Journal of Exercise Science & Fitness 21 (2023) 260–267

Contents lists available at ScienceDirect

Journal of Exercise Science & Fitness

journal homepage: www.elsevier.com/locate/jesf

Validity of the SKILLCOURT® technology for agility and cognitive performance assessment in healthy active adults

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A R T I C L E I N F O

Article history:
Received 31 October 2022
Received in revised form
21 April 2023
Accepted 26 April 2023
Available online 27 April 2023

Keywords:
Testing
Training
Sport
Motor-cognitive
Athlete

A B S T R A C T

Background/Objectives: Agility and cognitive abilities are typically assessed separately by different motor and cognitive tests. While many agility tests lack a reactive decision-making component, cognitive assessments are still mainly based on computer-based or paper-pencil tests with low ecological validity. This study is the first to validate the novel SKILLCOURT technology as an integrated assessment tool for agility and cognitive-motor performance.
Methods: Thirty-two healthy adults performed agility (Star Run), reactive agility (Random Star Run) and cognitive-motor (executive function test, 1-back decision making) performance assessments on the SKILLCOURT. Cognitive-motor tests included lower limb responses in a standing position to increase the ecological validity when compared to computer-based tests. Test results were compared to established motor and agility tests (countermovement jump, 10 m linear sprint, T-agility tests) as well as computer-based cognitive assessments (choice-reaction, Go-NoGo, task switching, memory span). Correlation and multiple regression analyses quantified the relation between SKILLCOURT performance and motor and cognitive outcomes.
Results: Star Run and Random Star Run tests were best predicted by linear sprint ($r = 0.68$, $p < 0.001$) and T-agility performance ($r = 0.77$, $p < 0.001$), respectively. The executive function test performance was well explained by computer-based assessments on choice reaction speed and cognitive flexibility ($r = 0.64$, $p < 0.001$). The 1-back test on the SKILLCOURT revealed moderate but significant correlations with the computer-based assessments ($r = 0.47$, $p = 0.007$).
Conclusion: The results support the validity of the SKILLCOURT technology for agility and cognitive assessments in more ecologically valid cognitive-motor tasks. This technology provides a promising alternative to existing performance assessment tools.

1. Introduction

Explosive actions including short sprints and change of direction movements as well as executive cognitive abilities (i.e., working memory, inhibition, cognitive flexibility) have repeatedly been shown performance determining factors in ball, team and racquet sports such as football, basketball or handball and a prerequisite to reach a high performance level.[1–5] Consequently, agility and cognition testing is suggested as an essential part of performance diagnostics and talent scouting.[6,7] Squat and countermovement jumps, linear sprints and the T-agility test are well established to assess domain-general explosiveness, agility and change of direction performance with high validity and reliability.[8,9] In the cognitive domain, standardized computer-based tests for executive functions are frequently used due to their high

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https://doi.org/10.1016/j.jesf.2023.04.003

validity[10] and have already been assessed in teams sports populations such as volleyball[6] and football players.[4] These tests determine behavioral parameters such as reaction time and error scores in working memory (e.g. n-back tests), decision making (e.g. choice reaction tasts) or cognitive flexibility (e.g. switch test), are performed in front of a computer screen and typically require a button press as motor response.

Although the abovementioned agility and cognition tests are validated and well-established assessment tools, they are limited in their ecological validity for sport-specific environments. The T-agility test includes only 90° and 180° turns while many team sports such as basketball[11] or football involve change of direction movements with angles between 0 and 15° or 105–135°.[12] Furthermore, most agility tests lack a reactive component requiring the athletes to adapt their movements to an external stimulus which is considered a key demand in team sports.[13,14] A major limitation of computer-based cognitive assessments is the low correspondence to natural human behavior.[15] This especially applies to the field of sport where Araujo et al.[16,17] emphasized the importance of ecological cognition considering the interaction between cognition and action. Computer-based cognitive tests are restricted in their ecological cognition since especially the interaction between cognition and lower body movement is considered an essential component in ball and team sports.[18] This also manifests in the relatively low correlation between cognitive and motor-cognitive function ($r = 0.31–0.54$), suggesting that computer-based cognitive tests may not predict performance in sport-specific situations.[18]

