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NATURAL PRIORITIZATION TENDENCIES DURING TEXTING WHILE WALKING

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INTRODUCTION

Dual tasking (DT), or completing more than one task concurrently, has become a common practice.[1] This practice requires the allocation of one's limited attentional resources to different tasks in a proportion that allows for the safe execution and completion of both tasks.[1] With nearly 70% of the adult and teen population owning a cell phone,[2] it is unsurprising that cell phone-based DTs have become an everyday occurrence in the lives of many.

However, this relatively new practice has introduced novel concerns regarding health and safety.[3–6] Observational research revealed that nearly 30% of the pedestrians use their mobile devices while crossing busy intersections, with 7% actively texting while crossing.[3] Using the cell phone while walking, especially when external attentional demands were high, was found to be associated with the exhibition of riskier street-crossing behaviors, a decrease in awareness of external surroundings, and a deviation from a

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straight line of progression, all of which jeopardize pedestrian safety.[4,5] From 2004 to 2010, the number of pedestrian injuries related to cell phone usage increased by 170%, making evident the risks that cell phone-based DTs pose to the pedestrian population.[6]

Though these findings have made it clear that DT walking is detrimental to pedestrian safety, this topic still warrants greater investigation, as task prioritization — an uneven distribution of attentional resources favoring the successful execution of one task over the other — tendencies are not yet fully understood. When completing DT activities, individuals tend to use the core motivation of minimizing pain and maximizing pleasure, a motivation that should ideally lead to the adoption of a "posture first" strategy.[7] This strategy would lead one to focus preferentially on walking instead of cell phone use, thus allowing for the successful avoidance of hazards and prevention of falling. However, it is not uncommon for people to adopt a "posture-second" strategy while under a DT condition, focusing preferentially on the completion of the cognitive task and compromising their ability to walk through the environment safely.[7]

Previous research on task prioritization has been done in various populations. Studies have revealed that patients with neurological pathologies consistently adopt a "posture second" strategy, allowing their walking performance to decrease to a greater extent than their secondary task performance when completing DTs due to a faulty estimation of hazards and a miscalculation of self-limitations.[7–9] The elderly have been found to consistently adopt a "posture first" strategy, allowing for a greater decrease in secondary task performance than walking performance in order to navigate safely and prevent falls.[10] While the strategies adopted by these specialized populations are consistent, research on the young, healthy population's task prioritization strategies has provided conflicting evidence, with some studies suggesting a "posture first" strategy and others refuting it.[7,11,12]

Therefore, this study was designed to determine the natural prioritization tendencies of the healthy, college-aged population during cell phone-based DT walking. It was hypothesized that the No Priority condition would be more similar to the Texting priority condition, suggesting that subjects naturally tend to prioritize the secondary task over walking.

METHODS

Participants: Fourteen college-aged subjects (7 m/7F) were recruited from the university and surrounding community (Table 1). This study was developed as a screening study and as such an *a priori* power analysis was not conducted. A *post-hoc* power analysis revealed power between variables to range from 1.00 down to 0.277. While *post-hoc* power analyses might be flawed,[13] all comparisons that were shown to have a statistically significant difference had a power higher than 0.937. Additionally, all statistically significant changes represented a 6% or larger biological change in the recorded variable. Participants were excluded if they had self-reported gait pathologies, musculotendinous injuries, and/or cognitive deficiencies that would interfere with their ability to complete the required tasks. Participants were required to own a mobile phone with a touch screen, QWERTY keyboard, and the capability to turn the autocorrect function off.

Table 1 Demographic Characteristics, Average (SD).

Age (years)	19.64 (1.39)
Height (cm)	171.18 (8.34)
Weight (kg)	68.58 (10.23)
Sex	7 Female, 7 Male

All subjects were right lower limb dominant, as they preferred to kick a ball with their right foot and stepped out first with their right limb when initiating gait. Eligible subjects provided informed consent as approved by the University of Scranton's Institutional Review Board.

Instrumentation: Data collection was completed in the Human Motion and Ergonomics Laboratory at the University of Scranton. A twelve-camera kestrel three-dimensional motion-capture system (Motion Analysis, San Rosa, CA USA) recorded kinematic data at 120 Hz. Twenty-nine (29) markers were applied to the subject according to a modified Helen Hayes marker set.[14] Cortex® and KinRT® software, a built-in add-on by Motion Analysis Corp, calculated joint kinematics. The Motion Analysis Crop add-on is a build-in function into the motion analysis motion capture software Cortex. It follows Kadaba[10] rigid body principles and streamlines the inverse dynamics process.

