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ORIENTATION ARTICLE

THE MOTOR LEARNING, MEMORY, KNOWLEDGE OF RESULTS: COMPARATIVE ANALYSIS OF HOMOGENEOUS GROUPS.

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Keywords: motor learning, memory, brain, enable 'motor, psychomotor development

ABSTRACT

There is ample experimental evidence of the positive-fixing motor task of having both a lower relative frequency (FR) which is provided with the knowledge of the result (CR) to the subject of learning, The outcome of the response, both the application of the formulation of a subjective estimate of first CR (SS).

It 'was, however, suggested the possibility of an interaction between these two variables,meaning that the individual, when he has to make an estimate subjective error, would benefit from greater FR. Taking up an interesting research is shown in a dissertation in Physiotherapy (Giulia Days 2000/01 Which is credited with having carried out a rigorous investigation and Articles) The authors of this paper have wanted to see exactly Proposing given to 60 young subjects, righthanded and in good health, and the same working hypothesis, but with a different device (Biodex System 4): a simple right elbow flexion with isokinetic contraction at 30 degrees / second. Subjects were asked:

1) to Assess Whether or not the mistake made after the end of the year,

2) CR was provided after each trial (100% FR), or after a trial every five (20% FR)

3) to mark the difference between the subjects who did not Had Gold SS to make an the latter was asked immediately after the conclusion of the trial, of perform a simple calculation. All subjects performed 20 sets of 10 repetitions each during a single session of practice. The next day was made a test of retention (consisting of 1 set of 15 repetitions without CR or SS The comparison between the groups at the retention test was performed with Analysis of variance, before and after adjustment for the initial conditions. The results showed that after adjustment the group of subjects who received the CR with 100% FR and formulation of SS during the period of practice, a test of retention in a Significantly better.

SUMMARY

There is ample experimental evidence of the positive attachment motor task of having both a lower relative frequency (FR) that comes with knowledge of the result (CR) on the learning the result of the response, as the application of the formulation of a subjective estimate of the first complete remission (SS). He "was, however, suggested a possible interaction between these two variables, meaning that the individual when he has to make an estimate subjective error, would attract a larger FR. Taking research interest is shown in a dissertation in Fisoterapia (Giulia Days 2000/01,which is credited for having conducted a thorough investigation and articles) the authors of this paper have liked to see exactly given offers to 60 young subjects, the right hand and healthy and the same working hypothesis, but with another device (Biodex System 4): a simple elbow flexion right to isokinetic 30 degrees / second.

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Subjects were asked:

1) to assess whether or not the mistake after the end of the year

2) CR was provided after each test (100% FR), or after a trial in five (20% FR)

3) to mark the difference between subjects who did or did not for an SS the latter asked immediately after the conclusion of the trial, perform a simple calculation. All subjects performed 20 sets of 10 repetitions of each during a single session of practice. The next day was made a test of retention (consisting of 1 set of 15 repetitions without CR or SS The comparison between groups in retention test was conducted with analysis of variance, before and after adjustment for initial conditions. The results showed that after adjustment group of subjects who received CR with 100% FR and the formulation of SS during the practical test of retention in a significantly better.

INTRODUCTION

Zingarelli dictionary of the Italian language defines 'learning' as "Relatively permanent change induced in an organism directly from the experience. A structured process, therefore, which involves various aspects of interaction with each other and has the distinctive character of stabilityover time.

Behavior change is relatively fixed it differentiated learning improved temporary (or casualor fortuitous) of performance. If the next day you're able to "remember" how to perform the task,the latter can not be called "learned".

Thus, learning is the ability of individuals to acquire think,process information: in practice, without memory there can be no learning.To assess whether changes occurred only transient or real learning, therefore, necessarythat benefit is reassessed at a later date. It was introduced by researchers at an experimentalprotocol able distinction between temporary effect (improved performance) and effects relatively permanent (teaching), which consists of two phases (Winstein, 1991): 1) acquisition phase (orpractice), during which the subject does Many trials (trial) in this phase, the different experimentalgroups receiving treatment with different levels of the independent variable under consideration forie different programs extrinsic feedback; 2) the transfer phase, in which all groups are transferred to a same level of the variables studied, such as lack of feedback extrinsic, this phase must be sufficiently distant from practice stage so that the transient effects of the independent variable are missing, and in this way, we can assume that the performance during the reflects the transfer of learning induced by the independent variable during data acquisition.

