Do Athletes Excel at Everyday Tasks?

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ABSTRACT

CHADDOCK, L., M. B. NEIDER, M. W. VOSS, J. G. GASPAR, and A. F. KRAMER. Do Athletes Excel at Everyday Tasks? *Med. Sci. Sports Exerc.*, Vol. 43, No. 10, pp. 1920–1926, 2011. **Purpose**: Cognitive enhancements are associated with sport training. We extended the sport-cognition literature by using a realistic street crossing task to examine the multitasking and processing speed abilities of collegiate athletes and nonathletes. **Methods**: Pedestrians navigated trafficked roads by walking on a treadmill in a virtual world, a challenge that requires the quick and simultaneous processing of multiple streams of information. **Results**: Athletes had higher street crossing success rates than nonathletes, as reflected by fewer collisions with moving vehicles. Athletes also showed faster processing speed on a computer-based test of simple reaction time, and shorter reaction times were associated with higher street crossing success rates. **Conclusions**: The results suggest that participation in athletics relates to superior street crossing multitasking abilities and that athlete and nonathlete differences in processing speed may underlie this difference. We suggest that cognitive skills trained in sport may transfer to performance on everyday fast-paced multitasking abilities. **Key Words:** COGNITION, MULTITASKING, PROCESSING SPEED, SPORT, STREET CROSSING

In today's fast-paced multitasking world, individuals encounter daily situations that require efficient processing of environmental stimuli and attention to concurrent tasks. An ability to focus and divide attention, quickly integrate perceptions and memories, and sustain concentration while juggling multiple tasks is likely to improve performance on these everyday challenges. The present study used virtual reality to explore how participation in sport relates to these multitasking and speed of processing skills in a realistic virtual reality street crossing task.

Two broad approaches pervade the sport-cognition literature. Some investigations attempt to understand the interaction between an athlete and his or her environment of expertise by using tasks designed to simulate sport context (e.g., soccer players search for a soccer ball in a realistic visual search scene) (10,29). In general, this research suggests that expert athletes outperform nonexperts on sport-specific tests of attention, memory, speed, and perception (16,29,32). Although this expert performance approach is valuable for knowledge about expertise differences in sport-specific cognition, other researchers study whether sport expertise can transcend sport to influence fundamental cognitive and perceptual measures outside the sport-specific domain (22). Performance benefits for athletes relative to control participants have been observed in classical laboratory tasks in which the testing environment is stripped of sport context (i.e., the modality of the laboratory task differs from the modality of the sport-specific field task) (3,9,15,19–22, 24,25). A meta-analysis further examined the relationship between sports training and core cognitive processes and reported a small-to-medium effect such that athletes outperformed nonathletes on laboratory measures of cognition including processing speed and measures of attention (31).

Taken together, it is possible that both sport-specific and sport-general cognitive enhancements are associated with competitive sport training. The present study extended the sport-cognition literature by studying athlete and nonathlete performance on a realistic street crossing task that challenged fundamental cognitive and perceptual skills. A street intersection was modeled in an immersive virtual reality environment, and participants were asked to navigate trafficked roads under different distraction conditions by walking on a treadmill that was integrated with the virtual world (17). We specifically used the street crossing paradigm to study the multitasking and processing speed abilities of collegiate athletes and nonathletes.

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Multitasking can be defined as an ability to perform more than one task concurrently. To successfully cross a street, pedestrians have to simultaneously attend to the flow of traffic, monitor and remember vehicle distances and speeds, and execute a crossing. Moreover, street crossing requires the coordination and simultaneous performance of multiple subtasks, not simply the performance of subtasks that do not overlap in time. Thus, we examined multitasking in athletes and nonathletes by studying their ability to successfully cross a virtual street. Further, subjects were sometimes asked to cross the street while conversing on a cellular phone or listening to music, two realistic distracter tasks that might introduce additional multitask challenges.

Speed enhancements for athletes have been reported in a sport-specific context (16) as well as in aspects of fundamental cognition (1,3,9,19,31). It is probable that an ability to quickly and flexibly (20) perceive, process, and respond to incoming environmental stimuli plays a role in street crossing performance. Further, multitasking is said to relate to efficiency of information processing (7,23). Thus, we administered a laboratory-based cognitive test of simple reaction time (RT) to try to provide some specificity to the cognitive abilities associated with potential athlete and nonathlete performance differences on the realistic multitask paradigm. We hypothesized that Division I athletes would show superior performance on the street crossing task, which would relate to faster processing speed on the simple RT task.

