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Receptive to bad reception: Jerky motion can make persuasive messages more effective

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ABSTRACT

When used deliberately in television and film, jerky motion captures attention. However, it can be distracting in the movements of characters in digital video. To what extent does this kind of jerkiness influence message processing? Based on a limited-capacity model of message processing, jerky character motion was predicted to increase compliance to a persuasive message. The present experiment manipulated the jerkiness of an actor's movements in a computer-delivered video to examine its effect on responses to a hypothetical medical scenario. Jerkiness, whether subtle or obvious, increased self-reported compliance. It also decreased heart rate variability, indicating attentional mediation. Though counterintuitive, these findings indicate that jerky character motion can make computer-mediated messages more persuasive.

1. Introduction

In contemporary film and television, jerky motion is used to catch an audience's attention, for example, to maintain interest despite environmental distractions (Bordwell, 2002; Cutting, Brunick, DeLong, Iricinschi, & Candan, 2011; Cutting, DeLong, & Nothelfer, 2010; DeLong, Brunick, & Cutting, 2012). Three prominent types of jerky motion are abrupt reframing, rapid cuts, and actors' idiosyncratic movement. Reframing is performed most often during handheld recording, whereas rapid cuts (i.e., discontinuous camera view changes) are added during postproduction editing. Occasionally, jerkiness is added to actors' movements (e.g., Max Headroom). However, when jerky motion is applied inexpertly or too often, it may cause queasiness and decrease how accurately scenes are recognized (Bordwell, 2007; Ebert, 2007; Garsoffky, Huff, & Schwan, 2007).

Because the production and distribution of online digital media is cheaper and easier than film and television, its technical quality varies considerably. As a result, jerky motion occurs more frequently in online videos, especially in actors' movements. When it occurs, it is more likely to be considered an unintended technical flaw (Hilderbrand, 2007).[1] This makes it more difficult to interpret the intention behind jerky motion. For example, when a video on YouTube is shaky, the video's creator may be perceived as either an amateur or one unconcerned with steady framing. Jerky motion may be introduced during filming, postproduction (including editing and encoding), and presentation (e.g., because of limitations in a viewer's network connection speed and hardware capabilities; Hartsell & Yuen, 2006; He & Gupta, 2001; Shephard, Ottewill, Phillips, & Collier, 2003).

Jerkiness also affects the perceived quality of online computer games. For example, massively multiplayer online role-playing games and online first-person shooter games rely on frequent and timely updates of players' positions and movements. Without these updates such games may behave erratically. As a result players' digital representations—their avatars—may move less smoothly or even unrealistically, decreasing players' effectiveness and enjoyment (Claypool, Claypool, & Damaa, 2006). In both online video and online gaming, jerkiness may be caused by technology that is buggy, outdated, or both. Therefore, in online digital content, jerky motion is common and often beyond the producer's control.

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[1] Examples of intentional digital distortion exist under names like glitch art and datamoshing (Brown & Kutty, 2012; Menkman, 2011).

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The potential effect of jerky motion on human cognition in processing mediated messages is significant because of the role of animated motion in computer-mediated communication and human–computer interaction. An increasing number of computer interfaces adopt an interaction style that draws on conversations as a metaphor. These interfaces may elicit behavior ordinarily directed toward other people (Nass, Steuer, & Tauber, 1994; Reeves & Nass, 2002; Sproull, Subramani, Kiesler, Walker, & Waters, 1996).[2] Conversation-based computer interfaces also facilitate learning by promoting cognition (Mayer, 2005). Sometimes, conversation-based interfaces are not merely applicable but ideal. They may, for example, support interaction when users can neither read nor type (Nass & Lee, 2001). Human-looking interfaces extend the conversation metaphor of human–computer interaction through graphical embodiment (Cassell, Sullivan, Prevost, & Churchill, 2000). Human-looking interfaces have advanced knowledge in scientific fields including pedagogy and social and cognitive science research (Baylor, 2002; MacDorman & Ishiguro, 2006). Practical benefits of human-looking interfaces include the treatment of social anxiety, the facilitation of remote learning, and the motivation of regular physical exercise (Bailenson et al., 2008; Fox & Bailenson, 2009; Kang & Gratch, 2010). Their promise has already inspired the delivery of educational material using avatars in multiuser game environments (De Lucia, Francese, Passero, & Tortora, 2009; Foster, 2007).

