Effects of Visual Tasks and Conversational Partner on Personal and Interpersonal Postural Activity

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The control of stance is influenced by activities that are engaged in during stance. We investigated simultaneous constraints imposed by individual-specific factors (such as the distance of visual targets) and of interpersonal factors arising from dyadic conversation. Each member of participant pairs looked at targets (drawings) that were similar to, but differed from, that of a conversational partner. Conversational partners conversed to identify the differing elements. In Experiments 1 and 2, members of each dyad conversed with each other or separately conversed with a confederate (an experimenter). We varied the distance of targets (Experiment 1) and their size (Experiment 2). In Experiment 3, target size could be the same for both members of a dyad (i.e., small-small, large-large) or could differ (i.e., small-large, large-small). Interpersonal postural coordination was stronger when members of dyads conversed with each other, replicating earlier studies, but this manipulation also influenced parameters of individual sway. In Experiment 3, interpersonal postural coordination also was influenced by variation in the size of the partner’s target. Analysis of the sway of individuals revealed influences of
target distance and size, replicating previous effects; however, these manipulations also influenced interpersonal postural coordination. Overall, the results indicate that postural activity was modulated simultaneously with respect to individual and dyadic parameters of the task situation. We argue that it may be useful, both theoretically and empirically, to interpret the effects of conversation on postural activity within the broader context of relations between postural control and the performance of suprapostural tasks.

Standing body sway is influenced by parameters of visual tasks that are engaged in during stance (for a review, see Woollacott & Shumway-Cook, 2002). For example, sway decreases during performance of precise visual tasks, such as reading, relative to sway during performance of less demanding visual tasks, such as looking at a blank target (Stoffregen, Pagulayan, Bardy, & Hettinger, 2000). These effects are sufficiently robust that they persist even when balance is challenged by motion of the surface of support, as occurs during stance on ships at sea (e.g., Stoffregen, Villard, & Yu, 2009; Yu et al., 2010). One widespread interpretation of these types of effects is in terms of hypothetical competition between postural control and visual performance for a limited pool of central processing resources (e.g., Woollacott & Shumway-Cook, 2002). An alternative interpretation can be derived from the ecological approach to perception and action (e.g., Riccio & Stoffregen, 1988). In this view (e.g., Stoffregen, Hove, Bardy, Riley, & Bonnet, 2007; Stoffregen, Smart, Bardy, & Pagulayan, 1999), postural sway can be modulated so as to facilitate the performance of “suprapostural” visual tasks by aiding in the stabilization of gaze relative to objects of interest in the environment.

Research on the perception and control of standing posture has focused on factors that influence the body sway of individuals. However, recent research has revealed that standing body sway can be influenced by a very different type of constraint arising from social interaction between persons. Shockley, Santana, and Fowler (2003) asked standing participants to converse about a set of visual targets. When members of a dyad conversed with each other, their body sway dynamics were more strongly coupled than when participants performed the same visual task while conversing with other people. This effect is remarkable for at least two reasons. First, postural control rarely enters conscious awareness—we rarely make deliberate decisions about how to sway. Second, ordinary standing body sway is not widely recognized as having functional consequences for conversation or for joint visual attention.

What is the source of the interpersonal postural coupling observed by Shockley et al. (2003)? One possibility is that the conversation task led to shared visual attention to the visual targets, that is, conversational partners may have tended to look at the same area of their respective targets at the same time. D. Richardson and Dale (2005) recorded the speech and eye movements of participants looking
at pictures of cast members of a TV sitcom and speaking spontaneously about their favorite episode and characters. Segments were played back to a separate set of listeners who looked at the same visual display of the cast members and listened to the corresponding speech about the cast members while their eye movements were recorded. They found that the listener was more likely than chance to be looking at the same cast member 2 s after the speaker fixated it. It is important to note that the degree of coordination between individual speaker-listener pairs correlated with the listeners’ accuracy on comprehension questions about the speech. In another study, D. C. Richardson, Dale, and Kirkham (2007) experimentally manipulated the level of background knowledge and evaluated its effect on gaze coordination. Participants first listened to a description of either the meaning of a specific painting by Dali or facts from his biography. They then saw Dali’s painting and discussed it while their gaze was tracked. Conversational partners who heard the same information had higher gaze coordination than those who heard different information.

The studies of D. Richardson and Dale (2005) and D. C. Richardson et al. (2007) suggest an important role of gaze trajectories in effective communication. It has even been suggested that the movement coordination (of eyes and body) observed during conversation may embody the cognitive coordination that is required to communicate effectively (Shockley, Richardson, & Dale, 2009). Given that visual constraints have been linked to changes in individual and interpersonal postural sway and that vision is essential to completing the communicative task employed by Shockley et al. (2003), it seems very likely that visual constraints would, likewise, influence the postural coordination that occurs during conversation.

In this study, we evaluated the simultaneous influence of dyadic conversation and individual factors on whole-body movement.

**POSTURAL STABILIZATION OF VISUAL PERFORMANCE**

One parameter of visual tasks that affects the postural activity of individuals is the distance of visual targets. A given displacement of the head in space will produce relatively large changes in visual stimulation relative to nearby targets and relatively small changes relative to distant targets. Thus, postural activity has a larger impact on visual performance for nearby targets than for distant targets. Standing body sway is reduced when participants view nearby targets relative to sway during viewing of more distant targets (e.g., Bles, Kapteyn, Brandt, & Arnold, 1980; Lee & Lishman, 1975; Stoffregen et al., 2000; Stoffregen et al., 1999; cf. Mayo, Wade, & Stoffregen, 2011). The influence of target distance on body sway applies only for targets that a person is looking at, not
for targets that are merely in the field of view (Mayo et al., 2011; Stoffregen et al., 1999). Thus, the influence of visual target distance is not mechanical; rather, it is intentional. In this sense, the influence of visual target distance on the body sway of individuals differs qualitatively from the influence on sway of mechanical factors, such as foot positioning or the rigidity of the support surface. In Experiment 1 of this study, we predicted that postural activity would be influenced by variations in the distance of visual targets that were the subject of dyadic conversation while simultaneously being influenced by variations in conversational partner.

