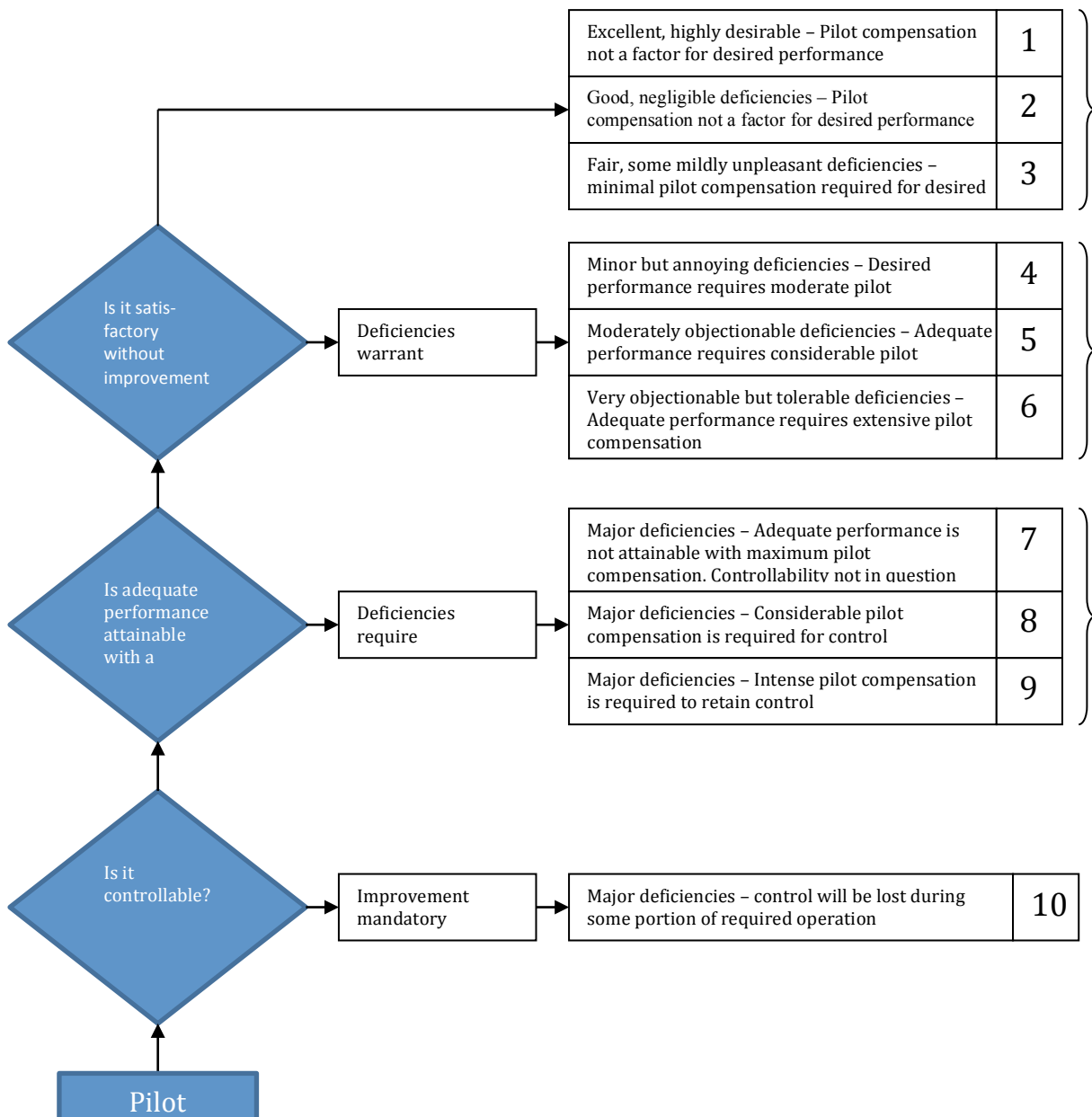


Modified Cooper Harper Scales (MCH)