Experimental procedure: Subjects wore tight spandex clothing and were barefoot for the duration of the data collection session. Subjects completed three different texting while walking conditions. For each trial, the researcher sent a short passage, via text, written at a 3rd-grade reading level to the subject. Subjects would not look at the passage right away. The researchers would instruct the subjects to start walking, then the subjects could look at the text. The subject was then asked to type a copy of that passage without using the backspace key to correct mistakes while walking. The autocorrect function was required to be turned off. After each trial, the subject sent the portion of the passage they completed to the researcher, and that message was later used to calculate texting accuracy and speed.

Subjects completed three different prioritization conditions: No Priority, Texting Priority, and Walking Priority (Table 2). Subjects always completed the No Priority condition first, where

Table 2 **Texting Passages.**

NO PRIORITY
(1) I have always wanted to fly. When I was just five years old, I would watch planes on television.
(2) I keep learning more about plants and the animals that depend on them.
(3) My teacher asked me to write a letter to the mayor asking for a change.
(4) It was Friday. The football game was Saturday and we were very excited.
(5) My family has lived in this community for many years. We still live in the same house
TEXTING PRIORITY
(1) The next morning, he left early to get to the game. When we got there, it was about to start.
(2) There is a store right down the street. The store owner knows that there are many customers.
(3) Most nights it is not difficult to do my job. But when we have problem, we have to get it solved.
(4) There were animals on the farm. They lived there happily. The farm family took care of them.
(5) I promised I would help pick the lemons before I went to school. I got up early.
WALKING PRIORITY
(1) The lemons grow all year. Every day, there are some to pick.
(2) My mother says our kitchen has foods from many places. She likes to drink tea from China.
(3) It was early spring and the settler family had a hard time all winter.
(4) The cows and horses have lots of grass to eat in the prairie. It makes a great pasture.
(5) The wheat plants had many more seeds. Those can be planted or used to make food.

they were asked to "walk while texting" and were given no further instruction. For the other two conditions, the researcher provided the subject with specific instructions as to what aspect of the DT activity they were to focus upon. Subjects were instructed to "focus on texting as accurately as possible" in the Texting Priority condition and to "focus on walking in as straight a line as possible with as normal a pattern as possible" for the Walking Priority condition. The order of the two explicitly instructed prioritization conditions was counterbalanced. Five (5) trials were completed for each of the three (3) prioritization conditions. Unrelated passages approximately 100 characters long were presented for each trial. The same passage was sent for the same condition for every subject. As none of the participants were able to complete the entire message, subjects actively typed for the entire duration of the trial. Each trial was completed at a self-selected pace across approximately 10 meters of level ground.

Outcome measures: Walking performance outcome variables included maximum peak joint angles in the sagittal plane for each lower extremity joint (ankle, knee, and hip), gait velocity, and stride length. At the ankle, peak plantarflexion in terminal stance and peak dorsiflexion at initial contact were used. At the knee, peak flexion in midswing and at initial contact were used. At the hip, peak extension in terminal stance and peak flexion at initial contact were used. Gait velocity was calculated by dividing the distance that the center of mass (COM) moved by the time of the trial. Stride length was defined as the distance from heel strike to the next ipsilateral heel strike.

The outcome variables regarding texting performance included texting accuracy and speed. Accuracy was represented by percent error, and was calculated as the number of characters that were incorrectly typed divided by the total number of characters typed (including spaces) over the course of the trial. The texting speed was calculated as the number of characters (including spaces) typed divided by the total time of the trial, and then converted into characters per second.[12]

Statistical analysis: All analyses were conducted as a repeated-measures ANOVA with texting condition as the within-subject factor. The Greenhouse–Geisser correction was used to determine the significance of the main effects. The Bonferroni adjustment for multiple comparisons was used to determine statistical significance regarding the pairwise comparisons between texting conditions. All outcome variables were tested for normality and were determined to be distributed normally according to the Shapiro–Wilk test, as the significance value was greater than 0.05. The alpha level was set to $p < 0.05$. Statistical analyses were completed in SPSS 23.

RESULTS

Though many of the outcome variables did not reveal statistically significant differences between the prioritization conditions, data suggest that the No Priority condition is more similar to the Walking Priority condition than the Texting Priority condition (Table 3, Figs. 1–3).

There was a significant main effect of prioritization condition on peak ankle plantarflexion in terminal stance ($F(2, 26) = 5.024$, $p = 0.028$; Table 3; Fig. 1). Peak plantarflexion in the Walking priority condition ($23.83 \pm 4.94°$) was significantly greater than the Texting Priority condition ($20.07 \pm 6.36°$; $p = 0.002$; Table 3; Fig. 1). Though the plantarflexion angle in the No Priority condition ($19.83 \pm 6.75°$) was less than both of the other conditions, there was no statistically significant difference, Table 3; Fig. 1.