The SKILLCOURT (movement concepts GmbH, Schweinfurt, Germany) is a novel technology aiming to address the abovementioned limitations of cognitive and agility assessments. It contains a 65” monitor in front of a 500 × 500 cm court including 8 outer (square fields) and 5 inner (circular fields) target fields where the players’ position is continuously scanned by a Lidar (light imaging, detection and ranging) system (see Fig. 1). The SKILLCOURT system is comparable to the SpeedCourt (GlobalSpeed GmbH, Hembach, Germany) that uses contact plates and that has previously been validated for agility testing by Düking et al.[19] However, while the SpeedCourt focusses on change of direction and reactive agility, the SKILLCOURT provides additional assessments on cognitive abilities (e.g., reaction speed, working memory, response inhibition, cognitive flexibility). Participants perform foot movements and runs in response to versatile cognitive tasks displayed on the screen. This setup allows involving larger scale motor activities which is suggested to be more closely related to sports and daily life activities compared to conventional computer-based or paper-pencil tests.[20] As a result, the system incorporates the three central demands of perceptual-cognitive function testing defined by Wilke et al.[21]: (A) quick lower limb movements, (B) visual/somatosensory input processing and (C) relevant cognitive ability testing.

The SKILLCOURT technology provides a promising diagnostic tool for sports as it allows incorporating cognitive assessments into lower extremity motor and agility tasks which corresponds to the motor-cognitive demands in many sports. This may be associated with a higher ecological validity when compared to widely used agility and computer-based tests that investigate agility and cognitive skills in separate assessments. While reliability has recently been confirmed[22] it needs to be established if the SKILLCOURT can be considered a valid assessment tool for the purpose of cognitive and agility diagnostics. This especially applies to the cognitive-motor tests. The more complex lower extremity movements when compared to a keyboard input on a computer may induce an interference between cognitive and motor functions[23,24] that in turn may reduce the test validity.[18] This study aimed to determine the concurrent validity of the SKILLCOURT technology against well-established tests on agility and cognitive performance. It was hypothesized that the SKILLCOURT would provide high validity for agility and cognitive assessments although lower correlations were expected for the cognitive-motor assessments due to interference between cognitive and motor processes.

2. Methods

Thirty-two healthy adults (18 male, 14 female, age: 25 ± 3 years, height: 174 ± 10 cm, weight: 72 ± 14 kg) participated in this study. The sample size was calculated with G*Power[25] to identify moderate correlations of at least $r = 0.45$ ($n = 26$) while accounting for potential dropouts. This number is well in line with previous research in the field by Wilke et al. (2020)[18] and Düking et al. (2016).[19] All participants must be active in sports but not on a professional level to ensure sufficient variability for correlation analyses while avoiding spurious correlations due to performance clustering. The participants were engaged in different sports (ball sport, team sports, endurance sports, fitness) with a weekly training load of 3.3 ± 1.4 h. All reported being free of injury as well as any cardiovascular or neurological disease and without any limitation in their cognitive or motor abilities. For all test days, participants were instructed to abstain from alcohol or caffeinated drinks and to avoid strenuous physical exercises at least 24 h before the test. Participants were informed about the experimental protocol and their written consent was obtained. The study was approved by the local Ethics Committee of the Faculty of Psychology and Sport Science, Goethe-University Frankfurt/Main, Germany (2021–60), in accordance with the declaration of Helsinki.

All participants completed two SKILLCOURT sessions with 7 days in between. Both sessions were combined with either the cognitive or motor assessment. The order was counterbalanced across participants based on pre-defined list of test orders. Each test was conducted three times. The best performance was considered

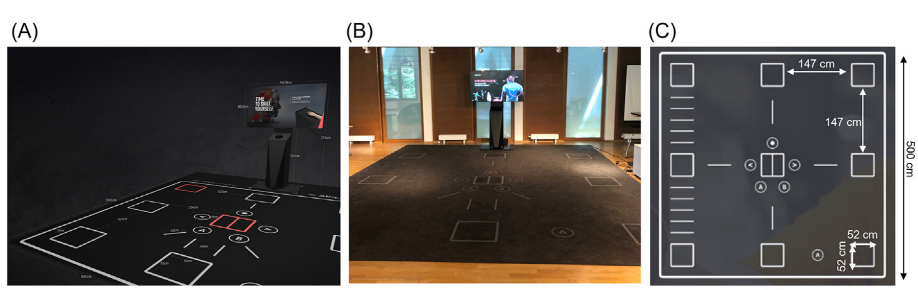

Fig. 1. Illustration of the SKILLCOURT technology (A) Schematic overview of the SKILLCOURT setup (B) SKILLCOURT setup in the lab. (C) Schematic top view with information on the dimensions of the 500 × 500 cm court.

for data analysis. The first testing session was considered as familiarization to reduce potential learning effects. No additional encouragement was given. Within participants, the test sessions were performed at the same time of the day. Both test days started with a standardized warm-up of 1-min jogging, 30 s jumping jacks, 2 sub-maximal 10 m sprints.

