From specific examples to general knowledge in language learning

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learning
language
knowledge
form
semantic
affixes
words
stems novel
generalisation

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Generalisation
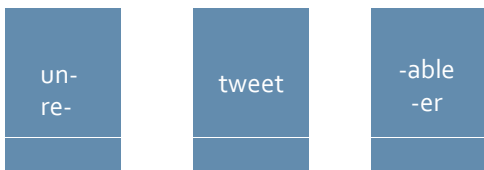
pig -> / p I g /
van -> / v { n /
vig -> / v I g /

I'm naturally blonde
so please speak slowly

The cows walked up the mountain for a picnic with the pigs.

Morphological Combination

| un-
re- | wash
paint
do | -able
-er |

washable, unwashable, washer, rewash, paintable, painter, unpaintable, repaint, undo, redo, doable, doer, undoable, redoable …

Morphological Generalisation

| un-
re- | tweet | -able
-er |

untweetable

"I'm the *decider* and I decide what's best"

decider = decide + -er (someone who does [stem])

redo   clean
repaint   unclean
rewire   cleaner
remake   cleanliness
reheat   cleanly
reprint   preclean
recreate   cleaning
reuse   reclean

print

meaning ←→ sound

•85% English words are morphologically structured (up to 100% in other languages)
•Morphology has priority over phonology in the world's writing systems (e.g. magician, health)

How do we acquire abstract knowledge about morphology?

•Recognized formally in primary literacy framework.

•Research suggests that current teaching practice patchy.

•Don't have a basic understanding of how generalisation process occurs.

Artificial Morpheme Learning

Training
▪ Train participants on novel words with a morphological structure e.g. sleepnule, teachnule, rugnule

Testing
▪ Is there evidence that participants have established an abstract representation of 'nule'?
▪ Signature of abstraction is *generalisation* (e.g. how do participants treat cooknule?).

Directly intervene into the language systems of individuals. Perfect control over what they learn and how they learn.

Experiment 1

3 cycles of:

3x study blocks
1x verification block

Experiment 1

4 novel affixes * 8 stems each * 12 presentations...

sleep_nule_	coin_ort_	van_uck_
rug_nule_	wheat_ort_	gun_uck_
teach_nule_	build_ort_	boot_uck_
...	...	...

Meanings transparent and consistent

sleepnule. *"A participant in a study about the effects of sleep"*

rugnule. *"A person who imports and sells handmade rugs"*

vanuck. *"The tax paid for importing a van from the United States"*

gunuck. *"The fine for possession of an illegal gun in Canada"*

Experiment 1
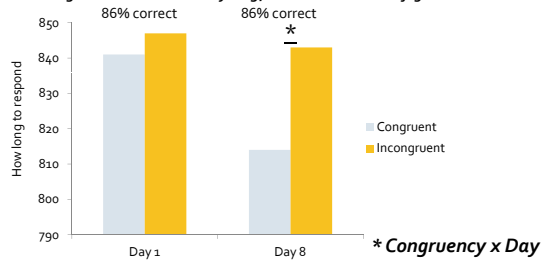
Experiment 1: Sentence Priming

Read aloud untrained items in semantically congruent and incongruent contexts, then make an explicit congruency judgment e.g.

The manager often argued with the ... pignule

When she was young, she snuck into the ... jugnule

Experiment 1: Sentence Priming

Read aloud untrained items in semantically congruent and incongruent contexts, then make an explicit congruency judgment e.g.

Congruent: "The manager often argued with the ... pignule"
Incongruent: "When she was young, she snuck into the ... jugnule"

* Congruency x Day

Experiment 1: Summary

Adults can extract morphemic generalisations from artificial vocabularies without being told that such generalisations exist

• Show evidence of explicit generalisation of the meanings of learned morphemic units immediately after training

• But unable to capitalise on this information in tasks demanding access to abstract lexical knowledge held in memory.

Generalisation doesn't arise immediately after learning. It requires a period of (overnight) consolidation.

Experiment 2: Summary

Adults can extract morphemic generalisations from artificial vocabularies without being told that such generalisations exist
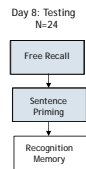
- Show evidence of explicit knowledge of learned morphemic units irrespective of number of exemplars in which those units are encountered.

- Ability to generalise in tasks that require access to abstract lexical knowledge held in memory *requires multiple exemplars.*

Generalisation requires multiple examples of whatever statistics / rules are being learned

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Experiment 3

(a) Study task:

(1) read novel item and definition   (2) hear novel item   (3) clear screen   (4) type novel item

(b) Verification task:

(1) read definition   (2) type novel item   (3) read novel item and definition

- 8 novel affixes, each with 8 stems

- 4 novel affixes have consistent meanings; 4 have two meanings

- Meanings all transparent

- Affix exposure equated (96x)

Day 8: Testing
N=24

Free Recall

Sentence Priming

Recognition Memory

Experiment 3: Free Recall

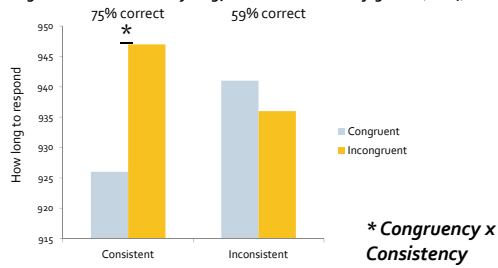| Consistent	Inconsistent
41% correct	37% correct

(*)

Same pattern observed in recognition memory task

Experiment 3: Sentence Priming

Read aloud generalisation items in semantically congruent and incongruent contexts, then make an explicit congruency judgment e.g.
Congruent: "The manager often argued with the … pignule" (N=64)
Incongruent: "When she was young, she snuck into the … jugnule" (N=64)

75% correct   59% correct

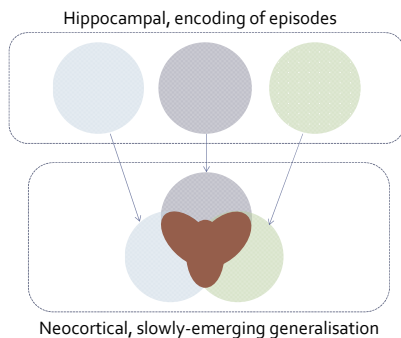** Congruency x Consistency*

Experiment 3: Summary

Adults can extract morphemic generalisations from artificial vocabularies without being told that such generalisations exist

• Inconsistency in examples provided at learning impacts on episodic memory processes but does not destroy them.

• Ability to generalise information in tasks that require access to abstract lexical knowledge held in memory requires consistency at the learning stage.

New knowledge is vulnerable to interference.
Successful generalisation requires consistency at learning.

Putting it all Together

Hippocampal, encoding of episodes

Neocortical, slowly-emerging generalisation

Implications for Teaching

• Possible to discover rule-based or statistical generalities without being told explicitly that they exist.

• This discovery process doesn't arise in the classroom; the abstract representations in long-term memory crucial guiding behaviour in novel situations take time to develop.

• This generalisation process requires multiple examples of the same rule or set of statistics during learning; it is not (just) about frequency.

• Initial learning is vulnerable to interference and can block generalisation. Don't train exceptions with regulars!

Implications for Teaching

thought
through

their
there

swimming
standing
playing
bring
cooking
dancing
thing

Thank you for listening!

Questions / feedback?

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