METHODS

Participants. Thirty-six students were recruited from the University of Illinois at Urbana-Champaign, including 18 athletes (8 males, 10 females) and 18 nonathletes (5 males, 13 females). An athlete was operationally defined as an individual involved in the National Collegiate Athletic Association (NCAA) Division I athletics at the university. The athlete sample consisted of two baseball players, one cross-country runner, one gymnast, two soccer players, five swimmers, three tennis players, one track-and-field athlete, and three wrestlers. A nonathlete was operationally defined as a collegiate student who did not participate in any university-organized athletics. Table 1 provides a list of demographic and self-reported physical activity and sport information for most of the sample (six subjects (one athlete, five nonathletes) did not complete the physical activity questionnaire). No statistically significant differences in age, gender, height, weight, grade point average, or video game experience (all $P > 0.1$) existed between the athlete and nonathlete groups. Subjects provided written informed consent in accordance with the Institutional Review Board of the University of Illinois at Urbana-Champaign and were paid $8 per hour for their participation. The study complied with NCAA regulations (NCAA Bylaw 16.11.1.11.2 for Institution-Based Research Studies, adopted April 30, 2009) and was approved by the institutional review board.

TABLE 1. Participant demographic and self-reported physical activity and sport information (mean ± SD (n)).

Variable	Athletes	Nonathletes
Age (yr)	20.6 ± 1.1 (18)	21.5 ± 2.2 (18)
Strenuous activity (number of times per week)[a]*	7.2 ± 4.2 (17)	2.4 ± 1.7 (13)
Sport (h·wk^{-1})[b]*	11.7 ± 8.2 (17)	0.31 ± 0.75 (13)
Weight training (h·wk^{-1})[c]*	2.6 ± 1.5 (17)	0.96 ± 1.6 (13)
Sport in-season practice (h·wk^{-1})	20.0 ± 5.3 (18)	N/A
Sport out-of-season practice (h·wk^{-1})	14.0 ± 7.6 (18)	N/A

[a] "Considering a 7-d period (a week), how many times, on average, are you involved in 'strenuous exercise' (heart beats rapidly) (e.g., running, jogging, hockey, football, soccer, squash, basketball, cross-country skiing, judo, rollerblading, vigorous swimming, vigorous long-distance cycling) for >15 min during your 'leisure time?' 'Leisure time' is time away from school, classes, or employment."
[b] "How many hours per week are you involved in sport (i.e., game with scorekeeping)?"
[c] "How many hours per week do you weight train?"
* Significant difference between athlete and nonathlete groups at $P < 0.01$.

FIGURE 1—Photograph of the street crossing paradigm in the virtual reality environment.

Virtual reality street crossing paradigm. We used a street crossing paradigm from a study by Neider et al. (17). The task was administered in the Beckman Institute's virtual reality CAVE environment (http://www.isl.uiuc.edu/Labs/CAVE/CAVE.html), which allowed an immersive and interactive street crossing experience (27) (Fig. 1). Participants walked on a LifeGear Walkease nonmotorized manual treadmill (Taya Hsiang, Taiwan) that enabled them to move through the virtual world at their own walking speed. To create the virtual reality experience, participants wore a pair of wireless CrystalEyes liquid crystal shutter goggles (StereoGraphics, San Rafael, CA). The goggles rapidly alternated the viewing screen displays to each eye, resulting in the perception of depth.

The virtual reality environment was composed of three rear-projected vertical viewing screens (303 cm wide × 273 cm high) and a front-projected floor screen (303 × 303 cm). All screens had a resolution of 1024 × 768 pixels. Each participant was approximately 150 cm from each wall when standing on the treadmill, which created a viewing angle of approximately 91° × 85°. Environment presentation, motion simulation, and data collection were integrated via a custom-designed program written in-house by the Illinois Simulator Laboratory using C++ and Python. Images were projected to the viewing screens via a computer with an Intel Xeon Core 2 Quad CPU (Santa Clara, CA) and 8 GB of RAM running on 64-bit Windows Server 2003 SP2 (Microsoft,

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Redmond, WA). Graphics were handled by an NVIDIA Quadro Plex 1000 Model II (Santa Clara, CA). Head position and orientation were monitored through an Ascension Flock of Birds 6DOF electromagnetic tracker (Fifth Dimension Technologies, Irvine, CA). Head movements were quantified as movements of the head from 10° in one direction to at least 10° in the other direction. The viewpoint of the participant in the virtual world was updated on the basis of his or her head movements.