An illustration of all SKILLCOURT tests is provided in Fig. 2. The SKILLCOURT assessment contained tests on planned agility (Star Run), reactive agility (Random Star Run), decision making and working memory (1-back test), as well as executive functioning (executive function test). The order of tasks was counterbalanced across participants. To reduce fatigue, participants were provided a break of 1:30 min between trials for the agility tests and 1 min for the cognitive assessments. Break times were based on a recent study by Mackala et al. 2020[26] where participants performed planned and unplanned agility tests with similar running times. All tests used in this study come with the SKILLCOURT software package and were not modified.

Agility and reactive agility performance were tested in the Star Run and Random Star Run, respectively. During the Star Run, participants had to run once at all 8 outer target fields on the SKILLCOURT in a predefined clockwise sequence. The participants were informed about the sequence beforehand to ensure a planned agility testing. In the Random Star Run, the sequence of the 8 target fields was randomized (random permutation without repetition) to include a decision-making component. After each run, participants had to return to the center field. Participants were instructed to complete the task as fast as possible. Performance was indicated by the overall running time.

Cognitive-motor assessments included a 1-back reaction and an executive function test. In the 1-back test (named 'remember forms' on the SKILLCOURT), a series of white symbols varying in shape was displayed on a background varying in colour. Participants had to decide if the displayed symbol and background colour matched the one, shown 1 trial (1-back) before. For every trial a decision (yes/no) was made by stepping on the left or right targets next to the center field. Within 60 s participants were instructed to make as many responses as possible while avoiding errors. The probability of 'yes' and 'no' responses was 50%.

For executive function testing the SKILLCOURT test 'decision pro' test was applied. The test contains six visual cues in three categories: odd and even numbers (numbers), blue and green squares (colour) as well as happy and neutral faces (emotion). In case of even numbers, green squares and happy faces participants should step on the left target next to the centerfield while odd numbers, blue squares and neutral faces required a step movement to the right target field. Due to the random presentation of stimuli, participants had to rapidly switch between categories (number, colour, emotion). Therefore, the test was suggested to address cognitive flexibility, response inhibition and decision-making abilities. Memorizing the six stimuli may further involve short term memory capacity. Overall, 24 stimuli were presented, 8 for each category (colour, number, faces). The participants were instructed to react as fast as possible while avoiding errors.

For both tests, the reaction time was determined as the time between stimulus appearance and entering the target field. To account for the number of errors during task performance and to consider reaction speed and error rate in a single variable, the inverse efficiency score (IES) was calculated according to equation (1) (EQ (1)).

$$IES = \frac{reaction\ time}{(1 - error\ rate)} \tag{EQ1}$$

T agility test and 10 m linear sprint time was assessed using timing gates (Brower Timing Systems, Salt Lake City, Utah USA). Participants were in a split-standing position with both heels on the ground and started at their own discretion. A vertical jump

