

## Meaning (Mis-)Match in the Directionality of German Particle Verbs

Diego Frassinelli, Alla Abrosimova, Sylvia Springorum & Sabine Schulte im Walde (University of Stuttgart)  
frassinelli@ims.uni-stuttgart.de

German particle verbs (PVs; e.g., *an-schieben* 'push sth. forward') are highly productive and ambiguous complex structures that combine a particle such as *an* with a base verb (BV; *schieben* 'push'). They often trigger meaning shifts of the BVs [1-2]. For example, while *an-schieben* emphasizes the horizontal direction of the pushing event *schieben*, the PV *auf-schieben* expresses a non-literal meaning ('postpone').

**Hypothesis** Our work investigates the directionality of the particles *an* and *auf*. We hypothesize that the particle *an* is primarily associated with a horizontal directionality, and *auf* with a vertical directionality. Consequently, combining the particle *an* with BVs that incorporate a horizontal direction (such as *schieben*), we expect a match between the particle and BV meanings (resulting in a literal PV). On the other hand, combining *an* with a vertical BV should result in a mismatch between particle and BV meanings (resulting in a meaning-shifted PV). Vice-versa for *auf*. Verbs in the match condition should be processed faster (facilitation) than verbs in the mismatch condition (inhibition).

**Item Selection** A group of native speakers (15 for each BV) classified 230 German BVs according to their most prominent direction (horizontal, vertical). From this set, we extracted all BVs with a preferred directionality (e.g., 79% of the time, *schieben* was classified as horizontal) and selected 11 horizontal and 11 vertical BVs that generate valid PVs in combination with both particles *an* and *auf*. The horizontal BVs were attached to *an* in the match condition and to *auf* in the mismatch condition; vice-versa for the vertical BVs.

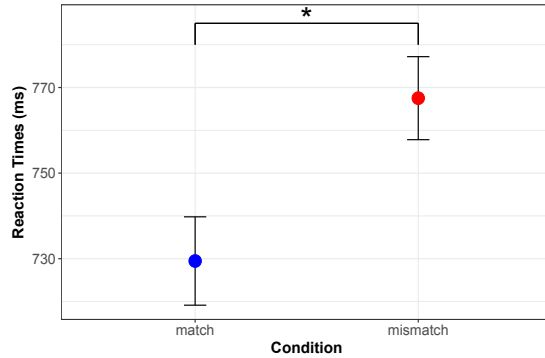
An ANOVA test was performed to exclude purely frequency or associative effects between the two conditions (*an*, *auf*). No significant effect of frequency of the PVs ( $F(1,1) = 0.12$ ,  $p = 0.75$ ) or of cosine similarity between the BV and the PV ( $F(1,1) = 1.45$ ,  $p=0.23$ ) were found.

**Experiment** To test our hypothesis, we performed a go/no-go lexical decision experiment. The primes were the particles (e.g., *an*) and the targets were the base verbs (e.g., *schieben*). A question about the type of particle used as prime was asked after each experimental trial. 69 German native speakers took part in the experiment ( $23\pm 3$  yo; 12 females). 3 participants were discarded: 1 didn't perform the required task, and 2 had reaction times (RTs) averaging 2.5 standard deviations above the grand mean.

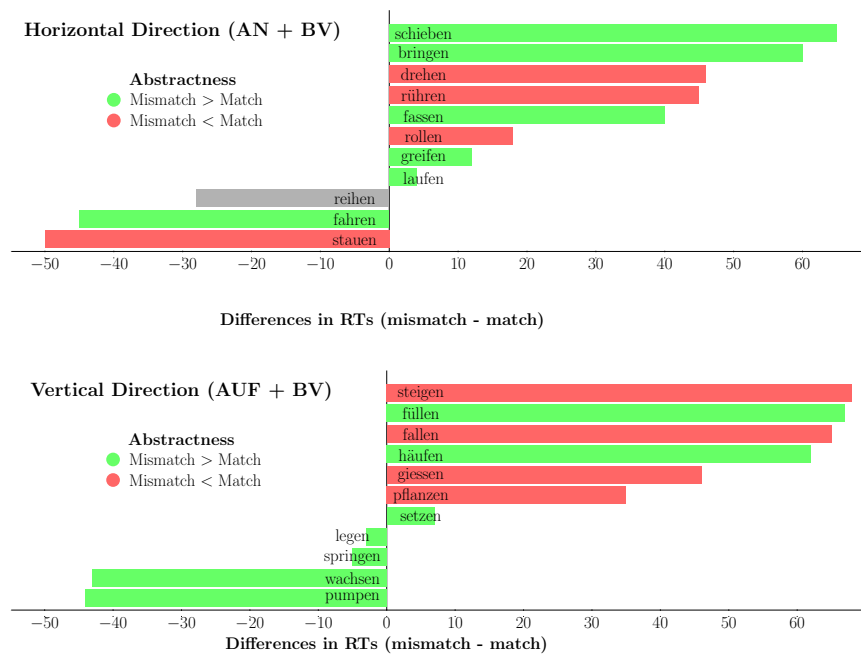
**Quantitative Analysis** As shown in Figure 1, subjects are slower in processing a verb in the mismatch condition ( $768\pm 8$ ms) than in the match condition ( $729\pm 10$ ms). We performed a LMER analysis [3] using log-transformed RTs as the dependent variable of the model, match/mismatch as the main factor, and random slope and intercept under Item and Subject [4]. The model shows a significant difference between the two conditions ( $\beta_{mismatch} = 0.05$ ,  $p < .05$ ).

**Qualitative Analyses** We performed a series of analyses by item. Figure 2 shows the differences between RTs in the mismatch and match conditions grouped by directionality: 15/22 verbs manifest a facilitation (positive values) for the match condition. The green bars in Figure 2 indicate whether the mismatch condition has higher abstract values than the match one [5]. We assume that a transition from literal to meaning-shifted readings is reflected in an increase in abstraction [6,7]: 13/22 verbs show this pattern. The red bars indicate cases where the PV in the mismatch condition is polysemous, in most cases including a shifted sense next to a synonym of the matching PV (e.g., *aufdrehen*<sub>meaning-shifted</sub> 'exhilarate' vs. *aufdrehen*<sub>literal</sub> ~ *andrehen* 'turn up').

**Discussion** Overall, this study strongly supports our hypothesis: it takes significantly longer to process a mismatching (inhibition) particle/BV pair than a matching (facilitation) pair. We conclude that the particles *an* and *auf* have a predominant horizontal/vertical directionality, respectively. Qualitative analyses showed that this effect can typically be attributed to meaning-shifted senses of (polysemous) PVs. Future work aims to incorporate the relation of meaning shifts and degree of PV polysemy into further investigations of particle directionality.



**Figure 1:** Average RTs (ms) and standard error for the **match** (e.g., an+horizontal BV, auf+vertical BV) and **mismatch** (e.g., an+vertical BV, auf+horizontal BV) conditions.



**Figure 2:** Differences in RTs (ms) between the mismatch and match condition for each BV (grouped by particle directionality). Positive values (**bars on the right**) indicate longer RTs for the mismatch condition than for the match condition. Abstraction differences are color-coded: **green bars** indicate that the mismatch condition has a higher abstraction score than the match condition; **red bars** indicate the opposite pattern. The **grey bar** marks a missing value.

## References:

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