In Shockley et al. (2003), dyads looked at visual targets (cartoon pictures) and discussed them. In interpreting their results, Shockley et al. (2003) and Shockley, Baker, Richardson, and Fowler (2007) focused on conversational aspects of this task, such as articulatory influences on postural activity. As noted earlier, these constraints are real; however, postural activity may also (simultaneously) have been influenced by the fact that the subject of conversation was things that participants were looking at. Participants’ ability to complete the picture puzzle task depended on their ability to converse about the pictures but also on their ability to see them. Accordingly, we can understand the overall task situation as depending upon successful performance of both conversational and visual components. In particular, it is likely that conversation led to coordination of gaze, with participants looking at those parts of the pictures that they were talking about at any given moment. Conversation about a visible target can lead to coupling of eye movements and head movements between members of a dyad, as demonstrated by Ashenfelter, Boker, Waddell, and Vitanov (2009) and by D. C. Richardson et al. (2007). Ashenfelter et al. reported data only on head rotation in pitch (nodding) and yaw (shaking). D. C. Richardson et al. reported data only on patterns of gaze (eye movements relative to features of visual targets). Neither Ashenfelter et al., nor D. C. Richardson et al. evaluated hypotheses relating to body sway (in both studies, participants were seated), and neither study included any manipulation of conversational partner.

In Experiment 2 of the present study, we manipulated the size of visual targets that served as the basis of dyadic conversation. Looking at smaller versions of a picture should tend to elicit relatively small changes in gaze amplitude, whereas looking at larger versions of the same picture should elicit relatively large changes in gaze amplitude. Stoffregen, Bardy, Bonnet, and Pagulayan (2006) evaluated standing body sway while individuals looked at visual targets that were stationary or oscillated in the horizontal plane. In other conditions participants made similar eye movements while their eyes were closed. The results revealed that body sway was reduced during eye movements (relative to sway when the eyes were stationary), but this effect occurred only when eye movements were visually guided, that is, when eye movements were made in the service of looking at something. In this sense, the effect of eye movements
on postural activity is intentional rather than mechanical. In Experiment 2, we predicted that postural activity would be influenced by variations in the size of visual targets that were the subject of dyadic conversation while simultaneously being influenced by variations in conversational partner.

MEASURES OF POSTURAL ACTIVITY

We separately evaluated the postural activity of individual participants and the coordination of postural activity between members of each participant pair. Effects of visual tasks on the postural activity of individuals have been documented in a variety of postural parameters, including measures of the activity of leg muscles, the magnitude of forces applied to the ground surface, and the kinematics of the head and torso (for a review, see Woollacott & Shumway-Cook, 2002). In the present study, we chose to evaluate the positional variability of the head and waist of individual participants, which we operationalized as the standard deviation of position (e.g., Stoffregen, Hove, et al., 2007; Stoffregen et al., 2000; Stoffregen et al., 1999).

Studies of interpersonal postural coordination in dyadic conversation typically have reported measures obtained from cross-recurrence quantification (CRQ; Ramenzoni, Davis, Riley, Shockley, & Baker, 2011; Shockley et al., 2007; Shockley et al., 2003; Stoffregen, Giveans, Villard, Yank, & Shockley, 2009). CRQ provides various measures of the shared activity between two time series embedded in a reconstructed phase space (see Shockley et al., 2003, for a more detailed description and Shockley, 2005, for a tutorial on CRQ). Following these studies, we used CRQ to evaluate interpersonal postural coordination.

GENERAL METHOD

Participants were tested in dyads. Each dyad participated in 4 trials in each of four experimental conditions for a total of 16 trials per dyad. Conditions were presented in blocks of 4 trials, with the order of blocks counterbalanced across dyads. During each trial, 2 participants stood upright while discussing with each other or someone else (experimental confederates) the subtle differences between two similar cartoon pictures. Participants stood back-to-back (without touching) such that they could not see each other. The pictures were the same as those used by Shockley et al. (2003). Pictures were individually displayed at eye level and were supported by large wooden stands that could easily be moved during the course of the experiment. Each member of a discussion pair (whether 2 participants talking with each other, or 1 participant talking with one confederate) was instructed to find the differences between his or her picture.
and the picture of the other member of the discussion pair. During trials, neither participant in a discussion pair was able to see the other’s picture. Therefore, verbal interaction was required between members of a discussion pair to solve the task. Different pairs of pictures were used for each trial. Participants were instructed to not move their feet during trials and to not turn around to look at each other or at each other’s targets. No other limitations were placed on the physical behavior of participants. They were permitted to talk, look around, gesture, and so on. Each trial was 120 s in duration. Although we used the same pictures that were used by Shockley et al. (2003), we adjusted their size. To do this, we scanned the original pictures and printed them to appropriate sizes using a high-definition poster printer.

Individuals did not see their partner’s target during trials, or before trials, and were instructed not to look at each other’s targets before or during trials; the experimenters emphasized that seeing the partner’s target would be cheating. The nature of the target was sometimes revealed in conversation during trials (e.g., “it’s hard to see when it’s far away,” or “I wish I had the big one”). In some conditions, members of a dyad conversed (i.e., did the picture puzzle task) with each other (such that only two people were talking, and only one pair of pictures was in use), whereas in other conditions each member of a dyad conversed with a different experimental confederate (such that four people were engaged in two separate conversations using separate pairs of pictures). Confederates always used the original targets from Shockley et al. (2003), which were 21.6 × 28 cm, which they held in their hands.

Movement data were collected using a magnetic tracking system (Fastrak, Polhemus Corp., Colchester, VT). Sensors were attached to the head and waist using elastic bands. Each sensor was sampled at 30 Hz.

Data Analysis

Our study was inspired by previous research on postural activity in individuals (e.g., Stoffregen et al., 1999) and in dyads (e.g., Shockley et al., 2003). To permit comparison of our results with these literatures we used dependent measures that were used in previous studies. To evaluate the magnitude of postural activity we used the positional variability of the head and waist in the anterior-posterior axis (Stoffregen, Giveans, et al., 2009; Stoffregen, Villard, et al., 2009). Positional variability was operationally defined as the standard deviation of head and waist position over the duration of each trial. To assess the dynamics of interpersonal postural coordination we used CRQ (Shockley et al., 2007; Shockley et al., 2003). For each trial, displacement (measured in centimeters) of the sensors at each participant’s waist and head in the anterior-posterior direction was converted into standard (z) scores to achieve a common scale without influencing the distribution of scores within each time series (Shockley et al., 2003). For
postural sway data, CRQ requires the embedding of two time series (x and y) in a reconstructed phase space (Abarbanel, 1996), implementing surrogate (time-delayed copies of x and y) dimensions created using the same time delay in the respective time series (see Shockley, 2005, for a tutorial). Through the use of CRQ, several different measures can be computed. Percent recurrence (%REC) reflects the proportion of locations in reconstructed phase space where the postural trajectories of a pair coincided (shared body configuration; i.e., where x and y converge within some radius in phase space; Shockley, 2005). Consecutive strings of recurrent points (diagonal lines in a recurrence plot) provide an index of the deterministic structure, or percent determinism (%DET), which is shared between the two time series. %DET is quantified as the ratio of the number of recurrent points that form diagonal lines (in the recurrence plot) to the total number of recurrent points. MaxLine indexes the length (in data points) of the longest sequence of consecutively recurrent points from x and y. Finally, entropy is calculated as the Shannon entropy of a histogram of diagonal line segment lengths and is accordingly an index of the complexity of the shared activity (i.e., the variety of lengths of parallel trajectories). Following Shockley et al. 2007 and Shockley et al. 2003, as calculation parameters we used a delay of 25 data points (0.42 s) and 10 embedding dimensions with a recurrence inclusion radius of 30% of the mean distance separating points in reconstructed phase space. We report only significant effects.