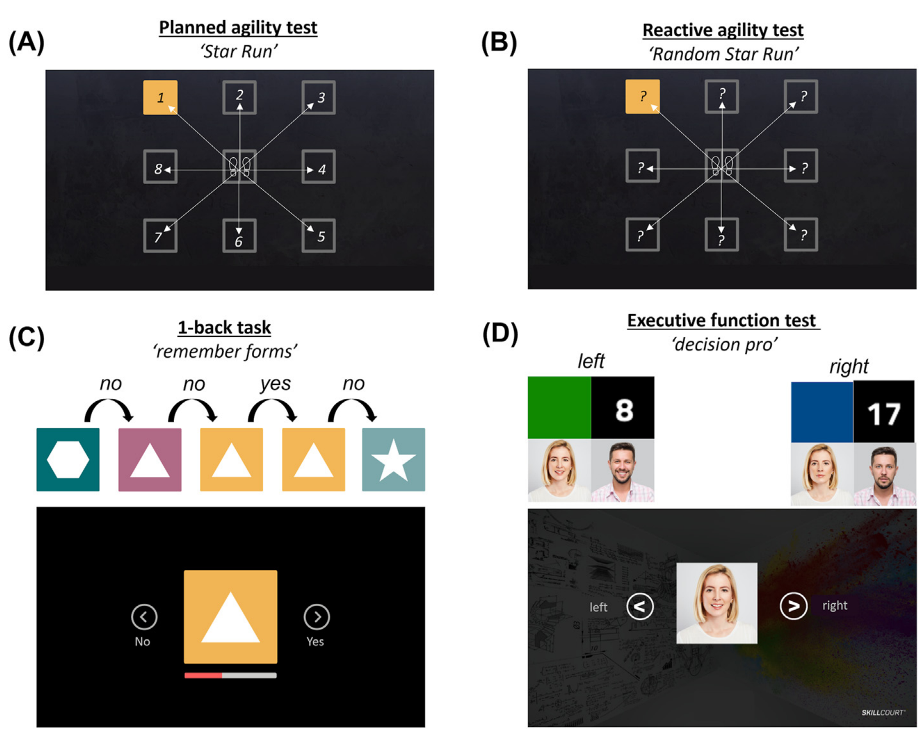

Fig. 2. Overview of the agility and cognitive tasks on the Skillcourt investigated in this study. (A) Planned agility test ('Star run') with a pre-defined running sequence. (B) Reactive agility test ('Random star run') with a random running sequence. (C) 1-back task ('remember forms') where participants decided if the presented symbol was identical to the one shown 1 trial before (1-back). (D) Executive function test ('decision pro') where participants decided based on colour, number and emotion if stepping to the left or right target field.

contact mat measured the jump height for the countermovement jump. Participants were instructed to perform a countermovement to a knee angle of about 120° followed by an explosive concentric contraction. Arms were placed at the hips. 3 trials were performed for both tests and pause times of 1:30 min and 30 s between trials were applied for the sprint and jump tests, respectively. The test selection was based on the studies of Paole et al. (2000)[27] and Franca et al. (2022)[9] indicating that the T-agility test measures a combination of agility leg speed and power that was expected to also determine the planned and reactive agility tests on the SKILLCOURT. Further, the change of direction characteristics in the T-agility test better correspond to the star run and random star run movement pattern when compared to alternatives such as the Illinois Agility Test or the 5-0-5-test.

The PsyToolkit toolbox[28,29] was used for the computer-based cognitive assessment. Responses were detected via keyboard inputs. The cognitive test battery included a simple- and choice-reaction (4-choice) task, a Go-NoGo task for response inhibition, a forward and backward visual span test determining spatial short term and working memory[30] as well as a task switching test assessing cognitive flexibility.[31] A break of 1 min was applied between the tests to reduce fatigue effects.

The simple and choice reaction tasked included 20 and 40 reaction trials, respectively with a randomized interstimulus interval between 1 and 3 s. Participants reacted as fast as possible in response to the appearance of an 'X' symbol in one (simple reaction) or one of four (choice reaction) white squares on the screen by pressing the corresponding key on the board. The average reaction time was calculated across all trials. In the Go-NoGo task, participants had to react as fast as possible to Go-Signals while inhibit a response during the No-Go trials. 30 visual stimuli with a constant interstimulus interval of 750 ms were presented. No-Go probability was 17% (5 trials). Average reaction time and IES were determined as outcome parameters. The cognitive flexibility task presented a series of 60 letter + number stimuli (e.g. 'G2'). In the single conditions, participants responded either to the letter (consonant or vowel) or number (odd or even) by pressing the 'b' or 'n' on the keyboard. In the switching condition, the condition changed between letter and number every two trials. Reaction time for the single conditions as well as for repetitive and switch trials in the switch condition were calculated. Participants were instructed to respond as fast and as precise as possible. In the forward and backward visual span tests, nine purple squares were presented. For each trial a random sequence of squares was highlighted. Following the presentation, participants had to click the squares in the same (forward) or reverse (backward) order. Sequences started with two squares and increased by one after every correct response. The test stopped after two wrong answers on the same level. Forward and backward visual span (highest successful sequence length) were defined as outcome parameters.

On overview of all tests and outcome parameters is presented in Table 1.