Wierwille and Casali 1986

Background and applications

The modified Cooper Harper scale is a uni-dimensional measure that uses a decision tree to elicit operator mental workload. The Cooper Harper Scales (Cooper & Harper 1969) is a decision tree rating scale that was originally developed as an aircraft handling measurement tool. The scales were used to attain subjective pilot ratings of the controllability of aircrafts. The output of the scale is based upon the controllability of the aircraft and also the level of input required by the pilot to maintain suitable control. The modified Cooper Harper Scale (Wierwille and Casali 1986) is based upon the assumption that there is a direct relationship between the level of difficulty of aircraft controllability and pilot workload. The MCH scale is presented in figure 1.



Administered post-trial, the MCH involves the participant simply following the decision tree, answering questions regarding the task and system under analysis, in order to elicit an appropriate workload rating.

Domain of application

Aviation.

Procedure and advice

Step 1: Define task(s)

The first step in a MCH analysis (aside from the process of gaining access to the required systems and personnel) is to define the tasks that are to be subjected to analysis. The type of tasks analysed are dependent upon the focus of the analysis. For example, when assessing the effects on operator workload caused by a novel design or a new process, it is useful to analyse as representative a set of tasks as possible. To analyse a full set of tasks will often be too time consuming and labour intensive, and so it is pertinent to use a set of tasks that use all aspects of the system under analysis.

Step 2: Conduct a HTA for the task(s) under analysis

Once the task(s) under analysis are defined clearly, a HTA should be conducted for each task. This allows the analyst(s) and participants to understand the task(s) fully.

Step 3: Selection of participants

Once the task(s) under analysis are clearly defined and described, it may be useful to select the participants that are to be involved in the analysis. This may not always be necessary and it may suffice to simply select participants randomly on the day. However, if workload is being compared across rank or experience levels, then clearly effort is required to select the appropriate participants.

Step 4: Brief participants

Before the task(s) under analysis are performed, all of the participants involved should be briefed regarding the purpose of the study and the MCH technique. It is recommended that participants are also given a workshop on workload and workload assessment. It may also be useful at this stage to take the participants through an example MCH application, so that they understand how the technique works and what is required of them as participants. It may even be pertinent to get the participants to perform a small task, and then get them to complete a workload profile questionnaire. This would act as a 'pilot run' of the procedure and would highlight any potential problems.

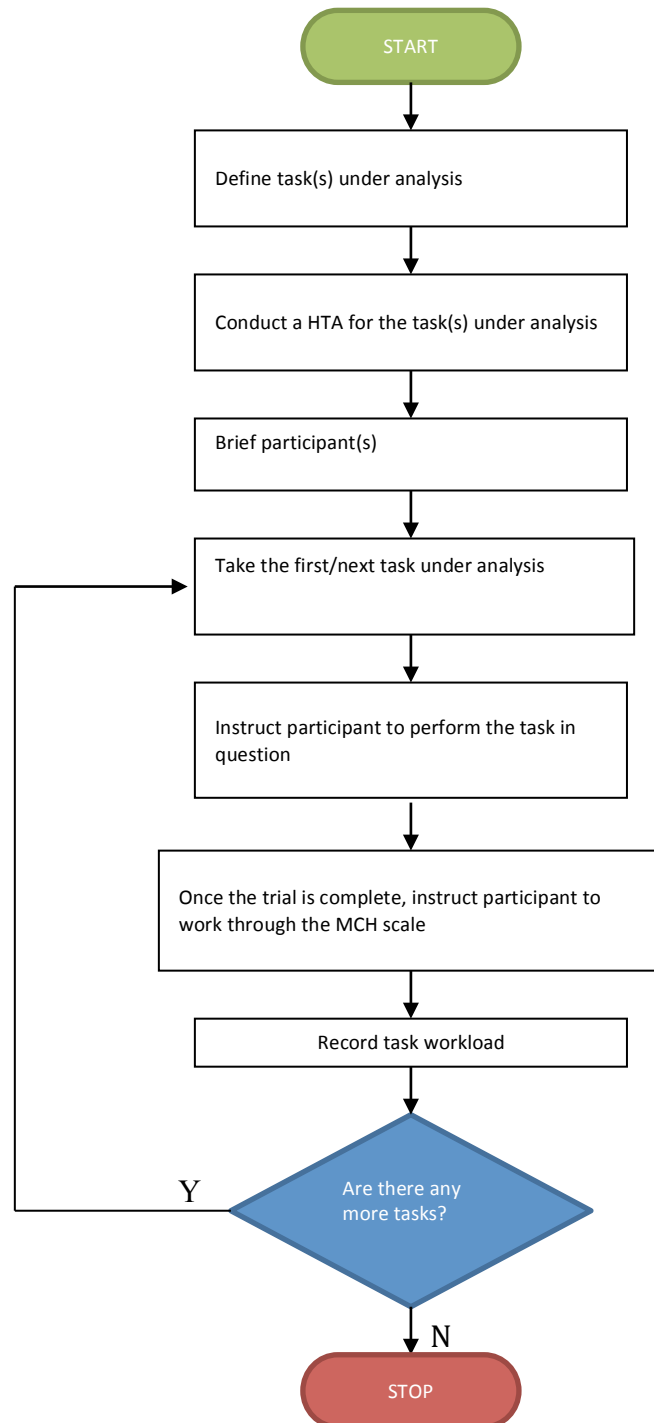
Step 5: Performance of the task under analysis

