考えられる前駆体

- 音節構造
- 音楽
- トリのさえずり
- 社会的知性（心の理論 ToM、互恵的利他主義）
- 航路探査
- 採食行動
- 数認知
- 道具使用、etc.

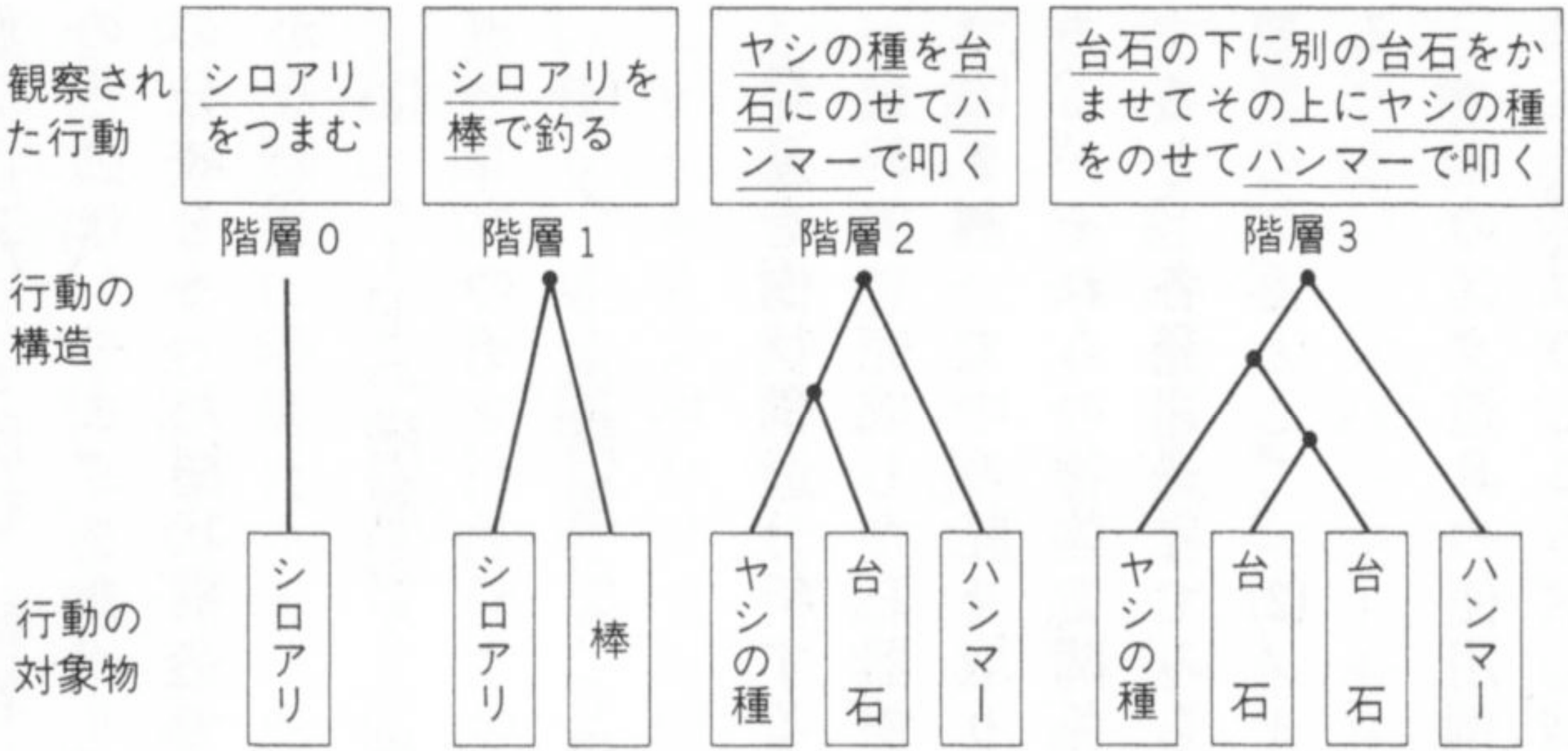


図 1-13　行動の樹状構造分析の例

松沢哲朗 『チンパンジーの心』

Action Grammar

- 物体の系列的な使用に見られる組み合わせ操作の階層

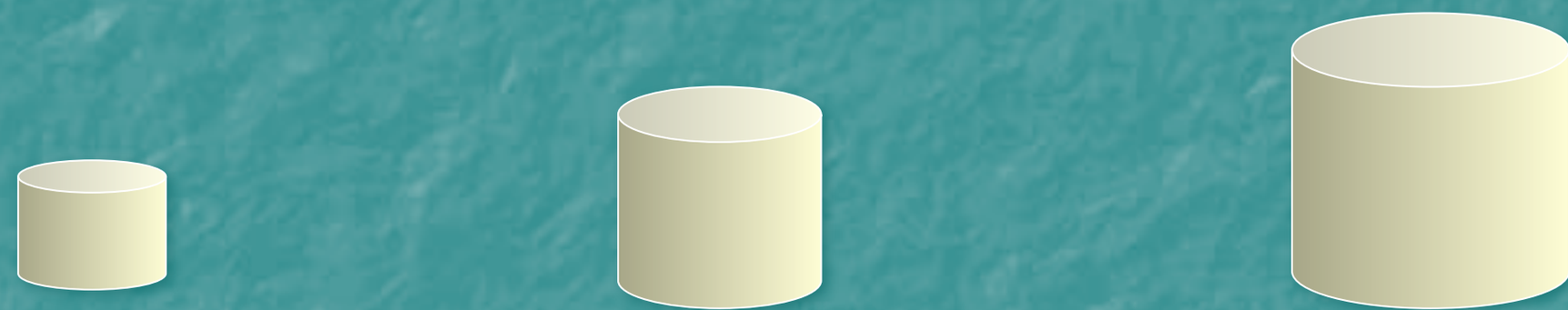
P. Greenfield. 1991. Language, tools, and brain: The ontogeny and phylogeny of hierarchically organized sequential behavior. *BBS* 14.

