# 144 - ASSOCIATION BETWEEN REACTION TIME (RT) AND MOVEMENT TIME (MT) IN A MOTOR SKILL

EDSON LUIZ FONSECA[2]
MARCO AURÉLIO DA SILVA VIANA FILHO[2]
ALBERTO TERGILENE NETO[2]
MÁRCIO MÁRIO VIEIRA[1, 2]
[1]-GEDAM/ UFMG- Grupo de Estudos em Desenvolvimento e Aprendizagem Motora- Universidade Federal de Minas Gerais
[2]-Faculdade Estácio de Sá de Belo Horizonte (FESBH)

## INTRODUCTION

Abilities consist of features or qualities related to the individual performance of motor skills, they are related to the process of motor learning and control (HIRTZ, 1971; SCHMIDT, 1988). These relatively permanent and stable features are decisive structures for the good level of performance and for the acquisition of motor skills (MAGILL, 2000). Therefore, motor skills can be defined as intentional movements aiming at reaching a final result that is of maximum certainty, less possible time and less energy waste (SANTOS; CORREA; FREUDENHEIM, 2003).

The abilities contribute to the execution of predictable and or unpredictable motor skills providing fast learning, being them daily or sports skills (CALVETE, 2005). The skillful nature of actions performed by individuals depends on the abilities developed and the amount and quality of motors skills experienced by the individual (SOUZA; ALMEIDA, 2006). Ideal levels of performance in either daily or sports abilities not only require efficacy in the task structure elaboration, but also in a good level of the abilities that constitute the task itself (MORI; OHTANI; IMANAKA, 2002). These levels allow for the control of situations that require fast response (high level of accuracy) or of greater coordination (SCHMIDT, 1993; GRECO; BENDA, 1998).

Among the many abilities we find reaction time (RT) and movement time (MT). RT consists of the ability to respond to a motor skill in a fast and objective way (SCHMIDT, 1988). RT corresponds in the time gap between the presentation of a stimulus and the initiation of the response, muscle contraction has been considered as the initiation of the response to a stimulus (SCHMIDT; WRISBERG, 2001; WEINECK, 1999; MAGILL, 2000).

RT serves as a tool to evaluate the speed and efficacy in the decision making of individuals, besides enabling an evaluation of his/her anticipation abilities (SOUZA; OLIVEIRA; OLIVEIRA, 2006). The improvement of RT through practice helps the decrease of uncertainty in the stage selection of response, reducing time gap in the movement programming, increasing performance efficacy (LIDOR; ARGOV; DANIEL, 1998; MAGILL, 2000).

RT can be divided in simple time of reaction, one stimulus to one response; TR of choice presents various stimuli and one adequate response to each stimulus; and discrimination RT that presents various stimuli and the individual must respond only to the required one (HAYWOOD; GETCHELL, 2004; MAGILL, 2000; RODRIGUES; RODRIGUES, 1984).

The movement time (MT) refers to the time gap between the initiation and termination of a motor skill and represents another way of evaluating motor skills, once the individual performs movements at higher speed or in greater number in a certain period of time. The subject can be considered more or less skillful, once the movements have same quality (SAGE, 1977).

RT and MT are considered relatively independent measures of performance, in the sense that TR cannot be used to predict TM or vice-versa (HENRY, 1961). In his study Henry (1961) used one hundred and eight subjects aged between eight and thirty years in four different movement complexity conditions evaluating simple, choice and discrimination RT's. The results presented a low association between RT and MT confirming the relative independence between the variables. Nevertheless, there was an indication of relation between MT and RT, the maintenance of constant stimuli associated with the increase of complexity of movement enabled greater TR (HENRY; ROGERS, 1960; SCHMIDT, 1988).

