Complexity: Friend or for when remediating syntactic processing deficits in aphasia?

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Complexity: Animal Findings

- **Complex/enriched environments** (Craft et al., 2005; Keiner et al., 2008)
  - e.g., presence of play objects, healthy peers
- **Complex/skilled behaviors** (Ding et al., 2003; Keiner et al., 2008)
  - e.g., skilled reaching
- **Effects on recovery** (Buchhold et al., 2007; Komitova et al., 2005; Loukavenko et al., 2007)
  - Positive neural gains in ipsi- and contralateral regions
  - ↑ extent and rate of recovery of impaired motor or cognitive skill
  - ↓ stress levels
  - ↑ functional recovery
Complexity: Animal Findings

- Complexity effects moderated by animal characteristics
  - Acute vs. chronic lesion (Farrell et al., 2001)
    - Early exposure to enriched environments detrimental to neuroplasticity mechanisms in cortical and hippocampal regions
  - Site of lesion (Loukavenko et al., 2007; Woodlee & Schallert, 2004)
    - Intensive weak-limb use during acute recovery has negative lesion and behavioral effects on animals with cortical but not subcortical lesions
    - Early exposure to enriched environment not detrimental following anterior thalamic lesions
  - Animal characteristics (Abramov et al., 2008; Gortz et al., 2008)
    - Premorbid behavioral differences between different mice strains still apparent regardless of environmental condition
Complexity: Aphasia Research

- **Traditional treatment approaches** (Bandur & Shewan, 2001; Helm-Estabrooks et al., 1981; Schuell et al., 1964)
  - Task, stimuli, and environment hierarchies progress from simple to complex/difficult

- **Complexity Account of Treatment Efficacy** (CATE; Thompson, 2007; Thompson et al., 2003; Thompson & Shapiro, 2007)
  - Complex treatment materials promote generalization/language learning
    - Start with complex and get generalization to simple
  - Linguistic relation between trained and untrained materials
    - Untrained must be *subset* of trained
CATE Applied to Treatments for Syntax Production

- Treatment of Underlying Forms (TUF; Ballard & Thompson, 1999; Jacobs & Thompson, 2000; Thompson, 1998; Thompson et al., 1998)
  - Train complex, noncanonical sentences (i.e., ≠ SVO) to evoke generalization to syntactically related but less complex structures
    - ↑ production of trained sentence structures
    - ↑ production of linguistically-related, less complex, untrained sentence structures
  - Most previous investigations probe production/comprehension of untrained structures via (Dickey & Thompson, 2007; Stadie et al., 2008; Thompson et al., 1998, 2003):
    - Constrained, sentence-level tasks
    - Tasks which exploit same response modality
Syntax Production Treatments: Generalization Issues

- Inconsistent generalization to less structured, communicative contexts (e.g., Thompson et al., 1996 vs. Ballard & Thompson, 1999)
  - Degree of morphosyntactic vs. pragmatic changes
  - Evaluated limited discourse contexts
  - According to CATE, generalization to discourse might not be expected:
    - Discourse ≠ subset primed sentence production training task
- Few studies have evaluated:
  - Cross-modal generalization (Jacobs & Thompson, 2000; Mitchum et al., 1993; Murray et al., 2007)
    - According to CATE, cross-modal generalization more likely if:
      - Untrained modality a subset of trained modality
  - Patient characteristics (Ballard & Thompson, 1999; Berndt & Mitchum, 1998; Dickey & Yoo, 2009; Lesniak et al., 2008; Murray et al., 2004)
    - Aphasia profile: ↑ comprehension deficits
    - Presence concomitant cognitive deficits
Therefore, to enhance the generalization effects of a syntax treatment via complexity manipulations:

- Target more complex syntactic structures
- Target in less structured/more complex environments
- Target less frequently used/more complex language modalities
- Acknowledge possible influence of participant characteristics
Example Study:
Murray & Karcher (2008)

- TUF to target complex syntactic structures
  - Train complex forms with wh-movement:
    - object-extracted embedded who-question sentences (OE)
      - e.g., “I know who the boy tickled.”
    - subject-extracted embedded who-question sentences (SE)
      - e.g., “I know who tickled the girl.”
  - Probe generalization to:
    - Related, simpler structures with wh-movement:
      - object-extracted matrix who-questions (OM)
        - e.g., “Who has the boy tickled?”
      - subject-extracted matrix who-questions (SM)
        - e.g., “Who has tickled the girl?”
    - Unrelated structures with NP movement:
      - passives
        - e.g., “The girl was tickled by the boy.”
Incorporate Discourse Training Module (DTM; Murray et al., 2007)
- Embed practice of OE and SE forms within a discourse framework:
  - Response Elaboration Training (Kearns, 1985)
  - Levels of Processing Hypothesis (Craik & Lockhart, 1972)
  - Transfer prerequisites (Geusgens et al., 2007; Robson et al., 2001)
    - Vary practice situation
    - Address transfer during learning

Target written production (Murray & Karcher, 2000; Murray et al., 2007)
- Probe spoken production of trained and untrained structures
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Treatment Procedures

- Each weekly tx session (16 sessions total)
  - 40 min probing → 20 min TUF → 30 min DTM

- TUF procedures (Ballard & Thompson, 1999; Murray et al., 2007)
  - write target sentence following clinician’s oral prime
  - regardless of accuracy, copy and then identify verb, agent, and theme in a printed active sentence
  - copy the target “who move” (OE) or “who stay” (SE) sentence and then identify verb and thematic roles in target sentence
  - arrange word/phrase cards to form target sentence, copy sentence, and then identify verb and thematic roles
  - repeat first step
Participant 2
Participant 2: Discourse data
Murray & Karcher (2008): Findings

- ↑ written production of trained sentences with generalization to:
  - Writing untrained exemplars of target sentence types
  - Writing untrained, syntactically related structures
- ↑ spoken production of trained and related, untrained structures
  - Spoken production never directly trained but clinician provided spoken models in treatment and probes
  - Akin to mirror neuron effects (Ahlsen, 2008)?
    - Neurons activated by perception and/or production
- ↑ written and spoken discourse
  - ↑ grammatical utterances, ↓ agrammatical utterances
  - Only marginal ↑ complex/embedding and limited to speech
    - Reflection of processing costs associated with producing complex structures in more demanding communicative contexts?
  - ↑ %CIUs, ↓ %word finding errors
- ↓ generalization and maintenance in participant with:
  - poorest comprehension, verb naming, and cognitive skills
Complexity in Syntax Production Treatment: Conclusions

- Complexity can enhance generalization
- Important caveats
  - Complexity of material not the only potent variable
    - Complexity of task, environment, language modality, etc.
  - Must consider patient characteristics
- Future research:
  - Influence of other independent variables identified by Raymer et al. (2008)
    - E.g., intensity and quantity of exposure to complex material
    - E.g., timing: acute vs. chronic recovery stages?
  - Neural correlates of generalization and moderating variables (e.g., Wierenga et al., 2006)
Selected References


Selected References