Some authors distinguish the second phase in real time and retention transfer (Kordus and Weeks, 1998), the latter is to check if the subject is able to use the skills acquired in a different context, or if his memory was a more generalized skill itself. For example, if a person has been taken to launch a ball distance from the target in a retention test conducted one or two days later, repeat control at the same distance, while in the transfer test ask the same task, but at a distance less than or greater than that exerted during the acquisition phase.

Learning a motor skill is influenced by several factors, but crucial element is the availability of feedback to inform learning about the success of its response (Winstein, 1991). The assessment is actually used in the early stages of learning to build or change at each subsequent pattern of movement, and can subsequently comparison between the movement and made the correct result.

Comments term means "Feedback", a feedback system is a system that has sensors that detect output parameters makes the comparison between the movement and made him, and indicates possible error. The feedback, then the learner success of its response and that is why it has long been as a critical factor for motor performance and learning.

Baroni and Welcome (1991) distinguish three categories of information on the move:

1) information devices (cons-body movement) mainly tactile and kinesthetic;

2) internal assessments (cons-Central), called by various authors also efferent copy or corollary discharge;

3) external evaluations (cons-motion effects), ie knowledge of results, knowledge of result (CR) can be defined

how the information representing the difference between the response and the ideal.

Seems to be shared in the literature the concept that a CR preparation is necessary learning a new motor response. The mechanism of feedback and knowledge of the result can be drawn directly by the person performing the task or which is supplied from outside. From this perspective, Winstein (1987) refers respectively Assessment intrinsic and extrinsic feedback. The feedback provides information intrinsic both during and after production of motion and is inherent to information from sensory receptors in muscles, joints, tendons and skin, or by sight and hearing. Conversely, the reactions are extrinsic information from a external source that increases the intrinsic reactions. The external source may be technician or a device as a biofeedback device, or a stopwatch. The more channels through which sensory information is provided, the greater the reference of correctness. That is, more = better result The potential of extrinsic feedback has been on display in some studies showed that motor learning can occur in the absence of intrinsic feedback. In a study of Rothwell et al. (1982)

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subjects, deprived of afferent learn new motor tasks while receiving visual feedback through extrinsic using an oscilloscope.

When the visual feedback was removed, the subject could perform the task, but Their performance has declined over time. The authors concluded that feedback was necessary in some respects to the following update regarding the CNS success and especially the accuracy of the movement. Comments can also be divided into extrinsic information results and information about the motor sequence that has Product action. The first case gives an external feedback Minutes enriched in the outcome of the movement, there is a form of words Knowledge of results (CR). The CR provides information on errors, therefore provides the learner with information about how to modify the movement in the next attempt. Knowledge of performance (COP) is rather a verbal feedback on the kind of movement that can be provided Only at the end of the movement.

Research on the importance of feedback extrinsic motor learning focused on CR (Adams, 1987). Mainly because of the ease Done with which the CR can be obtained and quantified in experimental conditions. There are many important variables in learning based the type of information provided to the person who learns a motor task and mode of administration of extrinsic feedback, which are the subject of Search for a long time. In research on the relationship between feedback and motor learning is created a condition of the environment in which the usefulness of testing feedback inherent relevant to the solution is minimized when the evaluation is presented again (in usually in the form of the RC) and examine its effects on the process learning (Winstein, 1991). Thus, an experimental protocol in May mimic closely the conditions of a patient with sensory deficit which is incapable effective use of intrinsic responses to the motor drive and then must rely on extrinsic information provided by the operator. This research paradigm is based on the premise that the functions of extrinsic feedback learning tasks in artificial laboratory, the same way exploits the inherent comments to situations of real life. Therefore, is considered that the process facilitated by the use of extrinsic feedback such as error correction or development of an internal reference of correctness, are similar to the process facilitated by the use inherent in natural conditions, in which the CR is not available or is redundant comments.

There are many parameters related to the administration of the CR can influence the level of motor learning, but most Some studies have focused on the relative frequency with which it is provided to the learner, knowledge of results. The term "Relative Frequency", the percentage of trials for which is provided comments during a workout that the total number tests, while the term "absolute frequency" indicates the total number of trial for which this assessment is provided (Winstein, 1991, Duncan and sdb, 1989). For example, if the CP and / or CR are given every 2 tests in a program of 20 events, the absolute frequency is 10 exposures information, while the relative frequency is 50%. The amount of feedback extrinsic can be increased by increasing the number of trials and then increase in absolute frequency, or provide the information most often During the tests, thus increasing the relative frequency. It is an ongoing debate about the frequency of CR and Protocol useful to optimize the dosing motor learning (Schmidt & Lee, 1999).