Statistical analyses were conducted using the SPSS software package (IBM SPSS Statistics 28). Kolmogorov-Smirnoff tests confirmed normal distribution for all variables. Correlations between SKILLCOURT performance and established cognitive and agility tests were estimated using Pearson product-moment and multiple regression analyses. The Star Run and Random Star Run performance on the SKILLCOURT was correlated with the motor assessment outcomes (5, 10 m linear sprint, T-agility test, CMJ). The executive function test ('decision pro') addressing cognitive flexibility, response inhibition, decision making and memory capacity was correlated to the computer-based Go-NoGo test, cognitive flexibility test and choice rection test as well as the outcome of the visual span task. The 1-back test ('remember forms) required quick decision making and was correlated to the simple and choice reaction time, the Go-NoGo test and repeat trials of the cognitive flexibility task. Parameters significantly correlating with the SKILLCOURT performance were included in "enter" and "stepwise forward" multiple regression models in SPSS. Multiple regression analyses were explorative and results must be interpreted with caution due to the limited number of participants relative to the number of predicting variables. The "enter" model included all predictor variables while in the "stepwise forward" approach variables were considered if the significance level of its F was <0.05. Regression analyses were performed to determine the overall predictive quality and the best predictor variables, respectively. Heteroscedasticity and autocorrelation were evaluated using Breusch-Pagan and Durbin-Watson tests. Correlations were considered small (<0.3), moderate (<0.5), large (<0.7), very large (<0.9) and nearly perfect (>0.89). The significance threshold was set to $p < 0.05$.

3. Results

Table 2 provides a summary of significant correlates for the dependent SKILLCOURT variables. Scatterplots of the correlation analysis are presented in Fig. 3. For agility, Star Run and Random Star Run tests on the SKILLCOURT were significantly correlated with the T-agility test ($0.66 \le r_{32} \le 0.74$, $p < 0.001$), 10 m sprinting time ($0.68 \le r_{32} \le 0.73$, $p < 0.001$) and the countermovement jump (CMJ) ($-0.59 \le r_{32} \le -0.65$, $p < 0.001$). The multiple regression including all predictors revealed a predictive quality of $r^2 = 0.49$ ($r_{3,28} = 0.70$, $F = 8.99$, $p < 0.001$) for the star run and $r^2 = 0.59$ ($r_{3,28} = 0.77$, $F = 13.68$, $p < 0.001$) for the random star run. Stepwise forward multiple regression analyses identified the 10 m sprint as the best predicting variable ($r_{1,30} = 0.68$, $F = 25.26$, $p < 0.001$) in the Star Run while T-agility test performance and CMJ were excluded from the model. In the Random Star Run, only the T-agility test performance remained as a predictor ($r_{1,30} = 0.74$, $F = 36.69$, $p < 0.001$).

The 1-back ('remember forms') reaction time and inverse efficiency score (IES) on the SKILLCOURT were significantly correlated to reaction speed in repeat trials of the switch test and choice reaction time ($0.35 \le r_{32} \le 0.47$; $p \le 0.043$). Multiple regression models including both variables revealed a predictive quality of $r^2 = 0.24$ ($r_{2,29} = 0.49$, $F = 4.56$, $p = 0.019$) and $r^2 = 0.26$ ($r_{2,29} = 0.51$, $F = 5.00$, $p = 0.014$) for reaction time and IES, respectively. In stepwise forward multiple regression models only the switch test reaction time remained as a predictor variable (reaction time: $r_{1,30} = 0.45$, $F = 7{,}74$, $p = 0.009$, IES: $r_{1,30} = 0.47$, $F = 8.49$, $p = 0.007$).

Reaction time and IES in the executive function test ('decision pro') test were significantly correlated to the reaction time in the switch test, the choice reaction test and the Go-NoGo test ($0.46 \le r_{32} \le 0.47$; $p \le 0.009$). The predictive quality for reaction time in the decision pro test when including all variables reached $r^2 = 0.46$ ($r_{3,28} = 0.68$, $F = 7.90$, $p < 0.001$). In the stepwise forward model, reaction time in the switch and choice reaction test remained as predicting variables ($r_{2,29} = 0.64$, $F = 10.25$, $p < 0.001$). Multiple regression models for IES were not calculated due to a violation of homoscedasticity.

4. Discussion

Star Run and Random Star Run were highly correlated to established sprint and agility tests. Strong relations to computer-based assessments were also observed for the executive function test ('decision pro') while correlations were moderate for the 1-back ('remember forms') SKILLCOURT task. The combined pattern of result support the validity of the SKILLCOURT system for agility and cognitive testing.