Human-looking interfaces could support decision-making tasks in medicine and other restricted domains. For example, computer medical expert systems can produce desirable patient outcomes (Bennett & Hauser, 2013; International Business Machines Corp., 2013; Lin, Lin, Lin, & Yang, 2009; Yu et al., 1979). Human-looking interfaces could make expert systems more accessible to professionals and to ordinary users. For example, patients may feel less apprehensive when seeking medical advice from a virtual clinician than from a human clinician (Bickmore, Pfeifer, & Jack, 2009; Lisetti, Yasavur, Visser, & Rishe, 2011). Elsewhere, animated agents and avatars have been found useful as aids in real-time 3D visualization and virtual shopping (Lee & Chung, 2005, 2008; Stock et al., 2008).

Social responses may be strongest to computer interfaces that most closely emulate human appearance and behavior (Cassell, Bickmore, Campbell, Vilhjálmsson, & Yan, 2001; Cassell & Tartaro, 2007; MacDorman & Ishiguro, 2006). However, early research suggests virtual encounters will also become more complicated. Specifically, as the interface becomes more humanlike, the interaction, consultation, or educational outcome may depend more on presentational factors like appearance, at least initially (Garau et al., 2003; Holzwarth, Janiszewski, & Neumann, 2006; Keeling, McGoldrick, & Beatty, 2010; Luo, McGoldrick, Beatty, & Keeling, 2006; MacDorman & Ishiguro, 2006; Nowak & Biocca, 2003). Depending on how human likeness is achieved, it could enhance or hinder acceptance of the interaction (Ho, MacDorman, & Pramono, 2008; MacDorman, Green, Ho, & Koch, 2009). Despite this variability, little formal scrutiny has been given to the perception of moving images (Smith, Levin, & Cutting, 2012), and even less to attitudes about animated virtual humans (MacDorman, Coram, Ho, & Patel, 2010). In summary, given the prevalence of jerky motion in online digital media, the potential difficulty of controlling jerkiness, its importance to human–computer interaction, and the relative lack of pertinent empirical data, an investigation of its influence on communication is warranted.

The objective of the present research is to identify technical artifacts, such as jerky motion, that influence the perception of electronically mediated messages. The next section describes how jerky motion could increase attention to a message, thus motivating the experimental hypotheses. Sections follow it on the methods, results, and discussion and conclusion.

[2] Nevertheless, interacting with social interfaces as if they are humans need not imply a belief that the interfaces *are* human (Mitchell, Ho, Patel, & MacDorman, 2011; Tourangeau, Couper, & Steiger, 2003).

2. Gaining compliance with jerky movement

2.1. Automatic responses to jerky movement

Rapid cuts, unsteady cameras, and the motion of onscreen objects can attract media viewers' attention automatically (Detenber, Simons, & Bennett, 1998; Hitchon, Duckler, & Thorson, 1994; Lang, Zhou, Schwartz, Bolls, & Potter, 2000). This effect goes mostly unnoticed when viewers are focused on the narrative (Bordwell, 1984; Saito & Yuka, 2007; Smith & Henderson, 2008). In online digital media, attention is also attracted through animated and pop-up advertisements on websites (Chung, 2007; Diao & Sundar, 2004; Lang, Borse, Wise, & David, 2002).

According to the limited capacity model of motivated mediated message processing (LC4MP; Lang, 2000, 2009), the effect of visual novelty on attention is mediated by an automatic action known as the orienting response, which is believed to facilitate discovery and learning (Sokolov, 1963). An assumption of the present research is that an orienting response is also elicited when perceiving nonhuman jerky motion in a human figure. Biological and nonbiological motion elicit different patterns of brain activity, which cannot be explained merely by motion complexity (Grossman & Blake, 2002; Pelphrey et al., 2003). The ability to recognize human motion is particularly well refined, owing to its usefulness in making inferences about others' intentions (Blake & Shiffrar, 2007; Blakemore & Decety, 2001).