In general, the literature on motor learning and protocols of good clinical practice They show that during the movement in Most tasks, almost any change that increases the availability Information provided by reaction (responsiveness, accuracy, frequency, number of channels) The benefits of performance and increase the percentage of improvement from one test to another. It is, however, sure, it helps learning and retention. From a theoretical viewpoint, have proposed two hypotheses on the optimal frequency of CR.

Early theories on information processing suggested that the CR is used mainly for motor learning in two complementary ways:

1) the learner needs a CR to test the hypothesis for the accuracy of the previous answer

2) all assumptions upon which the response is tested contributes to a better memory (reply Schmidt, 1975).

In other words, after completing the test, students will formulate a hypothesis response, ie it must estimate the success supported the test. It must then verify the correctness of this assumption, and this May be compared with the CR received. Based on this comparison, develop a hypothesis to answer, or a plan for the next trial. Consistent with this idea, Adams (1971) suggests that motor learning subjects must use the CR for the correction future responses based
on information from previous responses.

The strength of the memory that controls the response develops as a function Positive feedback produced by the reaction to the CR, namely Response of the hypothesis tested. Adams also said that when the knowledge of results is not provided, the learner can improve what has been learned from previous responses to the CR. Thus Based on this background, it was expected that 100% of the frequency of the RC were to maximize the effects of training on learning.

In more recent theoretical perspectives on development processes information, this assumption has been questioned. Indeed, it was suggests that, somehow, when the subject is given to learn high frequency of CR, some formulations of the CR will be used for guide future interventions. This type of assumptions have been reported by some authors hypothesis as a guide. One consequence of the assumption is that when participants

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receive during the driving test acquisition, a high frequency of CR, are unable to use the process additional memory or seek other sources of information contribute to the development of memory. In contrast, when provide participants with a low incidence of CR is encouraged engagement process additional memory during the test by untrained knowledge of the result. These processes, in turn, promote the development of memory. Based on recent perspectives on the use of CR for motor learning, it has been said that low frequency of CR, however, less than 100% may increase the effect motor learning and long-term retention.

Many studies have been conducted to compare the effect of another relative frequency of CR on the learning of many skills motor, with results generally in favor of this guide. In most If, indeed, it was found that subjects who practiced in task with a lower relative frequency of the feedback obtained extrinsic better results for a retention test. In fact, the authors support the theory of leadership are numerous.

One of the first studies that support the new theoretical perspectives was conducted in the early 90s by Winstein and Schmidt, has tried to maximize the positive effects attributed to the practice of learning in conditions of relative low frequency of CR, through manipulation the test program with CR and no CR within a training session. Two groups of subjects performed a complex system of movement space-time for 2 days under high (100%) or moderate (50%) relative frequency of the CR. In this experiment, the number of trials (196 to day) was kept constant between groups, allowing the covariance relative and absolute frequency. In group discount of 50% was paid progressive CR: daily, part of the test with CR was relatively High Early in practice (100%), but was gradually reduced towards the end practice (25%). Subsequently, at 2 days of practice, were administered each group tested retention after 5 minutes and after one day. The results showed that there was no difference in the level of the average error between groups during the acquisition phase. In the immediate retention test without CR, the group with 50% CR received a little more error lower (8.5 against 9.2) compared with 100%, and this difference was even more evident in the retention test later (10 against 12.1): for both groups, performance deteriorated between the end of the acquisition and retention test, but the decrease was significantly greater in the with 100% CR.

These results were reproduced by the same authors in a second experiment using the same program of RC in the previous experiment for a period of 2 days of practice, but where the retention test, conducted next day, consisted of 12 tests with the CR provided after each test. Surprisingly, the group of 50% had significant performance better than the group of 100% of CR, even in this test of retention with 100% CR. The reduction of 50% of the relative frequency of
CR in practice seems to support and develop a response capability independent of surface characteristics of the particular practice and conditions of detention. The results have been repeatedly confirmed by other authors who have compared groups with a different frequency of the RC. It is interesting to note that the results are similar, although the study population is old.

Although there are clearly age-related changes regarding the cognitive aspects and motor control, little research has been conducted on the effect of age learning motor skills. Based on available evidence that can handle the CR and the effects of this learning engines are similar in young and elderly.