Table 3 Comparisons of Measures of Gait and Texting Performance by Prioritization Condition, Averages (SD).

	No Priority	Texting Priority	Walking Priority	*p*-value*	Figure**
Gait					
Ankle plantarflexion (°)	19.83(6.75)[a,b]	20.07(6.36)[a]	23.83(4.94)[b]	0.028	Figure 1
Ankle dorsiflexion (°)	9.42(4.46)	10.16(4.23)	12.33(9.62)	0.864	Figure 1
Knee flexion (°)	60.83(4.67)	59.82(4.17)	61.36(4.49)	0.019	Figure 1
Knee flexion@HS (°)***	−2.36(5.06)	−2.16(5.15)	−2.50(5.04)	0.439	Figure 1
Hip flexion (°)	26.99(5.77)[a,b]	26.74(5.16)[a]	28.33(4.75)[b]	0.007	Figure 1
Hip extension (°)	10.36(4.28)	9.66(3.99)	10.49(3.73)	0.238	Figure 1
Velocity (m/s)	1.04(0.09)[a]	0.91(0.14)[b]	1.09(0.14)[a]	0.001	Figure 2
Stride length (m)	1.09(0.08)[a]	1.04(0.11)[b]	1.13(0.11)[a]	0.001	Figure 2
Texting					
Percent error (%)	4.0(2.0)[a,b]	2.0(1.0)[a]	5.0(3.0)[b]	0.004	Figure 3
Speed (characters/s)	6.99(1.92)[a]	5.81(1.57)[b]	5.77(1.40)[b]	0.000	Figure 3

*The *p*-value indicates the significance of the main effect of each outcome measure. The superscripts indicate significant differences between conditions (priority). Conditions with the same superscript letter *are not significantly different* from each other. Conditions with different superscript letters *are significantly different* from each other.

** The corresponding figure for each outcome measure's between condition (priority) comparisons is referenced here.

*** The knee never reached full extension. The negative values indicate the minimal degrees of flexion reached. HS = heel strike.

There was no significant main effect of prioritization on peak ankle dorsiflexion angle at initial contact ($F(2, 26) = 0.864$, $p = 0.372$; Table 3, Fig. 1).

There was a significant main effect of prioritization condition on peak knee flexion during midswing ($F(2, 26) = 11.139$, $p = 0.019$; Table 3, Fig. 1). However, there were no significant differences between conditions in the pairwise comparisons.

There was no significant main effect of prioritization condition on peak knee flexion at initial contact ($F(2, 26) = 0.803$, $p = 0.439$; Table 3, Fig. 1).

There was a significant main effect of prioritization condition on peak hip flexion at initial contact ($F(2, 26) = 12.000$, $p = 0.025$; Table 3; Fig. 1). Peak hip flexion was significantly greater in the Walking Priority condition ($28.33 \pm 4.75°$) than the Texting Priority condition ($26.74 \pm 5.16°$; $p = 0.017$; Table 3; Figure 1). Though the magnitude of peak hip flexion in the No Priority condition ($26.99 \pm 5.77°$; Table 3; Fig. 1) fell between the magnitudes of peak hip flexion in the Texting Priority and Walking Priority conditions, it was not significantly different from either condition.

There was no significant main effect of prioritization on peak hip extension at terminal stance ($F(2, 26) = 1.538$, $p = 0.238$; Table 3, Fig. 1).

There was a significant main effect of prioritization condition on gait velocity ($F(2, 26) = 12.000$, $p = 0.001$; Table 3; Fig. 2). Gait velocity in the Texting Priority condition (0.91 ± 0.14 m/s) was significantly less than the Walking Priority condition (1.09 ± 0.14 m/s; $p = 0.006$; Table 3; Fig. 2). The magnitude of the gait velocity in the No Priority condition (1.04 ± 0.09 m/s) fell between those of the Texting Priority and Walking Priority conditions, but it was only significantly different from the Texting Priority condition

