143 - LEARNING SKILL-MOTOR STRATEGIES THROUGH OBSERVATION AND REFERENCES BY CORTICAL STIMULATION VISUAL AND AUDITORY STIMULI: AN APPROACH OF MIRROR NEURONS.

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INTRODUCTION

The cellular changes resulting from learning and memory are called plasticity. The experience can give for active learning or living together with people, colors, music, sound, books, fragrances and other (SUGIMOTO, 2007). Among the learning processes we can mention the motor learning characterized as a change in ability to perform activities on the basis of practice or experience, performance improvement occurring each time, after a time interval (SOUZA; FRANÇA; CAMPOS , 2006). Since the improvement of learning occurs between 4 and 7 years (PALAFOX, 2007).

The identification of behavior imposed by the environment adapts to the individual's personality to the space where it is and gives characteristics of the person you talk, the stimuli may be concrete or from signals provided by the caller. In practice, this is a system that, within the brain, establishing the individual identity due to disturbances in circuitry that governs the capacity for empathy and the ability to "tune in" to the other emotions (OVADIA, 2007).

These brain cells called mirror are able to analyze scenes and interpret his intentions, revealing how learning takes place and why they like or dislike of certain things and objects. For from the observation of another person, these cells fire answers to chains of actions related to their intentions (Blakeslee, 2007). The activation of mirror neurons in areas of the premotor cortex in both hemispheres shows a response to scenes of action with clear intentions (BRINKOFSKI; BUCCINO, 2007).

In this context, the harmonic activity of the cerebral cortex can enhance the activation of mirror neurons, since there is a predominance of specific brain waves that favors this mechanism. The brain wave can be translated as a scan of electrical stimuli, made by neurons, within a predetermined time, in a harmonic way, creating brain rhythm (SANTOS, 2005).

These waveforms produced by the electrical activity of brain cells may be measured by devices like the EEG - Electroencephalogram. These are measured in cycles per second, or Hertz (Hz) and induce a man to four stages or levels of mind: Alpha, Beta, Theta and Delta which are related to states of consciousness (concentration, relaxation, etc.). And can be changed by changes in brain rhythm (IVALDO, 2008).

In this context, the cortical stimulation has proven to be a reliable protocol for controlled change of pace brain, it promotes neuronal recruitment in select brain areas, and the same amount in each hemisphere and is independent of individual differences in motor preparation and strategies execution of movement (ECARD et al., 2007).

Currently there have been alternative ways to stimulate the condition of an individual to learn, or stimulate the brain learns. There are methods that are associated with mechanical modeling among which is brain stimulation on photic and auditory synthesis. The latter was used in research: Alves, 2007; Feedburner, 2008; Chaves 2008; Almeida et al. 2007, aiming to create an environment conducive for cortical learning events.

METHODS

This study was reviewed and approved by the Ethics and Research of the Universidad Castelo Branco, protocol number 0099/2008, conducted by the Laboratory of Neuroscience, the research line of the Studies of Mechanisms and Processes for the Acquisition of motor behaviors.

The sample was represented by fifteen (n = 15) subjects aged between four and five years, and 8 (53.33%) were male and 7 (46.67%) female students, a school for children in private schools in the city of Ipatinga - Minas Gerais, without cognitive impairment and / or physical, or any other disorders that prevented the completion of training.

So, initially, proceeded to the distribution of the Terms of Consent and questionnaires on the health of participants to their respective guardians. For this, the educational institution selected for this study was aimed at meeting a greater number of participants and information on the steps of this research.

Those selected were divided randomly into three groups, with a control group (CG) who performed the task-skilled complex motor only with the feedback provided by the researcher, a second group (G1) who observed the previous group (CG) in carrying out the same task-skilled motor complex (theory of mirror neurons) before their own attempts, and the third group (G2) who had the same chance of notice given to the G1, before the complex task, but that before that was submitted to a session of cortical stimulation by photic and auditory synthesis.

It should be noted that the complex task in question, was to launch a meteorite to a reference site (stop). The skilled motor training was divided into Phase Acquisition for eighteen sessions of forty trials each, performed on alternate days to avoid interfering in the daily routine of classes, and transfer phase which consisted of one session of forty trials.

For the execution of skilled motor task, we used a runway launch of aluminum (KELSO; NORMAN, 1978) fixed on the floor with tape, measuring 1.34 inches long X 3.0 cm wide x 1.5 cm tall and weighing 288g; a meteorite metal on wheels, Ferrari model, the brand Fresh Metal, measuring 7.4 cm long X 2.8 cm wide x 2.0 cm high and weighing 32.0 g in the red for the three groups. All used the same course of release, and predetermined targets on the track delimit the location of stop (reference) of the bolide.