Chagas, Leite, Ugrinowitsch, Benda, Menzel, Souza and Moreira (2005), observed the level of correlation between MT in a specific motor skill in indoor soccer and RT of a simple motor task, finding a low correlation, therefore, there was no meaningful result. Myiamoto and Meira Jr (2004) observed the level of association between RT and MT between the departure of the group and the performance in 50m and 100m running competition. They concluded that the level of the ability of the racers are not related to RT, which does not corroborate with research done by Danev, Winter and Wartna (1971) and Phillips and Glencross (1985) in which results indicate that short RT leads to also short MT. Magill and Powell (1975) evaluated the association between the two abilities when tested in a single motor skill and they found significant correlation, differently from traditional testing methods. Pierson and Rash (1960) also found significant correlation between RT and MT and claim that these two abilities are conditioned by the same factor, maybe the same neural component.

Due to divergent results approaching the relation between RT and MT, and the few studies evaluating this association in one single motor skill showing that this association can determine higher levels of abilities, it is necessary to understand that besides the development of the abilities it is of utmost importance to promote their association. Therefore, the present study aims at observing the association between RT and MT in adults.

## METHOD AND MATERIALS

Ten adult volunteers took part of the experiment, of both genders, aged between 18 and 35 years (25, 7 ± 5, 4), without previous experience in the task.

There has been built some equipment composed of two structures: a platform containing six recipients numbered 1-6 and a control panel linked to a computer, composed of two diodes that provide visual stimulus to initiate the task and an answer key to register the measures of time. Some software has been developed to measure and store the time of reaction and time of movement provided by the equipment (Figure 1).

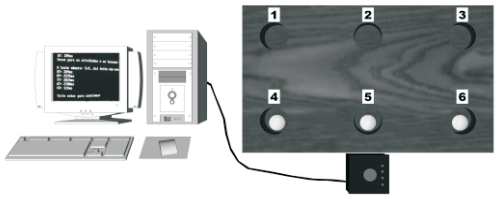

Figure 1- Schematic picture of the equipment

The task consisted of transporting tennis balls from the inferior part of the platform to the upper part of the platform in a pre-determined order (4-1/5-2/6-3) in the fastest possible way. The test was composed of fifteen tries in the manual transport task.

Before the beginning of each attempt the subjects were informed about the sequence of movements to be performed through a presentation of 8 x 11 cm card. At the sign of "get ready", provided by the researcher, the key would be pressed, and after the visual stimulus (lighting of diodes) the key would be let loose initiating the transport of the balls into the recipients in the pre-established order. At the end of the sequence, the key would be pressed again characterizing the end of the task.

**RESULTS**

Average values of RT and MT per subject and also the average presented in form the table below (Figure 2).

| Subject | RT | MT |
|---|---|---|
| 1 | 309,9 | 2482,1 |
| 2 | 373,3 | 2560,8 |
| 3 | 326,1 | 2866,8 |
| 4 | 369,8 | 2601,8 |
| 5 | 290,6 | 2557,8 |
| 6 | 311,1 | 2780,3 |
| 7 | 368,5 | 3210,0 |
| 8 | 334,6 | 2387,2 |
| 9 | 451,3 | 3528,9 |
| 10 | 254,8 | 24,999 |
| Average | 339,0 | 2747,6 |

Figure 2 – Graph Average results of reaction time (RT) and movement time (MT) in milliseconds (ms).

For the statistical analysis it was used Pearson's product-movement correlation test which detected significant value for the association of RT and MT (r=0,71; p=0,021).

**DISCUSSION AND CONCLUSION**

The results of this study have shown a significant correlation between RT and MT, therefore not corroborating with results obtained by Myiamoto and Meira JR (2004) that performed a test with runners and did not find a correlation between the abilities. They possibly reached this result because they dealt with different muscle groups and probably inferior members were better trained.

Another study done with indoor soccer male players evaluated RT from a movement of finger and MT was obtained from a spin movement to the left or right. This study did not corroborate ours either. Our main argument is that the abilities were different therefore needed also different programming (CHAGAS; LEITE; UGRINOWITSCH; BENDA; MENZEL; SOUZA; MOREIRA, 2005).

