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Lee, Timothy Donald ON THE LOCUS OF CONTEXTUAL INTERFERENCE IN MOTOR SKILL ACQUISITION The Louisiana State University and Agricultural and Mechanical Col PH.D.

Show Context Citation Context From the s to the present, the most widely accepted theory attributes the PRP effect to a central response-selection bottleneck RSB; Pashler, By by Mei-ching Lien " This dissertation is dedicated to a person who was not able to attend my graduation My father He was always proud of me. Proctor, for his generous but bracing supervision in the last four years. It has been a valuable learning experience working w It has been a valuable learning experience working with him. Especially, I have benefited from what he always tells me: Gregory Francis, James S. Nairne, Ian Neath, and Richard Schweickert. They provided an excellent learning environment for me. I am also thankful for these people who have been in the support team during my Show Context Citation Context The goal of every science is a cumulative development of its theoreticalstructure so that a larger part of its subject matter is explicable in termsof simpler principles. This traditional view of science has been challenged in psychology from many sources. One argument has been that it is better to One argument has been that it is better to view psychology in terms of shifting paradigms Kuhn, It often seems to be accepted, almost as a matter of course, that in psychology no cumulative development will take place. A different challenge to the view of psychology as a cumulative science is the notion that nothing new is discovered while the views of Helmholtz, Wundt, or some other elder of the field are being reworked, with no apparent gain in either insight or scope. These two challenges to the cumulative nature of psychological theory are persuasive, but they are not con-sistent. If we shift from paradigm to paradigm, it seems puzzling that the cur-rent paradigm would so exactly mirror that of years ago. On the other hand, if the solutions of years ago remain, what has happened to paradigm shifts? Another criticism that has been applied to the study of attention is that psycho-logical theories are sterile, in that they do not illuminate important natural behavior or provide a perspective on the nature of mind Neisser, American Psychological Association, Inc. Three experiments are reported that investigate the curious paradox that randomly ordering practice trials during motor-skill acquisition is detrimental to practice performance relative to blocked or repetitively ordered trials but facilitates retention performance. The results of Experiment 1 ref The results of Experiment 1 refute a notion that this contextual variety effect was actually due to a methodological confounding of the type of reaction paradigm simple or choice with the practice order manipulations. In Experiments 2 and 3, a third practice trial order serial was added, which contained identifiable conditions similar to both the blocked and random trial orders. Results indicated that this serial order was almost identical to findings observed under random practice conditions. These data were considered evidence that event repetitions during skill acquisition have critical consequences on the development of memory and speeded accessibility of action plans. The results were discussed in a theoretical framework that incorporates recently revamped notions of the role of cognition and mental effort in motor-skill acquisition. Relationships between contextual interference and related empirical and theoretical issues in cognition and the area of motor skills are also explored.: For highly practiced tasks, a common view is that there is an automated translation from intention to movement e. Previous research has shown that when a highly predictable, nonrepetitive event occurs, the problem-solving process may be circumvented. Scott Mackenzie, Steven J. Abstract- A touch-based text entry method was developed with the goal of reducing the attention demand on the user. The method, called H4touch, supports the entry of about 75 symbols and commands using only four soft keys. Each key is about 20 larger than the keys on a Qwerty soft keyboard on the sa Each key is about 20 larger than the keys on a Qwerty soft keyboard on the same device. Symbols are entered as Huffman codes with most letters requiring just two or three taps. The codes for the letters and common commands are learned after a few hours of practice. At such time, the user can enter text while visually attending to the message, rather than the keyboard. Similar eye-on-the-message interaction is not possible with a Qwerty soft keyboard,

since there are many keys and they are small. Human beings have a remarkable ability to accurately anticipate the time of occurrence of a predictable sensory event and synchronize an overt response with that event. Presumably this behaviour is mediated by central temporal mechanisms which are involved in timing the delay required to trigger the Presumably this behaviour is mediated by central temporal mechanisms which are involved in timing the delay required to trigger the response at some precise point in time. It was the purpose of this investigation to examine the nature and functioning of these human temporal mechanisms. The basic task, modelled after Kristofferson , involved presenting two brief stimuli, separated by a short time interval. Gerson, Monitored Joseph, A. Iauser , " Approved for public relefase; disthibo tion unlimited-ALL

Chapter 2 : Contextual Interference Effect by Kaylyn Smith on Prezi

etitions during skill acquisition have critical consequences on the development of memory and speeded accessibility of action plans. The results were discussed in a.

