The Vividness of Movement Imagery Questionnaire (VMIQ-2) – Translation and Reliability of a Hebrew Version

Gal Ziv, PhD, Ronnie Lidor, PhD, Michal Arnon, PhD, and Aviva Zeev, MSc

The Zinman College of Physical Education and Sport Sciences, Wingate Institute, Israel

ABSTRACT

Introduction: The Vividness of Movement Imagery Questionnaire 2 (VMIQ-2) assesses individuals’ ability to imagine themselves performing 12 simple motor tasks, from three perspectives: internal visual imagery, external visual imagery, and kinesthetic imagery. The purpose of the current study was twofold: (a) to describe the translation process of the VMIQ-2 into a Hebrew version, and (b) to test the reliability of the Hebrew version.

Method: Eighty-eight physical education students completed the questionnaire twice (test, re-test), with two weeks in-between the tests.

Results: Correlational analyses on the scores of the questionnaires given in the two phases – test and re-test – yielded two main findings: (a) there were no differences in mean scores of the questionnaires administered in the test phase and re-test phase; (b) significant moderate correlations between the questionnaires’ score in the test and re-test phases were observed.

Conclusions: The Hebrew version of the VMIQ-2 was found to be reliable. A number of implications are discussed concerning the use of the questionnaire in the fields of psychiatry and psychology.

INTRODUCTION

Motor imagery (MI) – the mental representation of movement without any bodily movement (1, 2) – is a central element in human functioning. This mental representation of movement is based on sensory experiences in which the real world can be embodied using combinations of different sensory modalities (3). The use of different sensory modalities enables individuals (e.g., performers) to mimic real experience, to visualize an image, and to feel movements as an image. All these representations are typically created intentionally, however sometimes they seem to arise automatically.

MI has been studied extensively in various scientific domains, among them sport (e.g., 4), motor learning and rehabilitation (e.g., 5, 6), and psychiatry (e.g., 7-9). Most studies have shown that MI can positively affect motor performance in both healthy individuals and individuals with health-related conditions. For example, MI has been shown to increase the state of flow and performance in adolescent tennis players (10), improve the execution of a standing long-jump when combined with physical practice (11), improve hand function in chronic stroke patients (12), and improve balance and gait ability in post-stroke patients (13).

However, the ability to imagine oneself performing motor tasks appears to be diminished in certain conditions, such as schizophrenia (e.g., 8, 14). In one study (8), the physical and imaginary performance of a Timed-Up-and-Go Test – a test that measures the ability to get up from a chair, walk, turn back, and sit back down – was examined. Schizophrenic patients (n = 17) who participated in this study performed both the actual physical movements and the MI of those movements slower than the matched control participants (n = 10). In another study (14), 10 schizophrenic patients were unable to accurately imagine the movement of pointing to a target. While the patients showed the expected speed-accuracy trade-off when they physically pointed to a target that changed in size, no reliable relationship between target size and speed-accuracy trade-off was observed.

Address for Correspondence: Dr. Gal Ziv, The Zinman College of Physical Education and Sport Sciences, Wingate Institute 42902, Israel - galziv@yahoo.com
off was observed when they imagined pointing at the target. Such studies on schizophrenia patients are important, as they can attest to the role of certain brain structures in the presence of schizophrenia. For example, it is possible that the deficits in MI found in schizophrenia patients relate to the role of the posterior parietal cortex in this disease (7).

In a recent opinion article on MI in clinical disorders, Moran and colleagues (15) postulated that research on MI processes offers intriguing insights into the neurocognitive mechanisms underlying – and psychological treatment of – certain clinical disorders, among them post-traumatic stress disorders, personality disorders and social anxiety disorders. In addition, the authors proposed that clinical researchers have much to learn from an emerging theoretical theme in cognitive neuroscience, namely the idea that the brain is a dynamic predictive system (16) that uses simulation as a mechanism for integrating the psychological processes of imagination, perception and action. For example, if a dynamic mental practice (e.g., imaging a skill while making the associated physical movements) can improve performance through enhanced mental representations, it seems possible that dynamic MI re-scripting could enrich therapeutic interventions for patients suffering from certain disorders, such as post-traumatic stress disorders.