**EXPERIMENT 1**

In Experiment 1, we crossed variations in target distance with variations in conversational partner. Members of a dyad conversed with each other or with confederates (Shockley et al., 2003).

As noted earlier, body sway tends to have a greater visual impact during viewing of nearby targets than during viewing of more distant targets. Put another way, how the body moves is less important (in terms of maintaining visual fixation) when targets are far away than when they are nearby. By this same logic, how two bodies move (relative to one another) would tend to have a smaller impact on joint visual attention for distant targets than for nearby targets. If interpersonal postural coordination is functionally related to joint visual attention in cooperative conversation, then such coordination should be greater during viewing of nearby targets than during viewing of more distant targets. Based on previous research with individuals (Stoffregen et al., 2000; Stoffregen et al., 1999), we predicted that target distance would influence the positional variability of the head and waist of individual participants such that positional variability should be greater when targets were farther away than when targets were closer. Following Shockley et al. (2003) and Stoffregen, Giveans, et al. (2009), we pre-
dicted that task partner would influence parameters of CRQ for dyads such that recurrence measures would be lower when participants were talking to confederates than when talking to each other. Finally, based on the findings of Stoffregen, Giveans, et al. (2009) we predicted that task partner would also influence the positional variability of individuals such that when talking to one’s task partner, postural sway variability would be lower than when talking to an experimenter.

Method

Participants. Thirty students at the University of Minnesota participated on a voluntary basis and provided informed consent. Seven males and 23 females participated in the study, ranging in age from 19 to 34 years ($M = 21.6$ years) and in height from 154.9 to 188 cm ($M = 171.1$ cm). All participants had normal or corrected-to-normal vision, with 15 participants wearing glasses or contact lenses.

Apparatus. The visual targets were the 16 pairs of black and white cartoon pictures used by Shockley et al. (2003). Each picture was reproduced in two sizes, 10.2 × 14.0 cm and 47.0 cm × 69.9. Each target was supported by a wooden stand.

Procedure. The task, stimuli, and procedure were replicated from Shockley et al. (2003). The 30 participants were organized into 15 dyads. Each dyad participated in 4 trials for each of the four experimental conditions, for a total of 16 trials per dyad. For the near target conditions, a pair of the smaller pictures was mounted on stands that were 0.5 m away from each member of the dyad. For the far target conditions, a pair of the larger pictures was mounted on stands that were 2.5 m from each member of the dyad. Similar near and far distances were used by Stoffregen et al. (2000) and Stoffregen et al. (1999). In all cases, the horizontal visual angle of each picture was 16° (by comparison, in Shockley et al., 2003, targets were 22 × 28 cm at a distance of 1.5 m, corresponding to a horizontal visual angle of 18°). The independent variables of target distance and task partner were crossed to create four conditions, which are illustrated in Figure 1. When experimenters served as conversational partners they always used the original targets from Shockley et al. (2003), which were 22 × 28 cm. For experimenters, targets were handheld.

Results

The goal of the task was to find as many differences as possible between the two similar pictures of a given pair of conversers. This encouraged a lively
interchange of inquiries and descriptions. Gesturing was common, and at the end of trials the experimenter often had to halt conversation. It was also common, at the end of trials, for participants to ask to see their partner’s picture. Similar effects were reported by Shockley et al. (2003). For each dependent variable, we conducted a $2 \times 2$ analysis of variance (ANOVA) on factors Target Distance and Conversational Partner.

**Positional variability.** We computed the positional variability of both head and waist position and the mean values of variability across trials and conditions. Separate two-factor, repeated-measures, within-participants ANOVAs were computed on motion of the head and on motion of the hips with target distance and task partner as factors.

The main effect of task partner was significant for positional variability of the head, $F(1, 29) = 5.467$, $p = .026$, accounting for 15.9% of the variance. Positional variability was greater when members of a dyad conversed with experimenters ($M = 2.01$ cm, $SD = 1.09$ cm) than when they conversed with each other ($M = 1.80$ cm, $SD = 0.91$ cm). The main effect of target distance was significant for positional variability of the head, $F(1, 29) = 8.457$, $p = .007$, accounting for 22.6% of the variance. Positional variability was greater with near targets ($M = 2.07$, $SD = 1.17$ cm) than with far targets.
FIGURE 2 Positional variability (in centimeters) of the head, Experiment 1, illustrating the interaction between target distance and task partner. The error bars are standard error.

(M = 1.74, SD = 0.83 cm). The Target Distance × Task Partner interaction was also significant for positional variability of the head, $F(1, 29) = 4.494$, $p = .043$, accounting for 13.4% of the variance, as illustrated in Figure 2. Post hoc t tests revealed that when speaking with an experimenter, positional variability was greater for the near target than for the far target ($p = .006$). In addition, while looking at the near target, positional variability was greater when speaking with an experimenter than when speaking together with the partner ($p = .003$).

**Cross-recurrence quantification.** For %REC, a two-factor ANOVA revealed a significant main effect of target distance for head movement, $F(1, 14) = 5.352$, $p = .036$, accounting for 27.6% of the variance. There was greater postural trajectory overlap with near targets ($M = 2.01\%$) than with far targets ($M = 1.67\%$). For entropy, a two-factor ANOVA revealed a significant main effect of conversational partner for head movement, $F(1, 14) = 6.07$, $p = .03$, accounting for 7.6% of the variance. Shared movement patterns were more complex (i.e., there was a greater variety in durations of shared trajectories) when members of a dyad conversed with each other ($M = 5.12$, $SD = 0.40$) than when they conversed with experimenters ($M = 4.90$, $SD = 0.41$).

