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University Forum (May 24, 2011)
Strategic Research Theme – Sciences of Learning

Application of implicit motor learning principles to speech motor learning

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The “speech motor learning” team

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Andy Tse
Ph.D. candidate
Background – speech and voice production

- Clients with motor speech and voice disorders have impaired regulation of speech and voice production (programming and execution of speech motor movements).

- Clinical examples
  - Parkinson’s disease – reduced pitch variability
  - Cerebral palsy – excessive pitch variability.
  - Hyperfunctional dysphonia – excessive laryngeal muscle tension.

- Treatments target at training clients to (re) learn motor skills for effective speech and voice production.
A typical definition of implicit learning…

“a person typically learns about the structure of a fairly complex stimulus environment without necessarily intending to do so, in such a way that the resulting knowledge is difficult to express.”

Berry & Dienes (1993, p.2)
Background
– Implicit motor learning paradigms

Implicit Motor Learning Paradigm

- Dual Task paradigm
  - Masters, 1992
  - Hardy, Mullen, Jones, 1996;
  - Maxwell, Masters, & Eves, 2000

- Feedback manipulations
  - Masters, & Maxwell, 2004;
  - Maxwell et al., 2003

- Errorless learning
  - Kerr, Masters, Maxwell, 2007
  - Maxwell, Masters, 2001;
  - Masters, Maxwell, Eves, 2009

- Analogy learning
  - Masters, 2000;
  - Liao & Masters, 2004;
  - Poolton, Masters, & Maxwell, 2006

- Subliminal learning
  - Masters, Maxwell, Eves, 2009
  - Masters, 2011
An analogy is ......

“a similarity between like features of two things, on which a comparison may be based”

Dictionary.com

e.g., the analogy between the heart and a pump
Advantages of analogy learning

- Easy to learn quickly.
- Performance is robust under stress.
- Learners are able to multi-task after training.
“speech production” & “motor learning”

SHS
- Expertise in speech treatment.
- Speech motor learning.

IHP
- Expertise in psychology of motor learning.
- Sport learning.

If the principles of general (non-speech) motor learning can be applied to speech motor learning??
Implications of research findings

- Practical (clinical application)
  - Inform clinicians an intervention program that can optimize clients’ learning of speech and voice production.

- Theoretical
  - Evaluate the universality of motor learning theories.
The use of analogy in speech motor performance

Aim of study

- To examine pitch variation in participants who received either analogy instructions or explicit instructions (modulating their intonation during speech production).
Methodology

**Step I** – Focus group for culturally appropriate analogies of monotone, normal and excessive intonation.

**Step II** – 40 participants completed a speech task following either analogy or explicit instructions.
 Explicit Instruction
Read aloud with no pitch variation. That is, speak without changes in the highness or lowness of your voice.

Explicit Instruction
Read aloud with moderate pitch variation. That is, speak with neither excessive nor minimal changes in the highness or lowness of your voice.

_Calm sea_ 無浪的海

_Moderate Sea_ 中浪的海
Results & implications

- Analogy instructions were significantly more effective than explicit instructions for inducing monotone.

Well-established advantages of analogy learning in sport learning.

Demonstrated its benefits in speech learning.
Study 2 – Examine the effectiveness of analogy instruction under stressful conditions.
Study Two
The effectiveness of analogy instructions under stressful conditions

Tse, A. C.Y., Masters, R.S.W., Whitehill, T., & Ma, E.P.-M (2010). The potential application of analogy learning in speech rehabilitation. Poster presentation at the 3rd HKASMSS Student Conference on Sport Medicine, Rehabilitation and Exercise Science, Hong Kong.

Best Paper Award !!
Results of Study Two

- Sig. decrease in pitch variation after instruction for both groups
- Sig. increase in pitch variation for Explicit Group

$p<0.008$
Future planning

- Continue our “programmatic research”.
  - children population, clinical populations, other implicit learning paradigms.

- Apply for external competitive grants (GRF, HHRSF)
  - Further our research to clinical applications.

- Explore international exchanges (e.g., with UQ)
  - Learn new techniques, generate new collaborations.

- Undergraduate dissertation studies
Added values of the SRT

2009

- Brain-storming research ideas at the first Town Hall Meeting in 2009.

2011 and onwards

- Collaborative research projects, co-supervise PhD and PDF.
- Established a programme of research to be further expanded.
Added values of the SRT

- Team personnel (supported by the SRT SoL)
  - Andy Tse (PhD candidate)
  - Dr. Andus Wong (Post-doctoral fellow)

- Projects to date
  - 2 completed, 3 in progress

- Research output
  - 10 refereed papers (5 published, 1 in press, 4 in preparation)
  - 6 conference presentations
  - 2 grants funded (internal)
Added values of the SRT

- Cross-disciplinary fertilizing
  - Transfer the scientific principles across disciplinary boundaries (SHS and IHP).
  - Enable us to pilot our ideas, generate research data.
  - Develop a specific track record and work within a programme of research.
Papers


Conference papers


Conference papers

4) Tse, A. C.-Y., Masters, R.S.W., Whitehill, T., & Ma, E.P.-M (2010). The potential application of analogy learning in speech rehabilitation. Poster presentation at the 3rd HKASMSS Student Conference on Sport Medicine, Rehabilitation and Exercise Science, The Chinese University of Hong Kong, Hong Kong. (Best paper award).

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- Effects of practice schedules on speech motor learning. Faculty of Education Research Fund. 2010-11. (HK$30,000).