- ペア方式 Pairing method
- ポット方式 Pot method
- 部分部品方式 Subassembly method

I. Pairing Method

I. Pairing Method

II. Pot Method

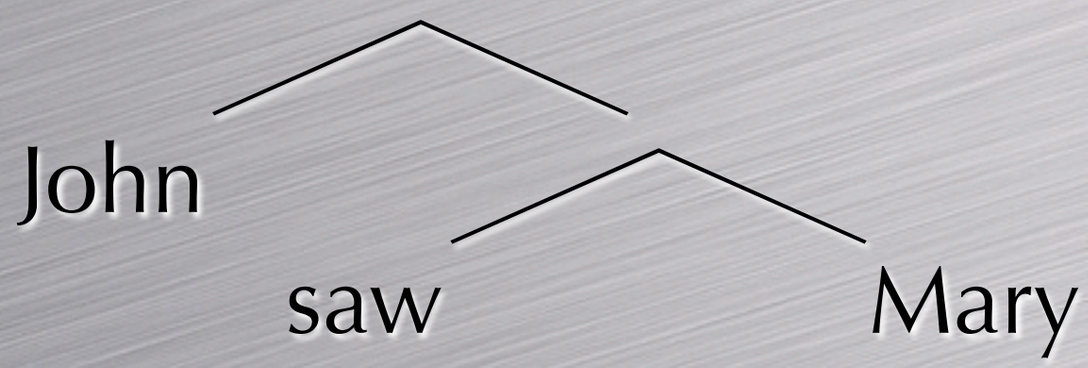


II. Pot Method

