**Design for Conceptual Replication of Experiment 1 by Wühr and Seegelke(2018)**

**Background**

[Hier habe ich mal eine längere und eine kürzere Fassung als Einleitung ins Thema im Angebot]

Alternative (1)

ATOM ("A theory of magnitude") is a theory proposed by Walsh(2003) about relations of "cortical metrics of time, space and quantity". This might also have implications on experimental research investigating stimulus-response tendencies comprising different numerical, temporal or spatial properties.

Many studies have investigated different aspects and proposals of this theory. For example Dehaene at al.(1990) found compatibility effects between numerical size and horizontal response location, which Dehaene et al.(1993) later coined as “Spatial-Numerical Association of Response Codes” (SNARC) effect, which is interpreted as a spatial mapping of numbers to horizontal locations.

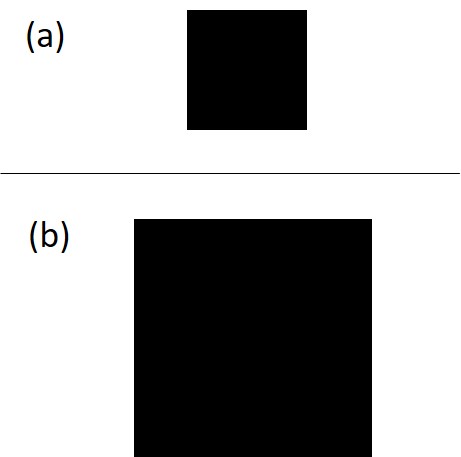
In 2013, Ren et al. have furthermore analogeously investigated the relationship between physical stimulus size and horizontal response location. Their results show similar compatibility effects of stimulus size and horizontal response location, but only for right hand responses. In 2018, Wühr and Seegelke attempted a conceptual replication and extension of this study. They claim that their results indicate the existence of a general magnitude code, as proposed in ATOM in that we might intrinsically associate small objects with the left side and large objects with the right. We will here aim to assess these findings via a conceptual replication of the first experiment from Wühr and Seegelke(2018).

In the experiment, subjects are presented with "small" or "large" stimulus objects and are required to judge their size as "small" or "large". The keys for subjects to communicate these judgements are mapped to either left- or right-handed responses and these mappings are switched once within the experiment.

Alternative (2)

The task is designed to see if responses are faster or more accurate when the size of the stimulus to respond to is compatible with the horizontal location of the response button, or the hand used to press that button. For example, Wühr and Seegelke(2018) found that participants in their experiment 1 were faster to respond to a large stimulus object with a key that is on the right of the keyboard (e.g. "Backspace", pressed with the right hand), than with a key that is on the left of the keyboard (e.g. "Tabulator", pressed with the right hand). For small stimulus objects, they found that reaction times were numerically faster for left-hand responses than for right-hand responses.

For each the two stimulus types ("small" vs. "large") used in the experiment, example stimulus objects are shown below.



**Physical stimulus size - spatial response location - compatibility**: - Is this object small or large?

For participants to judge whether the stimulus is a small or large object, ATOM would propose that subjects need to mentally activate an internal representation of size and the corresponding spatial response mapping in order to generate an action as response according to their judgement about stimulus size, and that these representations are linked. Ren et al. (2011), and Wühr and Seegelke (2018) showed that stimulus size and horizontal response location indeed exhibit compatibility effects, which can be regarded as evidence for this sub-aspect of ATOM. They found that the horizontal response mapping (key press with either left or right hand) to judgements about stimuli of different size influences response behavior and matters for success and swiftness of judgements of ‘small’ or ‘large’ stimulus objects.

# **Hypotheses**

We are here concerned with some specific predictions from previous experimental research by Wühr and Seegelke(2018), namely that small stimuli are associated with left responses, whereas large stimuli are associated with right responses in right-handed people. This stimulus size - response location compatibility effect is claimed to extend proposals of ATOM. In particular, we are going to address the following **research hypotheses**, which we will separately test for right- and, as an extension of the original experiment, left-handed people:

1. Response times for right-hand responses are faster to the larger stimulus than to the smaller stimulus.
2. Left-hand responses are faster to the smaller stimulus than to the larger stimulus.
3. The stimulus size – response location compatibility effect is larger for right-hand responses than for left-hand responses.

# **Design**

***Participants.*** Participants are recruited via [whatever media we will use to spread the link to the experiment]. By following the link to the experiment, participants declared to have normal or corrected-to-normal visual acuity and should be naive with respect to the purpose of the study. Participation is voluntary and not rewarded with material things or money but the experimenters' deep gratitude.]

***Materials.*** We will use information about the stimulus objects (i.e. information about how they are to be displayed concerning their form, size and position on the display) as provided by Wühr and Seegelke. In each trial, a visual stimulus object is presented in the center of the screen with gray background. A stimulus object is a simple black square, which is either small (2\*2 cm) or large (4\*4 cm). The 2 different types of stimulus objects are used for training trials and main trials. Pictures of the stimulus objects are shown above.