Table 1
Overview of cognitive and motor tests performed in the study.

Test Type	Test Name	Tested Ability	Outcome parameters	Performance
Skillcourt Test	'Remember forms' (1-back test)	Working memory flexibility, decision making	Reaction time (ms) Error rate (%)	809 (±69.6) 1.3 (±1.4)
	Decision pro	Executive function (working memory, inhibition and cognitive flexibility)	Reaction time (ms) Error rate (%)	836 (±97.1) 1.7 (±3.6)
	Star run	Change of direction/agility performance	Running time (s)	15.4 (±1.4)
	Random Star run	Reactive agility performance	Running time (s)	18.8 (±1.3)
Motor Test	T-Test	Agility	Running time (s)	10.7 (±0.95)
	10 m sprint	Strength/Explosive power	Running time (s)	2.09 (±0.16)
	Countermovement Jump	Strength/Explosive power	Jump height (cm)	37.8 (±9.7)
Cognitive Tests	Simple reaction test	Visuomotor reaction ability	Reaction time (ms)	254.6 (±19.3)
	4-Choice reaction test	Decision making ability	Reaction time (ms)	404.9 (±47.6)
	Corsi test (forward, backward)	Spatial working memory/short-term memory and flexibility	Forward memory span (items) Backward memory span (items)	6.3 (±1.1) 5.6 (±1.4)
	Go-NoGo test	Response inhibition	Reaction time (ms) Error rate (%)	329.3 (±27.9) 1.6 (±1.8)
	Task switching test	Cognitive flexibility	Reaction time (repetitive) (ms) Reaction time (switch) (ms) Task switching costs (ms)	864.7 (±182.5) 1220.7 (±247.0) 356.0 (±202.4)

Performance data indicate group average (±standard deviation). ms = milliseconds, cm = centimeters, s = seconds.

Table 2
Overview of dependent SKILLCOURT variables and significant correlating predictor variables from established cognitive and motor/agility tests.

Skillcourt test	Dependent variable	Predicting variables			Regression (enter model)	Regression (stepwise forward)
Star run	Task completion time	T-agility test ($r = 0.66$, $p < 0.001$)	10 m linear sprint ($r = 0.68$, $p < 0.001$)	CMJ ($r = -0.59$, $p < 0.001$)	$r = 0.7$, $p < 0.001$	$r = 0.68$, $p < 0.001$
Random star run		T-agility test ($r = 0.74$, $p < 0.001$)	10 m linear sprint ($r = 0.73$, $p < 0.001$)	CMJ ($r = -0.65$, $p < 0.001$)	$r = 0.77$, $p < 0.001$	$r = 0.74$, $p < 0.001$
1-back	Reaction time	Switch repeat reaction time ($r = 0.45$, $p = 0.009$)		Choice reaction time ($r = 0.35$, $p = 0.048$)	$r = 0.49$, $p = 0.019$	$r = 0.45$, $p = 0.009$
	IES	Switch repeat reaction time ($r = 0.47$, $p = 0.007$)		Choice reaction time ($r = 0.36$, $p = 0.043$)	$r = 0.51$, $p = 0.014$	$r = 0.47$, $p = 0.007$
Decision pro	Reaction time	Switch reaction time ($r = 0.52$, $p = 0.003$)	Choice reaction time ($r = 0.51$, $p = 0.003$)	Go-NoGo reaction time ($r = 0.49$, $p = 0.005$)	$r = 0.68$, $p < 0.001$	$r = 0.64$, $p < 0.001$
	IES	Switch reaction time ($r = 0.51$, $p = 0.003$)	Choice reaction time ($r = 0.51$, $p = 0.003$)	Go-NoGo reaction time ($r = 0.46$, $p = 0.009$)	–	

IES = inverse efficiency score. CMJ = countermovement jump.

Agility and reactive agility assessments on the SKILLCOURT revealed large or very large correlations to established linear sprint and agility tests ($r = 0.66–0.74$). These findings are well in accordance with the results of Düking et al.[19] who assessed the validity of the SpeedCourt system. The authors reported comparable correlation coefficients between 0.54 and 0.76 when correlating agility assessments on the SpeedCourt to the Illinois Agility Test and the 5-0-5 agility test. The SKILLCOURT thus qualifies as a promising diagnostic tool for agility performance that goes beyond previously used sprint and agility assessments. Especially, differentiating between agility (Star Run) and reactive agility (Random Star Run) provides the evaluation of decision-making abilities in highly dynamic environments that is essential in many sports.[2] The court-based setup further allows a comprehensive analysis of change-of-direction movements at multiple angles while the laser-based tracking on the court supports a standardized and objective performance measurement.