While it is important to study MI in both healthy and unhealthy individuals, measuring MI can be a challenging task due to the fact that the process of imagining is an internal one (17), and therefore cannot be measured directly without the use of advanced technical equipment (e.g., functional Magnetic Resonance Imaging). In addition, the ability to use MI can vary between individuals (e.g., those who have a high ability in using mental representations vs. those who have a weak ability), as well as between psychological conditions (e.g., stressful vs. non-stressful conditions). Therefore, in studies examining the influence of MI on motor performance, it is important to assess the participants’ ability to use MI. This assessment is usually accomplished with imagery questionnaires.

One such valid and reliable questionnaire is the Vividness of Movement Imagery Questionnaire 2 (VMIQ-2) (18). This questionnaire is composed of 12 items – walking, running, kicking a stone, bending down to pick up a coin, running up stairs, jumping sideways, throwing a stone into water, kicking a ball in the air, running downhill, jumping off a high wall, swinging on a rope, and jumping off a high wall. It requires individuals to imagine themselves performing the 12 items, from three imagery perspectives: internal visual imagery (a first-person perspective), external visual imagery (a third-person perspective), and kinesthetic imagery (feeling the movement). When using internal visual imagery, one sees him/herself performing a movement in his or her own mind; when using external visual imagery, one imagines performing a movement by looking at his or her body from the outside; when using kinesthetic imagery, one imagines how the movement feels. The VMIQ-2 is a revised version of the VMIQ (19), which was designed to measure visual and kinesthetic imagery of a variety of motor tasks (e.g., running downhill, jumping off a high wall).

The VMIQ has been used in imagery research (e.g., behavioral research and research on neural activation) and has captured the theoretical proposed effects of imagery ability (e.g., 20-22). The questionnaire was re-examined for three reasons: (a) to address the confused conceptualization within the imagery literature between the visual imagery modality (i.e., what an imager sees) and the kinesthetic imagery modality (i.e., imagining the feel of movement); (b) to determine the precise conceptualization of external visual imagery; and (c) to address the lack of rigorous psychometric testing of this instrument (18). A series of three studies (18) provided preliminary support for the revised VMIQ-2 as a psychometrically valid questionnaire.

Since MI is important as a psychological intervention for improving motor performance – and also as a diagnostic tool, and since there were no Hebrew versions of MI questionnaires, the purpose of the current study was twofold: (a) to describe the translation process of the VMIQ-2 into a Hebrew version, and (b) to test the reliability of the Hebrew version, so that researchers in various domains such as psychology, psychiatry, rehabilitation and sport will be able to use it for Hebrew speakers when conducting studies on MI.

**METHODS**

**PARTICIPANTS**

Eighty-eight physical education students (56 females and 32 males) participated in the current study. The mean age was 29.5±9.1 and 25.6±4.0 years for the male and female participants, respectively. The participants’ experience in sport was 12.5±9.8 and 10.5±6 years for the male and female participants, respectively. In addition, 46% of the participants were amateurs in their sport, 10% competed at a local club, 4% competed at a regional club, 12% competed at the national level, and 5% competed at the international level. The most common reported sports were running (13.5%), soccer (9.0%), basketball (9.0%) and swimming (4.5%).
The students were recruited from the undergraduate and graduate programs for physical education and sport sciences at the Academic College at the Wingate Institute, Israel. More specifically, the students were recruited from two classes: one introductory class on research methods taught in the undergraduate program, and one class on research methods in sport and exercise sciences taught in the graduate program. Students in the 4-year undergraduate program and students in the 2-year graduate program were asked to participate in one research project, according to their preference, during their period of studies. The study was approved by the Academic College ethics committee, and all the participants signed an informed consent form prior to participation in the study.

**PROCEDURE**

The translation process was composed of the following four steps: (a) the VMIQ-2 was translated, independently and separately, from English to Hebrew, by three native English speakers who possessed a very good command of the Hebrew language; (b) the three independent translations were then compared by the first and second authors, who then compiled a final version; (c) the final translation was then translated back to English by a fourth native English speaker, who also possessed a very good command of the Hebrew language; (d) the back-translated version was then compared to the original version by the first and second authors.

