Improving Fluid Intelligence – Single N-back Is As Effective As Dual N-back

Barbara E. Studer [1], Susanne M. Jaeggi[2], Martin Buschkuehl[2], Yi-Fen Su[3], John Jonides[2] , Walter J. Perrig[1]

[1]Department of Psychology, University of Bern, Switzerland
[2]Department of Psychology, University of Michigan, USA
[3]Department of Educational Psychology and Counseling, National Taiwan Normal University, Taipei, Taiwan

Aim

Investigate whether a single n-back intervention is a useful alternative to the complex dual n-back task that we used previously to demonstrate a transfer effect on tests of fluid intelligence (*Gf*; Jaeggi, Buschkuehl, Jonides, & Perrig, 2008).
Reasons for selecting a single task: a) dual and single n-back tasks recruit similar neural networks (Jaeggi et al., 2003), and b) single n-back performance correlates with *Gf* as well as dual n-back performance (Buschkuehl, Jaeggi & Jonides, under review).

Method

Participants

89 undergraduate students; recruited at the National Taiwan Normal University (mean age =19.4 years; *SD*=1.5)

Control group: 43 (41 women)
Experimental group: 46 (35 women)

The experimental group was divided into 2 groups; matched on age, gender and pre-test performance in criterion measures:

Dual n-back group: 21 (17 women)
Single n-back group: 25 (18 women)

Training Tasks

- **Dual n-back task:** Adaptive version as used in previous study (Jaeggi et al., 2008) but with 8 syllables of the Mandarin phonetic system for the auditory part instead of letters from the Latin alphabet.
- **Single n-back task:** Adaptive visuospatial version of the n-back task.

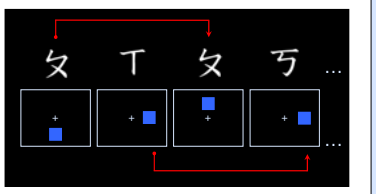
  Participants trained 5 times a week for a period of 4 weeks (15 rounds per session; i.e. 15-20 minutes).

Near Transfer Tasks

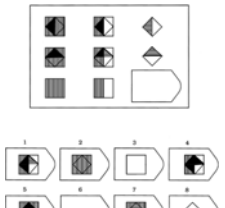
- Single and dual baseline n-back task (non-adaptive, 2-, 3-, and 4-back levels; for the single task, we used random shapes as stimuli which we used before; Jaeggi et al., 2003).

Far Transfer Tasks – Matrix Reasoning Tasks (*Gf*)

- Bochumer Matrizen-Test (BOMAT; Hossiep, Turck, & Hasella, 1999)
- Raven's Advanced Progressive Matrices (APM; Raven, 1990)



Dual n-back task (2-back example): The syllables and squares were presented simultaneously at a rate of 3 s. Responses were required for targets only.

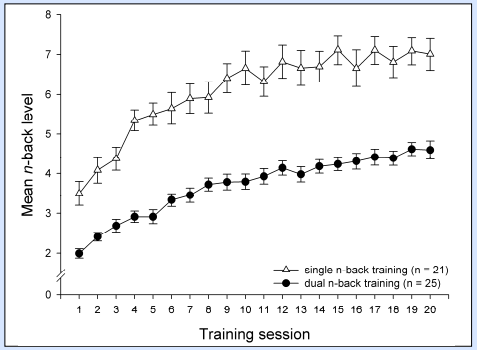


Reasoning Task (adapted from APM).

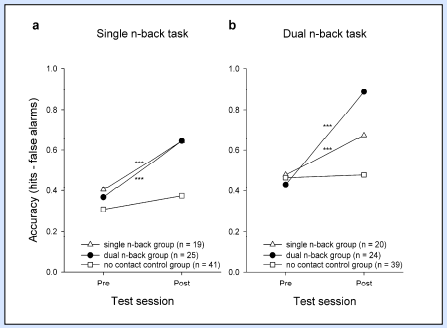
Results

Specific Training Effects

Both training groups improved their performance. Furthermore, there was a qualitative training difference between the two groups (session x group interaction ($F(19,836)=2.86$; $p<.001$), indicating that the single-task group improved more than the dual-task group ($t(30.10)=2.51$; $p<.05$).

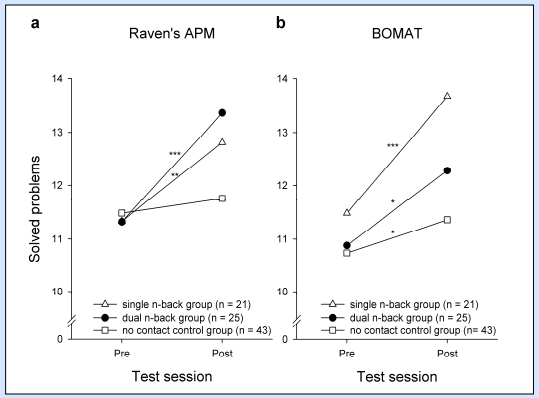


Near Transfer Effects



Intervention x session interactions:
a) Single task: $F(2,82)=15.74$; $p<.001$; b) Dual task: $F(2,80)=66.52$; $p<.001$.

Far Transfer Effects



Intervention x session interactions:
a) APM: $F(2,85)=5.03$; $p<.01$; b) BOMAT: $F(2,85)=3.45$; $p<.05$.

Note: *$p<.05$; **$p<.01$; ***$p<.001$

Discussion

Both intervention groups were able to transfer their n-back training performance to material with which they had been unfamiliar (random shapes). Thus, the intervention had an effect on some general underlying processes involved in n-back performance, rather than just building up a very task- and stimulus-specific skill.

Far transfer effects were observed in both matrices tasks after training. This replicates our prior results, but it also extends our findings by showing that the transfer effect was present in more than just one *Gf*-task, and, that it was obtained by training on a single n-back task as well.

Our results open a wider range of application for our training approach in that the single n-back task can be used for participant groups who would find the dual n-back task quite taxing. Furthermore, it makes the investigation of the processes in training and transfer more accessible because the processes engaged by the single n-back task are better understood than the ones in dual n-back tasks.

Literature

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Correspondence: sjaeggi@umich.edu