RT and MT are understood as independent abilities, which theoretically presupposes low correlation, from the point of view that the main influence on MT is muscular strength, whereas in RT require central processing previous to the movement (HENRY, 1961; HENRY; ROGERS,1960).

Magill and Powell (1975) observed the association between the two abilities from a single motor skill and found significant correlation. Phillips and Glencross (1985); Pierson and Rash (1960) also observed positive correlation between RT and MT.

The main claim of the results obtained in our study is that the same motor skill has been used to measure the correlation between RT and MT that theses abilities need a specific demand in relation to the muscle groups and the amount of mass to be moved.

Other authors conducted tests with different motor skills, that is, did not use the same task and did not find correlation between RT and MT (CHAGAS; LEITE; UGRINOWITSCH; BENDA; MENZEL; SOUZA; MOREIRA, 2005; MYIAMOTO; MEIRA JR, 2004).

From the analysis of the results obtained in this study, it is possible to conclude that there is significant correlation between simple reaction time and movement time in the same motor skill. These findings can determine that for a better performance or even for the process of acquisition of motor skills, it is not sufficient to improve the abilities, but also to promote interaction between them. However, we recommend further study that analyses the association between RT and MT, especially connecting the level of this association to the level of performance. We also suggest that the testing uses a single motor skill.

**REFERENCES**

CALVETE, S.A. Estudo das Capacidades Motoras de Adolescentes Obesos. (Dissertação de Mestrado). **Escola de Educação Física e Esporte** (EEFE), USP, São Paulo, 2005.

CHAGAS, M.H.; LEITE, C.M.F.; UGRINOWITSCH, H.; BENDA, R.N.; MENZEL, H.J.; SOUZA, P.R.C.; MOREIRA, E.A. Associação entre tempo de reação e de movimento em jogadores de futsal. **Rev. bras. Educ. Fís. Esp.**, São Paulo, v.19, n.4, p.269-275, out/dez, 2005.

DANEV, S.G.; WINTER, C.R.; WARTNA, G.F. **On the relation between reaction and motion time in a choice reaction task. Acta Psychologica,** v.35, p.188-97, 1971.

GRECO, P.J.; BENDA, R.N. **Iniciação Esportiva Universal. Belo Horizonte:** Editora UFMG, 1998, p.232.

HAYWWOD, K.M.; GETCHELL, N. **Desenvolvimento Motor ao Longo da Vida.** 3ª ed. Porto Alegre: Editora Artmed, 2004.

HENRY, F.M. Stimulus complexity, movement complexity, age, and sex in relation to reaction latency and speed in limb movements. **Research Quarterly**, v.32, p.353-366, 1961.

HENRY, F. M.; ROGERS, D. E. Increased response latency for complicated movements and the "memory drum" theory of neuromotor reaction. **Research Quarterly,** v.31, p.448-458, 1960.

HIRTZ, P. Strktue und Entwicklung Koordinativer Listungsvoraussetzungen bei Schulkindern. **Theorie und Praxis der Korperkultur**, v.26, p.503-510, 1971.

LIDOR, R., ARGOV, E., DANIEL, S. An exploratory study of perceptual-motor abilities of women: novice and skilled players of team handball. **Perceptual and Motor Skills**, 86, 279-288, 1998.

MAGILL, R.A. **Aprendizagem motora: conceitos e aplicações**. 5ª ed. São Paulo: Edgard Blücher LTDA, 2000.

MAGILL, R.A.; POWELL, F.M. Is the reaction time-movement time relationship essentially zero? **Perceptual and Motor Skills**, v.41, p.720-2, 1975.

MIYAMOTO, R.J.; MEIRA. JR. C.M. Tempo de reação e tempo das provas de 50 e 100 metros rasos do atletismo em federados e não federados. **Revista Portuguesa de Ciências do Desporto,** Porto, v.4, n.3, p.42-48, jul/dez, 2004.

MORI, S; OHTANI, Y; IMANAKA, K. Reaction time and anticipatory skills of karate athletes. **Human Movement Science**, 21, 213-230, 2002.