II. Pot Method

Merge (saw, Mary) = {saw, Mary}

Merge (John, {saw, Mary}) = {John, {saw, Mary}}



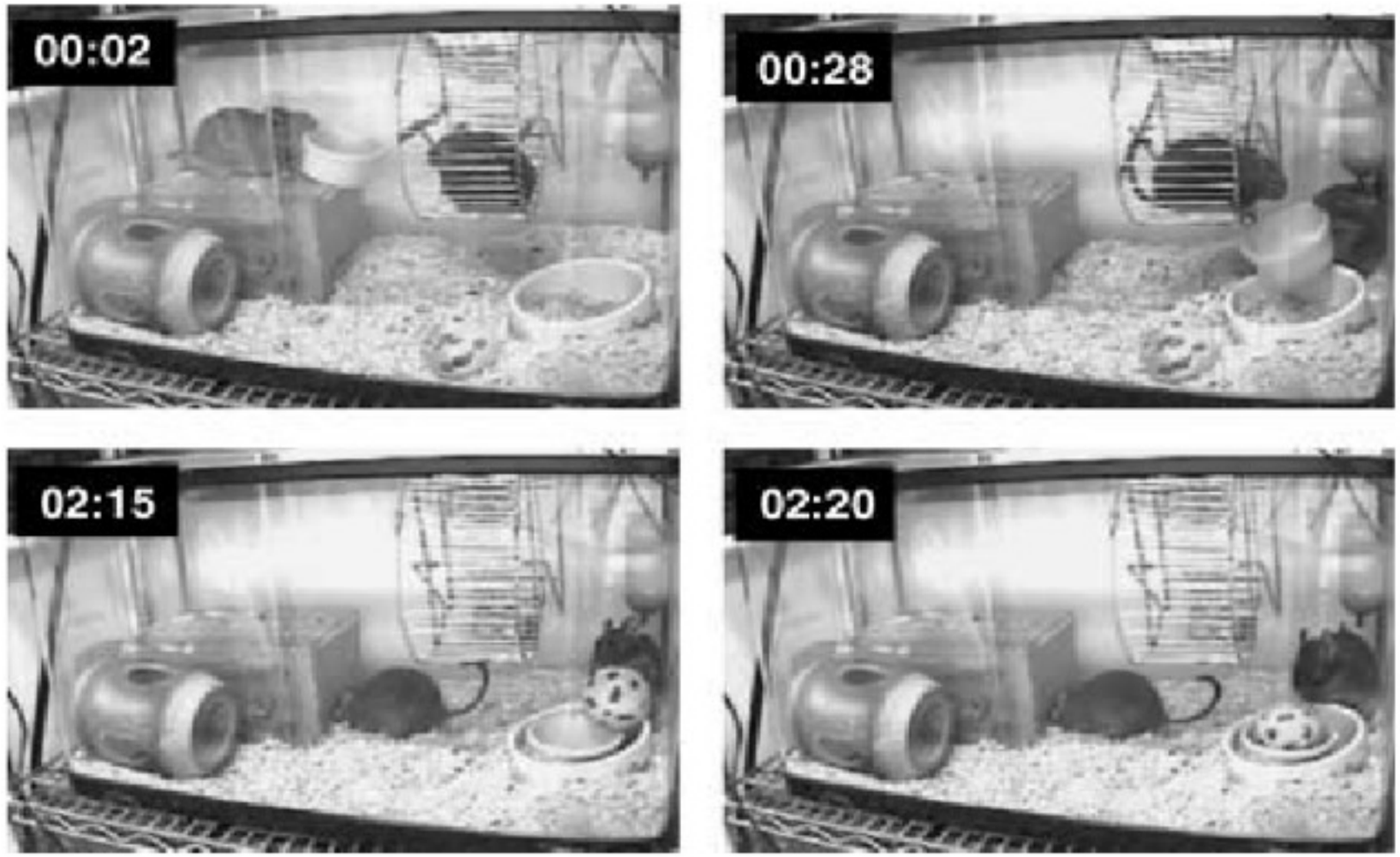
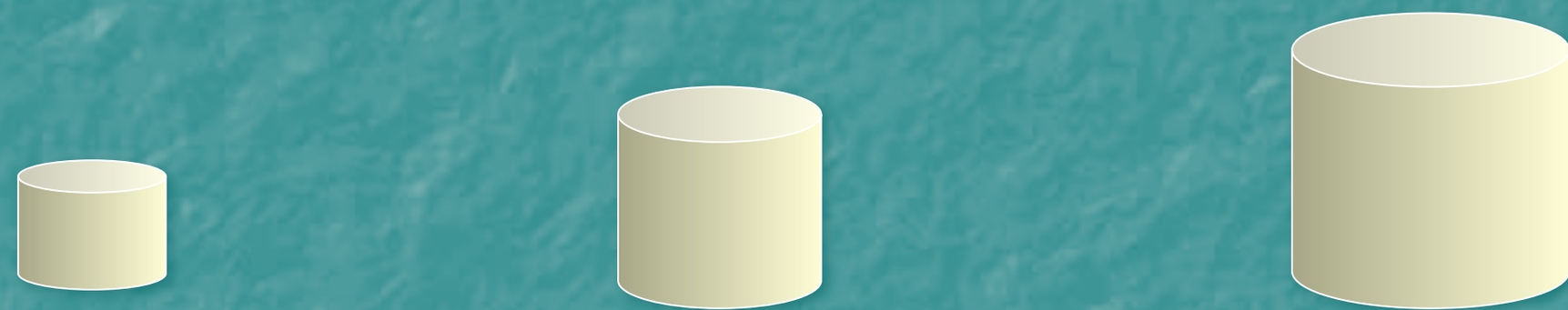