The orienting response can be measured reliably. One physical indicator of an orienting response is bradycardia, a temporary deceleration in heart rate (Graham & Clifton, 1966; Lang, Geiger, Strickwerda, & Sumner, 1993). An evolutionary explanation of bradycardia is that it facilitates homeostasis while deciding how to react to a novel stimulus (Campbell, Wood, & McBride, 1997). Bradycardia during media viewing is caused by an increase in regulatory influence of the parasympathetic nervous system relative to the deregulatory influence of the sympathetic nervous system (Lang, 2009; Lang, Bolls, Potter, & Kawahara, 1999; Quigley & Berntson, 1990; Richards & Casey, 1991). A related indicator of the orienting response is heart rate variability, which decreases during stressful activity (Delaney & Brodie, 2000). In many experiments a decrease in heart rate variability suggests an increase in cognitive effort (reviewed in Lang, Potter, & Bolls, 2009), though it may be more indicative of emotional strain (Nickel & Nachreiner, 2003).

Another set of indicators of the orienting response involves changes in the electrical conductance of skin (electrodermal activity), which varies with activation of the sympathetic nervous system (Lang et al., 1999). Measurement of skin conductance is divided further into measurement of tonic activity and measurement of phasic activity (Stern, Ray, & Quigley, 2001). Increases in tonic activity, measured using the skin conductance level, indicate autonomic arousal (Jacobs et al., 1994). Phasic activity is measured using the frequency of brief spikes in the conductance level, termed skin conductance responses. Although skin conductance responses may be pegged to the precise onset of one or more stimuli, the frequency of nonspecific skin conductance responses also varies with cognitive effort (Nikula, 1991).

2.2. Influence of orienting on automatic resource allocation and attitude formation

The orienting response elicited by rapid cuts causes changes in heart activity and skin conductance, which in turn predict increases in attention and physiological arousal, respectively (Lang et al., 2009). These changes affect how messages are processed: Although rapid cuts increase the overall processing of message-related information, they also increase the retention of unrelated information (Bolls, Muehling, & Yoon, 2003; Lang et al., 2009). Both kinds of information can affect attitude formation (Petty, Cacioppo, & Schumann, 1983).

2.3. Applying the limited capacity model to jerky motion in a digital medium

Aligning with LC4MP (Lang, 2000, 2009), the present study tested the extent to which jerky character motion increases attention and arousal and in turn increases compliance with an expert's recommendation.

2.3.1. Mediating effect of attention

Jerky character motion may increase attention to a message by evoking greater activity of the parasympathetic nervous system relative to the sympathetic nervous system. Hypothesis 1 (H1) asserts that viewing digital video with jerky character motion temporarily decreases viewers' heart rate (HR). Hypothesis 2 (H2) asserts that viewing digital video with jerky character motion temporarily decreases viewers' heart rate variability (HRV).

2.3.2. Mediating effect of arousal

Jerky character motion may increase arousal through activation of the sympathetic nervous system. Hypothesis 3 (H3) asserts that viewing digital video with jerky character motion increases viewers' skin conductance level (SCL). Hypothesis 4 (H4) asserts that viewing digital video with jerky character motion increases the short-term frequency of skin conductance responses (SCR).

2.3.3. Compliance

When an expert's recommendation is supported by information that is both claim-relevant (e.g., high-quality arguments) and claim-irrelevant (e.g., physical appearance), and when the video of the expert is jerky, both central- and peripheral-route processing are expected to produce a similar outcome: Viewers' compliance with the recommendation is predicted to increase. Hypothesis 5 (H5) asserts that viewing digital video with jerky motion increases self-reported agreement with actions derived from an expert's recommendation.

3. Method

A laboratory experiment was designed to examine the effects of jerky motion in a persuasive message. The experiment varied the jerkiness of the message delivery medium and measured its effects on both self-reported behavior (i.e., compliance with the message and perceptions of the source) and physiological behavior (i.e., heart rate, heart rate variance, skin conductance level, and skin conductance response events).

3.1. Participant characteristics and sampling

Participants were 76 students and staff (70% female) of a Mid-Atlantic U.S. university recruited for either course credit or a $10 cash payment. Participants' ages were 18–55 years (*Mdn* = 20.2).

3.2. Research design

The present between-groups experiment included both pretest and posttest measurement of physiological behavior and posttest-only measurement of self-reported behavior. There was one independent variable, jerkiness, with three levels.