But there is something about the way that we practice skills that matters when it comes to skill transfer and long-term retention. For years researchers have known that skills can be learned through either blocked practice or random practice So what is the difference between the two and which practice is more effective for skill learning? In blocked practice individuals rehearse the same skill over and over until some improvement is seen. This is commonly done in skill drills where players practice a single skill numerous times before moving on to the next drill. On the other hand, random practice involves practicing multiple skills in a random order with minimisation of the number of consecutive repetitions of any one skill. Research investigated which form of practice was more beneficial. Shea and Morgan conducted a test in which subjects practice three different tasks A, B, and C. The experiment involved responding to a stimulus with a correct series of rapid hand movements, with each task having a predetermined sequence. There were two experimental groups; one group that used block practice and one that used random practice. The blocked practice group completed all tasks in order, completing all of task A practice before moving onto task B which they completed before moving to task C. The random practice group practiced the tasks in no particular order just that no more than two consecutive trials could occur for any one task. The results of the experiment were split into an acquisition and retention phase. For the acquisition phase of the experiment the block practice group performed better. However differences during acquisition cannot be interpreted as differences in learning. Instead, retention tests are needed to evaluate learning. In the retention tests, the results indicated that it was the random group that performed better on the retention task thus suggesting that random practice is more effective in the learning of motor skills. But why is random practice more effective? One possible reason for the success of random practice stems from the elaboration hypothesis. This hypothesis states that when a learner performs a series of separate skills in a random order, the learner are able to compare and contrast the different skills and as such recognise the similarities and differences between the skills. By understanding and feeling how each movement is distinctive, the learner is able to store the movement more effectively within their long term memory. Another possible explanation as to why random practice is more effective is the action plan reconstruction hypothesis or the Forgetting Hypothesis. When task A is encountered again a few trials later, the learner must generate the solution anew; this leads to a relatively poor practice performance. In a blocked practice, the solution generated to the first trial is simply applied to the next trial, thus reducing the number of times that the learner must generate new solutions. Given this, practice performance for blocked trials is effective as once the solution is generated s remembered for a number of trials. However, learning is poor as the learner is not required to generate a new solution to the task for every trial. Given this, the key focus of the forgetting hypothesis is that new solutions are required frequently in random practice but not in blocked practice. Hence the development of the solution for the task is the key feature that facilitates learning. As a result, it is probably best if these hypotheses are considered as complementary rather than competing explanations of block versus random practice. In conclusion the beneficial effects of random practice may be due to several factors: ReferencesShow all Cuddy, L. When forgetting helps memory: An analysis of repetition effects. Journal of Verbal Learning and Verbal Behaviour, 21, Lee and Magill Lee, T. The locus of contextual interference in motor-skill acquisition. Journal of Experimental Psychology: Learning, Memory, and Cognition, 9,â€” Shea, J. Contextual interference effects on the acquisition, retention, and transfer of a motor skill. Human Learning and Memory , 5, â€”

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Chapter 3 : Motor learning - Wikipedia

The locus of contextual interference in motor-skill acquistion Article (PDF Available) in Journal of Experimental Psychology Learning Memory and Cognition 9(4) Â· October with Reads.