Swanson and Lee (1992) examined the effects of program exposure to CR in young adults (20-23 years) and older adults (60-82 years). Results showed that there were differences between young adults and seniors in the precision and consistency of performance when he received the CR. The differences accuracy remained without retention test of CR, but there was no more differences in variability. In addition, there was no interaction with age none of the variables related to the CR.

Similar results were reported by Wishart and Lee (1997). Using a trisegmentale task, in which each segment had clear goals calendar The authors compared 3 different manipulations of the relative frequency CR in young adults and the elderly. The 3 conditions are:

1) 100% of CR, in which the CR on the three segments was provided after each test;
2) 67% of CR, in which information has decreased gradually in the various tests;
3) 67% of CR, in which information has been decreasing over the different segments each test.

After 90 trials of acquisition, all subjects performed test of retention, transfer and reacquisition.

There were differences age-related as to the accuracy and consistency of movement in the test acquisition and retention, but not in the transfer test. However, None of these differences interacted with the manipulation of frequency CR. Surprisingly, there was no effect due to different reducing the information mode. Evidence to support the theory guide are also data effectiveness of a summary and an average CR CR. A CR means giving summary information on the outcome of each test in a series of tests after the series was completed, instead of providing extrinsic information after each event.

The average CR is a variant in which the CR is presented as the average number of tests. In both cases, it reduces the availability of extrinsic feedback to guide operations Then, whichever guide availability may discourage Further manufacturing processes that in turn promote the development of memory.

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Research findings on the influence of feedback and competitor also continues to support the theory, because the simultaneous reactions provides online help, and has been repeatedly demonstrated that hinders learning a motor skill (Winstein et al., 1996, Schmidt and Wulf, 1997).

The theory of leadership has, however, opinions, even contradictory; differences in results are mainly in studies on more complex tasks. For instance, Lai and Shea (1999) compared a group with 100% of FR with groups that received comments less than 100% FR, applied with different protocols, conclusion that they do not differ, but they were taken by the group to 100% a test of retention without CR. This difference in results, Guadagnoli and Kohl (2001) gave the following explanation: that the subject is to receive RC and how it intends to use it, are not independent of each other. In other words, if, before receiving feedback from the person prepare an assumption

Performance has been completed, it will use to compare CR between assumptions and actual results, of course This comparison is not possible for all tests for which receives feedback. But if the subject does not construct a hypothesis response, the CR will be used in a way that is totally different for mechanically driving the response later.

In fact, it has been established for some time to urge the subject to verbalize subjective estimate of the error is a useful strategy for improving learning. The first study investigated the influence of an estimate of performance by learning a motor task was conducted by Swinnen and al. (1990). These authors compared the acquisition of skills for a group of subjects who received 100% of CR after a short period with a another group receiving 100% of CR instantly.

The authors introduced However, estimates vary, study and 3 conditions of CR:

1) CR instant, for example, immediately after the completion of the movement,

2) CR late, or after an interval of 8 seconds,

3) CR delayed with an interval of 8 seconds, during which the subject was required to do an estimate of its performance.

The results showed that, whereas during the acquisition phase there was no difference between the three groups in a test of immediate retention (after 10 minutes) and late (after 2 days), the CR group showed an immediate sharp drop in performance than the other two groups. In the retention test later the group during the exercise was to estimate times were much better performance than the group with CR immediately, while the CR group had delayed the return through the other two.

Even a smaller range (3.2 seconds) has shown, in a second experiment, to have positive effects on learning that the immediate feedback. Liu and Wrisberg in 997 examined the effects of delay CR and the subjective assessment of the movement pattern acquisition and retention of a motor skill. Upon acquisition, 4 groups of participants performed 60 trials task of launching precision, respectively, the following conditions:

1) immediate CR

2) CR delayed

3) CR score more immediate form of traffic

4) evaluation of the most CR delayed movement.

The retention test was to measure the accuracy of the estimate is that the introduction of errors in absence of visual feedback and were given 5 minutes and 24 hours after acquisition. The accuracy of the launch was significantly higher during the acquisition, but significantly lower during the retention patients with CR compared to subjects with immediate CR delayed. However, Participants who had evaluated the shape of the movement performed during the practice sessions will conduct the launch with an accuracy significantly higher and with less error evaluation in a report by conservation other subjects. If the estimated variable is a subjective factor, it is understandable that lack of control of this variable in the experimental design can lead different results. For example, if we assume that subjects in the study of Lai and Shea (1999) have been assessing the accuracy of their own volition response, it would be possible to interpret their results in a different perspective: providing a greater number of tests to compare their assumptions with actual results (100% relative frequency of feedback) allows a greater number of comparisons and therefore a more sustainable memory.