3.3. Experimental manipulation

Participants viewed a video clip involving a scenario about a dilemma in medical ethics (MacDorman et al., 2010). In the scenario the participant takes the role of a family physician. The participant learns about a woman who contracted genital herpes from a recent extramarital affair. The participant is asked by the woman to delay disclosing this news to her husband, who is also one of the participant's patients. In the clip, a fictional ethicist named Dr. Richard Clark gives several reasons supporting immediate disclosure (Fig. 1; Appendix A). The ethicist closes by urging the observer to tell the husband about his wife's diagnosis.

The experimental manipulation of jerkiness affected the clip's sequence of video frames. The manipulation generated three treatment conditions: *normal*, *subtly jerky*, and *obviously jerky*. In the normal condition, the frame sequence was unmodified. In the subtly jerky condition, the frame sequence was manipulated at regular intervals (approximately once per second) by replacing two video frames with the preceding two frames, except when doing so would have made a noticeable discontinuity in the ethicist's movements. In the obviously jerky condition, the frame sequence was manipulated in the same places, but seven video frames were replaced by the preceding seven. Across all three conditions, the audio tracks were identical, and the video played at 29.97 frames per second.

3.4. Dependent variables and covariates

3.4.1. Physiological measures

Participants' electrocardial and electrodermal activity were measured before and during the video clip. Participants had electrodes attached to both ankles, one wrist, and two fingers (Venables & Christie, 1973). Data were collected at a sample rate of 200 Hz using a Biopac physiological data collection unit (Biopac Systems Inc.). To obtain a baseline reading before the clip, data were collected for approximately 30 s. Following a pause, recording resumed at the beginning of the video clip and continued for the duration of the 53-s clip.

Fig. 1. A frame from the video clip presented with varying levels of jerky movement. In the brief clip, an adviser lists reasons for disclosing a patient's medical news to her husband. Some of the clip's frames were reordered to create jerkiness in the adviser's movements. Two levels of jerkiness served as between-groups experimental manipulations.

Because HRV studies usually involve measurement periods exceeding one minute, the present study required short-term HRV measures that were robust against outliers. The initial measures chosen were pNN20[3] (proportion of interbeat intervals exceeding 20 ms) and RMSSD (the square root of the mean squared difference of successive beat intervals; Mietus, Peng, Henry, Goldsmith, & Goldberger, 2002; Stein, Bosner, Kleiger, & Conger, 1994). These are among the most common time-domain measures of HRV. Although the recommended measure in typical studies is RMSSD, and RMSSD is correlated with pNN50, pNN20 was retained because of its improved resistance to outliers (Kleiger et al., 1991; Mietus, 2006; Task Force of the European Society of Cardiology & the North American Society of Pacing & Electrophysiology, 1996). Both RMSSD and—to a lesser extent—pNN50 have been used in recording periods of approximately five minutes (Salahuddin, Cho, Jeong, & Kim, 2007; Tarkiainen et al., 2005).

3.4.2. Self-report measures

After viewing the clip, participants completed four self-report items. The first two items were questions assessing compliance with the persuasive message. The possible responses to these two items were *Definitely Not*, *Probably Not*, *Unsure*, *Probably*, and *Definitely*: (1) "When you meet Paul Gordon tomorrow, will you inform him of his exposure to genital herpes?" and (2) "If Paul Gordon has genital herpes, will you inform him that Kelly Gordon is the likely source?" Maintaining consistency with previous work (MacDorman et al., 2010), these items were operationalized as a two-level measure of compliance: Positive responses to the first item (informing the husband of his potential exposure) represented a greater degree of compliance than comparably positive responses to the second item (notifying the husband of the likely source of infection). The other two self-report items briefly tested the assumptions about source and message credibility. The possible responses to these two items were *Not at All True*, *Somewhat Untrue*, *Neither True nor Untrue*, *Somewhat True*, and *Very True*: (3) "I trust Dr. Clark's expertise in this matter" and (4) "I don't understand why Dr. Clark would make the recommendation he did" (for which scoring was reversed).