***Procedure.*** The experiment consists of four parts:

***(i)*** introduction & instructions

***(ii)*** training trial phase for first stimulus-response(S-R) mapping (10 trials)

***(iii)*** main experimental trial phase for first S-R mapping (2 stimuli × 30 repetitions = 60 trials)

***(iv)*** training trial phase for second S-R mapping (20 trials)

***(v***) main experimental trial phase for second S-R mapping (2 stimuli × 30 repetitions = 60 trials)

***(vi)*** post-experiment questionnaire

First, participants are welcomed to the experiment and shown written instructions about the task. Instructions include a description of the task, i.e. information about the sequence of events in a trial (fixation - stimulus presentation - key press given an S-R mapping) and the estimated duration of the experiment (15 minutes according to Wühr and Seegelke(2018)). Instructions emphasize that participants should strive to optimize speed and accuracy (this is not mentioned in the original paper but seems appropriate in this context, since a time-out occurs and an error message will be presented when participants' RT exceeds a period of 2000 ms).

Participants then perform a training block (10 trials) and an experimental block with the first S-R mapping(2 stimuli × 30 repetitions) followed by a training block (20 trials) and an experimental block with the second S-R mapping(2 stimuli × 30 repetitions). With the start of a new block, participants are given information about which keys to press for "small" or "large" stimuli (corresponding to the respective S-R mapping) and information on whether the next block belongs to training or main experimental phase.

The order of S-R mapping conditions for the first and second training and main trial phases (first = compatible – second = incompatible or first = incompatible – second = compatible) is determined experiment initially, uniformly at random once for each participant.

During the training phases participants will get accustomed to the task, specifically to the respective S-R mapping, by completing the given amount of practice trials (2 stimuli × 5 repetitions = 10 trials for the first S-R mapping, 2 stimuli × 10 repetitions = 20 trials for the second S-R mapping).

Each main experimental block contains 60 trials in random order (2 stimuli × 30 repetitions). The order in which individual trials are presented in the training and experimental phases is determined uniformly at random and on the fly for each participant.

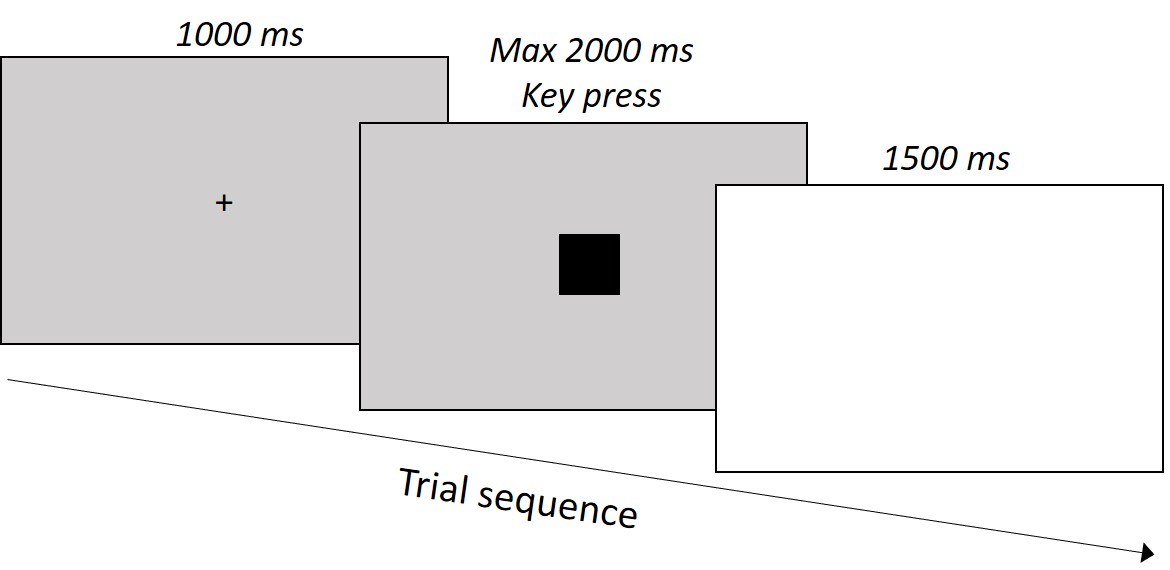
Participants can take a rest between blocks and start the next block at leisure.

Experimental trials within the training and main (test) phases are structured as follows (see also picture below):

* Each trial starts with the presentation of a fixation point (a small plus sign in Courier font, font size 18) for 1000 ms in the center of the screen.
* Afterwards, one of the two stimulus objects is displayed until a keypress occurs. Participants respond by pressing the left “Tabulator” key or the right “backspace” key on their keyboard. In the compatible mapping condition, the small stimulus required a response with the left (tab) key, whereas the large stimulus required a response with the right (backspace) key. The mapping is reversed in the incompatible mapping condition.

Participants should operate the left key with the index finger of their left hand and the right key with the index finger of their right hand.

* A correct response with an RT below 2000 ms is followed by a blank screen for 1500 ms. If a wrong key or no key is pressed within the maximum response period of 2000 ms, a corresponding error message is shown for 1500 ms in black color (Courier font, font size 24).



Finally, the experiment terminates with a post-experiment survey asking participants for their preferred hand (left or right) and to optionally supply socio-demographic information and comments.

# **References:**

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