While the test on executive functions ('decision pro') revealed strong correlations to computer-based cognitive assessments, only moderate correlations were observed for the 1-back test ('remember forms'). The latter can be explained by the interference between cognitive and motor functions.[23] In their review, Bayot et al.[23] argue that locomotion and posture involve both cognitive and motor components. In contrast to computer-based assessments that are performed in a seated position, the 1-back test on the SKILLCOURT requires the participant to maintain balance and control posture especially when changing between motor responses of the left and right leg. Cognitive resources required for the control of posture and balance on the SKILLCOURT may thus interfere with task-specific cognitive processing and reduce the correlation to computer-based assessments. Support to this assumption comes from recent results of Wilke et al.[18] In their study, the authors used a Fitlight system to assess cognitive-motor function which was compared to standardized neuropsychological assessments. Like the SKILLCOURT, moderate correlations between cognitive-motor and computer-based tasks ($r = 0.31–0.54$) where found which is comparable to the results in this study ($r = 0.35–0.47$). Based on these findings it may be speculated that cognitive-motor interference in the 1-back task on the SKILLCOURT affected the correlation with purely cognitive computer-based assessments. Consequently, the validity of the motor-cognitive 1-back assessment to determine decision making and working memory abilities is limited.

This raises the question, why correlations were stronger for the executive function test ('decision pro'). The discrepancy can best be explained by the relative contribution of cognitive and motor

