the periods of high efficiency in the midmorning. Under all three conditions the amount of work to be performed was constant.

The following dependent variables were recorded: the quantity and quality of the pieces produced, the lengths of the rest breaks gained within the subgoal periods, and finally, the strain experienced by the workers assessed shortly before and after the shift, as well as before the breakfast pause. Work strain was assessed by the BMSI questionnaire from Plath and Richter (1984).

As expected, the actual performance output of all groups matched the assigned graphs quite well. Apart from these goal-induced temporal variations in performance, the average number of pieces produced did not differ significantly among the groups. The groups did not differ in performance quality as well. In all groups the average number of defective pieces produced was under 1% and fell remarkably short of the former quota of about 10%. There were no group differences in the average amount of time used for taking breaks. Only the lengths of the single pauses gained within the subgoal periods varied in inverse relation to the temporal variations in performance output and ranged between 3 and 6 minutes per subgoal period. This finding that—independent of the specific shape of the graphs—all graphs induced a more adequate utilization of the rest allowance than before in the form of taking many short rest breaks.

Nevertheless, the shape of the performance graphs influenced the strain reactions of the workers. In accordance with the theory of circadian performance rhythms, the workers following curve III stated being significantly more strained than the others, especially after the shift.

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Quantitative Methods and Psychometrics

No. 041   **Borkenau, P., & Ostendorf, F. (1987).** On the factor structure of retrospectively estimated and on-line coded act frequencies: A comparison of methods. [Untersuchungen zur faktoriellen Struktur retrospektiv geschätzter und on-line kodierter Verhaltensfrequenzen: Eine Vergleichsstudie.] *Zeitschrift für Differentielle und Diagnostische Psychologie, 8*, 259–274. ‹41 Ref., 7 Tab.›

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Several authors, most notably Shweder (1975), argue that the correlations among retrospective judgments of act frequencies reflect the semantic similarity relations among behavior-descriptive terms rather than the structure of behavior itself. The evidence, however, suggests that this claim may be the result of the neglect of act-overlap among behavior categories in most on-line observational coding schemes.

Therefore, the present study investigates whether the structure of retrospectively estimated and on-line-coded act frequencies become more similar if the on-line coding scheme takes into account overlapping activities among categories.

The proceedings of eight discussion groups comprising a total of 48 subjects were videotaped. The tapes were then analyzed by three methods:

a) retrospective estimates for 16 behavior categories,

b) a forced-choice on-line assignment of activities to one of these categories, and

c) on-line prototypicality ratings of each activity for all 16 categories.

Prototypicalities were estimated on 7-point rating scales with the endpoints "very good example for the behavior category" (+3) and "blatant counter-example for the behavior category" (–3). Finally, semantic similarity estimates among the 16 categories under study were obtained from a sample of 20 subjects. The mono-trait-heteromethod coefficients, the heterotrait-monomethod coefficients, and the correlations across category-pairs and among the heterotrait-monomethod matrices have been published elsewhere (Borkenau & Ostendorf, 1987). The factor structures are presented here.

It was found that the retrospective estimates of act frequencies had a positive manifold structure. This finding reflects considerable differences in overall verbal activity among the 48 subjects. All substantial factor loadings were positive in sign. Three clusters of variables were identified that are related to cooperative activities, antagonistic activities, and task-irrelevant activities. A positive manifold structure and predominantly positive factor loadings were also obtained for the forced-choice on-line codings, but the factors are hardly interpretable here. In particular, cooperative and antagonistic activities have very similar loadings. In contrast, for the behavior frequencies that were derived from the on-line (multiple) prototypicality ratings, substantial negative factor loadings occur, and the first factor contrasts cooperative activities (positive loadings) and antagonistic activities (negative loadings).

Numerical estimates of factor congruence were performed. Compared to the factor pattern of the semantic similarities, the on-line behavior codings which consider overlapping activities resemble the semantic relations more than the on-line codings performed on a forced-choice basis. Compared to the factor pattern of the retrospective frequency estimates, however, forced-choice on-line codings provide a better match than on-line codings that consider overlapping activities. Thus, our systematic overlap hypothesis was not directly supported by the results.

The most reasonable explanation of the present findings is that correlations among retrospective frequency estimates reflect two major sources of covariance, i.e., differences in overall activity among subjects that result in a positive manifold structure, and semantic relations among the behavior categories. Moreover, the problem has not yet been solved as to how to best go about considering differences in the overall activity of target persons in an on-line coding scheme with overlapping categories. Thus, the generalizability of the present findings may be limited to situations where (a) behavior frequencies are estimated instead of trait dispositions of target persons, and (b) the target persons differ considerably in overall activity.

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No. 042   **Michelsen, U.A., & Müller, J. (1988).** Localization of the frequency of single events in the Equal-Distribution Test: A means for distractor analysis. [Eingrenzung der Häufigkeit einzelner Ereignisse beim Test auf Gleichverteilung: Ein Instrument zur Distraktorenanalyse.] *Diagnostica, 34,* 119–135. ‹12 Ref., 6 Fig., 2 Tab.›

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With the help of the chi^2 test for goodness of fit, it is possible to find out to what extent an assumption can be made about the equal distribution of the underlying universe by means of a random sample. Of course, merely establishing that equal distribution can or cannot be assumed gives no indication of how often single results can appear in the sample without casing the equal distribution hypothesis to be abandoned.

Based on the usual chi^2 goodness-of-fit test for a polynomial distribution, a special statistically founded method was developed which is suitable for determining how often single occurrences can appear in a sample with any given number of categories and a certain level of significance without, as mentioned above, causing the equal distribution hypothesis to be abandoned.

In a sample with only two characteristic features, e.g., male or female, it is possible to determine exactly the lowest and the highest limits of frequency that will allow the equal distribution hypothesis with a certain probability to be accepted. In samples with three or more characteristic features, it is only possible to determine an interval for the lowest and for the highest limit of frequency. The equal distribution hypothesis can be accepted, within the area in which both intervals overlap. Beyond the lowest and the highest limits of the intervals, the equal distribution hypothesis must be rejected. In between these extremes, there is an area within which it is impossible to decide whether the equal distribution hypothesis can be accepted or not.

The method developed here estimates the probability of acceptance or rejection of the equal distribution hypothesis regarding the frequency of single events in the sample. Consequently, conclusions can be made which go beyond the usual chi^2 goodness-of-fit test for equal distribution. A special possibility of application is the distractor analysis of programmed problems.

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