3.5. Procedure

Study sessions could accommodate up to two participants per session, so participants took part in the study in groups of one or two depending on session enrollment and attendance. After entering the lab, participants completed a pretest questionnaire, electrodes were attached for collection of physiological data, and baseline measures of heart rate and skin conductance were recorded. After the baseline measures, participants read a written introduction to the medical ethics dilemma scenario and viewed the video clip on a 48-in. (122-cm) plasma screen monitor at a distance of approximately 3–4 feet (1 m) while physiological data were recorded. After the clip, the electrodes were removed, a posttest questionnaire was administered, and participants were debriefed.

4. Results

4.1. Statistical methods

To test groupwise differences in the psychophysiological dependent variables, a linear model was assumed. To test gender differences in the decisions about the case, the nonparametric Mann–Whitney *U* test was used because of its tolerance of nonnormal distributions. Test statistics were interpreted with a significance level of $\alpha = .05$. Following Cramer and Bock (1966), to guard against Type I error inflation from multiple comparisons, MANCOVA was performed before individual ANCOVAs.

4.2. Preparation of physiological data

4.2.1. Electrocardial activity

Electrocardiogram data were filtered using a bandpass between 0.5 Hz and 35 Hz (Ruha, Sallinen, & Nissilä, 1997). Recording error led to dropping two cases: one in the subtly jerky condition, and one in the obviously jerky condition. Heartbeats and interbeat intervals were obtained using the QRS peak detector in *AcqKnowledge* 4.2 (Biopac Systems Inc.). Next, filtering and calculation of the time-domain HRV measures was performed using the *HRV Toolkit* (Goldberger et al., 2000). Interbeat intervals were excluded when exceeding at least one of two bounds: a fixed range of 0.4–2.0 s and ±20% of a rolling mean of ±5 intervals.[4] This process yielded the three values to be tested: average time between normal heartbeats (AVNN), RMSSD, and pNN20.

4.2.2. Electrodermal activity

Using *AcqKnowledge*, SCR events were tagged using a first-pass detection threshold of 0.02 μS and a second-pass rejection threshold of 10% of the subject's largest peak (Kim, Bang, & Kim, 2004). Low signal–noise ratio forced the dropping of six cases: two in the smooth condition, one in the subtly jerky condition, and three in the obviously jerky condition.

4.2.3. Preparation of self-report data

Responses from all 76 participants were included. Both the normal and subtly jerky conditions had 24 participants, and the obviously jerky condition had 28 participants.

4.3. Analysis of physiological data (H1–H4)

To account for physiological differences among participants, baseline (pretest) measurements of HR (in beats per minute) and SCL were included as covariates in separate MANCOVAs. Before doing so, one-way ANOVAs were conducted to test the assumption that baseline values were not significantly different among groups. This assumption was supported for both measures: baseline BPM $F(2,71) = 0.29$, $p = .75$ and baseline SCL $F(2,67) = 0.15$, $p = .87$.

4.3.1. Electrocardial activity

MANCOVA was conducted with jerkiness as the independent variable, baseline BPM as a covariate, and AVNN, RMSSD, and pNN20 as dependent variables. Controlling for baseline HR, the multivariate effect of jerkiness was nonsignificant but marginal, Pillai's trace = .15, $F(6,138) = 1.92$, $p = .08$, *partial* $\eta^2 = .08$. In other words jerkiness accounted for 8% of the variance left unexplained by baseline HR in the canonically derived composite dependent variable. Before conducting individual ANCOVAs, the assumption of homogeneity of variance was tested for all three measures of electrocardial activity. A series of Levene's *F* tests indicated the homogeneity of variance assumption was tenable; of the three tests, the maximum $F(2,71) = 1.43$, $p = .25$.

4.3.2. Heart rate

Although jerkiness had a significant effect on AVNN, $F(2,70) = 3.92$, $p = .02$, *partial* $\eta^2 = .10$, the pattern was inconsistent. AVNN

[3] This measure is seen more often with the threshold at 50 ms (pNN50). However, a shorter threshold of 20 ms was used here to increase sensitivity.

[4] This is a sliding window average filter with window size $2N + 1$ (Mietus, 2006). To limit the loss of data at the beginning and end of each recording, $N = 5$.

was least (i.e., HR was greatest) in the subtly jerky condition ($M = 0.728$ s, $SE = 0.009$ s) and comparable between the normal and obviously jerky conditions (normal $M = 0.754$ s, $SE = 0.009$ s; obviously jerky $M = 0.762$ s, $SE = 0.008$ s). These results failed to support Hypothesis 1, which asserted a decrease in HR from jerkiness.