**Discussion**

In Experiment 1, we sought to determine how dyadic postural activity would be affected by variations in the distance of visual targets. We also sought to determine whether the influence of target distance on the body sway of
individuals (Stoffregen et al., 1999) would be replicated in the presence of dyadic conversation. The results reveal that postural activity was influenced simultaneously by physical and social aspects of the situation. However, the nature of the effects differed, in some ways, from previous studies.

Our measure of %REC did not vary with conversational partner, contrary to a finding of Shockley et al. (2003). However, variation in conversational partner did influence interpersonal postural coordination, as reflected in the complexity of shared postural trajectories, which was greater when conversing with the other participant than when participants were conversing with experimenter. In addition, our manipulation of conversational partner revealed robust effects on positional variability. Replicating an effect first reported by Stoffregen, Giveans, et al. (2009), we found that positional variability was reduced when participants spoke with each other relative to when they spoke with experimenters. Shockley et al. (2003) and Stoffregen, Giveans, et al. (2009) evaluated motion of the waist and head and found that variations in speaking partner influenced CRQ for the waist but not the head. By contrast, in Experiment 1 we found effects of conversational partner were limited to movement of the head.

The distance of visual targets influenced interpersonal coordination of head movements as indexed by CRQ. Consistent with our prediction, there was greater overlap between trajectories (i.e., percent recurrence) when viewing the near targets than when viewing the far targets. This effect is novel and indicates that the influence of visual parameters of suprapostural tasks extends to targets used in dyadic conversation.

Target distance also influenced positional variability of the head. Head position was more variable when viewing near targets than when viewing far targets. The direction of this effect was the opposite of previous studies (e.g., Stoffregen et al., 2000; Stoffregen et al., 1999). The anomalous direction of this effect may be related to the fact that participants not only looked at the visual targets but also discussed them with another person. The task situation was more complex and less constrained than typically is the case in research on standing posture in individuals.

Finally, we found an interaction between conversational partner and target distance on positional variability of the head (Figure 2). This interaction confirmed our prediction that the effects of conversational partner would be stronger for nearby targets than for more distant targets. This interaction is consistent with the idea that head movement provides functional support for performance of the dyadic conversation task (cf. Ashenfelter et al., 2009).

Overall, the results show that conversational factors and visual target factors can have simultaneous effects on head movement. Moreover, social and visual target factors can simultaneously influence the same dependent variables (in this case, the positional variability of the head). Stoffregen, Giveans, et al. (2009)
found that postural activity was influenced by variations in the rigidity of the support surface and that interpersonal postural coordination was influenced by conversational partner only during stance on a rigid surface. Thus, Experiment 1 of the present study is the first demonstration that a given parameter of postural activity (positional variability) can simultaneously be influenced by visual and social factors (distance and partner, respectively).

EXPERIMENT 2

For individuals, standing postural activity differs as a function of whether visual targets are stationary or in motion (Cinelli, Patla, & Stuart, 2007; Stoffregen, Bardy, Bonnet, Hove, & Oullier, 2007; Stoffregen et al., 2006; cf. Glasauer, Schneider, Jahn, Strupp, & Brandt, 2005). In those studies, the position of visual targets varied only in the horizontal axis (i.e., left-right and right-left). Other researchers have investigated movements related to gaze in the context of dyadic conversation. D. C. Richardson et al. (2007; cf. D. Richardson & Dale, 2005) asked dyads to look at paintings. Sometimes one participant spoke about the painting while the other listened, whereas at other times the two participants discussed the painting. Participants were free to look anywhere in the painting. D. C. Richardson et al. (2007) found temporal coupling of participants’ eye movements in both monologues and dialogues. D. C. Richardson et al. (2007) collected data only about gaze (using a remote eye-tracking camera), and participants were seated. There was no controlled manipulation of target size. In Experiment 1 of the present study participants were free to look anywhere on the two-dimensional target (cf. Hunter & Hoffman, 2001). Because we covaried target distance and target size, the visual angle of targets was constant across conditions. In Experiment 2, participants did the picture puzzle task from Experiment 1. Members of each dyad again conversed with each other or with experimenters. All targets were at the same distance such that larger and smaller targets subtended larger and smaller visual angles, respectively. Therefore, discussion of the larger targets presumably required larger shifts in gaze (including larger eye movements) than discussion of the smaller targets. If postural activity were modulated to support the coordination of interpersonal gaze, then interpersonal postural coordination should be greater during discussion of larger targets than during discussion of smaller targets.

In Experiment 2, we crossed the variation in target size (large vs. small visual angle) with the variation in conversational partner (participant vs. experimenter) to yield a $2 \times 2$, within-participants design. We predicted that each of these independent variables would influence both the positional variability of postural activity and the dynamics of interpersonal postural coordination.
Method

Participants. Thirty students at the University of Minnesota participated on a voluntary basis and provided informed consent. Eleven males and 19 females participated in the study, ranging in age from 19 to 36 years ($M = 22.8$ years) and in height from 157 to 196 cm ($M = 170.4$ cm). All participants had normal or corrected-to-normal vision, with 15 participants wearing glasses or contact lenses.

Procedure. All targets were presented at a distance of 1.0 m. The small targets were $19 \times 27$ cm, yielding a horizontal visual angle of $15.4^\circ$. The large targets were $61 \times 99$ cm, yielding horizontal visual angle $52.7^\circ$. When experimenters served as conversational partners they always used the original targets from Shockley et al. (2003), which were $22 \times 28$ cm. For experimenters, targets were handheld.

Results

Across participants, natural conversations were again elicited due to the nature of the picture task. With the goal of the task being to find as many differences as possible within a 2-min time frame, very lively conversations were often seen. As in Experiment 1 gesturing and pointing were common, and in many cases participants had to be asked to stop upon the completion of the 2-min time limit. For each dependent variable, we conducted a $2 \times 2$ ANOVA on factors Target Size and Conversational Partner.

Positional variability. There were no significant effects.

Cross-recurrence quantification. Regarding %REC, the main effect of task partner was significant for the head, $F(1,14) = 5.85$, $p = .029$, accounting for 29% of the variance. %REC was greater when participants conversed with each other ($M = 3.56\%$, $SD = 1.57\%$) than when they conversed with experimenters ($M = 2.93\%$, $SD = 1.22\%$). For both the head and the waist the main effect of target size was significant (head: $F(1,14) = 9.72$, $p = .008$, accounting for 41% of the variance; waist: $F(1,14) = 4.25$, $p = .045$, accounting for 26% of the variance). In each case, %REC was greater for large targets than for small targets (Figure 3).