All values obtained were recorded at the end of each release, and recorded on individual cards. Fixed metrics of 5.0 to 5.0 cm, on the side of all track guided the observer. The values recorded by the meteorite with its front, at the reference (target) platform, were recorded as follows: 0 (zero) defaults to hit the target; POSITIVE when the bolide stopped above the target reference: NEGATIVE below the target, a (annulled), when the meteorite was shocked at the end of the runway or leaves it.

In the last phase, we made forty pitches in a single block called Transfer (TANI, 2000; VIEIRA, 2006), which amounted to six hundred and eighty pitches for eighteen sessions of motor training. The data collected were compared in a model of pre-and post-test.

The data collected were analyzed and the values used in statistics, descriptive model (mean and standard deviation) and inferential model, through analysis of variance. Also analyzed type parametric and nonparametric. In non-parametric model was selected for the mathematical order to Kruskal Wallis test, for the parametric model, Oneway ANOVA. The software used

was SPSS 11.0. All tests effectuated obey the criterion of $p \leq 0.05$.

RESULTS

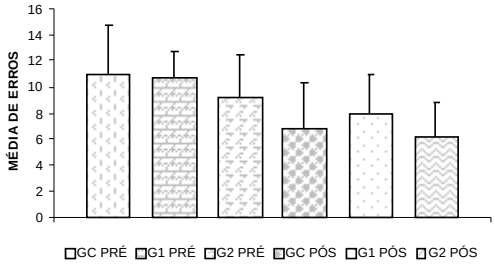
During the acquisition and transfer, the dependent variable measured was the number of absolute errors. Table 1 describes the variable mean absolute error by comparing the pre and post-intervention, the task of launching the meteorite to a reference site (stop) between the CG, G1 and G2. This table can be seen that, despite the reduction in the number of absolute errors have decreased in all groups; these differences were not statistically significant.

TABLE 1. Average absolute errors between the groups GC, G1 and G2, comparison of pre and post-tests after training skilled motor task to launch the meteorite to a reference site (stop).

GROUPS	PRE-TEST $\bar{x} - s$	POST TEST $\bar{x} - s$	LEVENE	ANOVA
GC	11 ± 3,67	6,8 ± 3,49		
G1	10,6 ± 2,07	8 ± 2,92	0,68	0,104
G2	9,2 ± 3,27	6,2 ± 2,68		

ANOVA* $p \leq 0,05$.

The data described in Table 1 are plotted in Figure 1. In this figure one sees clearly the decrease in the average absolute errors of the experimental groups, possibly be reflected in improved performance of skilled-motor learning. This reduction was higher in G1 (63%) in this group, the individuals performed the task with the feedback from the researcher and the observation of other practitioners, but without the use of cortical stimulation. The second group that was on reduction of absolute errors was the GC (49%) who had only the feedback of the researcher performing the task. Finally, G2, there was a smaller reduction in errors (33%), whose addition to the observation of other children and the feedback from the researcher, received the photic stimulation and auditory synthesis.

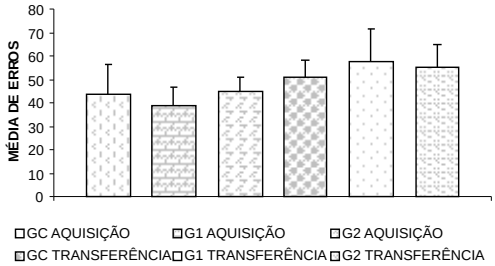


ANOVA* $p \leq 0,05$

FIGURE 1. Mean absolute errors between the groups GC, G1 and G2, comparing pre-and post-tests after training skilled motor task to launch the meteorite to a reference site (stop).

Another comparison made in this study was between the average absolute errors in skilled motor task, among the three groups in the acquisition phase to the phase of transfer.

Data for this comparison are plotted in Figure 2, where one can observe a similar performance between GC and G2 and a decrease of absolute errors in G1 ($p \leq 0.05$). The fact that the G1 have better performance was due to the number of errors in shooting attempts, the task of launching the meteorite to a reference site (stop), was lower for the other two groups.



ANOVA* $p \leq 0,05$

FIGURE 2. Mean absolute errors between the groups GC, G1 and G2, the task of launching the meteorite to a reference site (stop) comparison of the acquisition phase to the transfer.

It is worth mentioning that in the transfer, the marking of the new target on the runway differentiated from the other three previous markings known by children in the acquisition phase and was conducted in a single block of trials with a single meeting. In the Acquisition Phase, three meetings were alternated during the week, with forty trials each.

