FEEDBACK AFTER GOOD TRIALS ENHANCES LEARNING

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Recent studies investigating the effects of self-controlled feedback suggest that one factor might needs to be taken into account when determining the effectiveness of augmented feedback is the accuracy of the movements for which feedback is provided (Chiviacowsky & Wulf, 2002, in press). While giving learners the opportunity to decide after which trials they want to receive feedback (i.e., self-controlled feedback) has generally been found to enhance learning compared to not giving them this opportunity (i.e., yoked condition) (e.g., Chiviacowsky & Wulf, 2002, in press; Janelle, Barba, Frehlich, Tennant, & Cauraugh, 1997; Janelle, Kim, & Singer, 1995), the study by Chiviacowsky and Wulf (2002) revealed another interesting finding: Learners preferred to receive feedback after they thought they had a relatively successful trial, but not when they thought their performance was relatively poor. This was evident from post-experimental interviews of self-controlled learners. Furthermore, interviews of yoked learners showed that they also would have preferred to receive feedback after good trials, but not after poor trials. Of course, for them feedback was distributed essentially randomly; that is, feedback was provided independent of their performance on the respective trial. However, self-controlled learners had, on average, smaller errors on those trials on which they requested feedback relative to trials on which they did not ask for feedback (Chiviacowsky & Wulf, 2002, in press). That is, they indeed asked for feedback predominantly after good trials. This not only suggests that self-controlled feedback might be more effective because it is more in accordance with the performer’s needs, or preferences, than externally controlled feedback (yoked condition); it might also suggest that feedback is actually more effective if it is presented after good trials, compared to poor trials (independent of whether or not feedback is self-controlled).

The purpose of the present study was, therefore, to determine whether feedback is more effective when it is provided after relatively good or relatively poor trials. If learning indeed benefits more from feedback after successful rather than unsuccessful trials, this would pose additional difficulties for the guidance view of feedback. In the present study, participants practiced a motor task (tossing bean bags to a target) and received feedback on 3 trials out of 6 trials at the completion of each 6-trial block (i.e., 50% feedback). While one group was provided KR about the accuracy of the 3 best throws in each block, another group was given KR about the 3 poorest throws. The effectiveness of feedback after good versus poor practice trials was assessed in a retention test without KR one day after practice.

Results

Practice. The KR poor group tended to have somewhat larger lower scores than the KR good group early in practice, but both groups increased their scores and showed similar performances toward the end of practice (see Figure 1, left).

Retention. On the retention test without KR, which was performed one day after the practice phase, the KR good group had clearly higher accuracy scores than the KR poor group (see Figure 1, right). Thus, providing KR after the most effective trials during practice resulted in superior learning compared to providing KR after the least effective trials.

