

Statistical learning



Statistical learning- Approach to language learning which suggests that humans can process and learn language by probabilistic patterns and associations within language. How to segment spoken language?

- Infants segment speech stream based on probability of certain sounds occurring with others

- Not just associative learning - based on Transition Probabilities (TPs) created using artificial languages e. g.

pabikugolatutibudodarogolatupabiku... = high TP of 'pa' + 'bi', high TP of 'bi' + 'ku' but 'ku' + ?

Support for statistical learning:

SAFFRAN, ASLIN & NEWPORT (1996) Exposed 8 mth olds to speech stream of 3 syllable nonsense words, used novelty preference test (as infants fixate on something for longer if they have dishabituated) - infants listened to part words (e. g. bikuti) for longer = successful segmentation

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Support for statistical learning:

ASLIN, SAFFRAN & NEWPORT (1998) But SAFFRAN, ASLIN & NEWPORT (1996)

- did not discern whether infants used TPs or simply tracked frequencies.

Revised study by allowing two words to occur twice as frequently as other two but infants still showed discrimination effects, so clear use of TPs to segment speech

Support for statistical learning:

SAFFRAN (2001) Tested in adults and 6-9 yr olds. Adults significantly better and more reliable at segmenting speech, though children did still acquire basic aspects of the language

BUT poses questions for idea of 'sensitive period' in early childhood - shouldn't children be comparable to, if not better than, adults? Support for statistical learning as an ability:

CONWAY ET AL (2010) Visual implicit learning task using constrained grammar and auditory sentence perception task - significant correlation between high score on word order predictability and high score on implicit learning = so good implicit learners more sensitive to context and word order predictability in speech? Support for statistical learning as an ability:

KIDD (2012) Same task as CONWAY ET AL (2012) but tested syntactic priming - also correlated with statistical learning ability in 5 yr olds Support for statistical learning as an ability:

MISYAK & CHRISTIANSEN (2011) Artificial grammar task on adjacent and non-adjacent dependencies as well as test of memory factors, lexical comprehension and non-verbal abilities - statistical learning scores correlated with verbal working memory and comprehension scores, and also served as a better predictor of comprehension than good verbal working memory Problems with statistical learning as an ability: Facts

If statistical learning is an ability this would suggest that lower ability = language learning impairment. But that majority of speakers do still eventually master the language...? Statistical learning of non-adjacent dependencies:

NEWPORT & ASLIN (2004) e. g.

pasukutitadogoretutinedodagopipamakugofetudabapi

- Adults tested on speech stream where relations between syllables were non-adjacent. Found no acquisition of relations so suggested that non-adjacent dependencies not learnable

- BUT learnable if segments marked for consonants and vowels (e. g. pakutegagubepogitadokibakapude...) - perhaps selectivities for learning patterns more common to natural language?

Statistical learning of non-adjacent dependencies:

PACTON & PERRUCHET (2008) Role of attention for non-adjacent dependencies - tested ppts using digit sequences. When attention focused on subtracting non-adj digits, accuracy in non-adj dependency recognition test higher, and same pattern found for adj dependencies when subtracting adjacents, and both groups failed to learn the other pattern - double dissociation, learnable if attention focused

Statistical learning of non-adjacent dependencies:

GOMEZ (2002) Tested adults and 18 mth olds using speech stream made up of 3 element strings (e. g. pel-kicey-jic). Size of cohort from which middle element drawn varied (2, 6, 12, 24) = the larger the set size, the greater the accuracy so variability key factor

Statistical learning of non-adjacent dependencies:

AMATO & MACDONALD (2010) Paradigm combining artificial language with sentence processing methods (where direct object was predicted by non-adjacent noun and verb) then shown picture and asked if it was correct or not given the context. When picture matched correct nonsense objects, ppts' accuracy higher than for mismatch = ppts learned non-adj dependencies despite no explicit awareness of patterns

FITCH & HAUSER (2004) Compared results from artificial language experiments using finite state grammars with those using phrase structure grammars - concluded that phrase structure grammar can be learned by humans and monkeys, finite state grammar only

by humans = so nativist idea that hierarchical structures key to human language? REY ET AL (2012) After intensive paired-associate training baboons can learn hierarchical structures - not special human ability CORBALLIS (2007) Songbirds can learn certain hierarchical structures - counters Chomsky and nativist approach, suggests that statistical hierarchical learning not solely in humans SAFFRAN ET AL (1999) Statistical learning in non-speech setting? Adults and 8 mth olds exposed to non-linguistic auditory sequences ('tone words') - both groups segmented tone stream and the performance was no different from that on syllable streams - not unique to speech Problems with statistical learning:

JOHNSON & TYLER (2010) Criticised artificial language experiments as studies too dissimilar to natural language. Varied length of words in word segmentation task on 5 and 8 mth olds and found no learning effects - statistical learning too simplistic Attempt to combat criticism:

SAFFRAN ET AL (2009) Recognised issue of ecological validity so set up expt on TPs in fluent, infant-directed speech. 8 mth olds showed signs of statistical learning but language contained very few words and was deliberately directed towards infants Problems with statistical learning:

JOHNSON & JUSCZYK (2001) Compared statistics with speech cues using a Head Turn Preference test on infants - infants consistently found speech cues more useful than statistics Problems with statistical learning: Facts Despite attempts to be more ecologically valid, less artificial measures for testing statistical learning are required in order to be able to generalise results to natural language learning