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APPLICATION OF A SELF-SUFFICIENT LEARN PROGRAM TO CONTROL OBJECTS WITH SIX DEGREES OF FREEDOM

Abstract

Introduction Manual control of moving objects in weightlessness requires simultaneous commandment of all six degrees of freedom of movement. This paper presents the current state of the development and evaluation of a self-sufficient training tool ("6df") for an important operational skill required during space flight, e.g. manual spacecraft docking or controlling a robot arm). The tool was applied to a terrestrial control cohort in preparation of space experiments, using EEG to assess the remaining cognitive capacity during the docking training. The methodological results will be presented here. Method Sixteen subjects participated in the study using the 6df version 7.28. All of them were untrained in docking maneuvers. The voluntary subjects were not paid and participated for their own interest only. After an initial instruction session they took their lessons autonomously. Weekly training sessions were planned; the daily session duration was limited to 45 minutes. Single sets consisted of 8 tasks. Tasks were automatically selected in dependence of the results of the last unit. Immediately after the task a feedback screen informed about the performance. The performance parameters are identical with the Russian regular docking training software. After participating in the psychophysiological experiment the subjects could optionally use the Russian standard trainer for spacecraft docking as it was applied from 2008 till 2011 onboard ISS. Results All subjects successfully learned and practiced the hand controlled docking in the 6df simulator. However, individual learning courses differed substantially. The subjects needed between 115 to 267 successful tasks in 18 to 41 task sets at 8 to 30 days before reaching the required skills to run a standard docking task. The EEG-experiments (published elsewhere) confirmed the training success. The last two of five tasks of the Russian regular docking training were already performed in sufficient quality by the participating subjects. Conclusions The successful development of a self-sufficient learning program could provide a possible application in long-term space flights. The basic education of space fliers could be improved by using the 6df tool before training in expensive real shaped training units, thus saving time and costs. Independent terrestrial studies (including a larger female cohort) were run and are planned at DLR (:envihab), in the USA (University of Philadelphia), and in Russia (IBMP).