To provide real-time walking speed information to the virtual reality environment, eight magnets on the flywheel of the treadmill opened and closed a magnetic switch during pedestrian movement. The switch openings and closings were counted by a microcontroller (http://www.moderndevice.com) and communicated to a computer every 20 ms over a 57,600-baud serial connection. Note that a participant had to overcome some friction when initiating walking on the manual treadmill, but the friction was the same on every trial for every subject.

The task on each trial was to safely cross an unsigned intersection while avoiding traffic. Each participant began each trial in an alley between two buildings. He or she was instructed to walk forward until the street became visible and then to cross when he or she determined it was safe. The two-way street consisted of two lanes that totaled 8 m in width, and moving cars traveled at different speeds on the road. Car speed ranged from 65 to 90 $km{\cdot}h^{-1}$ (i.e., 40–55 mph), and the starting speed for each car was selected randomly on each trial. The speed of the individual cars never increased, but if two cars came within 15 m (i.e., 49 ft) of each other, the second car slowed to match the speed of the first car, and the second car maintained this slower speed for the remainder of the trial. Cars did not change speed to avoid subjects. The distance between cars at the start of each trial was also randomly selected, and the distance ranged from 45 to 90 m (i.e., 148–295 ft). Equivalent distributions of car speeds and distances between cars were administered to each subject across all trials.

Each participant was instructed to walk (not run) on the treadmill to cross both lanes of traffic without being hit by a vehicle. Simulated spoken feedback was given if a subject successfully crossed the street, and visual feedback was provided if a subject was hit by a car. If the participant did not complete the trial within a 30-s time limit (that began when the street became visible), the trial ended and an error was recorded. Note that if a participant entered the street, he or she either avoided cars to cross safely or was struck by a vehicle; there was no ''safe zone'' in which he or she could wait for cars to pass. In addition, only forward motion was possible on the treadmill (i.e., participants could not step backward to avoid cars).

A subject performed the street crossing task under three distraction conditions—no distraction, conversing on a cellular phone with a hands-free device, or listening to music through headphones on an iPod nano (Apple, Cupertino, CA). Conversations in the cell phone condition were conducted between the subject and a confederate, and the confederate was instructed to keep the conversation flowing. For the music listening condition, each participant selected from a variety of music playlists (e.g., pop, rhythm and blues, country, alternative, dance, etc.) and listened to music via headphones. The distraction conditions were blocked and counterbalanced across 96 experimental trials (two blocks of 16 trials for each distraction condition, six total blocks per subject). Block order was counterbalanced such that each block and distraction type was presented an equal number of times in each presentation position across all participants. Each subject also received 10 practice trials before the experiment to acclimate to the treadmill as well as to the virtual reality environment. The experiment lasted approximately 60 min.

Simple RT task. A laboratory-based simple RT task was administered to participants on a desktop computer. During the task, an asterisk appeared to either the left or the right of a central fixation cross, and participants were asked to maintain their gaze on the fixation cross and to respond as quickly as possible to the presence of the asterisk (at either location) by pressing the "Z" computer key with their right index finger. Only responses that occurred after the presentation of the asterisk ended the trial (i.e., responses that occurred before the asterisk appeared were not recorded). Forty-eight trials were administered, with varying interstimulus intervals (length of time a fixation cross was presented between asterisk presentations) of 150, 350, 550, and 750 ms, such that stimulus onset would not become predictable. Twelve trials of each of the four possible interstimulus intervals were randomly administered across the task, with an equivalent number of left and right stimulus positions for each interval. Participants also completed eight practice trials that consisted of two trials per interstimulus interval. Stimulus presentation, timing, and task performance measures were controlled by E-Prime software (Psychology Software Tools, Inc., Sharpsburg, PA). The simple RT task lasted approximately 6 minutes and was administered before the street crossing task.

RESULTS

The results are presented in four sections: 1) athlete and nonathlete differences in street crossing abilities, 2) athlete and nonathlete differences in simple RT performance, 3) the relationship between street crossing performance and simple RT performance, and 4) the relationship between group, street crossing performance, and simple RT performance.

Athletes, Nonathletes, and Street Crossing

All measures were entered into a repeated-measures ANOVA with distraction condition (no distraction, phone, music) as the within-subjects factor and group (athlete, nonathlete) as the between-subjects factor. The familywise α level was set at $P = 0.05$.