4.3.3. Heart rate variability

After controlling for the effect of pretest BPM, the effect of jerkiness on RMSSD and pNN20 was nonsignificant but marginal, RMSSD $F(2,70) = 1.84$, $p = .17$, *partial* $\eta^2 = .05$; pNN20 $F(2,70) = 1.51$, $p = .23$, *partial* $\eta^2 = .04$. Pairwise comparisons among the three groups indicated a nearly significant decrease in RMSSD from the normal condition to the subtly jerky condition, Fisher's LSD = 0.007, $p = .07$. These results gave insufficient support to Hypothesis 2, which asserted a decrease in HRV from jerkiness.

4.3.4. Electrodermal activity

Following the pattern for electrocardial activity, MANCOVA was conducted with jerkiness as the independent variable, pretest SCL as a covariate, and SCL and SCR as dependent variables. The multivariate effect of jerkiness was not statistically significant, Pillai's trace = .05, $F(4,132) = 0.85$, $p = .50$. This nonsignificant result precluded the need for further tests and failed to support Hypotheses 3 and 4.

4.4. Analysis of self-reported data (H5)

4.4.1. Decisions about the dilemma

Participants' overall responses were mixed: first item (intention to inform the husband of his exposure to herpes; range 1–5 with 5 indicating "definitely inform") $M = 3.33$, $SD = 1.34$; second item (intent to inform the husband that his wife is the likely source if he tests positive; same range and interpretation as the previous item) $M = 2.74$, $SD = 1.27$.

Gender effects were tested next. Although females' responses were slightly more in favor of disclosure for both items, the differences were not statistically significant; first item $U = 491.5$, $p = .17$; second item $U = 538.5$, $p = .41$.[5] For this reason gender was not used as a covariate in other tests.

One-way ANOVAs were conducted to test whether at least one mean difference existed among the three levels of jerkiness (normal, subtly jerky, and obviously jerky) on the two items indicating compliance. Although jerkiness had no significant effect on the first item, intent to inform the husband of his exposure to herpes, $F(2,73) = 1.70$, $p = .19$, $\omega^2 = .02$, it had a significant effect on the second item, intent to inform the husband that his wife is the likely source if he tests positive, $F(2,73) = 3.81$, $p = .03$, $\omega^2 = .07$. Intent to reveal the likely source was similar between the subtly jerky ($M = 3.00$, $SE = 0.25$) and obviously jerky treatment groups ($M = 3.00$, $SE = 0.23$), and lower in the normal treatment group ($M = 2.17$, $SE = 0.25$). These responses partially supported Hypothesis 5, which predicted an increase in compliance from jerkiness.[6]

4.4.2. Assessments of source credibility

The ethicist was described as a somewhat credible source: on the first item, $M = 3.79$ (range 1–5 with 5 indicating "very true"), $SD = 0.99$; on the second item (same range and interpretation as the previous item), $M = 3.74$, $SD = 1.38$. The correlation between these items was large, Pearson's $r = .54$, $p < .001$. These two assessments of the ethicist's credibility were not significantly affected by jerkiness, first item $F = 0.51$, $p = .60$, second item $F = 0.73$, $p = .48$.

[5] The parametric counterpart to U, the t test, was also nonsignificant for gender.

[6] The nonparametric counterpart to ANOVA, the Kruskal–Wallis test, indicated similar results.

5. Discussion and conclusion

Through a controlled experiment, the present study found a medium increase in self-reported compliance with an onscreen expert's recommendation when the expert's movements were jerky. Even though self-reported perceptions of the source's credibility did not vary significantly across conditions, both jerky motion conditions elicited greater scores than the normal condition for one indicator of compliance. Therefore, jerky motion not only increased the effectiveness of the message, it did so without influencing reported source credibility, and it required only minor manipulation of the original clip. In contrast with previous studies (e.g., MacDorman et al., 2010), gender effects on the two decisions did not reach statistical significance.