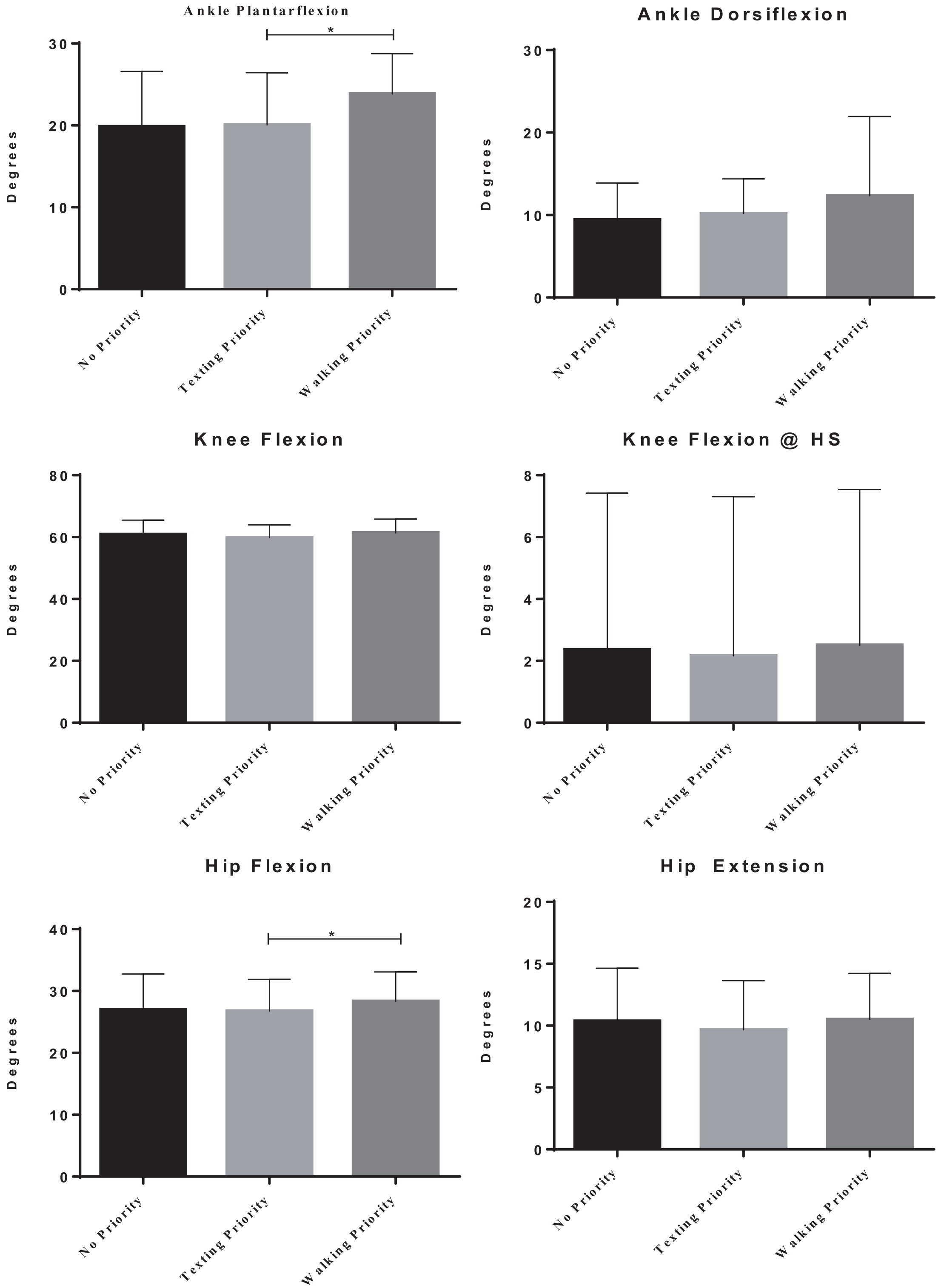

Fig. 1 A comparison of the average peak lower extremity joint angles in the sagittal plane of motion by prioritization condition with SD error bars. In this figure, ■ is the No Priority condition, ■ is the Texting Priority condition, and ■ is the Walking Priority condition. * indicates a significant difference between conditions.

