Does semantic relatedness help or hurt re-learning of object names in aphasia? Insights from two patients with activation and inhibition deficit

Training picture naming in semantically-related contexts (e.g., a "fruits" block) is common practice in aphasia rehabilitation. Semantic relatedness may help learning by increasing activation of the features of the target, but it may also hurt learning by increasing the activation of competitors that must be inhibited. We investigated the effects of semantic-homogeneity of training blocks on learning in two individuals with post-stroke aphasia, one with an inhibition deficit (QD) and one with an activation deficit (XR). Table 1 summarizes the characteristics of the two participants.

On two separate baselines, 445 pictures were administered and 27 which were unnamed on both occasions were selected for each participant. These were divided into nine blocks: three related blocks (e.g., birds, fruits, furniture), three mixed blocks (items from the same related categories but mixed within the block), and three unrelated blocks (items from categories different from the related condition). Training consisted of six sessions, one week apart. On each session, all nine blocks were trained in pseudorandomized order. Each block contained two cycles of three words (total of 27 items/session, each trained twice). On each trial, a picture was presented with its name, two unique features were named for the item and participants were encouraged to recall the name which was presented again at the end of the trial for the participant to repeat. Outcome measures were obtained by presenting all 27 pictures for 30 seconds in random order, once right after training (short-term recall), once at the beginning of a session (long-term recall), and on three occasions 2, 6, and 16 weeks after the last training session (long-term retention).

Figure 1 shows the results. Data were analyzed with multi-level mixed effect models, with fixed effects of subject, condition and session, and random effect of items. Treatment of subjects as fixed effects allowed us to test dissociations between the two participants.

Short-term recall: we found a reliable advantage for the related vs. unrelated condition ($z = -1.98$, $p = 0.047$) and a different timeline for the effect of relatedness for the two participants (subject x condition x session interaction: $z = -2.0$, $p = 0.045$), with an earlier advantage in QD and a later advantage in XR. No reliable differences were found between related and mixed conditions.

Long-term recall: unrelated and mixed conditions patterned similarly and both models showed reliable subject x condition x session interactions ($z = z = -2.51$, $p= 0.01$, and $z = 2.95$, $p = 0.003$), with an early advantage of relatedness for QD which quickly turned into a disadvantage, and a later advantage of relatedness for XR.

Long-term retention: Both unrelated and mixed conditions showed a disadvantage compared to the related condition ($z = 1.81$, $p = 0.07$; $z = 2.31$, $p = 0.021$) with no reliable subject x condition interaction.

To summarize, semantic relatedness benefitted early stages of learning, but this advantage turned into a disadvantage for long-term retention. Deficit type modulated the timing of the effect, with an earlier and shorter-lived advantage of relatedness in inhibition deficit.

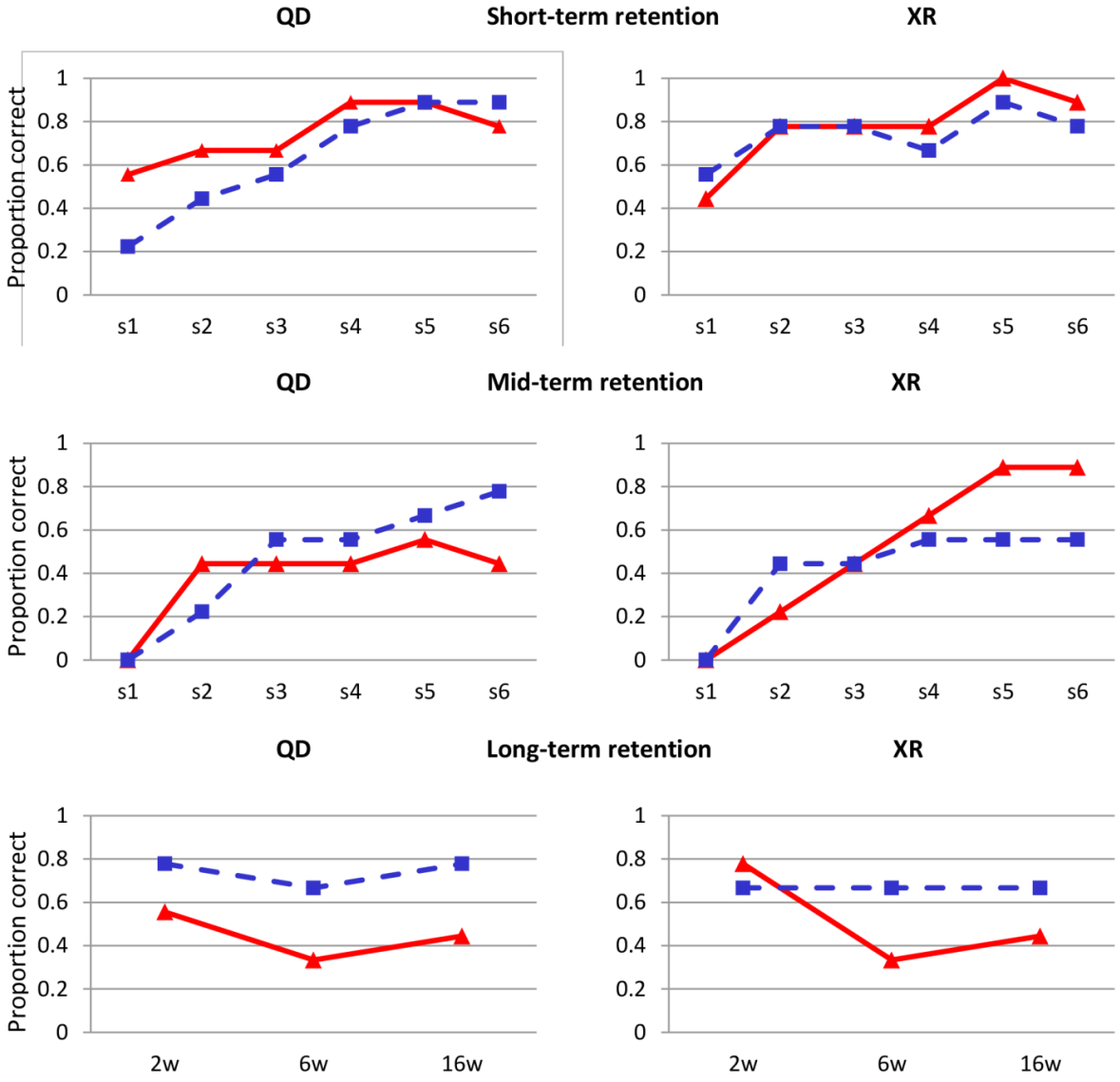

Figure 1 - Proportion of accurate responses on short-term retention, mid-term retention and long-term retention in the related and unrelated conditions in the two participants. In both participants, an early advantage for semantic similarity turns into a disadvantage for long-term retention. The difference between the two participants is in the timing of the switch, which is earlier for the participant with poor inhibitory control. s = session.