

calibrating the magnitude and timing of hand opening to the necessary opening of the tongs.

In a first experiment, three groups of participants each used one pair of pliers: the hinge was close to the fingers, the hinge was in the middle or far from the fingers. An object was picked up repetitively in blocks of three sets and its size and distance varied over the blocks. In the first set the picking up was done with the fingers, in the second set with the pair of pliers, and third with the fingers again.

Movement time was longer and the velocity profile was more asymmetric with pliers. In addition, pliers' grasps exhibited a plateau phase in the finger opening. The effect of the hinge was canceled out by compensatory opening of the fingers, that is, the finger opening made the pliers opening almost equal to the opening of the fingers without a pair of pliers. The main difficulty in learning to handle the tool seems to be related to the timing of the opening: The more the movement of the end-effector differed from the movement of the fingers (i.e., when the hinge was not in the middle), the more difficult it was to coordinate the timing of the grasp with the reach.

The setup of the first experiment, with a change between finger grasps and pliers' grasps, together with the switch in object size and distance over blocks, might have clouded the calibration behavior. Currently, we are setting up an experiment in which participants use one pair of pliers to pick up one object at one distance repetitively for at least 50 times a day, for three days in a row. This experiment, ought to help us determine the changes in kinematics to calibrate to the properties of the tool, which should contribute to our understanding of how people learn to use a tool dexterous.

The use of strategies in motor learning: Validation of a new questionnaire

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Analyzing cognitive learning, strategies are an important topic of psychological research since many years. On the majority, studies are focussed on the relation between the use of learning strategies and academic achievement (e.g., Artelt, 2006; Zimmerman & Schunk, 2001) and the development and/or evaluation of strategy trainings (e.g., Schmitz, 2006). Numerous assessment procedures are available, mainly in the form of self-report questionnaires (for a current review: Spörer & Brunstein, 2006). By contrast, researchers in the field of motor learning has ignored so far this crucial aspect of learning.

Thus, we developed a questionnaire to measure motor learning strategies. Based on the conceptions of psychological measures, five groups of strategies are differentiated: (1) Cognitive strategies, (2) Meta-cognitive strategies, (3) Management of internal resources, (4) Management of external resources, and (5) Motor strategies. Each group of strategies is measured by one subscale. Altogether, the instrument,

named 'StraBL' (abbreviation of 'strategies of motor learning' in german), contains of 35 items.

Using hypothetical learning situations, the StraBL questionnaire was evaluated in two studies.

Study 1

The first study was conducted to test the factorial validity of the questionnaire. A sample of 170 university students (92 men, 78 women; $M = 24.2$ years) imagined how to learn skiing and then completed the StraBL inventory. An exploratory factor analysis led to a 5-factor solution with meaningful and relatively high (≥ 0.50 for 31 items) item-factor correlations. This solution explains 53.2% of total variance. Further evidence of validity is provided by correlations between the use of learning strategies and goal orientations. The internal consistency (Cronbach) of the subscales ranged between $\alpha = 0.78$ and $\alpha = 0.84$.

Study 2

According to psychological research, the use of learning strategies depends on the learning context. The aim of this study was to examine if the strategies measured by the StraBL questionnaire are also context-specific. 240 university students (120 men, 120 women; $M = 24.4$ years) learned hypothetically motor skills from different sports (swimming, athletics, skiing, table tennis, gymnastics, golf) and then responded to the StraBL questionnaire. The results revealed that most of the strategies (23 of 35) were used differently, depending on the sport skill which was learned. For example, the strategy "I practice single parts of the skill" was frequently used to learn athletic skills, but very rarely to learn golf or swimming. Thus, it seems that strategies of motor learning are related to the learning context as strategies of cognitive learning are. This argues for the (construct) validity of the StraBL questionnaire.

The present instrument may be useful for research in sport psychology. However, in further studies it should be applied not only to university students but also to other groups of adults learners.

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