Presence-Related Influences of a Small Talking Facial Image on Psychophysiological Measures of Emotion and Attention

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Summary

We examined the effects of a small talking facial image on (a) emotional responses as indexed by self-report and facial electromyography (EMG) and (b) attention and engagement as indexed by so-called respiratory sinus arrhythmia (RSA) when viewing/listening to financial news from a simulated pocket PC among 36 subjects. The results showed that a talking facial image was rated as more pleasant and arousing as compared to a static facial image, and elicited progressively increasing zygomatic EMG activity. In addition, a talking facial image was associated with a decrease in RSA, but only among individuals scoring high on dispositional behavioral activation system (BAS) sensitivity. It is suggested that a small talking facial image contributes to sustained attention and engagement particularly among high BAS scorers, given that it may increase the sense of presence.

1 Introduction

A moving facial image presented on the television screen or screen of new telecommunication devices, together with the audio message, is likely to increase the sense of presence, i.e., the perceptual illusion that a mediated experience is not mediated (Held & Durlach, 1992; Lombard & Ditton, 1997). It should be emphasized that, although a complete sense of presence may be elicited only by emerging technologies, such as virtual reality, more traditional media offer a lesser degree of presence as well (e.g., Lombard & Ditton, 1997). A considerable body of evidence suggests that people tend to ignore the mediated nature of a television personality, incorrectly perceive he or she as a social actor, and respond to social cues he or she provides just as they would in nonmediated communication (i.e., parasocial interaction; for a review, see Lombard &

Ditton, 1997). This aspect of presence is also intensified by direct address (e.g., a news anchor speaks directly to the camera and therefore, apparently, the viewer). Thus, a moving image of human face may contribute to the perceptual illusion of nonmediation and on-going social interaction.

Importantly, media presentations that engender a greater sense of presence have been suggested as often eliciting greater physiological arousal, engagement, and attention (Lombard & Ditton, 1997; Pugnetti, Meehan, & Mendozzi, 2001). As noted by Jordan and Sergeant (1998), the trend to technological miniaturization, the increasing role of dynamic facial images in communications, and the role of bandwidth constraints in image transmission mean that current technology is probably producing the smallest talking faces ever experienced by human observers. That being so, it would be of interest to examine the potential presence-related influences of a small talking facial image on psychophysiological measures indexing emotions and attention.

It is also possible that there are important individual difference variables (i.e., moderator variables) that might affect the nature and magnitude of relations between a talking facial image and physiological activity. Dispositional behavioral inhibition system (BIS) and behavioral activation system (BAS) sensitivities are such potential moderators. According to Gray (1991), these two primary brain motivational systems underlie behavior and affect. BAS activity may moderate the relationship between a moving image of human face and psychophysiological responses, given that the BAS regulates appetitive motivation and individuals with high BAS sensitivity are likely to respond more strongly to cues of forthcoming social interaction (i.e., a positive incentive), such as a talking facial image.

In view of the above considerations, the aim of the present investigation was to explore the potential presence-related effects of a small talking facial image on psychophysiological measures indexing emotions and attention when viewing/listening to financial news messages from a (simulated) pocket PC with a small screen. In addition, the potential moderating influence of dispositional BIS and BAS sensitivities on this relationship was examined. Facial electromyography (EMG) was used to index emotions, given that increased activity at the zygomaticus major and corrugator supercilii muscle regions has been associated with positive emotions and negative emotions, respectively (Lang, Greenwald, Bradley, & Hamm, 1993). Respiratory sinus arrhythmia (RSA, i.e., respiratory-locked oscillations in HR) is a non-invasive index of parasympathetic nervous system function (Berntson et al., 1997), and was used to index

attention and engagement. High baseline level of RSA has been associated with the ability to maintain attention, while RSA is suppressed during states of sustained attention (e.g., Weber, Van der Molen, & Molenaar, 1994). Although RSA may also be used to index emotional stress and stress vulnerability (Berntson et al., 1997), RSA was used as an index of attention in the present study, given that the present experiment was not particularly stressful.

2 Method

2.1 Subjects

Subjects were 36 (13 males) Finnish undergraduates with varying majors.

2.2 Stimulus materials

The stimuli for this experiment consisted of 32 financial news messages that were selected on the basis of a pre-test procedure. The messages were randomized to be presented in either the static-face or moving-face condition. For the moving-face condition, RealVideo news clips were professionally produced from 16 news messages. In these color video clips, a newscaster read aloud the news messages. The frame size was 52 mm (width) × 39 mm (height). For the static-face condition, RealAudio clips from 16 news messages read aloud by a newscaster were produced. Single frames taken from the motion clips were presented in connection with the RealAudio clips. The same female newscaster read all video and audio news messages. The messages were presented on the screen (width: 60 mm, height: 80 mm) of a simulated Casio Cassiopeia E-115 Pocket PC.

2.3 Measures

2.3.1 Valence and arousal

Subjects rated their emotional reactions in terms of valence and arousal to each of the news messages using 9-point pictorial scales presented on a computer screen. These scales resemble P. J. Lang's (1980) Self-Assessment Manikin.

2.3.2 Interest ratings

Subjects rated interest in the news messages using a 5-point scale, ranging from 1 (not interesting at all) to 5 (very interesting).

2.3.3 News watching

Subjects were asked to report how often they watch news in general and financial news in particular from television using 7-point scales.