PHILLIPS, J; GLENCROSS, D. The independence of reaction and movement time in programmed movements. **Acta Psychologica**, Oxford, v.59, p.209-225, 1985.

PIERSON, W.R.; RASCH, P.J. Generality of speed factor in simple reaction time and movement time. **Perceptual and Motor Skills**, Missoula, v.11, p.123-128, 1960.

RODRIGUES, S.C.P.;RODRIGUES, M.I.K. Estudo de Correlação entre Tempo de Reação e Tempo de Movimento no Karatê. **Revista Kinesis,** v.Especial, p.107-117, 1984.

SAGE, G.H. Introduction to motor behavior: a neuropsychological approach. 2nd ed. Massachusets: **Addison-Wesley,** 1977.

SANTOS, S.; CORREA, U.C.; FREUDENHEIM, A.M. Variabilidade de performance numa tarefa de "timing" antecipatório em indivíduos de diferentes faixas etárias. **Revista Paulista de Educação Física,** v.17, n.2, p.154 - 162, jul./dez., 2003.

SCHMIDT, R.A.; WRISBERG, C.A. **Aprendizagem e performance motora: uma abordagem da aprendizagem baseada no problema.** 2ª ed. Porto Alegre: Artmed, 2001.

SCHMIDT, R.A. **Aprendizagem e Performance Motora: dos princípios à prática.** São Paulo: Editora Movimento, 1993.

SCHMIDT, R.A. Motor control and learning: a behavioral emphasis. 2nd ed. Champaing: **Human Kinetics,** 1988.

SOUZA, A.P.S.; OLIVEIRA, C.A.O.; OLIVEIRA, M.A. Medidas de tempo de reação simples em jogadores profissionais de voleibol **Revista Digital**, Buenos Aires, v.10, n.93, 2006.

SOUZA, G.M.; ALMEIDA, F.S. Queixa de dor músculo-esquelética das atletas de 6 a 20 anos praticantes de ginástica artística feminina. **Arq Med ABC,** São Bernardo do Campo/SP, v.31, n.2, p.67-72, 2006.

WEINECK, J. **Treinamento ideal.** 9ª ed. São Paulo: Manole, 1999.

Edson Luiz Fonseca

Endereço para contato: Avenida Arthur Bernardes, número 200, apartamento 202. Bairro Santa Lúcia, Belo Horizonte Mg. Brasil. Cep 30350-310

Email: edlfonseca@yahoo.com.br

**ASSOCIATION BETWEEN REACTION TIME (RT) AND MOVEMENT TIME (MT) IN MOTOR SKILLS**

The aim of the present study was to analyze the association between reaction time and movement time in adults. The reaction time was measured using a platform containing six recipients numbered 1-6 and a control panel linked to a computer, composed of two diodes that provided visual stimulus to initiate the task and an answer key to register the measures of time. The task was to carry tennis balls from the bottom of the platform to the top in the following order (4-1/5-2/6-3) in the highest possible speed. It was interpreted as the reaction period the time between the presentation of the stimulus and the released of the hand of the response-key to start the task. The movement time was measured from the release of the key up to the time that that the subject placed the balls in the pre-determined sequence and pressed the key again, characterizing thus the end of task. The subjects were 10 adults of both genders, aged between 18 and 35 years with no previous experience in the task. For the statistical analysis it was used Pearson's product-movement correlation test which detected significant value for the association of RT and MT (r=0,71; p=0,021). The results indicate significant correlation between RT and MT with adults.