Regarding %DET, the results are illustrated in Figure 4. We found a significant main effect of target size for the head, $F(1,14) = 8.44$, $p = .012$, accounting for 38% of the variance. The main effect of target size was also significant for the waist, $F(1,14) = 14.72$, $p = .002$, accounting for 51% of the variance. For both the head and the waist, %DET was greater for large targets than for small targets.
Discussion

CRQ revealed that interpersonal coordination of head movement was influenced by our manipulation of conversational partner. There was greater shared activity for the head when participants conversed with each other than when they conversed with experimenters. The direction of the effect was the same as observed by Shockley et al. (2003) and by Stoffregen, Giveans, et al. (2009) when participants were standing on a solid floor. Shockley et al. (2003) and Stoffregen, Giveans, et al. (2009) evaluated motion of the waist and head and found effects of speaking partner on CRQ for the waist only. In Experiment 2 of the present study, the CRQ results for the head relate to similar effects reported
by Ashenfelter et al. (2009) and D. C. Richardson et al. (2007) though their participants were seated.

Although CRQ was influenced by conversational partner, it was more broadly influenced by target size, including effects on both the head and the waist for both recurrence measures. There were greater shared postural configurations and postural patterns when participants were working with large targets than when working with small targets. The most obvious explanation for these findings is that because targets were larger there was a greater amplitude of visual scanning, involving greater postural activity, generally, which permitted greater coordination among participants. This interpretation may seem unlikely given that there were no significant effects for positional variability of either the waist or the head. However, cross-recurrence measures have sometimes been found to be sensitive to changes in movement dynamics to which variability measures were insensitive (e.g., Pellecchia, Shockley, & Turvey, 2005; Shockley & Turvey, 2005, 2006). Accordingly, it may be the case that although postural sway variability was affected by the target distance manipulation (Experiment 1), sway variability was less affected by changes in target size (Experiment 2), whereas cross-recurrence measures were sensitive to these. An alternative possibility is that the larger targets required a functional organization that was more similar across members of the pair whereas the smaller targets didn’t require as similar a functional organization to complete the task.

There were no significant effects of target size or conversational partner on positional variability of the head or waist. Horizontal eye movements influence standing body sway in individuals (Stoffregen, Bardy, et al., 2006, 2007), but in those studies eye movements were prescribed by the experimenters and were limited to the horizontal plane, were of constant amplitude and frequency (within trials), and occurred in the absence of manual gestures (which are common in the picture puzzle task). In the present study, changes in gaze occurred in the service of a dyadic conversation task; were under participants’ own control; and (presumably) varied in direction, amplitude, and frequency. Any of these differences between the experimental situations may account for the absence of effects of target size on positional variability in Experiment 2.

EXPERIMENT 3

In Experiment 1 the distance of targets was constant across participants in a given condition, whereas in Experiment 2 the size of targets was constant across participants in a given condition. That is, each member of a dyad saw targets that were at the same distance (either near or far) and the same size (either large or small) as his or her partner’s target. When members of dyads conversed with
each other it is likely that they shared joint visual attention such that changes in gaze were coordinated in time, direction, and magnitude (D. C. Richardson et al., 2007). In Experiments 1 and 2 the coordination of gaze would tend to be facilitated by the fact that target size and distance were the same for both participants. In Experiment 3, we manipulated one aspect of this interpersonal coupling and examined the effects of this manipulation on postural activity. To do this, we introduced variations in the size of targets between members of a pair. In Experiment 3, the large-large and small-small conditions were the same as in Experiment 2. However, we also contrasted these to conditions in which 1 participant in a pair had a large target whereas the other participant in that pair had a small target. When the 2 participants looked at different-size targets there was a disjunction between the amplitude of gaze shifts needed by each participant to maintain joint visual attention to a given aspect of the picture. The mismatch in target size could be expected to have little or no effect on the direction of interpersonal gaze shifts. Thus, interpersonal postural coordination related to the direction of gaze shifts should be preserved across within-dyad variations in the size of visual targets.

In Experiment 3, we did not include a variation in speaking partner. However, our use of different-size targets within trials constituted a manipulation of social constraints. On any given trial participants were not informed of (and could not see) the size of their partner’s target. For this reason, any effects of the partner’s target size on postural activity would be interpersonal (i.e., social) effects.

The covariation of each participant’s target (own target size: large vs. small) with the size of the partner’s target (partner target size: matched vs. mismatched) yielded a $2 \times 2$, within-dyads design. Following Experiment 2, we predicted that postural activity would differ when both partners looked at small versus large targets. In addition, we predicted that postural activity would differ between conditions in which partners looked at same-size (matched) versus different-size targets (mismatched). Recurrence measures were predicted to be greater in large-large conditions than in small-small conditions. Large-small (i.e., mismatched size) conditions were expected to yield a decrease in recurrence measures relative to matched conditions.

Method

Participants. Twenty-four students at the University of Minnesota participated on a voluntary basis and provided informed consent. Eleven males and 13 females participated in the study, ranging in age from 18 to 25 years ($M = 20.9$ years) and in height from 152.4 to 190.5 cm ($M = 172.1$ cm). All participants had normal or corrected-to-normal vision, with 6 participants wearing glasses or contact lenses.
Apparatus. The same 16 pairs of black and white cartoon pictures from Experiment 1 were used as the stimuli. In this experiment, the size of the pictures varied with condition, being either 19 × 27 cm (small) or 61 × 99 cm (large). These pictures were individually displayed 1.0 m away from the participant at eye level and were supported by large wooden stands that remained stationary during the course of the experiment. For the small picture conditions, a maximum horizontal visual angle of 15.4° was produced. Conversely, for the large picture conditions, the maximum horizontal visual angle was 52.7°.

Procedure. The task, stimuli, and procedure were again replicated from Shockley et al. (2003). The 24 participants were organized into 12 dyads. Each dyad participated in four trials for each of four experimental conditions. Participants stood facing away from each other.

On individual trials, participants were not informed of the size of their partner’s target. Participants were instructed not to look at the partner’s target as this could influence their performance on the picture puzzle task. As in Experiments 1 and 2, participants sometimes looked at each other’s targets at the end of trials to verify the differences that they had identified. Consequently, these participants understood that we were manipulating target size.