2.3.4 BIS and BAS sensitivities

Dispositional BIS and BAS sensitivities of the participants were measured with the BIS/BAS scales (Carver & White, 1994), a 20-item self-administered questionnaire. The BAS scale is comprised of three subscales: Drive, Reward Responsiveness, and Fun Seeking.

2.4 Physiological data collection

Electrocardiogram (ECG) was recorded using the Psylab Model BIO2 isolated AC amplifier (Contact Precision Instruments, London, UK). Three Red Dot Ag/AgCl electrodes (3M Health Care, Borken, Germany) were placed in a modified Lead II position.

Facial EMG activity was recorded from the left corrugator supercilii and zygomatic major muscle regions using surface Ag/AgCl electrodes with a contact area of 4 mm diameter (Med Assoc. Inc., St. Albans, VT). Electrodes were filled with TD-240 electrode gel (Med Assoc. Inc). The raw EMG signal was amplified, and frequencies below 30 Hz and above 10 kHz were filtered out, using the Psylab Model EEG8 amplifier. The raw signal was rectified and integrated using the Psylab INT8 contour following integrator (time constant = 50 ms).

The digital data collection was controlled by Psylab7 software, and all physiological signals were sampled at a rate of 500 Hz.

2.5 Data analysis

To quantify RSA, the ECG data were analyzed off line by using WinCPRS software (Absolute Aliens Ay, Turku, Finland). The inter-beat interval data were subjected to spectral analysis using the fast Fourier transform (FFT) technique. RSA was indexed by the spectral power for the 0.15-0.40 Hz frequency band (see Porges and Bohrer, 1990). Mean values for facial EMG activity were derived for each 30 s epoch during the news messages. All data were then analyzed by the General Linear Model (GLM) Repeated Measures procedure in SPSS, with continuous independent variables (i.e., BIS and BAS), each in turn, as a covariate.

3 Results

3.1 Affective dimensions

There was a significant main effect for facial motion in predicting pleasure, $\underline{F}(1, 36) = 17.11$, $\underline{p} < .001$. That is, moving-face messages were rated as more pleasant than static-face messages. In addition, a significant main effect for facial motion in predicting arousal was revealed, $\underline{F}(1, 36) = 18.70$, $\underline{p} < .001$. That is, moving-face messages were rated as more arousing than static-face messages.

3.2 Interest ratings

Interest ratings tended to be higher for the moving-face compared with static-face messages, but this difference narrowly failed to reach statistical significance, $\underline{F}(1, 36) = 4.02$, $\underline{p} = .053$.

3.3 Facial EMG

There was a significant Facial Motion × Time interaction in the zygomatic data when adjustment was made for baseline zygomatic activity, $\underline{F}(5, 28) = 2.65$, $\underline{p} = .044$, $\eta^2 = .32$. The linear trend in zygomatic activity across time was significantly influenced by facial motion, $\underline{F}(1, 32) = 12.47$, $\underline{p} = .001$, $\eta^2 = .28$. After the initial steep decline in zygomatic activity during both the static-face and moving-face messages, the moving-face messages prompted progressively higher zygomatic activity than the static-face messages.

3.4　Respiratory sinus arrhythmia

After adjusting for baseline RSA, the GLM Repeated Measures procedure revealed a significant main effect for facial motion when predicting RSA during the news messages, $F(1, 32) = 4.89$, $p = .034$, $\eta^2 = .13$. That is, RSA was lower during the talking face (M = 5.97) than during static-face (M = 6.03) messages. However, there was also a significant BAS Fun Seeking × Facial Motion interaction for RSA, $F(1, 30) = 6.45$, $p = .017$, $\eta^2 = .18$. A talking facial image was associated with a decrease in RSA among high Fun Seeking scorers, but not among low Fun Seeking scorers.

Habitual watching of news from television did not interact significantly with facial image motion in predicting any of the dependent variables.

4　Discussion

In the present investigation, we examined the effects of a talking facial image on (a) emotional responses as indexed by self-report and facial EMG and (b) attention as indexed by RSA when viewing/listening to financial news from a simulated pocket PC with a small screen. These effects were hypothesized as being related to the presence phenomenon.

We found that a talking facial image was rated as more pleasant and arousing as compared to a static facial image. This finding was also supported by the EMG data. That is, zygomatic activity that indexes positive emotions increased progressively during the talking face condition (see Lang et al., 1993). Importantly, the results showed that a talking facial image was associated with a decrease in RSA particularly among high BAS Fun Seeking scorers. This suggests that facial image motion presented on a small screen increases attention only among high Fun Seekers, given that RSA is suppressed during states of sustained attention (e.g., Weber et al., 1994). This finding is in line with the hypothesis that a talking facial image might increase the sense of presence and act as a positive incentive for high BAS individuals, thereby resulting in stronger engagement. Apparently, dispositional BAS sensitivity may be an interesting moderator variable in the research on the presence phenomenon.

The present findings shed light on how to improve media communication to audiences. In the future, media presentations will increasingly be personalized. That is,

the form of a given media presentation may be different for different viewers so that the form of the presentation will be adapted to fit the individual characteristics (e.g., BAS sensitivity) of the viewer. These findings also suggest that RSA may be a particularly useful and easily applicable psychophysiological measure in presence research.

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