Savage-Rumbaugh et al (1986)  
Spontaneous symbol acquisition and communicative use by pygmy chimpanzees

Kanzi + lexigram keyboard
Thinking about human language

• Furious green ideas sleep peacefully

• Does the sentence make sense?
• Can the word order be changed?
• Is the sentence grammatical?
• How did you make these decisions?
Thinking about human language

• Acquiring human language

• Is the ability to use human language learned or innate?

• The nature or nurture debate
Language theories….

• The **behaviourist** theory (Skinner)

• children learn by imitation and reinforcement

• **operant conditioning**…
Language theories....

• NATURE: Nativist theory (Chomsky)

• children are born with an innate Language Acquisition Device

• the ability to learn & use language is hard wired into the human brain
Language theories....

• NURTURE: **Behaviourist Theory**: Skinner
• this theory emphasises performance
• a child imitates what she hears and is reinforced when correct
• gradually vocalisations are shaped and words are learned
Language theories….

• NURTURE (Skinner) PROBLEMS

• it would take too long
• Young children make errors: eg:
  • “I runned………..”, “I goed…”
• All children (even deaf) ‘babble’ in same way
Language theories....

• The NATIVIST theory (Chomsky)

• all humans are ‘prepared’ to learn language
• all normal children acquire language in similar stages
• linguistic universals exist in every language
• BUT, maybe ‘critical period’ (eg; Genie)
LINGUISTIC UNIVERSALS

• THREE COMPONENTS of language
  
  • PHONOLOGY - SOUND PATTERNS
  
  • SYNTAX - WORD PATTERNS
  
  • SEMANTICS - MEANING PATTERNS
LINGUISTIC UNIVERSALS

• SEMANTICITY - words have meanings
• DISPLACEMENT - words can be used to refer to things that are not present in time and space
• STRUCTURE DEPENDENCE - words can be ‘chunked together’ and moved around -
  e.g. the policeman shot the man in the garage
• CREATIVITY - each sentence that is spoken might be a unique ‘utterance’
• GENERALISATION - from one situation to another
LINGUISTIC UNIVERSALS
Features of Language

• SEMANTICITY –

• DISPLACEMENT –

• STRUCTURE DEPENDENCE –

• CREATIVITY –

• GENERALISATION –
Language --- the great debate

• Why teach language to apes?

• the rationale

• if apes can learn language it supports Skinner (nurture) if not perhaps Chomsky is right (nature)
Teaching language to apes

• The earliest experiment
• The Kelloggs and Gua

• brought up like human baby
• continually exposed to speech
• ‘understood’ 70 words but never spoke
• chimps have NO vocal chords
Savage-Rumbaugh & Lana

- Symbolic keyboard linked to computer and a vending machine
- If Lana requested ‘food’ she received it
- Lana understood symbols like ‘more’
- YES - semanticity YES - displacement
- NO - structure dependence
Gardner & Gardner (Washoe)

• A case study
• Participant - a female chimp
• Age - approx 1 year old
• Procedure - Washoe lived in a caravan in the Gardner’s garden & was taught American Sign Language (ASL)
Washoe’s progress ...

- First SINGLE WORDS
- come, gimme, hurry, sweet, tickle
- 34 after 21 months
- by 4 years over 100 signs
- YES - SEMANTICITY
- signed TOOTHBRUSH in bathroom
- signed FLOWER in garden and when shown picture of flower
Washoe’s progress ...

- YES - CREATIVITY
- Washoe spontaneously used combinations of signs
- GIMME TICKLE - come and tickle me
- OPEN FOOD DRINK - open the fridge
- LISTEN EAT - listen to the dinner gong
- GO SWEET - take me to the raspberry bushes
Washoe’s progress ...

- NO STRUCTURE DEPENDENCE
- English children usually put the SUBJECT before the ACTION
  - Mummy come
  - Eve read
  - Car gone
- Washoe did not seem to do this
- GO SWEET or SWEET GO both used for take me to the raspberry bushes
Savage-Rumbaugh et al (1986) Spontaneous symbol acquisition and communicative use by pygmy chimpanzees

- Kanzi & Sue Savage-Rumbaugh
- ‘having a chat’
Savage-Rumbaugh et al (1986) Spontaneous symbol acquisition and communicative use by pygmy chimpanzees

- Kanzi’s lexigram ‘keyboard’
Savage-Rumbaugh et al (1986)
Spontaneous symbol acquisition and communicative use by pygmy chimpanzees

- Research question: Can Kanzi learn symbolic language without training in the same way children do?
- Method: Case Study - longitudinal design
- The report of Kanzi’s language development (the findings) is described as ‘serendipitous’ - occurred by happy chance
Bonobo Chimpanzees (Pygmy)

• These differ from other apes in following ways:
• More developed in social communication;
  - eye contact
  - gesture
  - vocalisations
• Better prepared to learn language than other apes
Savage-Rumbaugh et al (1986)