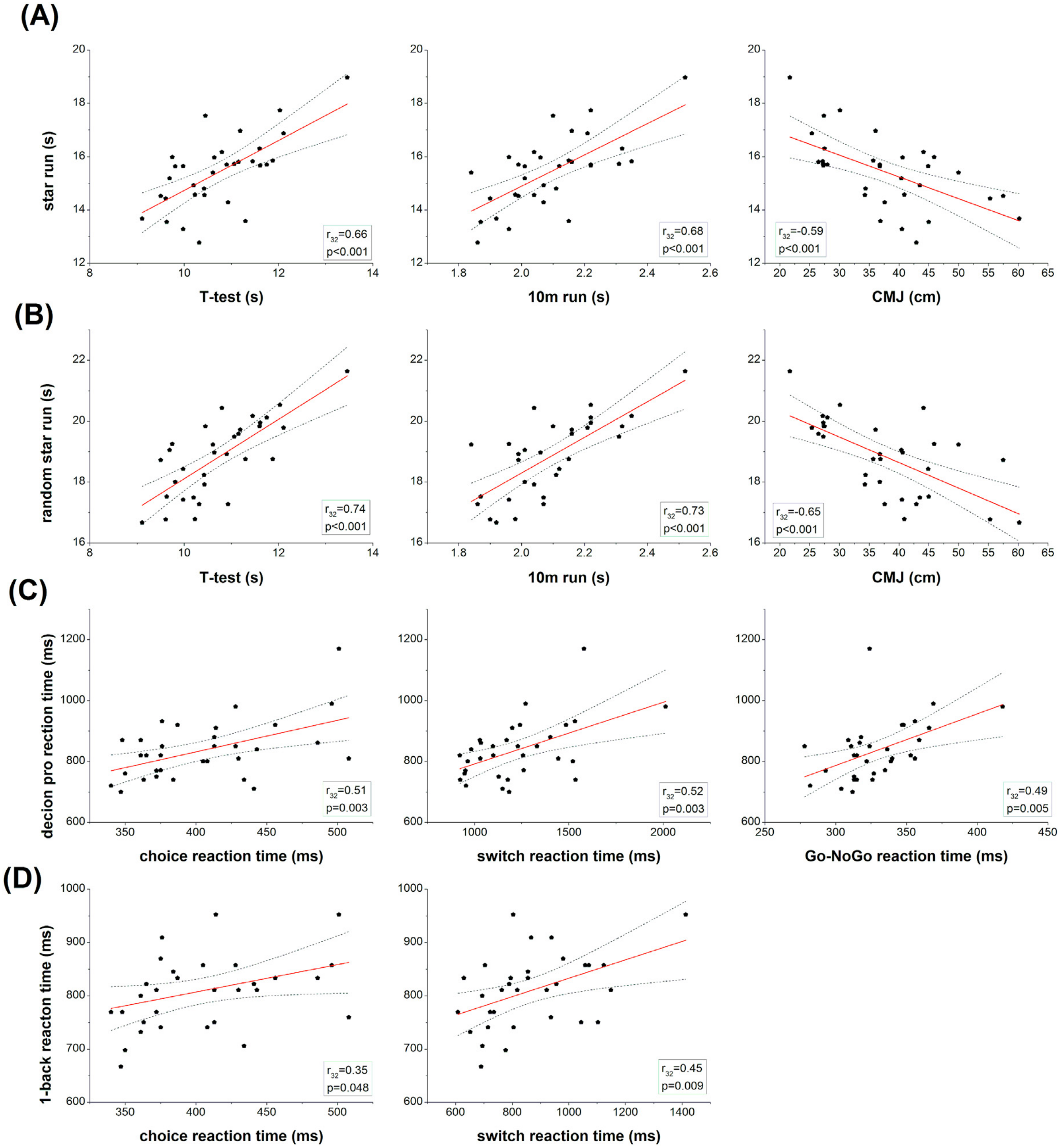

Fig. 3. Illustration of the correlations between SKILLCOURT tests and established agility and computer-based assessments. (A) Correlations for the planned agility test ("star run"), (B) correlations for the reactive agility test ("random star run"), (C) correlations for the executive function test ("decision pro"), (D) correlations for the 1-back test ("remember forms"). Solid red lines represent the regression line. Dashed black lines reflect 95% confidence intervals.

components to the task performance. While the motor task was identical for both assessments, the executive function test required decision making, response inhibition and task switching resulting in a high cognitive load. In contrast, the 1-back test mainly depends on the participants decision-making ability accompanied by less cognitive load.[32] Therefore, the relative contribution of cognition may have been higher for the executive function test which explains the stronger correlation with purely cognitive computer-based assessments. Conversely, the greater importance of motor components in the 1-back test increased the motor-cognitive interference which resulted in a lower correlation to the computer test.

4.1. Limitations

Although motor-cognitive and computer-based assessments addressed the same cognitive construct, there were differences in the test setup and stimulus design. This may have affected the correlation coefficients and requires future research standardizing the cognitive component of the task. In addition, follow-up studies will elaborate on the ecological validity of motor-cognitive assessments that has been hypothesized for the SKILLCOURT but was not the objective of this study. Finally, while this study focused on healthy adult participants, future research will have to confirm the findings also in athlete populations.

5. Conclusion

The results of this study indicate that the SKILLCOURT technology qualifies as a valid assessment tool for agility and cognitive function testing. Especially agility tests and complex executive performance were strongly linked to established agility and cognitive tests. This technology provides a more ecologically valid alternative to existing planned agility and paper-pencil/computer protocols. However, due to the stronger contribution of motor processes to task performance in the cognitive-motor assessments on the SKILLCOURT when compared to traditional computer-tests, the potential interference between cognitive and motor functions needs to be taken into consideration when interpreting the test results.

Interest statement

Movement concepts GmbH supported the study by providing the SKILLCOURT technology for data acquisition. TH provides scientific consultancy to movement concepts GmbH. The company was not involved in any aspect of the study including study design, data acquisition, data analysis, result interpretation and writing the manuscript. The company had no right to approve or disapprove the publication of the final article."

Author statement

The contributions of the authors to this paper are summarized below:

TH: conception and study design, data analysis and interpretation, drafting the article, final approval.

DF: conception and study design, data acquisition and interpretation, reviewing the article, final approval.

FG: conception and study design, data acquisition and interpretation, reviewing the article, final approval.

WB: conception and study design, data interpretation, reviewing the article, final approval.

FP: conception and study design, reviewing the article, final approval.

CH: conception and study design, reviewing the article, final approval.

LV: conception and study design, data interpretation, reviewing the article, final approval.

Funding information

No specific funding was received for this study. Movement concepts GmbH supported the study by providing the Skillcourt technology for data acquisition. The company was not involved in any aspect of the study including study design, data acquisition, data analysis, result interpretation and writing the manuscript. The company had no right to approve or disapprove the publication of the final article.

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