DISCUSSION

During the acquisition phase, there were no significant differences between the experimental groups. The results do not support the hypothesis of variability of practice on Schema Theory (MARINOVIC; FREUDENHEIM, 2001). These results also do not support the predictions of the Principle of Contextual Interference. In this case, one possible explanation for these results may be related to the concept that, according Marinovic and Freudenheim, the effect of contextual interference is observed only when the variability involves a change of motor programs. Therefore, the variability used in this study - change in the parameters - might not be appropriate to test the effect of contextual interference. Likewise, the statistical analysis did not reveal differences between the groups.

The fact that the G1 have better performance because of the number of errors in the shooting of attempts have been lower compared to other groups, contradicting the theory of scheme because it was not the group submitted to conditions most favorable from the point of view of improved performance in the Acquisition Phase.

Therefore, as argued theoretically by Schema Theory and the Principle of Contextual Interference, the descriptive and inferential analysis showed a tendency of superiority on the G1 and G2 GC, in the acquisition phase, and the CG in the other

two groups in transfer. These trends indicate that possibly the assumptions Barreiros (MARINOVIC; FREUDENHEIM, 2001; BARREIROS, 2006; MAGILL, 2000), on the use of varied practice law, at the beginning of the acquisition of motor skills, are correct, ie, practice can be beneficial early in the acquisition process.

Therefore, maintaining the limitations of a descriptive analysis, the trends reported point to the need for training of generalized motor program, favored by the practice, prior to the strengthening of the scheme. In this sense, taking into account that the subjects are beginners in the task at hand, the number of attempts, perhaps, was not sufficient to trigger the formation of the motor program. Therefore, the level of experience, as an important variable for the effect of such practices in the acquisition of motor skills, shows that the number of attempts to practice, in the acquisition phase, to be more extensive. However, no significant differences between groups in the proposed training.

Interestingly, the fact that the results of wave activity are different between the groups by level numbers, does not prevent the fluctuation of positive results for the motor performance in complex applied. This is due to the fact that there are many other influential factors involved in this training, the authors cite as Brazil Neto, 2004; Boggio et al., 2006, Almeida et al. 2007; Alves, 2007; Ecard et al. 2007; Feedburner, 2008, Chaves 2008 and Ivaldo, 2008.

For trends, one should consider the approach of mirror neurons with enhanced cortical stimulation through photic sensitization and hearing as an alternative to improve the acquisition process. They are also using measures that allow inferences about the process that took place in these practices.

In future work, one must consider that subjects beginners need large number of attempts to make the formation of generalized motor program and thus maximize learning.

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LEARNING SKILL-MOTOR STRATEGIES THROUGH OBSERVATION AND REFERENCES BY CORTICAL STIMULATION VISUAL AND AUDITORY STIMULI: AN APPROACH OF MIRROR NEURONS.

ABSTRACT

Goal: Verifying the theoretical possibility that the learning of a motor skill may come from the observation of other practitioners and be intensified due to the protocol of sensitization of cortical waves via cortical stimulation. **Methods:** The sample involves fifteen children, both male and female, aged four to five years old, divided randomly into three groups. That practiced a motor training which was according to the mirror-neuron theory. To verify the possible alterations in the cortical standard, the electroencephalogram was done (pre and post tests) and the motor performance of the groups was observed. The data were analyzed through the descriptive statistics (average and standard deviation) and studied by using statistical instruments in the inferential model through the analyses of variance of parametric type (Anova) and non-parametric type (Kruskall Wallis). **Results**: It was observed that in the Acquisition and Transference Phase, the group obtained improvement in the motor performance due to the decrease of absolute mistakes average and balance in the cortical waves. The values obtained

were not significant. **Conclusion:** The hypothesis that was investigated in the mirror-neuron approach, associated with the cortical stimulation, demonstrated increase in the global performance of the group, improving the development, the agility and the skilled-motor capacity.

KEY-WORDS: Skilled-motor learning, mirror-neurons, cortical stimulation.

QUALIFIÉS-MOTOR APPRENTISSAGE PAR L'OBSERVATION STRATEGIES ET REFERENCES STIMULATION CORTICALE VIA SINTETIZAÇÃO LUMINEUSE ET L'AUDITION: UNE APPROCHE DES NEURONES MIROIR.

