Data sheet

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Article: Pfister, R., Kiesel, A., & Melcher, T. (2010). Adaptive control of ideomotor effect anticipations. *Acta Psychologica*, *135*(3), 316-322. doi: 10.1016/j.actpsy.2010.08.006

In retrospect: The experiments reported in this article were partly performed to prepare the ground for an fMRI investigation of response-effect (R-E) compatibility; this follow-up study was eventually published some time later (Pfister, Melcher, Kiesel, Dechent & Gruber, 2014, *Neuroscience*). To this end, we have performed four experiments in which we probed for the conditions under which R-E compatibility effects can be induced when R-E mappings change in a trial-wise manner.

In the first submission we had included all four experiments but chose to report only two of them after initial rejections. The data of the additional experiments is also available (see the File List below). In a nutshell, the experiments differed in the following way:

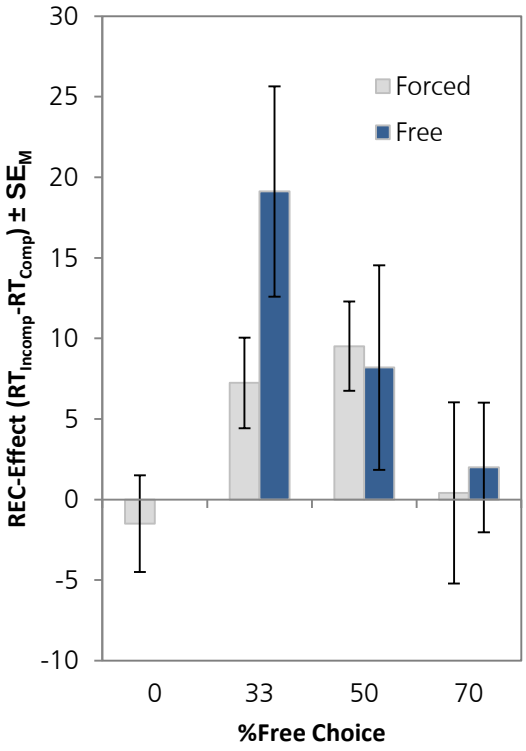
- Exp. 1: 100% forced choice or 100% free choice (with 50% nogo in the latter case)
- Exp. 2: 50% forced choice and 50% free choice
- Exp. 3: 67% forced choice and 33% free choice
- Exp. 4: 30% forced choice and 70% free choice

An extended description of the first three experiments can also be found in my diploma thesis (http://roland-pfister.net/publications/theses/Pfister_2010_Diploma_Thesis.pdf).

While preparing the data files, I noticed that the forced choice condition of Experiment 1 was treated slightly different to what is described in the article (the free choice condition was analysed as described). In addition to the applied trial filters (only correct trials, RT >= 100), we had further excluded trials following errors and, importantly, we had aggregated separately for forced left and forced right responses (including rounding to whole ms), and averaged the resulting mean response times (RTs) only afterward.

SPSS syntax for recreating the original analyses can be found in the syntax file for Experiment 1 (see the File List below). When looking at the data analysis in this article with some more experience, however, I believe that the entire set would have benefitted from a more conservative approach. That is: If I were to analyse the data today, I would certainly exclude post-error trials for all analyses, the first trial of each block, and I would also apply a better outlier correction, such as removing trials in which the RT deviates more than 2/2.5/3 standard deviations from the corresponding cell mean.

Applying such a more conservative analysis to the data of both experiments shows that the results of Experiment 1 appear to be much stronger, whereas the main effect of compatibility only shows a vague trend ($p < .2$) for Experiment 2. I would attribute this finding to the rather limited power (and I would still be willing to believe that an effect exists in this condition). A very revealing data pattern emerges, however, when plotting the data of all four experiments against each other.



The figure shows the R-E compatibility effects for free and forced choice trials as a function of how many free choice trials were included in the design. The first (0%) and third (50%) condition represent Experiment 1 (forced choice) and Experiment 2 of the article.

Here are the complete statistics (also with more useful follow-up tests than reported in the article):

- Condition 1: 0% free choice vs 100% free choice + nogo (Exp. 1)
  - Choice: $F(1, 22) = 1.45$, $p = .241$, $\eta_p^2 = .06$
  - Compatibility: $F(2, 21) = 4.40$, $p = .025$, $\eta_p^2 = .33$
  - Interaction: $F(2, 21) = 5.29$, $p = .014$, $\eta_p^2 = .30$
  - REC-Effect Forced Choice: $t(11) = 2.57$, $p = .026$, $d = 0.74$
  - REC-Effect Free Choice: $t(11) = 2.93$, $p = .014$, $d = 0.84$
- Condition 2: 33% choice (Supplementary Exp. 1)
  - Choice: $F(1, 11) = 66.48$, $p < .001$, $\eta_p^2 = .59$
  - Compatibility: $F(2, 10) = 8.74$, $p = .006$, $\eta_p^2 = .64$
  - Interaction: $F(2, 10) = 1.90$, $p = .199$, $\eta_p^2 = .28$
  - REC-Effect Forced Choice: $t(11) = 2.57$, $p = .026$, $d = 0.74$
  - REC-Effect Free Choice: $t(11) = 2.93$, $p = .014$, $d = 0.84$
- Condition 3: 50% free choice (Exp. 2)
  - Choice: $F(1, 11) = 11.02$, $p = .007$, $\eta_p^2 = .50$
  - Compatibility: $F(2, 10) = 2.09$, $p = .174$, $\eta_p^2 = .29$
  - Interaction: $F(2, 10) = 0.42$, $p = .669$, $\eta_p^2 = .08$
  - REC-Effect Forced Choice: $t(11) = 3.43$, $p = .006$, $d = 0.99$
  - REC-Effect Free Choice: $t(11) = 1.29$, $p = .223$, $d = 0.37$