Results

For each dependent variable, we conducted a 2 × 2 ANOVA on factors Own Target Size and Partner Target Size.

Positional variability. The results are illustrated in Figure 5. For movement at the waist, the main effect of own target size was significant, \( F(1, 23) = 4.753, p = .04 \), accounting for 17.1% of the variance. Positional variability tended to be greater when viewing small targets than when viewing large targets. The main effect of partner target size was also significant, \( F(1, 23) = 5.113, p = .034 \), accounting for 18.2% of the variance. Positional variability tended to be greater when target sizes were mismatched than when they were matched.

Cross-recurrence quantification. Regarding %REC, for the head, a two-way ANOVA revealed a significant main effect of own target size, \( F(1, 11) = 16.26, p = .002 \), accounting for 60% of the variance, with greater %REC when looking at large targets (\( M = 3.29, SD = 0.92 \)) than when looking at small targets (\( M = 2.37, SD = 1.08 \)). The main effect of partner target size, \( F(1, 11) = 16.18, p = .002 \), accounting for 60% of the variance, was also significant, with greater %REC when target sizes matched (\( M = 3.29, SD = 1.06 \)) than when they were mismatched (\( M = 2.37, SD = 0.94 \)). In addition, the Own Target Size × Partner Target Size interaction was significant,
$F(1, 11) = 5.06, p = .046$, accounting for 31% of the variance (Figure 6). Post hoc pairwise comparisons showed that the interaction was driven by the fact that %REC was greater in the large target, matched-sizes condition than in each of the other three conditions (all $ps < .005$).

Regarding %DET, the main effect of own target size was significant for the head, $F(1, 11) = 5.05, p = .046$, accounting for 31% of the variance, with lower %DET when viewing large targets ($M = 99.17, SD = 0.51$) than when

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**FIGURE 5** Positional variability (in centimeters) of the waist, Experiment 3. The error bars are standard error.

**FIGURE 6** Percent recurrence (%REC) for the head, Experiment 3. The error bars are standard error.
viewing small targets ($M = 99.41, SD = 0.54$). For the head, the interaction between own target size and partner target size was also significant, $F(1, 11) = 11.96, p = .005$ (Figure 7). Post hoc pairwise comparisons revealed that the interaction was driven by the fact that the large target-matched sizes condition was greater in magnitude than each of the other three conditions (all $ps < .05$). For the waist, the main effect of own target size was significant, $F(1, 11) = 5.74, p = .036$, accounting for 34% of the variance, with greater %DET when looking at large targets ($M = 98.90, SD = 0.63$) than when looking at small targets ($M = 98.62, SD = 0.76$).

Discussion

In Experiment 3, target pictures for the joint task were either large or small. Within dyads, each person’s target either matched the size of his or her partner’s target (small-small or large-large) or did not match (small-large or large-small). When target size was matched the amplitude of gaze shifts used in joint attention would tend to be similar between members of the dyad. When target size was mismatched the amplitude of gaze shifts would tend to differ between members of a dyad.

The results reveal that recurrence measures of coordination were influenced by the size of the target that each individual looked at. When both members of a dyad looked at large targets percent recurrence and percent determinism were higher than when both participants looked at small targets. These effects replicate effects observed in the same conditions in Experiment 2. The sole exception was that in Experiment 3 matched target size did not influence %REC

FIGURE 7  Percent determinism (%DET) for the head, Experiment 3. The error bars are standard error.
for the waist. As in Experiment 2, we interpret these effects as reflecting the greater amplitude of visual scanning required by the larger targets.

Measures of recurrence differed between conditions where target sizes were matched versus mismatched, with greater %REC and %DET for matched target sizes. However, significant interactions revealed that these differences in recurrence occurred only when both members of a dyad looked at large targets (Figures 6 and 7). The other three conditions did not differ from each other. Contrary to our prediction, recurrence when target sizes were mismatched did not differ from recurrence when both targets were small.

Interestingly, although our manipulation of own target size influenced %DET for both the head and the waist, these effects differed qualitatively. For movement of the head, %DET was reduced for the large targets and increased for the small targets. For movement of the waist this pattern was reversed: %DET was increased for large targets and reduced for small targets. This result demonstrates that the interpersonal coordination of head movements differed from interpersonal coordination of waist movement, an effect that is novel in the literature on interpersonal coordination (cf. Ramenzoni et al., 2011).

In addition to effects on interpersonal postural coordination, Experiment 3 revealed effects on the positional variability of the waist in individual participants. At the waist, positional variability was influenced by own target size, that is, by the target size that each person looked at. Variability was greater for small targets than for large targets. This effect is the opposite of what might be expected on the basis of studies that have examined postural activity in individuals. We address the significance of this finding in the General Discussion. Positional variability of the waist was also influenced by the target size of each participant’s conversational partner. This effect indicates an influence of the dyadic interaction on positional variability and in this sense is logically similar to effects of the partner manipulation on positional variability in Experiment 1. Post hoc tests confirmed the influence of the partner’s target size: The size of a given participant’s target influenced his or her positional variability only when the partner was looking at a large target.

Our mismatch of target sizes appears to have altered the amplitude coupling of dyadic eye movements but, presumably, did not alter the directional coupling of changes in gaze. Directional coupling of gaze between members of a dyad could be manipulated by cutting up the cartoon pictures (e.g., into quarters) and rearranging the pieces differently for each member of a dyad such that all elements of the pictures would be visible, but the relative location of elements would differ between members of a dyad. In this case, dyads would no longer be able to discuss location of picture elements in terms of overall picture geography; attention to a given picture element would require members of a dyad to shift their gaze not only different amounts (as in our manipulation of target size) but also in different directions.
GENERAL DISCUSSION

In three experiments, pairs of participants engaged in a conversational task. We manipulated the conversational partner (Experiments 1 and 2) and the size of the partner’s visual target (Experiment 3). We covaried these manipulations with variation of the distance of visual targets viewed by individual participants in the conversation task (Experiment 1) and with variation in target size (Experiments 2 and 3). We collected data on the postural activity (movement of the head and waist) for each individual. We evaluated the dynamics of coupling between members of each dyad. In separate analyses we evaluated the postural activity of individual participants during performance of the dyadic conversation task. Each of our manipulations influenced interpersonal coupling of movement and influenced postural activity considered at the level of the individual. These effects suggest that dyadic conversation can simultaneously influence both individual movement and interpersonal coordination of movement.