The participant:
- **KANZI** born 28/10/80 in captivity, his mother was a ‘language chimp’
- Assigned to the language research centre at 6 months & reared in a language using environment with humans
- When 2.5 yrs old it was observed that he was using symbols spontaneously (perhaps because he had observed his mother)
- Also sister **MALIKA**
Savage-Rumbaugh et al (1986)

Serendipitous observation

Kanzi

• began to use symbols without training after he was separated from his mother
• identified symbols correctly and did not confuse them (e.g. apple, orange, banana)
• understood spoken words
Savage-Rumbaugh et al (1986)

The visual symbol system

- Indoors: battery powered keyboard with geometric symbols that brighten when touched, then speech synthesiser ‘speaks’ the word
- Outdoors: copy of keyboard as laminated pointing board
- Each symbol called a lexigram
Savage-Rumbaugh et al (1986)

Kanzi’s ( & Mulika’s) outdoor environment:

- 55 acres forest; 17 food locations; must travel to ‘get food’ each location for a specific food type e.g. bananas to treehouse, peaches to lookout
- Kanzi learned where all the food was located
- could select a food from photos on the ground and could guide another person to his chosen location
- learned to use the symbols on the keyboard to indicate where he wanted to go
Savage-Rumbaugh et al (1986)

Longitudinal case study - data collection

- records kept of Kanzi’s/ Malika’s language development (symbol use) for 17 months
- from the age of 2 1/2
- computerised records from keyboard
- notes from observers when outside
- Compared with progress of common apes: Sherman & Austin (different setting)
Savage-Rumbaugh et al (1986)

Longitudinal case study

The data (assessing Kanzi’s symbol use)

- correct or incorrect
- spontaneous
- imitation
- structured (e.g. responds to question)
- also behavioural concordance (agreement)
- e.g. if request to ‘go to treehouse’ led a person to the treehouse
Controls:

• Analysis of videotape against real time coding of symbol use by 2 observers

• Vocabulary Acquisition Criteria:
  1. Appropriate symbol production
  2. Occurs spontaneously 9/10 occasions & concordance is 9/10
Savage-Rumbaugh et al (1986)

Results

- Figure showing the proportion of total utterance types over months of age, with different categories labeled as follows:
  - A: Single words used spontaneously
  - B: Single words elicited by companion's queries
  - C: Single words used in imitation or as a result of prompting
  - D: Combinations used spontaneously
  - E: Combinations elicited by companion's queries
  - F: Combinations used in imitation or as a result of prompting
Savage-Rumbaugh et al. (1986)

Results
2530 correct combinations
many were ‘two foods’
e.g. hotdog & coke
265 imitated

person (g) chase Kanzi’ person
(g) chase person (g)

\[ g = \text{gesture to indicate ‘who’} \]
\[ \text{indicates structure dependence / correct syntax} \]

Example combinations:

- Chase person1(g) person2(g)
- Person1(g) pat(g) person2(g)
- Person1(g) person2(g) pat(g)
- Person1(g) chase person2(g)
- Person1(g) grab person2(g)
- Person1(g) chase (g) person2(g)
- Person1(g) person2(g) chase Kanzi
- Kanzi chase person(g)
- Chase bite person(g)
- Person(g) chase Kanzi
Savage-Rumbaugh et al (1986)

• Testing Kanzi
• given lexigram and/or photo
• asked to match to object
• also match to spoken English
• see example list
Savage-Rumbaugh et al (1986)

- Kanzi: comparison of imitated or spontaneous to ‘other ape learners’

<table>
<thead>
<tr>
<th>Subject</th>
<th>Proportion of imitated utterances</th>
<th>Proportion of spontaneous utterances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kanzi</td>
<td>.11</td>
<td>.80</td>
</tr>
<tr>
<td>Mulika</td>
<td>.20</td>
<td>.67</td>
</tr>
<tr>
<td>Nim</td>
<td>.39</td>
<td>.56</td>
</tr>
<tr>
<td>Sherman</td>
<td>.10</td>
<td>.78</td>
</tr>
<tr>
<td>Austin</td>
<td>.05</td>
<td>.90</td>
</tr>
</tbody>
</table>
Savage-Rumbaugh et al (1986)

• Conclusion
• Kanzi learned to use the symbols spontaneously
• Compared to other species of chimps pygmy chimpanzees appear to be able to learn and use language more like a human child
• Kanzi & the language universals?
• semanticity - YES; creativity - YES;
• structure dependence - YES;
• Generalisation - YES; Displacement - YES
Savage-Rumbaugh et al (1986)

Evaluative issues:

• ++ both quantitative and qualitative data
• ?? validity of measurement
• ?? reliability of measurement
• ?? representativeness of sample
• ?? ecological validity (level of realism)
• ?? generalisability to other pygmy chimps
• ?? ethical issues
• ?? differences between Kanzi & child learner
• ?? usefulness
Savage-Rumbaugh et al (1986)

- Spontaneous symbol acquisition and communicative use by pygmy chimpanzees