- Condition 4: 70% free choice (Supplementary Exp. 2)

  Choice: $F(1, 11) = 0.04$, $p = .836$, $\eta_p^2 = .00$

  Compatibility: $F(2, 10) = 0.09$, $p = .912$, $\eta_p^2 = .02$

  Interaction: $F(2, 10) = 0.42$, $p = .669$, $\eta_p^2 = .08$ (coincidentally similar to Exp. 2)

  REC-Effect Forced Choice: $t(11) = 0.07$, $p = .943$, $d = 0.02$

  REC-Effect Free Choice: $t(11) = 0.49$, $p = .631$, $d = 0.14$

Two observations seem noteworthy: First, there were no R-E compatibility effects for purely forced choice settings. This observation likely reflects the focus on stimulus aspects while not paying too much attention to the (task-irrelevant, non-salient) effects, just as described in the article. Second, adding just a few free choice trials helps tremendously in shifting the participants' attention toward the action effects. This is only true up to a certain point though (50% free choice), whereas there R-E compatibility effects disappear with too many free choice trials. This is likely driven by increased tendencies to pre-plan a response irrespective of upcoming compatibility condition (and therefore irrespective of the effect that is going to result from the action). Note that with 50% free choice, pre-planned responses will be correct in already 75% of the cases (if a free choice target comes up, or if a forced choice target comes up that happens to call for precisely this response). Consistent with this expectation, the compatibility effect of the free choice condition in Experiment 1 (13 ms, $SE = 4.2$) is highly similar to the R-E compatibility effect for the free choice trials of the 33% condition (in both cases, pre-planning is not really useful because the pre-planned response will be adequate in only about 50% of the cases – either due to non-matching forced choice trials or due to nogo trials).

That is: Ideomotor action-effect anticipations for environment-related effects (as measured via R-E compatibility effects) occur only if (1) participants attend the action effects one way or another and (2) if they don't plan their response before knowing what is going to result from this action.

[This conclusion was also present in the original submission of these data, though it was deemed too complex by some of the reviewers...].

File list

Icon key: = tab-delimited data; = SPSS syntax

Pfister_Kiesel_Melcher_2010_Exp1_Raw.dat	Data of Exp. 1
Pfister_Kiesel_Melcher_2010_Exp1_Syntax.sps	Syntax for Exp. 1
Pfister_Kiesel_Melcher_2010_Exp2_Raw.dat	Data of Exp. 2
Pfister_Kiesel_Melcher_2010_Exp2_Syntax.sps	Syntax for Exp. 2 and for Sup. Exp. 1-2
Pfister_Kiesel_Melcher_2010_SupExp1_Raw.dat	Data of Supplementary Exp. 1
Pfister_Kiesel_Melcher_2010_SupExp2_Raw.dat	Data of Supplementary Exp. 2

Experiment 1: Variable coding

Experiment	11 = Exp. 1, forced choice condition, 12 = Exp. 1, free choice condition
Subject	Subject number
Condition	Counterbalancing
Session	1 = Training blocks, 2 = test blocks
Block	Block number; 1-4 training blocks, 5-10 test blocks
Blocktrial	Trial number within block
Trial	Continuous trial number
Compatibility	-1 = incompatible, 0 = neutral, 1 = compatible
Choice	1 = forced left, 2 = forced right, 3 = free, 4 = nogo
Deviant	0 = normal trial, 1 = deviant effect (orange instead of blue square)
Oversampling	Trial timing (mainly for fMRI purposes)
Jittering	Trial timing (mainly for fMRI purposes)
Response	0 = no response, 1 = left key, 2 = right key
RT	Response time in ms
Effect_Location	1 = left effect, 2 = right effect, 3/4 upper/lower effect in the center of the screen
Deviant_RT	RT for detecting deviant effects
Error_Type	0 = correct, 1 = anticipation, 2 = miss, 3 = wrong keystroke, 4 = "detection" reaction after normal effect, 5 = double keystroke as deviant reaction, 6 = deviant reaction carried out serially instead of simultaneously, 7 = missed deviant effect
Filter_Correct	1 = use trial (correct), 0 = don't use trial
Filter_N_1	1 = use trial (this and the preceding trial correct), 0 = don't use trial

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Experiment 2, Supplementary Experiment 1, Supplementary Experiment 2

Variable coding is exactly as in Experiment 1 with the main exception that there is no variable to code for experiment (since all variables were manipulated within-subjects). The variable Filter_N_1 has been manually inserted in the logfile of Experiment 2 after data collection to make all logfiles as comparable as possible.