In these circumstances, in effect, the degree of learning in May be a function of how many times the assumption of the response is tested. In Most of the literature on the effectiveness of different frequency Extrinsic feedback this aspect is not considered. Assuming that the relative frequency and subjective estimation of the error could interact and this interaction may explain some possible data conflicting reports in the literature, Guadagnoli and Kohl (2001) have therefore conducted a study to assess the possible link between these two variables. The authors proposed to review the considerations on the relative frequency conditions in which participants are instructed to use different strategies to Practice should, theoretically, promote the different uses of the CR for motor learning. 64 young healthy subjects performed a simple motor task production of a target with isometric force of flexor muscles of fingers and 1) were, or should not estimate the error in the response just ended 2) have received the VC after each test (100% relative frequency) or after every fifth trial (20% relative frequency). The practice period consisted of 10 sets of 15 repetitions of the task performed during one session

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and a retention test consisting of a series of 15 repetitions without CR and without respect, was made after 24 hours. The analysis results showed that the group that received the CR with frequency of 100% and was subjectively estimate the error in the response made fewer errors on tests of retention. Both groups received 20% CR poorer performance on tests of retention, without differences related to having or not doing the estimate, while the group receiving 100% of CR and not involved in the estimate showed the worst performance retention. These results are in line with the prediction that learning is a function the extent to which subjects use the RC to test the hypothesis about the answer.

Indeed, under conditions where the reaction of the subject understands the situation, The CR will provide verification of this hypothesis, if a high frequency of CR optimize motor learning compared to a low frequency of CR. In However, a person can not use CR to test the hypothesis of response if the answer does not include a hypothesis to be tested. Easy Extrinsic feedback this aspect is not considered. Assuming that the relative frequency and subjective estimation of the error could interact and this interaction may explain some possible data conflicting reports in the literature, Guadagnoli and Kohl (2001) Therefore have conducted a study to assess the possible link between these two variables. The authors proposed to review the considerations on the relative frequency Conditions in Which Participants are instructed to use different strategies to Practice should, theoretically, Promote the different uses of the CR for motor learning. 64 young healthy subjects performed a simple motor task production of a target with isometric force of flexor muscles of fingers and 1) were, or should not estimate the error in the response just ended 2) have received the VC after each test (100% relative frequency) or after every fifth trial (20% relative frequency). The practice period consisted of 10 sets of 15 repetitions of the task performed during one session and a retention test consisting of a series of 15 repetitions without CR and without respect, was made after 24 hours. The analysis results showed that the group that received the CR with frequency of 100% and was subjectively estimate the error in the Response made fewer errors on tests of retention. Both groups received 20% CR poorer performance on tests of retention, without differences related to having or not doing the estimate, while the group receiving 100% of CR and Not Involved in the estimate showed the worst performance retention. These results are in line with the prediction that learning is a function

To which extent the subjects use the RC to test the hypothesis about the answer. Indeed, under conditions where the reaction of the subject understands the situation, The CR Will Provide verification of this hypothesis, if a high frequency of CR optimize motor learning compared to a low frequency of CR. In However, a person can not use CR to test the hypothesis of response if the answer does not include a hypothesis to be tested. Easy repetitive responses, which do not require participants to estimate the error response, may discourage individuals to create hypotheses and answer In this case, theoretically, the CR can serve as a guide.

PURPOSE OF THE STUDY:

The relative frequency with which it is supplied to the learner, a Extrinsic feedback on the outcome of the response (see the results, CR) is, among other variables, one of the most studied. The best guess is that the high frequency of CR during the period of practice interfere with learning because the subject, in this case, use the external information to guide the response and is not obliged to use memory processes and seek other sources of information that contribute Further development of memory. But there is also evidence to the contrary, and it is postulated that these conflicting results can be explained considering the possible interactions between the frequency of CR and the estimated subjective error by the learner. It has long been, in fact, require an estimate of the object accomplished in a practice test supports capacity building in motion.