Behavioural approach[edit] Structure of practice and contextual interference[edit] Contextual interference was originally defined as "function interference in learning responsible for memory improvement". Although varied practice may lead to poor performance throughout the acquisition phase, it is important for the development of the schemata, which is responsible for the assembly and improved retention and transfer of motor learning. In a review of literature, [3] the authors identify that there were few patterns to explain the improvements in experiments that use the contextual interference paradigm. Although there were no patterns in the literature, common areas and limitations that justified interference effects were identified: Most of the studies supporting interference effect used slow movements that enabled movement adjustments during movement execution. According to some authors bilateral transfer may be elicited through alternate practice conditions, as a source of information can develop from both sides of the body. Despite improvements seen in these studies, interference effects would not be attributed to their improvements, and it would have been a coincidence of task characteristics and schedule of practice. Procedural manipulations, which vary between experiments e. Feedback given during practice[edit] Feedback is regarded as a critical variable for skill acquisition and is broadly defined as any kind of sensory information related to a response or movement. Typical sources of intrinsic feedback include vision , proprioception and audition. Extrinsic feedback is augmented information provided by an external source, in addition to intrinsic feedback. Extrinsic feedback is sometimes categorized as knowledge of performance or knowledge of results. Several studies have manipulated the presentation features of feedback information e. See Figure 4, Figure 6, and summary Table 1 [8] for a detailed explanation of feedback manipulation and knowledge of results see below. Knowledge of performance[edit] Knowledge of performance KP or kinematic feedback refers to information provided to a performer, indicating the quality or patterning of their movement. KP tends to be distinct from intrinsic feedback and more useful in real-world tasks. It is a strategy often employed by coaches or rehabilitation practitioners. Knowledge of results[edit] Knowledge of results KR is defined as extrinsic or augmented information provided to a performer after a response, indicating the success of their actions with regard to an environmental goal. Experimental design and knowledge of results[edit] Often, experimenters fail to separate the relatively permanent aspect of change in the capability for responding i. In order to account for this, transfer designs have been created which involve two distinct phases. The column headings may be titled "Experiment 1" and "Experiment 2" and indicate the conditions you wish to compare. The row headings are titled "Acquisition" and "Transfer" whereby: The acquisition block 2 columns contains the test conditions in which some variable is manipulated i. This block represents the transient effects of KR i. When presented with a no-KR condition, this block represents the persistent effects of KR i. Conversely, if this block is given to subjects in a format where KR is available, transient and persistent effects of KR are convoluted and it is argued not interpretable for learning effects. After a rest period, the change in the capability for responding i. Functional role of knowledge of results and potential confounding of effects[edit] KR seems to have many different roles, some of which can be viewed as temporary or transient i. Three of these roles include: The motivational influence can increase the effort and interest of the performer in the task as well as maintain this interest once KR is removed. The associative function of KR is likely to be involved in the formation of associations between stimulus and response i. For an alternate discussion on how KR may calibrate the motor system to the outside world see schema theory in motor program. The guidance role of KR is likely the most influential to learning [1] as both internal and external sources of feedback play a guiding role in performance of a motor task. As the performer is informed of errors in task performance, the discrepancy can be used to continually improve performance in following trials. However, the guidance hypothesis postulates that

provision of too much external, augmented feedback e. The learning process, especially for a difficult task, results in the creation of a representation of the task where all relevant information pertaining to task performance is integrated. This representation becomes tightly coupled with increasing experience performing the task. As a result, removing or adding a significant source of information after a practice period where it was present or not, does not cause performance to deteriorate. Alternating motor learning and physical practice can ultimately lead to a great, if not better performance as opposed to just physical practice. Physiological approach[edit] The cerebellum and basal ganglia are critical for motor learning. As a result of the universal need for properly calibrated movement, it is not surprising that the cerebellum and basal ganglia are widely conserved across vertebrates from fish to humans. And although this can be a refined process much has been learned from studies of simple behaviors. These behaviors include eyeblink conditioning , motor learning in the vestibulo-ocular reflex , and birdsong. Research on Aplysia californica , the sea slug, has yielded detailed knowledge of the cellular mechanisms of a simple form of learning. A type of motor learning occurs during operation of a brain-computer interface. Using single-cell recording techniques, Dr. Emilio Bizzi and his collaborators have shown the behavior of certain cells, known as " memory cells ," can undergo lasting alteration with practice. Motor learning is also accomplished on the musculoskeletal level. Each motor neuron in the body innervates one or more muscle cells, and together these cells form what is known as a motor unit. For a person to perform even the simplest motor task, the activity of thousands of these motor units must be coordinated. It appears that the body handles this challenge by organizing motor units into modules of units whose activity is correlated. Common motor learning paradigms include robot arm paradigms, where individuals are encouraged to resist against a hand held device throughout specific arm movements. Another important concept to motor learning is the amount practice implemented in an intervention. Studies regarding the relationship between the amount of training received and the retention of the memory a set amount of time afterwards have been a popular focus in research. It has been shown that over learning leads to major improvements in long term retention and little effect on performance. Research that has implemented motor learning and rehabilitation practice has been used within the stroke population and includes arm ability training, constraint-induced movement therapy , electromyograph -triggered neuromuscular stimulation, interactive robot therapy and virtual reality-based rehabilitation. A recent study ischemic conditioning was delivered via blood pressure cuff inflation and deflation to the arm, to facilitate learning. It showed for the first time in humans and animals, that ischemic conditioning can enhance motor learning and that the enhancement is retained over time. The potential benefits of ischemic conditioning extend far beyond stroke to other neuro-, geriatric, and pediatric rehabilitation populations.

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Chapter 4 : Contextual Interference Effect Depends on the Amount of Time Separating Acquisition and Tes

Get this from a library! On the locus of contextual interference in motor skill acquisition. [Timothy Donald Lee].