TABLE 2. Participant street crossing task performance (mean ± SD) as a function of athlete and nonathlete groups.

Variable	Athletes (n = 18)	Nonathletes (n = 18)
Success rate (%)—no distraction*	74.6 ± 13.0	56.1 ± 20.5
Success rate (%)—phone*	66.0 ± 19.8	50.3 ± 24.4
Success rate (%)—music*	75.5 ± 10.1	58.7 ± 19.7
Collision rate (%)—no distraction*	22.9 ± 12.2	38.5 ± 19.5
Collision rate (%)—phone*	25.0 ± 14.5	37.5 ± 20.3
Collision rate (%)—music*	22.4 ± 10.5	35.9 ± 18.0
Time-out rate (%)—no distraction	2.4 ± 2.9	5.4 ± 7.0
Time-out rate (%)—phone	9.0 ± 13.0	12.1 ± 16.6
Time-out rate (%)—music	2.1 ± 4.7	5.4 ± 10.0

* Significant difference between athlete and nonathlete groups at $P < 0.05$.

Crossing success rates. A repeated-measures ANOVA demonstrated a main effect of group ($F_{1,34}$ = 10.17, P = 0.003) and a main effect of distraction condition ($F_{2,68}$ = 6.21, P = 0.003) on street crossing success rates. Athletes (mean = 72.05%, SE = 3.77%) were more successful than nonathletes (mean = 55.04%, SE = 3.77%) at crossing the street across all distraction conditions (see Table 2 for mean success rates as a function of athletic status for each distraction condition). Further, in support of a study by Neider et al. (17), paired t-tests showed that all participants had significantly lower crossing success rates when conversing on a cellular phone (mean = 58.16%, SD = 23.23%) compared with both the undistracted (mean = 65.36%, SD = 19.34%) (t_{35} = 2.92, P = 0.006) and music (mean = 67.10%, SD = 17.62%) (t_{35} = 2.82, P = 0.008) conditions. Listening to music did not induce a performance cost relative to the no distraction condition (P > 0.4).

Crossing error rates.

Collision rate. A collision rate based on the percentage of subject–vehicle collisions was calculated for each participant in an attempt to better understand the crossing performance success rates. A repeated-measures ANOVA revealed a main effect of group ($F_{1,34}$ = 8.33, P = 0.007) such that nonathletes (mean = 37.34%, SE = 3.40%) were involved in significantly more collisions than athletes (mean = 23.44%, SE = 3.40%) (see Table 2 for mean collision rates as a function of athletic status for each distraction condition). The main effect of distraction condition and the group × distraction condition interaction did not reach significance (both P > 0.6).

Time-out rate. A time-out rate based on the percentage of trials in which a subject failed to reach the opposite side of the road in the 30-s time limit was also calculated for each participant. Time-out rates did not differ as a function of group ($F_{1,34}$ = 1.27, P = 0.268) (see Table 2 for mean athlete and nonathlete time-out rates for each distraction condition). Nevertheless, in further support of Neider et al.'s (17) results, a main effect of distraction condition ($F_{2,68}$ = 10.44, P < 0.001) was found such that participants were less likely to complete a crossing within the trial period (i.e., more time-outs) when conversing on a cell phone (mean = 10.59%, SD = 14.81%) than when undistracted (mean = 3.91%, SD = 5.51%) (t_{35} = 3.42, P = 0.002) or listening to music (mean = 3.73%, SD = 7.90%) (t_{35} = 3.35, P = 0.002). No difference in time-out rate between the undistracted and music conditions was found (P > 0.8).

Overall, the results indicate that athletes were more likely to successfully cross a street than nonathletes, as reflected by fewer collisions with vehicles. The following section explores specific behaviors during the virtual reality street crossing task (total trial duration, initiation and crossing duration, head turns, distance between subjects and vehicles) that may relate to increased success rates in individuals with competitive sports training.

Behaviors during successful trials of the street crossing task.

Total trial duration. The total time for athletes and nonathletes to complete a trial (i.e., time to walk from one gate at the start of the trial to another gate that ended the trial, including initiation and crossing duration, measured in seconds) was examined. No group differences were found, but there was a main effect of distraction condition ($F_{2,68}$ = 21.92, P < 0.001), with the shortest trial durations in the music condition (mean = 13.63 s, SD = 4.12 s) followed by the undistracted (mean = 14.49 s, SD = 4.40 s) and the phone conditions (mean = 16.12 s, SD = 4.42 s) (all t values > 2.8, P values < 0.005).