RÉSUMÉ

Objectif: Vérification de la possibilité théorique que l'apprentissage d'habiletés motrices mai résultat de l'observation d'autres praticiens et d'intensifier selon un protocole de sensibilisation des vagues corticale par stimulation corticale. **Méthodes:** L'échantillon se compose de quinze enfants, les deux sexes, âgés de quatre à cinq ans, répartis au hasard en trois groupes. Moteur de formation pratiqué en tant que théorie des neurones miroir. EEG a été effectuée (pré-et post-tests) et a observé la performance motrice des groupes. Les données ont été analysées en utilisant les statistiques descriptives (moyenne et écart-type) ont été étudiés à l'aide d'outils statistiques, le modèle d'inférence, avec une analyse de variance de type paramétrique (ANOVA) et non paramétriques (Kruskall Wallis). **Résultats:** on observe que la phase d'acquisition et de transfert, les groupes ont amélioré leur performance motrice, en réduisant les erreurs moyenne absolue et l'équilibre dans les vagues corticale. Les valeurs ne sont pas statistiquement significatifs. **Conclusion:** L'hypothèse d'une enquête dans l'approche des neurones miroirs associés à la stimulation corticale ont montré une augmentation de la performance globale des groupes amélioration des performances, l'agilité et la capacité de conduite qualifiés.

MOTS-CLÉS: apprentissage des neurones miroir qualifiés à moteur, la stimulation corticale.

CALIFICADO-MOTOR APRENDIZAJE POR OBSERVACIÓN REFERENCIAS Y ESTRATEGIAS DE ESTIMULACIÓN CORTICAL VIA SINTETIZAÇÃO FÓTICA Y OÍR: UN ENFOQUE DE LAS NEURONAS ESPEJO.

RESUMEN

Objetivo: Verificación de la posibilidad teórica de que el aprendizaje de las habilidades motoras pueden derivarse de la observación de otros profesionales y se intensificarán de acuerdo a un protocolo de sensibilización de las ondas corticales mediante estimulación cortical. **Métodos:** La muestra se compone de quince niños, de ambos sexos, con edades entre cuatro a cinco años, divididos aleatoriamente en tres grupos. La formación de motor Ejerció como una teoría de las neuronas espejo. EEG se llevó a cabo (pre-y post-test) y observó el rendimiento del motor de los grupos. Los datos fueron analizados utilizando estadística descriptiva (media y desviación estándar) fueron estudiados usando herramientas estadísticas, el modelo inferencial, con el análisis de varianza de tipo paramétrico (ANOVA) y no paramétricos (Kruskall Wallis). **Resultados:** Se observó que la fase de adquisición y transferencia, los grupos de mejora de su rendimiento del motor mediante la reducción de los errores medios absolutos y el equilibrio en las ondas corticales. Los valores no fueron estadísticamente significativas. **Conclusión:** La hipótesis de la investigación en el enfoque de las neuronas espejo asociados con la estimulación cortical mostró un aumento en el rendimiento general de los grupos de mejorar el rendimiento, agilidad y capacidad de conducción especializada.

PALABRAS CLAVE: aprendizaje cualificados neuronas espejo de motor, la estimulación cortical.

APRENDIZAGEM HÁBIL-MOTORA ATRAVÉS DE ESTRATÉGIAS DE OBSERVAÇÃO E REFERÊNCIAS DA ESTIMULAÇÃO CORTICAL VIA SINTETIZAÇÃO FÓTICA E AUDITIVA: uma abordagem dos neurônios-espelho.

RESUMO

Objetivo: Verificação da possibilidade teórica de que a aprendizagem de uma habilidade motora possa decorrer da observação de outros praticantes e ser intensificada em função de um protocolo de sensitização de ondas corticais via estimulação cortical. **Métodos:** A amostra constituída por quinze crianças, ambos os gêneros, faixa etária entre quatro a cinco anos, divididas aleatoriamente em três grupos. Praticaram um treinamento motor conforme teoria dos neurônios-espelho. Foi realizado eletroencefalograma (pré e pós-testes) e observada a performance motora dos grupos. Os dados foram analisados por estatística descritiva (média e desvio padrão) e estudados utilizando-se instrumentos estatísticos, no modelo inferencial, com análises de variância do tipo paramétrico (Anova) e não paramétrico (Kruskall Wallis). **Resultados:** Observou-se que na Fase de Aquisição e Transferência, os grupos obtiveram melhora na performance motora pela diminuição na média de erros absolutos e equilíbrio nas ondas corticais. Os valores não foram estatisticamente significativos. **Conclusão:** A hipótese investigada na abordagem dos neurônios-espelho, associada à estimulação cortical, demonstrou aumento na performance global dos grupos melhorando o desempenho, a agilidade e a capacidade hábil-motriz.

PALAVRAS-CHAVE: aprendizagem hábil-motora, neurônios-espelho, estimulação cortical.

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