Figure 1. A Degu manipulating object with "pot" strategy. (by the male of pair DG). The bowl had the diameter of 13 cm and weighted 586 g, the food cup 9 cm and 46 g, and the ball 7 cm and 22 g.

N. Tokimoto and K. Okanoya: Spontaneous construction of "Chinese boxes" by Degus (*Octodon degu*): A rudiment of recursive intelligence? *Japanese Psychological Research* 46 (2004).

III. Subassembly Method



III. Subassembly Method

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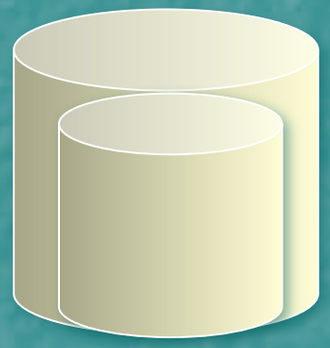


Merge (saw, Mary) = {saw, Mary}

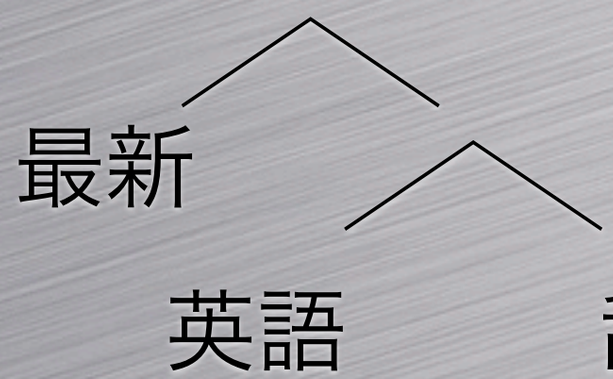
Merge (the, boy) = {the, boy}

Merge ({the, boy}, {saw, Mary})