Characteristics of Task Partners

Conversation influenced interpersonal coordination as indexed by CRQ with effects observed in different dependent variables in different experiments. In Experiments 1 and 2 measures of interpersonal coordination were influenced by our manipulation of conversational partner (Partner vs. Experimenter), replicating earlier studies (Shockley et al., 2003; Stoffregen, Giveans, et al., 2009). In Experiment 3 we did not manipulate conversational partner; however, we found that measures of interpersonal coordination were influenced by the relative size of visual targets viewed by members of each dyad. Individuals could not see and did not know the size of their partner’s target; accordingly, these effects can be interpreted as influences of conversation upon interpersonal coordination.

Shockley et al. (2003) found that interpersonal postural coordination was influenced by variations in speaking partner. Shockley et al. (2007) found interpersonal postural coordination was influenced by prosody (e.g., patterns of word stress). Ramenzoni et al. (2011) asked one member of a dyad to hold a rod within a ring held by the other member. They found that interpersonal postural coupling was influenced by variations in the difficulty of the interpersonal manual task (i.e., the size of the ring). Interpersonal coordination of head movements can be influenced by variations in social status (Ashenfelter et al., 2009), whereas coupling of eye movements between individuals can be influenced by social roles (monologue vs. dialogue; D. C. Richardson et al., 2007). In the present study, we have shown that interpersonal postural coordination (as indexed by CRQ) can be influenced by the size of a partner’s visual target (matched vs. mismatched between members of a dyad). Thus, the present study is part of a growing body of evidence which suggests that a variety of interpersonal factors,
some subtle and some less subtle, can influence interpersonal coupling of the eyes, the head, and the entire body.

In addition to its influence on interpersonal coordination, as indexed by CRQ, conversation was found to influence a qualitatively different measure of postural activity, the positional variability of individual participants. In Experiment 1, our manipulation of conversational partner influenced the positional variability of the head. In Experiment 3, our manipulation of the relative size of visual targets influenced the positional variability of the waist. In Experiment 3 our manipulation of the relative size of visual targets exerted simultaneous influence on the positional variability of individuals and the dynamics of interpersonal coordination. With one exception, previous studies have found postural effects of dyadic conversation exclusively in CRQ. The exception was Stoffregen, Giveans, et al. (2009), who found that the positional variability of individuals was greater when they conversed with an experimenter than when they conversed with the other member of their dyad. The results of Experiments 1 and 3 reveal (with different manipulations) that variations in interpersonal factors (e.g., speaking partner, partner’s target size) can influence even relatively crude parameters of postural activity, such as positional variability.

Our results, combined with those of Stoffregen, Giveans, et al. (2009); Ramenzoni et al. (2011); and Riley, Richardson, Shockley, and Ramenzoni (2011) suggest that interpersonal factors may have broad-based effects on postural activity. We interpret these effects as evidence of the robustness and psychological reality of interpersonal influences on the control of whole-body movement.

Characteristics of Task Targets

The standing body sway of individuals is influenced by properties of visual targets that are relevant to suprapostural tasks (e.g., Woollacott & Shumway-Cook, 2002). As one example, a person tends to sway more when viewing more distant targets and less when viewing nearby targets (Lee & Lishman, 1975; Mayo et al., 2011; Stoffregen et al., 1999). As another example, a person tends to sway more during fixation of stationary targets and less when using gaze shifts to look at moving targets (e.g., Stoffregen, Bardy, et al., 2007; Stoffregen et al., 2006). In the present study, we found that positional variability was influenced by the distance of visual targets (Experiment 1), and by their size (Experiment 3, Own Target Size). These effects confirm broadly reported effects of visual tasks on the postural activity of individuals (Woollacott & Shumway-Cook, 2002). However, the direction of these effects differed qualitatively from some previous studies of stance in individuals (e.g., Lee & Lishman, 1975; Mayo et al., 2011; Stoffregen et al., 1999). Rather than swaying more when viewing more distant targets, participants in Experiment 1 of the present study swayed less when viewing more distant targets than when viewing nearby targets. In
Experiment 3, rather than swaying more when viewing larger targets, participants swayed less when viewing larger targets than when viewing smaller targets. In the present experiments participants were always engaged in dyadic interactions compared with the studies reviewed by Woollacott and Shumway-Cook in which participants were never engaged in dyadic interactions. Thus, the unusual effects, in the present study, of target distance and size on the sway of individuals may reflect differences in the organization of postural activity between individual and dyadic situations.

In each experiment we found that parameters of visual targets (their distance or size) influenced interpersonal postural coordination as indexed by CRQ. These effects echo similar effects from Ramenzoni et al. (2011) in the context of visual-manual tasks. Ramenzoni et al. found that interpersonal postural coordination (as indexed by CRQ) was influenced by variations in foot placement (tandem vs. side-by-side), which are known to influence the standing sway of individuals (e.g., Day, Steiger, Thompson, & Marsen, 1993). In individuals, postural activity also is influenced by the rigidity of the support surface (e.g., Smart, Mobley, Otten, Smith, & Amin, 2004). Stoffregen, Giveans, et al. (2009) found that interpersonal postural coordination was influenced by speaking partner when standing on a rigid floor but not when standing on a nonrigid floor. One implication of these effects is that CRQ measures are sensitive to a variety of influences of task constraints on interpersonal postural coordination. More broadly, these effects suggest that interpersonal postural coordination may be routinely influenced by parameters of tasks that typically are not thought of as being related to the interpersonal interaction as such.

Competition or Integration?

Our experimental design makes it possible, in principle, to interpret interpersonal task effects within the larger literature relating postural control to parameters of suprapostural tasks. Conversation can be understood as a suprapostural task in the sense that the performance criteria for conversation (e.g., linguistic comprehension, social interaction) differ qualitatively from the performance criteria for postural control (e.g., maintaining the body’s center of mass over the base of support). As noted in the introduction, visual suprapostural tasks often influence concurrent postural activity. Research has also shown that postural activity can be influenced by auditory suprapostural tasks, such as auditory reaction time for detection or classification (Woollacott & Shumway-Cook, 2002). A widely held view of such interactions is that they are competitive, that is, that postural control competes with other simultaneous activities for a limited pool of central processing resources (e.g., Woollacott & Shumway-Cook, 2002).