Guadagnoli and Kohl (2001) suggested that the obligation to be a hypothesis on the performance just ended (estimation error) May influence how it will use the CR provided thereafter: In this case, the CR is not used as a guide Besides this provision, but to verify the correctness of the hypothesis made. If this hypothesis is correct, the subject should receive high relative frequency of reactions. The authors have verified that hypothesis in learning a task for the production of isometric force with flexor. The results provided some support to this theoretical formulation, stressing that the two variables (frequency of CR and estimate) are not independent in their effects to a test of retention.

The aim of our study is to further test this hypothesis learning a motor task similar, namely the realization of a simple motion with the elbow flexor muscles, all right-handed young healthy subjects.

METHOD

Topics

Participated in the study of 60 healthy young subjects aged between 21 to 39 years (mean 24.1 ± 3.2), including 27 women and 33 men. The only criterion inclusion were:

1) the absence of disease transmitted by the central nervous system and peripheral;
2) lack of musculo-skeletal level Right.

All subjects were informed of the purpose of the study and participated voluntarily.

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Procedure

All subjects performed a training session on time learning a simple motor task. The task was production target of positive working with the muscles of the elbow flexion Right leg during isokinetic concentric contraction at a rate of 30 ° / s. For the study we used a machine isokinetic Biodex System 4. It is a device which can perform diagnostic tests and exercises with continuous passive motion and various types of muscular activity muscle: isometric, isokinetic and isotonic (concentric and eccentric). Data for torque, speed and position is stored with a frequency of 100 Hz The system allows you to record with the greatest precise position of all moving parts (rear seat, the position engine block, lever position used, etc..) so that each subject running the trial with all the joints involved in a position almost identical.

The target of work to learn was calculated as that corresponding third of the average work delivered by 5 subjects of the same sex, a same age during isokinetic contraction at the same ceiling speed. None of the 10 subjects on which it was noted the work ceiling subsequently participated in the training. To measure the maximum working expressible with the elbow flexor muscles, subjects were seated the seat of the aircraft, with the seat tilted back 30 ° and the position of the support arm and the dynamometer was made coincide with the axis of the elbow joint, centered sull'epicondilo humerus. To make the movements of elbow flexion, the subject is acting on the lever dynamometer gripping a handle with your right hand. After selecting the range of motion, for all was 40 ° to 130 ° (measured between the arm and the bench) and after data acquisition weight on the limb, which gave rise to the test. To measure work maximum expressible by the elbow flexor muscles were performed 8 repetitions of the movement at a speed of 30 ° / s.

The first three repetitions, ceiling disk and no interval, were used for heating and to familiarize the subject with the car. After a rest interval of 30 seconds, it dropped to five repetitions used measure the ceiling work. For such repetitions the subject was instructed to perform elbow flexion exercise utmost available range of motion joint force. Rehearsals have been separated interval 5 seconds to avoid effects related to fatigue muscle. When the test was recorded on the maximum working hours expressed joules, which is the best work done during rehearsal. It was therefore calculated the average values obtained in five subjects of the same sex and the goal was to get established as corresponding to one third of average. Based on the results of 10 subjects played maximum contractions, the result was the AR follows: For males, the production of a 23-J, women volunteers, producing a work of 15 J. All study participants were then performed in the task learning during a training session consists of 20 series 10 repetitions of the task, for a total of 200 repetitions. The interval between repetitions of the same series was 7 seconds, while that between different series was 4 minutes. Before starting training, have been recorded the height of each subject and the positions of dynamometer, the support arm and manipulated to make the next test in the same conditions. During training, the position general topics and the bench and walking motion of the elbow Both were the same as that used for evaluating the work of the ceiling during training were applied to the belt stabilize the trunk. To assess the influence of frequency on the CR, another the frequency of the subjective estimate of the error and a possible interaction between these two variables, in agreement with the work cited in G. Days subjects were divided into four groups: • Group A (100% FR No SS): The subjects received VC after each attempt (100% FR), with a delay of about 3 seconds after each test, immediately after the completion of each repetition, subjects were asked to perform a calculation Simple mental (mathematical operation), while there they were never invited to make a subjective estimate of the positive work produced during the trial just completed (no SS);

• Group B (100% EN + SS): The subjects received CR also after each attempt (100% FR), with a delay about 3 seconds after each test, immediately after the completion of each repetition, before giving the CR, these subjects has been invited to give a subjective assessment of work done during the Test (SS +);

• Group C (20% EN No SS): These subjects received the the information twice in each series and Specifically, after the trial, fifth and tenth in each series (20% FR); In this case, the information has been provided with a delay of 3 seconds compared to the end of testing these materials (such as group A) We never asked to give a personal opinion on the performance just closed (no SS) and immediately after the completion of each repetition, as a disruptive, have been invited to perform a simple Mathematics

• Group D (20% EN + SS): the subjects received the extrinsic information with a relative frequency of 20%, with same way as group C, while a subjective estimate was requested immediately after the conclusion of each test.