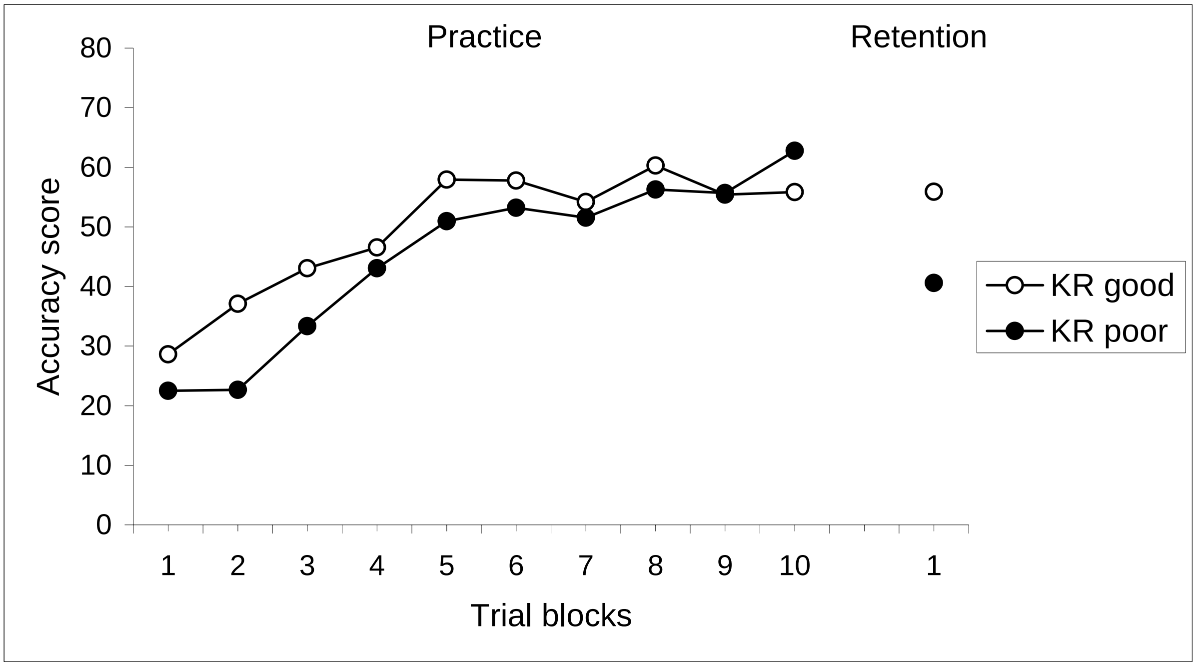

Figure 1

<u>Discussion</u>

The present results showed a learning advantage if feedback was presented after trials with relatively small errors, or high accuracy scores (KR good group), compared to trials with relatively large errors, or low accuracy scores (KR poor group). That is, even though both groups received KR on 50% of the practice trials, retention performance was enhanced if the feedback was given on the more accurate 50% of the trials rather than on the less accurate 50%. Importantly, learning was also enhanced when feedback was self-controlled, compared to yoked control conditions. Thus, if learning is enhanced when feedback is given primarily after good trials, this might be one reason for the benefits of self-controlled feedback. Of course, this does not answer the question *why* feedback after good trials benefits learning.

One possible explanation for this effect might be that, if feedback is presented after good trials while poor trials are essentially ignored, it creates a greater success experience for learners than giving feedback after relatively poor trials and ignoring good trials. This success experience might be more motivating for learners and, in turn, could enhance the learning process. Even though learners in the present study were not informed on which trials they would be given feedback, the KR good group has clearly smaller errors on those trials on which they received feedback than did the KR poor group. Given the fact that learners appear to be relatively sensitive to how well they perform (Chiviacowsky & Wulf, 2002), it is possible that learners noticed a relationship between their performance and the provision of feedback. If, and to what extent, learners become aware of such a relationship could be determined through post-experimental interviews in future studies.

We believe that there is another reason for the learning advantages of providing feedback after good trials. Maxwell, Masters, Kerr, and Weedon (2001) have recently made a case for the benefits of learning “without” errors. They showed that golf putting was enhanced (in retention and transfer) if errors were reduced during practice by having participants putt from the shortest distance first and systematically increasing the distance (“errorless group”), as compared to starting with the longest distance and systematically decreasing the distance (“errorful group”). Maxwell et al. (2001) argued that reducing errors during practice promotes an unselective, or implicit, mode of learning (e.g., Berry & Broadbent, 1988). In contrast, practice conditions that induce relatively large errors promote a selective, or more explicit, mode of learning. The Maxwell et al. (2001) study provided support for the view that increased errors during practice result in a more explicit mode of learning by showing that errorful learners generated more error-correction hypotheses than did errorless learners. In addition, errorful learners made more visible adjustments to their technique. This suggests that errors during practice induce a conscious (explicit) type of control, which is detrimental to learning. Indeed, several studies have shown that explicit learning is often less effective than implicit learning (e.g., Berry & Broadbent, 1988; Green & Flowers, 1991; Reber, 1976; Reber, Kassin, Lewis, & Cantor, 1980; Shea, Wulf, Whitacre, & Park, 2001). According to Maxwell and colleagues, reducing errors during practice encourages learners to repeat (successful) movements, thereby promoting an unconscious type of learning. Giving learners feedback about relatively unsuccessful trials (KR poor) – which might act in a similar way as “errorful” learning – might induce a conscious (explicit) type of learning. In contrast, proving feedback on relatively successful trials (KR good) would be similar to “errorless” learning. Because it encourages learners to repeat a movement, or make only small adjustments, this kind of feedback might promote a more unconscious (implicit) type of learning. As a consequence, learning is enhanced.