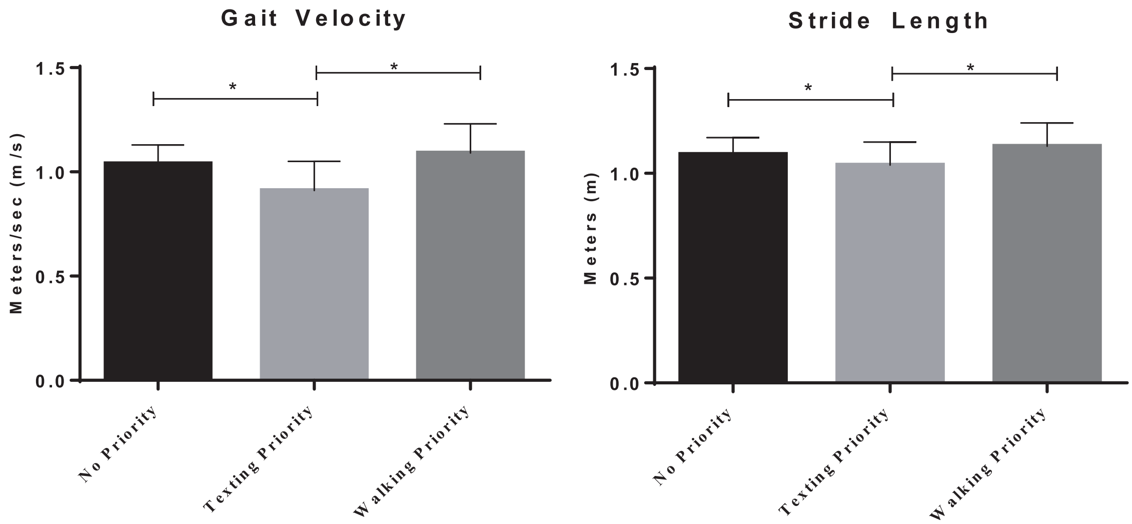

Fig. 2 A comparison of the average gait velocity and stride length by prioritization condition with SD error bars. In this figure, ■ is the No Priority condition, ■ is the Texting Priority condition, and ■ is the Walking Priority condition. * indicates a significant difference between conditions.

($p = 0.002$; Table 3; Fig. 2). Similar to the results regarding gait velocity, there was a significant main effect of prioritization condition on stride length ($F(2, 26) = 11.200$; $p = 0.001$), were stride length in the Texting Priority condition (1.04 ± 0.11 m) was significantly less than that in the Walking Priority condition (1.13 ± 0.11 m; $p = 0.005$; Table 3; Fig. 2). While the magnitude of stride length in the No Priority condition (1.09 ± 0.08 m) did fall between the Texting and Walking Priority conditions, it was only significantly greater than the Texting Priority condition ($p = 0.004$; Table 3; Fig. 2).

As for the difference in texting performance between prioritization conditions, there was a significant main effect of prioritization condition

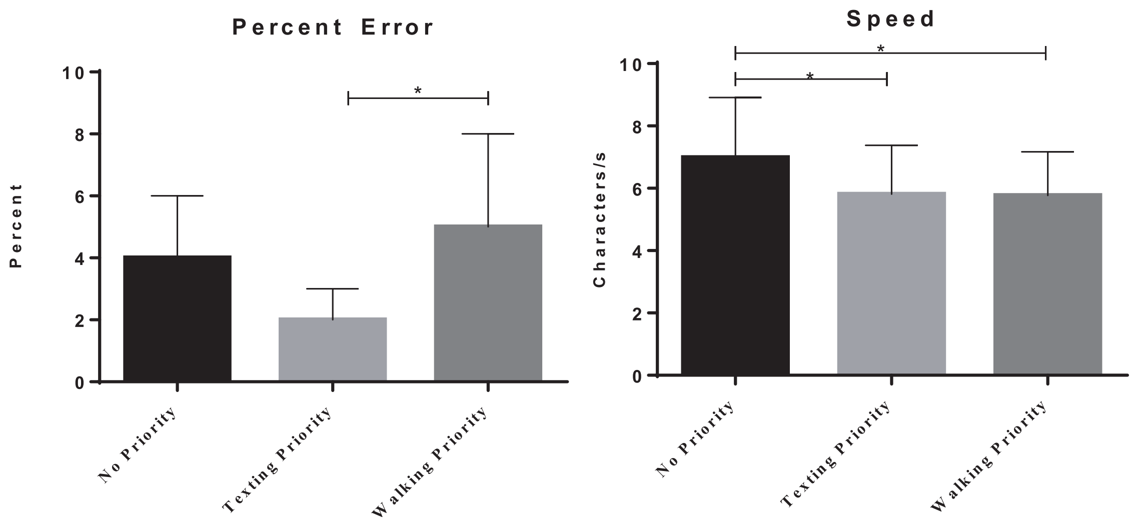

Fig. 3 A comparison of the average texting accuracy (in percent error) and speed between prioritization conditions with SD error bars. In this figure, ■ is the No Priority condition, ■ is the Texting Priority condition, and ■ is the Walking Priority condition. * indicates a significant difference between conditions.

on both percent error ($F(2,26) = 8.558$, $p = 0.004$) and texting speed ($F(2,26) = 11.135$; $p = 0.000$; Table 3; Fig. 3). Percent error was significantly greater in the Walking Priority condition ($5.0 \pm 3.0\%$) as compared to the Texting Priority condition ($2.0 \pm 1.0\%$; $p = 0.010$; Table 3, Fig. 3). The percent error in the No Priority condition was not significantly different from either of the other conditions. The texting speed in the No Priority condition (6.99 ± 1.92 characters/s) was significantly greater than both the Texting Priority (5.81 ± 1.57 characters/s; $p = 0.006$) and the Walking Priority (5.77 ± 1.40 characters/s; $p = 0.006$; Table 3; Fig. 3) conditions. There was no significant difference between the Texting Priority and Walking Priority conditions.