The day after the training session, they played together a retention test consisting of a single set of 10 repetitions. On this occasion, during the retention test, none had received no information on the outcome of the service just ended, and was not required either to make a subjective estimate, or to play a Mental arithmetic.

ANALYSIS OF DATA

For each series was calculated the average error over the target achieved during each repetition, and this value was then expressed percentage of the target. Then averaged and the error standard for each group. Statistics have been developed on data from the first series practice and retention test. For comparison between groups to test retention has been used analysis of variance, before and after adjustment for the initial conditions.

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RESULTS

In all groups there was a progressive reduction Error practice, this result was maintained only part of the retention test. The following table shows the mean and standard error for the four groups during the first practice round, and regarded as the basis for testing retention Baseline retention

100% non-SS EN 0254 2216 + 3059 + 0355
100% SS EN 2953 + 0252 + 2329 + 0312
20% No SS EN 0797 2165 + 4267 + 0314
20% SS EN 4007 + 0572 + 1283 + 0094

Analysis of variance revealed no significant difference between groups performance initially, although the average error was significantly greater in groups 3 and 4 compared with groups 1 and 2. The comparison between groups in retention test indicated that the the type of training-related differences were not significant, even if it noticed a trend towards better performance of Group 4. Test your After adjusting for initial conditions, the difference between the two groups was significant enough.

DISCUSSION

On a purely theoretical you can assume that if the subject must be an SS before receiving the CR, it will have a high CR FR as This will make more comparisons between his own assumptions about the response and the results actually obtained. Conversely, If SS is not made, the person will receive a minimum of FR CR, as it will be thus encouraged to engage in additional processes memory processes, which in turn promote the development of memory trace. EN with a high level of feedback, some formulations of the CR will therefore be used to guide future interventions. We must always bear in mind the componen "appropriate human" this in any activity (simultaneous thoughts / distractions) of each individual quantifiable, but no ... The results do not support this hypothesis because, unlike with that reported by Guadagnoli and Kohl (2001), while they are in agreement with results in the work of G. Days (PhD U. physiotherapy 2000/2001).

Indeed, in our work, only the subjects assigned to Group 4 differed significantly from the other. If performance other three groups at the retention test did not differ between them. There would therefore be assumed that the most important variable is reduction of RF. In fact, subjects in group 2 is differed from the others, indicating that the application of a hypothesis about their answer was no facilitation in the presence of RF high external feedback. These people, perhaps using information from outside to lead the response in subsequent trials more or less similar to what happened to the subjects in Group 1. The request for an SS does not seem in itself a an effective strategy for improving learning in the presence of a high EN, is obviously a very important negative factor. For Group 3, the explanation, however, could be that in our protocol condition "no SS was the introduction of a disturbance and nothing else. Among these subjects, indeed, was necessary to perform a mental calculation, immediately after the completion of the trial, namely a phase in which the subject was involved in development process memory. Presumably the effect is disturbing to fully offset the advantage of low EN external feedback.

It is therefore possible to determine whether the introduction of the application to formulate a subjective assumptions about their performance is really a facilitator of learning the motor task, we have proposed. The fact that the combination of low RF + SS led to results better condition than the low FR SS could be due simply that it was actually a condition in which the RF low was associated with a disruptive factor (performance mental arithmetic). For many authors, it is clear that application of subjective estimates fosters practiced motor skills, situations in which the comparison is made between conditions of SS or non-SS, without introducing any disturbance. We considered it significant that the introduction of mental arithmetic on SS groups did not demonstrate a powerful disruptive, so cancel the beneficial effect of an EN low. Not you always have no idea how important it is to avoid spoilers scene immediately after the completion of a motor task. There may be many, in fact, elements environmental noise: the noise and congestion, phones ringing, loud music, the behavior of the operator. It should also be stressed that the completion of engine performance Learning does not exhaust the mental exercise that the person has to do: no check adequately the demands on the subject, both during task immediately after, may therefore affect the performance itself

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