Janelle Find articles by Christopher M. Received Jun 12; Accepted Oct This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits use, distribution and reproduction in other forums, provided the original authors and source are credited and subject to any copyright notices concerning any third-party graphics etc. This article has been cited by other articles in PMC. Abstract We examined the impact of self-controlled knowledge of results on the acquisition, retention, and transfer of anticipation timing skill as a function of random and blocked practice schedules. Forty-eight undergraduate students were divided into experimental groups that practiced under varying combinations of random or blocked as well as self-controlled or yoked practice conditions. Anticipation timing performance 5, 13, and 21 mph was recorded during acquisition and during a short term no-feedback retention test. A transfer test, administered 24 h after the retention test, consisted of two novel anticipation timing speeds 9, 17 mph. Absolute error AE and variable error VE of timing served as the dependent measures. All participants improved their accuracy and consistency across acquisition blocks; however, those who practiced under blocked rather than random conditions had greater accuracy lower AE regardless of feedback delivery. During retention and transfer, those who practiced under random conditions showed greater consistency lower VE compared to their blocked counterparts. Finally, participants who controlled their feedback schedule were more accurate lower AE and less variable lower VE during transfer compared to yoked participants, regardless of practice scheduling. Our findings indicate that practicing under a random schedule improves retention and transfer consistency, while self-control of feedback is advantageous to both the accuracy and consistency with which anticipation timing skill transfers to novel task demands. The combination of these learning manipulations, however, does not improve skill retention or transfer above and beyond their orthogonal effects. Knowledge of results KR is a form of augmented feedback that provides outcome related information concerning how well a task was performed. A large body of literature provides compelling evidence that KR enhances motor learning in a variety of ways e. Traditionally, KR has been provided to the learner according to a set schedule determined beforehand by the experimenter, but researchers have become increasingly interested in feedback manipulations that shift at least some control of feedback delivery to the learners. Self-controlled feedback Self-controlled feedback SCFB schedules allow learners to decide when they will receive feedback, which gives them control over when feedback is administered e. Self-controlled feedback has been established as an effective means of facilitating motor learning for a variety of tasks such as object tossing Janelle et al. Manipulations of self-control in addition to feedback have been shown to benefit learning for a variety of other types of instructional support, including physical guidance Wulf and Toole, , total amount of practice Post et al. The latter set of findings is intriguing because the established benefits of SCFB have thus far been limited to single task learning situations e. It therefore remains unknown how SCFB might interact with traditional practice schedule manipulations such as those seen in comparisons of blocked and random practice effects Shea and Morgan, It has been argued that both feedback and practice schedule manipulations can alter the functional demand of a learning situation and ultimately influence motor learning Guadagnoli and Lee, Accordingly, our examination of the effects of SCFB on learning in blocked and random practice schedules represents a test of the generalizability of SC effects to different practice structures known to also influence motor learning. Blocked and random practice schedules Shea and Morgan reported the first evidence that motor learning would be facilitated by practicing multiple tasks according to a random schedule. Since then, a large body of evidence has documented the performance and learning effects of blocked and random practice schedules when acquiring a variety of different skills Magill and Hall, In a blocked practice schedule, participants practice a single task over consecutive trials before moving to other tasks e. In contrast, a random practice schedule presents tasks in an unsystematic fashion e. Typically, random practice schedules