Crossing initiation behaviors. Next, three measures during the crossing initiation period (i.e., when a participant was standing on the sidewalk before entering the roadway) were compared in athletes and nonathletes. No group differences were found for mean initiation duration (the amount of time the subject waited on the sidewalk before initiating a crossing), number of head turns during initiation (while the subject was on the sidewalk, preparing to cross), or the distance between the participant and the nearest vehicle at the time of roadway entry (all P > 0.4). An omnibus main effect of distraction condition for the mean initiation duration was found ($F_{2,68}$ = 20.23, P < 0.001), and paired t-tests showed significant differences in initiation duration between the three distraction conditions, with the shortest duration for music (mean = 8.22 s, SD = 4.03 s) followed by the undistracted (mean = 9.04 s, SD = 3.98 s) and the phone conditions (mean = 10.37 s, SD = 4.4 s) (all t values > 3.00, P values < 0.004). The number of head turns and the distance to the nearest vehicle during the crossing initiation period did not differ as a function of distraction condition (both P values > 0.1).

Street crossing behaviors. Similar behavioral measures to those analyzed during street crossing initiation were also examined during crossing. No group differences were found in mean crossing duration (which only included time spent by participants in the roadway), number of head turns during crossing, and distance to the nearest vehicle at roadway exit (all P values > 0.1). A main effect of distraction condition on street crossing duration was found ($F_{2,68}$ = 4.96, P = 0.01) such that crossing durations during both the phone (mean = 3.48 s, SD = 0.47 s) and undistracted conditions (mean = 3.40 s, SD = 0.58 s) were significantly longer than those during the music condition (mean = 3.31 s, SD = 0.53 s) (all t values > 2.1, P values < 0.036). There was no main effect of distraction condition on the number of head turns during crossing or the distance to the nearest vehicle at roadway exit (both P values > 0.2).

Split-half analysis. Because the street crossing task was physically demanding, a split-half analysis was conducted to examine group differences in crossing success rates and trial durations for the first and second halves of the task (i.e., first 48 trials vs second 48 trials of the paradigm). This analysis helps to address the role of task fatigue, important because of likely differences in fitness levels between the athletes and nonathletes. Across all participants, there were no differences in crossing success rates between the first and second halves of the task for any distraction condition (paired t-tests, all P values > 0.18). Comparing the crossing success rates of each group separately also did not yield significant differences between the first and second halves of the task (all P values > 0.12). Along the same lines, no athlete and nonathlete differences in trial durations for each half of the task were found (all t values < 0.8, P values > 0.30).

Athletes, Nonathletes, and Simple RT Task Performance

Simple RT data of 15 athletes and 15 nonathletes were entered into the analysis (after six subjects were excluded because of failure to complete the cognitive testing session). A main effect of group was found such that athletes (mean = 237.26 ms, SE = 8.88 ms) showed shorter RT than nonathletes (mean = 272.28 ms, SE = 8.88 ms) across all interstimulus intervals ($F_{1,28}$ = 7.78, P = 0.009).

Street Crossing Performance and Simple RT Task Performance

Street crossing success rates across all distraction conditions were negatively correlated with simple RT task performance (averaged across all interstimulus intervals) ($r = -0.368$, P = 0.04).

Athletes, Nonathletes, Street Crossing Performance, and Simple RT Task Performance

To further examine the role of processing speed in the relationship between athletic status and street crossing performance, simple RT task performance (across all interstimulus intervals) was entered as a covariate in a univariate ANCOVA that examined the effect of group (athlete and nonathlete) on street crossing success rates (across all distraction conditions). No significant effect was found ($F_{1,27}$ = 1.95, P > 0.17), thereby supporting a role for processing speed in the link between sport participation and street crossing performance.

DISCUSSION

The present study is the first to investigate the association between sport expertise and everyday life skills using a realistic virtual reality street crossing paradigm. Compared with nonathletes, collegiate Division I athletes showed higher street crossing success rates, as reflected by fewer collisions with moving vehicles. Athletes also showed faster processing speed on a test of simple RT, and shorter RT on the cognitive paradigm were associated with higher street crossing success rates. Further, athlete and nonathlete group differences in street crossing rates were no longer significant when simple RT was added as a covariate. Together, the results extend athletic research to new cognitive territory by demonstrating a beneficial relationship between sport, a multitasking activity, and speed of information processing. The findings suggest that superior processing speed in athletes may be a factor contributing to better performance in a realistic multitask challenge.