DISCUSSION

The results of this study suggest healthy, young adults are able to amenably shift their attention during texting while walking DT, as revealed by the differences in peak joint angles in the sagittal plane, stride length, and gait velocity between the Texting Priority and Walking Priority conditions. These data also suggest that the instructions provided regarding prioritization are directly related to the prioritization strategy adopted. Further, the results suggest that when not provided with specific instructions, this population preferentially adopts a "posture first" strategy, as indicated by the significant difference between the No Priority and Texting Priority conditions, but not between the No Priority and Walking Priority conditions for both stride length and gait velocity.

Effect sizes of each comparison were calculated to help explain some of the large standard deviations in the joint kinematics. Calculated effect sizes ranged from low (0.04) to large (1.28) and all statistically significant differences had effect sizes between 0.32 and 1.28. Of the six statistically significant pairs observed, five had an effect size larger than 0.50. This translates to biological differences ranging from 5.94% (effect size 0.32) to 19.78% (effect size 1.28). While an almost 20% change is a biologically relevant change 5.94% is as well, as small changes in gait can lead to increased fall risk.[15] Additionally, we used a repeated measure design which controlled for factors that cause variability between subjects. This can be outlined by knee flexion data (Fig. 1) which did not change between conditions, thereby advocating any observed changes (statistical and/or biological) are relevant to the condition by which they were observed.

The significant differences between the Walking Priority condition and the Texting Priority condition suggest that the healthy, young adult population is able to flexibly shift their attention during a DT activity. Attention, as a limited resource, must be divided between tasks when two or more tasks are completed concurrently.[1] The results of this study suggest that though the total attentional resources available may be set, the distribution of those resources to the various tasks can be altered depending on the instructions provided to the individual, as those instructions determine the individual's goal (e.g. better performance on the texting task or the walking task), Table 3, Figs. 1–3.

Previous research has supported this instruction-based shift in attention between tasks.[16,17] During the completion of the auditory analogue of the Stroop Test, instructed focus on the walking task was associated with a 0.16 s longer latency time of the Stroop test and a 0.08 m/s faster gait velocity than instructed focus on the cognitive task.[16] Additionally, both the older adult and younger adult populations were capable of shifting their attention during the completion of a verbal fluency task, wherein subjects were instructed to recall as many words as possible starting with a predefined letter. For both populations, gait speed was greater in the gait priority condition than in the cognitive priority condition, with a 0.12 m/s increase in the younger group and a 0.07 m/s increase in the older group.[17] In the current study, gait velocity in the Walking Priority condition was 0.18 m/s faster than in the Texting Priority condition. Therefore, both of these previous studies, as well as the current study, revealed a direct relationship between the subjects' performance of the tasks and the instructions provided, as the instructions prompted a shift of attentional resources preferentially toward one aspect of the DT and caused significant changes to the measured outcome variables (Table 3, Fig. 2).

The instruction-based alterations in the distribution of attentional resources between tasks could explain the differences in gait kinematics between the Walking Priority condition and the Texting Priority condition. In the current study, subjects were explicitly instructed to walk in "as straight a line as possible with as normal a pattern as possible" for the Walking Priority condition, whereas they were instructed to focus on "texting as accurately as possible" in the Texting Priority condition. The greater gait velocity (Table 3, Fig. 2) in the Walking Priority condition could indicate the subjects' attempt to accomplish the goals set by the specified instructions, as this would have elicited a stabilizing effect on gait by allowing the center of mass (COM) to "catch up" with the moving of the base of support (BOS).[18] Therefore, the increased gait velocity associated with the Walking Priority condition could reveal an attempt to maintain balance during gait, in order to maintain a straight line of progression.

The longer stride length (Table 3, Fig. 2) in the Walking Priority condition as compared to the Texting Priority condition could point to the subjects' attempt to maintain a "normal" gait pattern, as ST gait was shown to be characterized by a longer stride length than DT gait.[19] Further, the significant differences found in peak lower extremity joint angles could reveal the mechanisms by which the stride length was increased for the Walking Priority condition. Peak ankle plantarflexion (Table 3; Fig. 1) in pre-swing was significantly greater in the Walking Priority condition than in the Texting Priority condition. In pre-swing, plantar flexion due to the elastic recoil of the Achilles tendon generates a propulsive force in the trailing limb.[15] Thus, greater plantarflexion would indicate a greater propulsive force, which could correspond to an increased forward progression of the trailing limb through the swing phase of gait and a resultant increase in stride length. Hip flexion was greater (Table 3, Fig. 1) in the Walking Priority condition than in the Texting Priority condition as well. This larger degree of hip flexion indicated a greater range of motion (ROM) of the hip joint in the sagittal plane of motion. As gait can be described as the linear progression of the body due to the rotary motion of joints, this increase in rotary motion at the hip could correspond to an increased linear progression of the body through a greater stride length.[15]