Next, the subject should perform the task under analysis. The MCH is normally administered post-trial.

Step 6: Completion of the Cooper Harper scale

Once the participant has completed the task in question, the Cooper Harper scale should be completed. The participant simply works through the decision tree to arrive at a workload rating for the task under analysis. If there are further task(s), then the participant should repeat steps 5 and 6 until all tasks have been assigned a workload rating.

Flowchart



Advantages

- Very easy and quick to use, requiring no additional equipment.
- Non-intrusive measure of workload
- A number of validation studies have been conducted using the Cooper Harper scales. Wierwinke (1974) reported a high co-efficient between subjective difficulty rating and objective workload level.
- The MCH scales have been widely used over to measure workload in a variety of domains.
- According to Casali & Wierwille (1986) the Cooper Harper scales are inexpensive, unobtrusive, easily administered and easily transferable.
- High face validity.
- According to Wierwille & Eggemeier (1993) the MCH technique has been successfully applied to workload assessment in numerous flight simulation experiments incorporating demand manipulations.
- The data obtained when using uni-dimensional tools is easier to analyse than when using multi-dimensional tools.

Disadvantages

- Dated.
- Developed originally to rate controllability of aircrafts.
- Limited to manual control tasks.
- NASA TLX and SWAT are more appropriate.
- Data is collected post-trial. This is subject to a number of problems, such as a correlation with performance. Participants are also poor at reporting past mental events.
- Uni-dimensional.

Related methods

There are a number of other subjective workload assessment techniques, including the NASA TLX, SWAT, workload profile, DRAWS, MACE and Bedford scales. MCH is a uni-dimensional, decision tree based workload assessment technique, which is similar to the Bedford scale workload assessment technique. It is also recommended that a task analysis (such as HTA) of the task or scenario under analysis is conducted before the MCH data collection procedure begins.

Approximate training and application times

The MCH scale is a very quick and easy procedure, so training and application times are both estimated to be very low. The application time is also dependent upon the length of the task(s) under analysis.

Reliability and Validity

Wierwinke (1974) reported an extremely high co-efficient between subjective task difficulty rating and objective workload level. Wickens also suggests that subjective workload assessment techniques possess high face validity.

Bibliography

- Casali, J. G. & Wierwille, W. W (1983). A comparison of rating scale, secondary task, physiological, and primary task workload estimation techniques in a simulated flight task emphasising communications load. *Human Factors*, 25, pp 623-641
- Cooper, G. E & Harper, R. P. (1969). The use of pilot rating in the evaluation of aircraft handling qualities. Report No. ASD-TR-76-19. (Moffett Field, CA: National Aeronautics and Space Administration).