When major differences between the original and the back-translated versions of the questionnaire were observed, the first and second authors decided on the proper corrections to be made in the Hebrew questionnaire, and a final Hebrew version was produced. For example, it was our purpose to provide clear definitions in Hebrew for the three imagery terms: internal visual imagery, external visual imagery and kinesthetic imagery (see the Instructions Section in the Hebrew translation of the Vividness of Movement Imagery Questionnaire [VMIQ-2]; the Hebrew translation is presented in Appendix 1). We wanted to ensure that the final version of the imagery definitions took into account all the relevant translation comments made in each phase of the translation process. Therefore, we discussed the definitions with the translators, and based on these discussions we carefully selected each word included in each definition, in order to assist the participants to correctly distinguish among the three modes of imagery. The translation procedure was performed according to the guidelines proposed by Banville, Desrosiers and Genet-Volet (23) and Sperber, Devellis and Boehlecke (24).

Ninety-three students completed the questionnaire in the test phase. However, due to personal reasons five of them did not attend the re-test phase, and therefore the data of only the 88 students who completed the questionnaire twice were analyzed. The final Hebrew version was administered to these 88 physical education students at both the test phase and the re-test phase, with two weeks in-between the phases. Data were collected at the beginning of the fall semester. The questionnaire was administered to the students at the beginning of the class sessions that they attended. A short general explanation about the questionnaire was provided to the students by the first or second author, who also distributed the questionnaires and remained in the classrooms until the last student completed the questionnaire. No questions were allowed during the completion of the questionnaire. It took the students about 30 minutes to complete the questionnaire.

**STATISTICAL ANALYSIS**

The percentage of participants who scored exactly the same in both phases – test and re-test, in each of the 12 questions in the three types of imagery – was calculated. The percentage of participants who scored in the re-test phase exactly the same, one point above, or one point below the score they received in the test phase was calculated as well. Reliability between the 12 items within each of the three categories of imagery was calculated and reported as Cronbach’s alpha. In addition, correlational relationships between the three categories of imagery – internal visual imagery, external visual imagery and kinesthetic imagery – were calculated. Lastly, test-re-test reliability was examined by calculating correlations and performing paired t-tests between the two scores of the questionnaires.

We used the above-mentioned statistical analyses since one of the objectives of the current study was to test the reliability of the three imagery modes – internal visual imagery, external visual imagery and kinesthetic imagery – in the Hebrew version of the VMIQ-2. The 12 items included in each imagery mode reflect familiar and frequently-used motor activities. Since the participants were asked to imagine these activities using three different modes of imagery, it was our aim to test the reliability of each mode. In fact, in the selection of these statistical analyses we followed statistical recommendations on the use of correlational analyses (e.g., 25), as well on how to measure imagery ability and imagery use (e.g., 26).
RESULTS

RELIABILITY WITHIN EACH IMAGERY CATEGORY
In the first phase of the questionnaire delivery (test), Cronbach’s alpha was .91, .95, and .94 for the external imagery, internal imagery and kinesthetic imagery, respectively. In the second phase (re-test), Cronbach’s alpha was .94, .94, and .95 for the external imagery, internal imagery and kinesthetic imagery, respectively.

CORRELATIONS BETWEEN THE THREE IMAGERY CATEGORIES AND WITHIN EACH CATEGORY BETWEEN PHASES (TEST, RE-TEST)
The correlations between the three categories of imagery in the test and re-test phases of the study are presented in Table 1. In both the test phase and the re-test phase, correlations were moderate between external imagery and internal imagery and between external imagery and kinesthetic imagery; however, they were larger between the internal imagery and kinesthetic imagery. Correlations between the test and re-test of each imagery category were .72 for external imagery, .57 for internal imagery, and .66 for kinesthetic imagery.

MEAN DIFFERENCES BETWEEN TEST AND RE-TEST
No significant differences were found in the mean scores between test and re-test in any of the three imagery categories – for the external imagery: t (85) = .24, p = .81, ES = .03, for the internal imagery: t (84) = -.58, p = .65, ES = .06, or for the kinesthetic imagery: t (85) = -1.2, p = .23, ES = .13.

PERCENTAGE OF PARTICIPANTS WITH THE SAME RESPONSES IN THE TEST AND RE-TEST PHASES
The percentage of participants who had the same score in the test and re-test phases of the study is presented in Table 2. On all items except one, over 39% of the participants had the same exact score during the test and re-test phases. On one item (“jumping of a high wall” from “a first-person perspective”), only 30.9% of participants responded the same in both phases. In addition, over 76% of the scores in the re-test phase were exactly the same as, or one point lower or one point higher than, the scores in the test phase.