**KEY WORDS:** Reaction Time, Movement Time, Adults.

**ASSOCIATION ENTRE TEMPS DE RÉACTION (RT) ET À LA MOUVEMENT TEMPS (MT) DANS LES HABILETÉS MOTRICES**

L'objectif de la présente étude était analyser l`association entre temps de réaction et de mouvement chez les adultes. Le temps de réaction a été mesurée en utilisant un plate-forme reliée à un micro-ordinateur contenant six recipeinetes cotées de 1 à 6. La tâche consistait à transporter les balles de tennis du fond du la plate-forme au sommet dans l'ordre suivant (4-1/5-2/6-3), aussi vite que possibile. Il a été interprété comme le temps de réaction entre la période aprés la présentation du stimulus et quand le gars lâcher le main de la clé de réponses pour démarrer la tâche. Depuis le temps de mouvement a été mesurée de la libération de la clé jusqu`au moment ou fait circuler lês boules dans la séquence prédéterminée et pressé la touche à nouveau, caractérisant la fin de tâche. L`échantillon était composé de 10 adultes des deux sexes, âges entre 18 et 35 ans, sans experiénce dans la tâche. Pour l'analyse statistique en utilisant la corrélation produit de Pearson moment , qui a présenté une valeur significative pour l'association (r=0,71, p=0,021) Les résultats indiquent qu`il existe une corrélation significative entre RT et MT avec des adultes.

**MOTS CLÉS:** Temps de Réaction, Mouvement Temps, Adultes.

**ASOCIACIÓN ENTRE TIEMPO DE REACCIÓN (RT) Y EL TIEMPO DE MOVIMIENTO (TM) EN HABILIDADES MOTORAS**

El objetivo del presente estudio fue la análisis de la asociación entre el tiempo de reacción y el tiempo de movimiento en adultos. El tiempo de reacción fue medido con una caja de madera conectada a una microcomputadora con seis contenedores numerados desde el 1 hasta el 6. La tarea consistía en llevar pelotas de tenis desde el fondo de la plataforma al

inicio, en la siguiente orden (4-1/5-2/6-3) en la mayor velocidad. Él tiempo de reacción fue interpretado como el período entre la presentación del estímulo y cuando el sujeto liberó la mano de la respuesta-clave para comenzar la tarea, el tiempo de movimiento fue medido desde la liberación de la mano de la respuesta-clave hasta el momento que se llevó las pelotas, en la secuencia pre-determinada y se presionó la tecla novamente, caracterizando al final de la tarea. Los sujetos fueron 10 adultos de ambos sexos con edad entre 18 y 35 años sin experiencia en la tarea. Para el análisis estadístico se utilizó el correlación Pearson que encontró un valor significativo para la asociación (r=0,71; p=0,021). Los resultados indican la existencia de correlación entre RT y MT con adultos.

**PALABRAS CLAVE:** Tiempo de reacción, tiempo de Movimiento, Adultos.

**ASSOCIAÇÃO ENTRE TEMPO DE REAÇÃO (TR) E TEMPO DE MOVIMENTO (TM) EM UMA HABILIDADE MOTORA**

O objetivo do presente estudo foi analisar a associação entre tempo de reação (TR) e movimento (TM) em adultos. O TR foi medido utilizando uma plataforma ligada a um microcomputador contendo seis recipientes enumerados de 1 a 6. A tarefa consistia em transportar bolas de tênis da parte inferior da plataforma para a parte superior na seguinte ordem (4-1/5-2/6-3), na maior velocidade possível. Interpretou-se como TR o período entre a apresentação do estímulo e o momento em que o sujeito soltou a mão da chave de respostas para iniciar a tarefa. Já o tempo de movimento foi mensurado a partir da soltura da chave até o momento em que se transportou as bolas na seqüência pré-determinada e pressionou a chave novamente, caracterizando assim o fim da tarefa. A amostra foi composta por 10 adultos, de ambos os sexos, com faixa etária entre 18 e 35 anos, inexperientes na tarefa. Para a análise estatística foi utilizado a correlação produto-momento de Pearson no qual foi detectado valor significativo para a associação (r=0,71; p=0,021). Os resultados indicam que há correlação significativa entre TR e TM com adultos.

**PALAVRAS CHAVES:** Tempo de Reação Simples, Tempo de Movimento, Adultos.

PUBLICAÇÃO NO FIEP BULLETIN ON-LINE: http://www.fiepbulletin.net/80/a2/144