The study also found statistically significant effects of jerky motion on heart rate. However, the corresponding effects on skin conductivity were not found. Two likely causes are the short duration of the treatment and habituation to the jerky movements. (The clip contained nearly 50 instances of jerky movement, and the jerkiness was applied at irregular intervals.) The only hypothesis supported with statistical significance was H5. The lack of significant physiological differences among groups (H1–H4) suggests the links among attention, arousal, and compliance are complex.

Prior research on mediated messages has been inconclusive. Research supporting a model of technology as social actors suggests technical flaws cause negative evaluations of message sources (Nass & Brave, 2007; Nass & Moon, 2000; Nass & Yen, 2010; Nass et al., 1994; Reeves & Nass, 2002), whereas research supporting a limited-capacity model of resource allocation and message encoding suggest such flaws motivate increased message retention (Diemand-Yauman, Oppenheimer, & Vaughan, 2011; Lang et al., 1999, 2000; Lang, 2000). The current study more closely supports the latter set of findings.

The present study is novel in two ways: Its experimental manipulation is a common yet understudied artifact of online digital media, jerky motion, and its results support an alternative explanation of related findings (MacDorman et al., 2010; Reeves & Voelker, 1993). Instead of detracting from a message's claims, technical flaws may increase its persuasiveness if attitudes about the source are otherwise positive and if the flaws appear unrelated to the source. The first of these two conditions may be satisfied by an authority heuristic (e.g., Koh & Sundar, 2010); the second may be satisfied by making salient the means of message delivery (e.g., streaming video over a wireless Internet connection).

Jerky motion may recapture attention in otherwise nonarousing messages (Lang et al., 2009). In consumer advertising, examples of potentially nonarousing appeals include a list of a product's benefits and a ranking of a product's performance relative to competing products. Jerky motion could also promote the retention of information in remote interactions, including consultations between physicians and patients and teleconferences among business colleagues.

5.1. Limitations

First, the strongest effects of the orienting response on heart rate occur just after stimulus delivery (Graham & Clifton, 1966; Lang et al., 1993). However, to measure the effect of this initial response, the jerkiness manipulation would need to be restricted to the first seconds of the clip. Second, because physiological data were collected concurrently with playback of the clip, events taking place immediately before and after the clip were not recorded. Third, because the onsets of jerky movements were not marked in participants' recordings, the frequency of event-specific SCRs (i.e., SCRs appearing 1–5 s after each jerky movement) could not be measured.

5.2. Future work

In determining possible facilitators of compliance, the current study focused on two physiological indicators of the orienting response: heart activity and skin electrical conductivity. Nevertheless, the present between-subjects experimental design permits measuring other potentially relevant factors, including current mood, pre- and post-treatment confidence in the decisions, and awareness of the experimental manipulation (Maheswaran & Chaiken, 1991; Mayer & Gaschke, 1988; Reeves & Voelker, 1993). Furthermore, the precision of measuring related outcomes could be increased, including attention to claims (i.e., operationalized as retention of relevant message details), and opinions about the message source's warmth (or trustworthiness), competence, and degree of goodwill (Fiske, Cuddy, & Glick, 2007; McCroskey & Teven, 1999). By distinguishing between attitudes about the message and attitudes about the source, future studies may determine the extent to which these two factors mediate the effects of jerky motion on persuasion.

Another potential line of research involves conceptual replication, including replacing the dilemma in medical ethics with a dilemma in another situation, replacing the human advisor with a clearly computer-controlled agent, or replacing the single-judgment paradigm with a team-building exercise (Lafferty, Eady, & Pond, 1974; Nass, Fogg, & Moon, 1996). Lastly, the significant influence of pretest arousal on the present results suggests a deeper investigation of individual differences predicting susceptibility to the persuasive effects of jerky motion.

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Appendix A. Text of persuasive message

Hello. I'm Dr. Richard Clark, assistant professor of medical ethics at Purdue University. This case presents us with a tough dilemma. Ignoring the potential for harm to one of your patients can have serious consequences and should not be taken lightly. Sometimes the harm principle allows you to take action to protect your patients. In this case the harm to Paul is both serious and foreseeable, and this outweighs concerns about Kelly's confidentiality. In fact, her attitude shows that she has no real intention of protecting Paul or telling him about his risk of exposure. If Paul were to contract herpes, he might take it out on Kelly, or he might take action against you for not telling him. For all these reasons, I strongly urge you to tell Paul about Kelly's condition.

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