= {{the, boy}, {saw, Mary}}

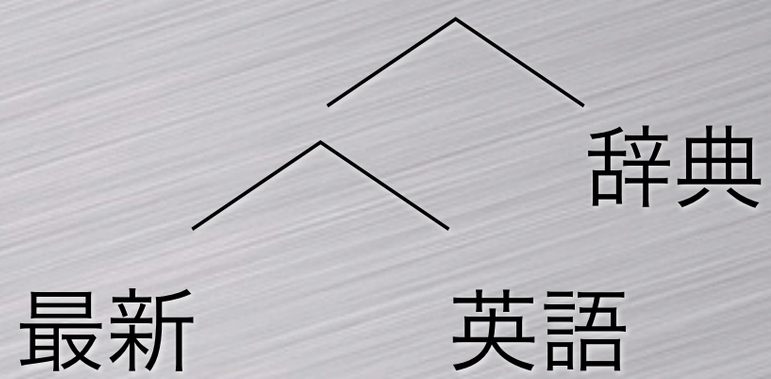
複合語形成

右方分岐



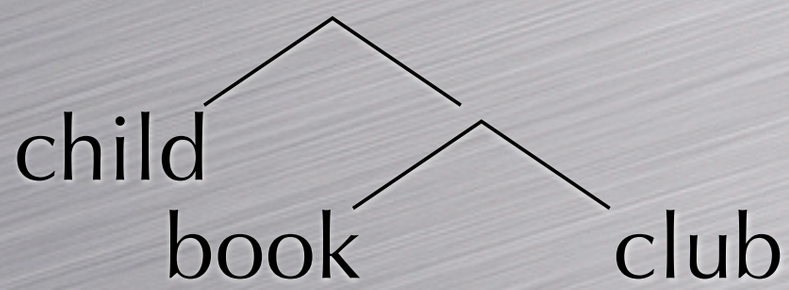
Pot Method

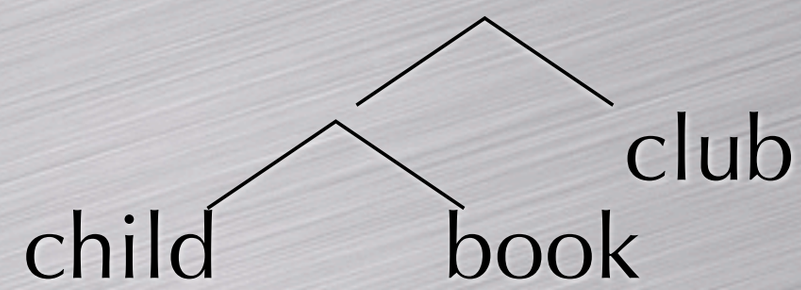
左方分岐



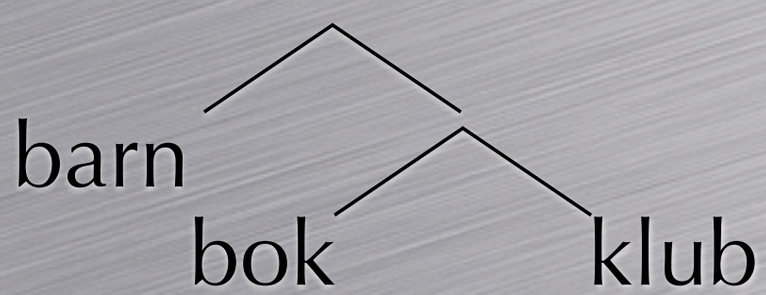
Subassembly Method

English:





Swedish:



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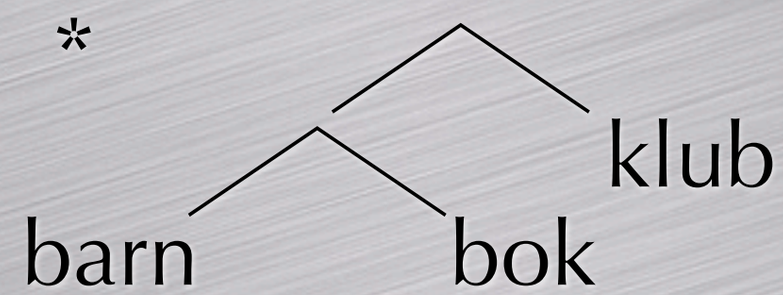

T. Roeper & W. Snyder. 2005. Language learnability and the forms of recursion. In: A.M.D. Sciullo ed. *UG and External Systems: Language, Brain and Computation*.

- Pot Merge:
  - Merge (A,B): A attracts B, forming {A,B}=A.
  - Merge (A,C): <u>A attracts C</u>, forming {{A,B},C}=<u>A</u>.

- Subassembly Merge:
  - Merge (A,B): A attracts B, forming {A,B}=A.
  - Merge (A,C): <u>C attracts A</u>, forming {{A,B},C}=<u>C</u>.

- サブアセンブリ型Mergeの起源
  - ワーキングメモリ
  - チャンク化
  - 反転可能性
  - 無限化
- Phase = derivational chunk
- Phase Impenetrability Condition:

  Once formed, chunks cannot be unpacked.