The differences in texting accuracy between the two explicit prioritization conditions could represent the subject's attempt to accomplish the goal set by the instructions provided in the Texting Priority condition (Table 3, Fig. 3). Texting accuracy, as represented by percent error, was better (less) in the Texting Priority condition than in the Walking Priority condition. The instructions to text "as accurately as possible" may have prompted subjects to allocate greater attentional resources to the texting task and consequently enhance secondary task performance. This finding has previously been supported for the completion of the auditory analogue of the Stroop Test, as latency time decreased and response accuracy increased in response to instructed focus on the cognitive task.[16]

The differences between the Texting Priority and Walking Priority conditions suggest that subjects adopt different strategies of prioritization in response to the specific instructions provided. The Texting Priority condition was associated with more detrimental walking characteristics (slower gait velocity and shorter stride length suggesting a destabilized and abnormal gait pattern) and a greater performance of the texting task (greater texting accuracy), (Table 3, Fig. 2). This would suggest the adoption of a "posture second" prioritization strategy in response to instructed focus on the secondary task.[7] The opposite could be said of the Walking Priority condition, as the faster gait velocity and longer stride length indicated a more regular and stabilized gait pattern, and poorer texting accuracy indicated inferior cognitive task performance. These changes would suggest the adoption of the "posture first" strategy in response to instructed focus on the walking task.[7] Though one can infer the adoption of these strategies based on the comparisons between prioritization conditions, it would be beneficial to collect data on the single task (ST) performance of both walking and texting in order to quantify the absolute changes in performance from the undistracted ST conditions, and more concretely define the DT cost related to each condition.

Though explicit instructions impacted the prioritization strategy adopted by the subject and caused significant differences in task performance, individuals are not typically presented with instructions as they text while walking in the real world. Therefore, it is also necessary to determine the "default" strategy adopted by subjects when no specific instructions are provided. The values for gait velocity and stride length in the No Priority condition were significantly different from those of the Texting Priority condition, but not from those of the Walking Priority condition (Table 3, Fig. 2). Therefore, these walking characteristics suggest that the prioritization strategy selected in the No Priority condition is more similar to the "posture first" strategy observed in the Walking Priority condition than the "posture second" strategy in the Texting Priority condition. The subjects in this study naturally tended to prioritize walking over texting without explicit instruction to do so.

This preferential priority for walking over secondary task performance has been previously supported for the healthy, young population.[11] Young subjects were found to allow more hesitations (slowed performance) and stops (complete cessation of performance) in their secondary task performance than in their walking performance when they completed complex secondary tasks (e.g. carrying a full tray with slippery shoes on).[11] Thus, it was suggested that the young individuals focused on the execution of the postural task at the expense of the cognitive task.[11] Though the texting while walking task used in this study is fundamentally different from the tasks used in the .Bloem, Valkenburg[11] study both studies support the adoption of the "posture first" strategy by young individuals in response to complex DT combinations.

This natural adoption of the "posture first" strategy could alleviate some of the potential risks of texting while walking. The division of attention between a cell phone-based task and walking has been shown to be detrimental to pedestrian safety, as it was associated with a failure to exhibit safe street-crossing behaviors,[4] and was characterized by decreased situational awareness and a deviation from a straight line of progression.[5] The results of the current study, however, indicate that though these detriments to walking ability and resultant safety hazards exist, pedestrians may naturally adopt the "posture first" strategy in order to optimize postural control and avoid loss of balance. In other words, the natural selection of the "posture first" strategy could reveal an unconscious attempt to compensate for the division of attention and subsequent decrease in walking performance associated with dual tasking. Additionally, the results of the current study indicate that the adopted "posture first" strategy may alleviate some of the potential DT cost and resultant risk to pedestrian safety associated with texting while walking, as it would be even greater and more harmful if individuals were to preferentially prioritize texting.

Though the current study and the study by . Bloem, Valkenburg[11] suggests a preferential focus of walking over texting, other studies have revealed a natural prioritization of the secondary task over walking in the young adult population. Yogev-Seligmann, Rotem-Galili[17] found that younger adults preferentially focused on a verbal fluency task over a walking task when provided with no specific instructions. Another study on task prioritization during texting while walking revealed a tendency to prioritize texting over walking in the laboratory setting, and a relatively equal prioritization in the real world.