DISCUSSION
The current study had two purposes: to describe the translation process of the VMIQ-2 into a Hebrew version, and to test the reliability of the Hebrew version. The main findings that emerged from our study were that: (a) no differences in mean scores were found between the questionnaires administered in the test phase and the re-test phase; (b) moderate correlations were found between the scores of the questionnaires given in the test phase and the re-test phase; (c) more than 39% of the scores of the questionnaire items were exactly the same in the phases of test and re-test, except for one item (“jumping of a high wall” from “a first-person perspective”); and (d) a relatively high correlation was found between the internal imagery and the kinesthetic imagery in both the first and the second completion of the questionnaire. Based on these findings, the Hebrew version of the VMIQ-2 was found to be reliable, and therefore can be used by both researchers and practitioners who aim at collecting data in the Hebrew language on MI.

The correlational relationships between the internal imagery and the kinesthetic imagery (.76 and .79 for the test and re-test phases, respectively) suggest that the participants in our study may have viewed these categories as similar. In another study, a higher correlation between internal visual imagery and kinesthetic imagery (.41) com-

| Table 1. Correlations between the Three Categories of Imagery in Phases of Test and Re-test |
|---------------------------------|----------------|----------------|----------------|
| Imagery Categories             | Test   | Re-test  |
| External and internal          | .44    | .61    |
| External and kinesthetic       | .48    | .51    |
| Internal and kinesthetic       | .76    | .79    |
pared to external visual imagery and kinesthetic imagery (.15) was reported (27). While these correlations are lower than the ones found in the current study, they still suggest that the perception of internal visual imagery can be similar to that of kinesthetic imagery. Interestingly, when Callow and Hardy (27) altered the instructions for filling in the external visual imagery section from “watch somebody else from an external perspective” to “watch yourself from an external perspective,” the correlation between the internal visual imagery and the kinesthetic imagery was lower (.23), and the correlation between the external visual imagery and the kinesthetic imagery was higher (.60). These findings suggest that the way individuals imagine themselves performing motor tasks is related to whether they are instructed to view themselves or someone else perform these tasks. In our study, for the external visual imagery, the participants were instructed to view themselves from an external perspective. The correlations between external visual imagery and kinesthetic imagery were .48 and .51 for the test and re-test phases, respectively, and these are similar to those reported in Callow and Hardy’s study (.61) (27).

The high correlation values between the internal visual imagery and the kinesthetic imagery suggest that, if needed, individuals can fulfill the external and internal visual imagery and disregard the kinesthetic imagery. This can be useful when there are time constraints. Under those circumstances, the ability to perform well in these two categories can be enough to assess an individual’s MI.

One limitation of the current study should be mentioned. All the students who participated in our study were physical education students who had a background in sport and physical activity. In various settings in the motor domain (e.g., learning a new motor skill or practicing an already acquired skill), individuals typically use MI to enrich their learning/performance experience. It is speculated that the students who participated in our study had frequently used MI processes in their learning/performance environments, and therefore this experience might have influenced the scores they obtained in the test and re-test phases. Therefore, it is proposed that the Hebrew version of the VMIQ-2 be given to additional populations that do not have a background in the sport/physical activity domain.

In conclusion, the findings obtained in the current study suggest that the Hebrew version of the VMIQ-2 is reliable, and that researchers/practitioners can use this version when assessing individuals’ ability to imagine themselves performing various motor tasks. Since measuring MI can be a challenging task, due to the fact that the process of imagining is an internal one, the use of questionnaires such as the VMIQ-2 can assist researchers/practitioners in assessing the effectiveness of a given psychological intervention/diagnostic process to improve MI ability. This applies to both healthy and clinical (e.g., post-traumatic stress disorders, personality disorders and social anxiety disorders) populations.

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Appendix 1. The Hebrew Translation of the Vividness of Movement Imagery Questionnaire 2 (VMIQ-2)

She'elot behorot/hiot shel hamitiyot ghnuta

Shemut befrishot haotarim.

Dimahei imitit be'me'os ha'dimah lecha, zechuah vitinah tox, hineni, tox ha'erenah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tox ha'shekvah tou