness ratings

VH	Pain Unpleasantness
Male	32.42* (15.17)
Female	44.77* (14.54)
Caucasian	44.30 (14.28)
African American	42.90 (15.27)

* < .05 significant difference between participants on pain unpleasantness ratings

Table 4

Means and standard deviations of pain-related negative mood ratings

VH	Negative Mood
Male	37.87* (15.44)
Female	40.23* (15.11)
Caucasian	39.84* (14.97)
African American	38.12* (16.02)

* < .05 significant difference between participants on pain-related negative mood ratings

Table 5

Means and standard deviations of pain-coping ratings

VH	Coping
Male	32.47* (13.63)
Female	34.76* (13.80)
Caucasian	34.47* (13.56)
African American	23.79* (13.07)

* < .05 significant difference between participants on pain-coping ratings

Table 6

Means and standard deviations of recommending medical help ratings

VH	Recommending Medical Help
Male	44.05* (21.16)
Female	47.15* (20.94)
Caucasian	45.80 (21.35)
African American	45.28 (20.71)

* < .05 significant difference between participants on recommending medical help ratings