are created with the stipulations that no task will be performed more than two times in immediate succession, and that each trial block will present an equal number of trials on each task. Blocked practice schedules typically facilitate immediate performance during skill acquisition when compared to random schedules Simon and Bjork, ; Shebilske et al. During retention and transfer tests, however, random practice schedules have frequently been shown to facilitate learning compared to blocked schedules e. Blocked practice schedules are thought to produce relatively low levels of contextual interference during skill acquisition, so immediate performance is facilitated relative to higher contextual interference conditions created with practice schedules that present tasks quasi-randomly or even in a serial order see Lee and Magill, Prominent explanations of practice schedule effects rely on the idea that higher levels of contextual interference introduced during practice result in deeper information processing that ultimately facilitates learning compared to conditions that do not face such a challenge Lee and Magill, ; Shea and Zimny, , Despite substantial evidence that random practice facilitates learning compared to blocked practice, there is also evidence indicating that random practice is not always advantageous Del Rey et al. Practice schedules that cause high levels of contextual interference may present too great of a challenge for learners. For example, Wrisberg and Mead found a learning advantage for blocked practice cf. Similarly, Landin and Hebert found that a schedule designed to introduce an intermediate level of contextual interference facilitated the learning of a basketball set shot by participants with a moderate amount of experience. Although research suggests that participants may choose their practice schedule in a manner that increases CI Wu and Magill, Wulf and Shea argued that practice structures that increase the challenge in a learning setting will not facilitate learning of complex tasks that impose a high processing load because their combination will simply be too challenging for learners. For relatively difficult tasks learning should be facilitated by a blocked practice schedule that prevents the challenge from becoming too great. As a general rule, reduced relative frequency of KR has been shown to degrade immediate performance but to facilitate learning Salmoni et al. Presumably, the provision of self-control over the administration of feedback should allow learners to fine-tune the challenge they face when presented with either a blocked or random practice schedule. For example, learners might choose to request a relatively high frequency of feedback to offset the challenge imposed by a random practice schedule. Similarly, learners might not need or prefer feedback as frequently when learning in blocked schedule. Evidence indicates that SCFB participants strategically tailor feedback administration during practice. For example, some studies have reported relatively low KR request frequencies e. On the one hand, it seems plausible that the effects of SCFB might operate independently of those produced by practice schedule manipulations. In other words, the previous demonstrations of the generalizability of SC manipulations suggest that a benefit should be seen regardless of the challenge presented by the practice schedule. The purpose of this investigation was, therefore, to examine the independent and combined effects of practice schedule blocked or random and feedback self or yoked manipulations on the performance and learning of a simple motor skill. Two primary hypotheses were offered for the practice scheduling and feedback manipulation main effects, respectively. Consistent with prior work e. Tentative assertions were also made concerning the expected interactions of the two practice manipulations. Considering both participant skill and task difficulty, past research has indicated that anticipation timing tasks, albeit novel, present rather low task difficulty. As such, we expected that for this task, which required low levels of KR for both blocked and random practice conditions, the effects of practice schedule would interact with and be augmented by the benefits of SCFB. More specifically, while performance was expected to suffer relative to blocked conditions during acquisition, we expected that those who learned under random practice conditions but who could control feedback frequency would demonstrate better retention and transfer to novel anticipation timing speeds. Materials and Methods Participants Forty-eight undergraduate students 24 women with a mean age of Male and female participants were placed in equal numbers in each experimental group. All participants were randomly assigned evenly to a practice schedule Random vs. Blocked and then randomly assigned to a feedback schedule Self-controlled vs. Yoked , which yielded four experimental groups: All participants signed

informed consent forms prior to the experiment approved by the Institutional Review Board at Kyungpook National University. The apparatus runway was 1. Participants sat 3 m in front of the target light of the BAT and were asked to press the response button with the thumb of their dominant hand at the exact time when the sequential illumination of approaching lights reached the target light. The stream of lights ran from left to right toward the target light located on the right end of the timer. A yellow colored warning light on the left end of the timer indicated the initiation of the trial. Three different speeds of the runway were used: A transfer test was administered 24 h after the retention test, at two novel speeds 9 and 17 mph. Procedure Upon arriving in the laboratory, participants were provided with instructions concerning the task and the feedback provision procedure. Three practice trials, including one trial of each slow, moderate, and fast target speed, were administered to familiarize participants with the apparatus and task. The experimenter instructed participants that the warning light would appear for 1. During acquisition, verbal KR comprising the direction and magnitude of errors was available following the trial performance for self-controlled participants whenever they requested it, and for yoked participants according to a schedule produced by their counterparts in the self-controlled condition. During the acquisition phase, all participants completed 90 total trials of each of the three speeds e. Participants in SC-R and YK-R groups completed the 90 trials in three blocks of 30 trials using a random practice schedule. The participants in SC-B and YK-B group executed 30 trials of each of three speeds in three blocks, consisting of 90 trials in total, according to the blocked practice schedule. In the blocked condition, 30 trials of each of the three slow, moderate, and fast speeds were completed consecutively during the trial block. The retention test consisted of 30 trials, of three speeds in a serial order i. The inter-trial interval was 5 s, during which data was recorded and feedback was provided during the acquisition trials. To assess stability and long-term learning, a transfer test 20 trials was conducted approximately 24 h after the experiment; consisting of 10 trials of each of two novel speeds, in an alternating sequence i. A rest interval of 1 min was provided for all groups between each trial block. All participants performed the retention and transfer test without KR. AE was calculated by taking the absolute value of each error score across each of the three trial blocks, resulting in an unbiased measure of total error. Additionally, AE was less sensitive to potential outliers compared to other measures of total error, such as root-mean-square error. VE was calculated by taking the standard deviation between the total reaction times and the mean reaction time, thereby providing a measure of consistency across trials. Prior to all subsequent analysis, data was collapsed across speeds within each of the acquisition, retention, and transfer portions of the experiment. Bonferroni adjusted t-tests and simple effects tests were implemented as follow ups for significant main effects and interactions, respectively. Greenhouseâ€”Geisser degrees of freedom corrections were applied for ANOVAs where the sphericity assumption was violated. Breaking down KR requests separately during the three trials blocks revealed that the SC-R group requested feedback on 8.