In each of our experiments, postural activity was simultaneously influenced by parameters of the visual targets (i.e., their distance and size) and by parameters
of the conversation task (i.e., speaking partner and the size of the partner’s visual target). We found no evidence that one type of factor suppressed or eliminated the other. Similar effects have been reported by Ramenzoni et al. (2011), who covaried the difficulty of interpersonal manual tasks and the configuration of the body in stance and found that each of these factors simultaneously influenced the control of standing body sway. The results of both studies are compatible with the hypothesis that postural activity was organized (in part) so as to facilitate performance of the interpersonal tasks.

A direct test of the hypothesis that postural activity is influenced by dyadic conversation would require a comparison of sway when participants were engaged in conversation with sway when they were not. We are not aware of any studies that have included this comparison; accordingly, this would be an appropriate focus for future research.

The simultaneous tuning, in the present experiments, of postural activity relative to parameters of visual targets and parameters of interpersonal interaction resembles (in qualitative terms) effects observed among individuals on ships at sea. On a ship at sea, Chen and Stoffregen (2012) asked experienced mariners to perform a manual aiming task in which they kept the beam of a handheld laser on visual targets. Chen and Stoffregen varied parameters of the aiming task that influence body sway in individuals on land (Balasubramaniam, Riley, & Turvey, 2000), including the size of the aiming targets and their location relative to the body. Simultaneously, they varied the orientation of the body relative to the long axis of the ship. Results revealed that movement of the head and torso were simultaneously influenced by target size, target location, and body orientation. Thus, standing posture was simultaneously controlled relative to at least three separate external parameters. Work at sea often is collaborative (e.g., Hutchins, 1999), involving conversations in the context of joint visual attention. It would be interesting, from both theoretical and applied perspectives, to examine the possibility of interpersonal postural coordination related to joint visual attention in the context of ship motion.

Contrasting Dynamics of Tasks and Dyads

The amplitude of gaze shifts is a continuous variable. However, gradual changes in target size will tend to yield a discontinuous change in the behavior of individuals, a phase transition from gaze shifts that are accomplished solely through eye movements and gaze shifts that are accomplished through integrated movements of the eyes and head. It may be that interpersonal postural coordination is related to the head rotation component of gaze shifts (defined relative to the body), to the eye rotation component (defined relative to the head), or only to the resultant shifts in gaze (where the latter is defined relative to the environment). In the
picture puzzle task used by Shockley et al. (2003) and in the present experiments individual gaze shifts are highly variable due to the fact that areas of interest are distributed across each picture. Thus, on the basis of existing research we do not know whether interpersonal postural coordination was influenced by head movement, by eye rotation, or by resulting gaze shifts. In future research, it would be interesting to use as visual targets (for cooperative conversation) dynamic displays in which the magnitude of horizontal gaze shifts could be varied (within a trial) by the experimenter. One option would be to set a fixed magnitude for one member (greater or less than 15°), while continuously varying (increase or decrease) magnitude for the other or perhaps using amplitude steps (cf. frequency steps; Bardy, Oullier, Bootsma, & Stoffregen, 2002). Would there be a change in interpersonal postural coordination at the shift toward or away from same-magnitude (across the two members) gaze shifts? Another option would be to vary continuously (or in steps) displays for both members, either the same way (e.g., both increasing) or contrasting (one increasing the other decreasing).

Body Segments

In different experiments, we found effects of social variables (task partner, partner target size) on the head and the waist. As noted earlier, previous studies have found effects of dyadic conversation on movement of the waist but not the head (Shockley et al., 2003; Stoffregen, Giveans, et al., 2009). Thus, ours is the first study of standing posture to identify effects of conversational partner on movement of the head. The observed variation in the locus of these effects across studies suggests that the overall postural organization is very flexible, that different body segments are controlled relative to different referents (e.g., task goals) on a task-specific or even a situation-specific basis. In other words, different patterns of movement can be assembled to achieve the same outcome under different task constraints (Shockley et al., 2009). This may reflect a functional organization of postural control that is defined across members of an interacting pair (e.g., Riley et al., 2011).

Functional Interpersonal Coupling

Why does spontaneous interpersonal postural coupling occur? Shockley et al. (2007) offered an explanation of this effect in terms of articulatory constraints involved in speech. In individuals, speaking is coordinated with breathing: Speech sounds are produced as we exhale and speech pauses as we inhale. Dyadic conversation is characterized by turn taking such that individual coordination of speaking and breathing is likely to result in interpersonal coordination of...
breathing. In breathing, the chest expands and contracts, producing a cyclical oscillation of the body’s overall center of mass that, in turn, leads to subtle fluctuations in body posture. In this way, interpersonal coordination of postural activity might exist as a consequence of the mechanics of speech. This argument implies that coordination of interpersonal postural activity is an effect or outcome of coordinated dyadic conversation. M. J. Richardson, Marsh, and Schmidt (2005) offered a similar interpretation of the interpersonal postural coordination reported by Shockley et al. (2003). However, speech coordination may not be the sole source of the effects observed by Shockley et al. (2007) and Shockley et al. (2003). For example, Shockley et al. (2007) only observed greater coordination with more similar speech when the two participants were copresent. When virtual pairs were compared—participants who articulated the same word sequences as one another but who did so at different times as one another—they did not show this relationship. In the present study, in addition to evaluating whether postural coordination may result from dyadic interaction, we also evaluated whether postural coordination may occur in the service of interpersonal tasks. We did this by evaluating interpersonal postural coordination in the context of variations in task parameters that are related to postural control in individuals. Our results are consistent with the hypothesis that adjustments to standing body sway supported the performance of both visual and interpersonal aspects of the picture puzzle task.

We studied interpersonal postural coordination in the context of conversations about visual targets, that is, participants talked about things that they were looking at. In individuals, postural sway is influenced by variations in visual tasks but also by variations in manual tasks, such as precision touching (Riley, Stoffregen, Grocki, & Turvey, 1999). Accordingly, it would be interesting to investigate the degree of interpersonal postural coupling that might occur in the context of conversations about nonvisual targets.

CONCLUSION

We covaried parameters of conversational tasks (speaking partner and the size of the partner’s visual target) and parameters of visual targets (distance and size). Our manipulations exerted simultaneous influence on the coupling of postural activity between members of dyads. In most cases these manipulations also (and independently) influenced the dynamics of individuals’ postural activity. The results extend the range of parameters that are known to influence interpersonal postural coordination. The results also suggest that it may be useful, both theoretically and empirically, to interpret the effects of conversation on postural activity within the broader context of relations between postural control and the performance of suprapostural tasks.
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REFERENCES