Humans are limited in their capacity to rapidly and accurately perform concurrent tasks. Performance decrements and response slowing are found on both laboratory-based multitask paradigms (e.g., dual task, task switching) and real-world multitask challenges (e.g., conversing on a cellular phone while driving) (2,6,7,12,23,30). These multitasking costs are often attributed to a bottleneck that prevents response selection and decision-making processes from occurring simultaneously (23).

An ability to efficiently process information is said to improve multitasking performance (7,23,26). That is, if information passes through the bottleneck efficiently and quickly, more information can be processed in a shorter time frame and performance can be maximized. The current study indicates that athletes are faster than nonathletes in the coordination of a motor response and the processing of information, which may affect the capacity to process concurrent streams of information. The findings extend basic research by suggesting that participation in sport can positively influence speed of processing (as suggested by Mann et al. (16) and Voss et al. (31)) as well as multitasking abilities (8).

Although efficiency of information processing may be one mechanism underlying athlete and nonathlete differences in street crossing performance, additional research is needed to characterize other cognitive factors that play a role in the cognitively complex multitask paradigm that involves attention, speed, working memory, and inhibition. For example, athlete and nonathlete performance differences on a flanker task of selective attention and interference control (11) (a task unexplored in the sport-cognition literature but often used in fitness-cognition research (4,5,13)) or a task of visuospatial attentional orienting (1,3,9,18,19,21,22) may relate to differences in the ability to focus attention and inhibit distraction during traffic navigation. In addition, task performance on a visuospatial working memory task may predict one's ability to create precise representations of a street crossing environment (e.g., recollection of locations and speeds of moving traffic) that could relate to street crossing success rates.

Although speculative, a lack of group differences in physical measures of crossing speed and fatigue (i.e., total street crossing trial durations, behaviors while initiating a crossing, behaviors while crossing, and success rates during the first and second halves of the task) suggests that differences in cognitive abilities play a greater role in street crossing multitask performance differences than treadmill coordination and endurance. To gain insight into the role of fitness and athletics in multitasking, future research should include a high-fit age-matched group, especially given many reports that demonstrate enhanced brain structure and function with high levels of aerobic fitness (14).

It is interesting to note that although distraction, and in particular conversation on a hands-free cellular phone, disrupted street crossing performance, athletic ability was not beneficial for performance on the more challenging distraction task relative to the less demanding conditions (i.e., undistracted or listening to music). We hypothesize that athletes are not more competent than nonathletes in time sharing conversation with a complex psychomotor task like crossing a busy street because complex conversation does not frequently occur during athletic practice and performance.

Finally, whereas our study provides insight into the relationship between athletic participation and street crossing performance, the cross-sectional design does not allow causal or directional interpretations. We speculate that athletes are faster multitaskers than nonathletes, but it is also possible that successful virtual reality street crossers with fast processing speed are more likely to excel at sports. Future research will attempt to distinguish between these possibilities.

It should also be noted that we evaluated street crossing performance on a virtual roadway rather than at an actual street intersection to eliminate the dangers associated with challenging crossing situations and to provide experimental control. We designed our paradigm to replicate many of the important aspects of street crossing, while also permitting the objective measurement of street crossing behaviors in a safe situation and with sufficient levels of difficulty to ensure the power to detect group differences. Although it is possible that the performance rates on our challenging paradigm do not accurately reflect real-world street crossing, the high level of interaction and immersion, as reflected by participant movements controlling the virtual world and high-quality graphics, suggest that our paradigm does provide a valid and realistic approximation of what might be encountered in the real world (27). Nevertheless, additional research should attempt to further validate our paradigm as well as include measurements of "time to contact," which relates to a participant's judgment of whether a traffic gap is sufficient to safely cross a street on the basis of the nearest vehicle's speed and distance (28).

In summary, the present study extends the literature on the cognitive and perceptual skills of the expert athlete by studying athlete and nonathlete performance on a realistic street crossing multitasking and processing speed paradigm. To provide a sport-specific example, it is plausible that an elite soccer player not only shows an ability to multitask and process incoming information quickly on a fast-paced soccer field by running, kicking, attending to the clock, noting the present offensive and defensive formations, executing a play, and finding open players to whom to pass, but also shows these skills in the context of real-world tasks. Our results suggest that cognitive skills trained in sport may engender transfer to performance on everyday challenges.

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