A model for the determination of task prioritization developed by Yogev-Seligmann, Hausdorff[7] could explain the conflicting results between the previous study using verbal fluency as the cognitive task and the current study using texting as the cognitive task. This model suggests that the interplay between hazard estimation and postural reserve determines whether an individual will place priority on the cognitive or motor task in a certain DT situation.[7] Hazard estimation is defined as one's self-awareness or ability to determine potential hazards and evaluate self-limitations that could prevent task completion, and postural reserve is defined as one's ability to respond effectively to a postural threat.[7]

Hazard estimation should have been comparable between the two studies, as both selected subjects free from cognitive deficiencies that would limit their ability to complete the DT and both completed their testing in laboratory settings relatively free from external hazards.[7] Postural reserve, however, should have been lower when the more complex secondary task was used, as this required the allocation of greater attentional resources for successful completion of the task and presented a more significant threat to balance.[7] Therefore, the more complex task (texting) presented a greater postural threat than the simpler task (verbal fluency), suggesting lower postural reserve for the subjects completing the texting task. Lower postural reserve would necessitate the shift of attention preferentially toward the walking task and away from the completion of the secondary task in order to maintain stability.[7] This could explain why the current study observed a "posture first" strategy, while the previous study did not.

The conflicting results between the Plummer, Apple[12] study and the current study could potentially be explained by differences in methodologies. Though both studies used texting as the secondary task, .Plummer, Apple[12] used the app "MySpeed" as the secondary task, while the current study required subjects to type a copy of a passage sent to them via text message. The MySpeed application ensured that subjects typed every character of the phrase provided, presented subjects with feedback indicating their errors, and forced them to correct the errors to complete the task.[12] Conversely, the subjects in the current study completed the task without using the backspace key and were provided with no immediate feedback on their performance. Though subjects were not provided with explicit instructions to focus on the texting task in either study, the immediate error feedback provided in the MySpeed app may have served as an implicit form of prioritization instructions, prompting the subjects to focus preferentially on the secondary task to ensure accuracy and avoid making mistakes that would require correction. This could explain why subjects in the previous study adopted a "posture second" strategy, even when the cognitive task should have provided a large enough postural threat to necessitate the shift of attention toward the walking task.

While the significant differences in outcome variables related to walking performance consistently supported a preferential focus on walking over texting, the differences related to texting performance revealed less consistent trends. Though texting percent error was greater in the Walking Priority condition than in the Texting Priority condition as previously explained, there was no significant difference between the No Priority condition and either of the explicitly instructed prioritization conditions (Table 3, Fig. 3). However, as the percent error of the No Priority condition was closer in value to that of the Walking Priority condition, it is possible that the sample size of the current study was too small to reveal the significant differences. If this trend were shown to be statistically significant with larger sample size, texting accuracy data would also suggest the adoption of the "posture first" strategy and be consistent with the trends for the walking performance outcome variables. It would be necessary to repeat the study with a greater sample size to determine whether or not this was the case.

The results for texting speed revealed that providing any instructions, whether they prompt texting or walking prioritization, leads to equivalent decreases in texting speed (Table 3, Fig. 3). The decrease in texting speed in the Walking Priority condition was consistent with the adoption of the "posture first" strategy observed, as the performance of the secondary task should have decreased to allow for enhanced walking performance.[7] The decreased texting speed for the Texting Priority condition, however, conflicts with expectations, as instructed focus on the secondary task should have corresponded to improved texting performance.[7] However, this observed decrease in speed is likely related to the instructions that were provided, as subjects were specifically asked to text "as accurately as possible" without any mention of speed. This may have prompted subjects to decrease texting speed in order to increase accuracy, as the two are typically inversely related. Therefore, it could be interesting to determine whether this trend would remain if subjects were instructed to focus on texting both as accurately and as quickly as possible.

There are several limitations to the current study. The small sample size and the homogeneity of the participants limited the generalizability of the results to other healthy, young adults. The laboratory setting also minimized the external distractions of the testing environment and removed the real threat to safety, which could mean that the changes observed may only be present in a low-distraction environment. Thus, it would be interesting to compare prioritization tendencies between a laboratory setting and a real-world setting in future studies. Future research could also investigate the prioritization strategies adopted by other populations, such as those with neurological pathologies, concussed individuals, and the elderly, or when subjects complete simpler cell phone-based DTs, such as reading or conversing.

CONCLUSION

This study supports that the healthy, young adult population is capable of flexibly shifting their attention in response to prioritization instructions. The prioritization strategy selected and the resultant changes to both walking and texting performances are directly related to the instructions provided. When given no instructions, the subjects tend to adopt the "posture first" strategy, which could suggest an unconscious method of compensation for the DT cost to performance that is associated with the division of attentional resources.

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