Emergence of compositional abstractions in human collaborative assembly

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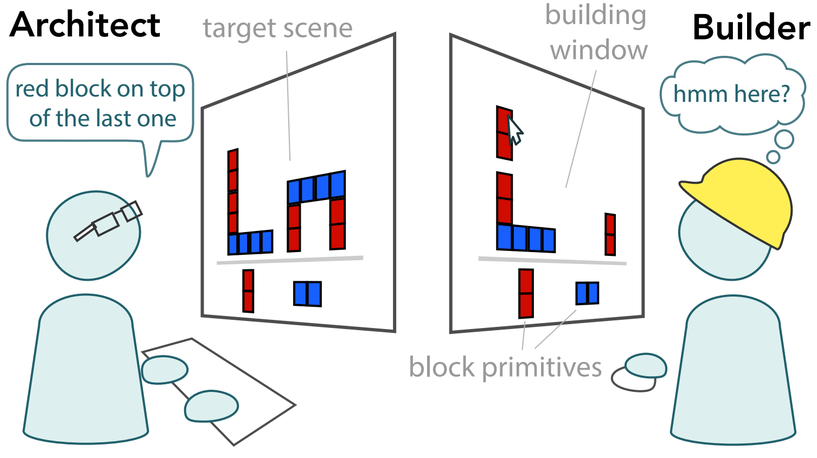
Question

Collaborators benefit from common representation of the relevant objects and actions needed to achieve shared goals.

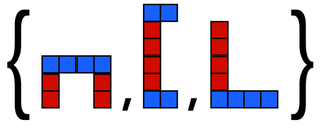
How do humans develop language to coordinate on shared object representations at the appropriate level of abstraction?

Collaborative assembly task

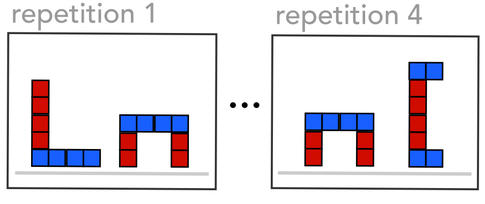


***Architect** views block towers and sends instructions*

***Builder** follows instructions to recreate towers*



Dyads repeatedly built same three towers...



...across four repetition blocks, in scenes containing two towers each.

Results

Architects used more abstract expressions

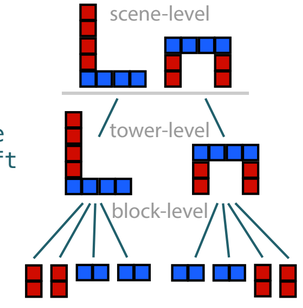
Tower-level referring expressions emerged in in later repetitions

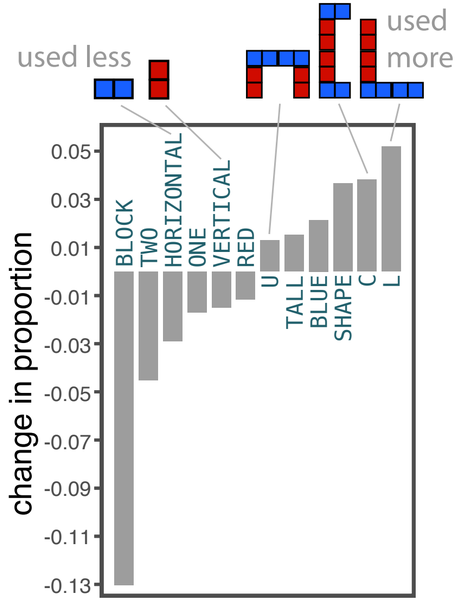
repetition 1

```
okay two blocks
placed horizontally
side by side. one
spot from left...
```

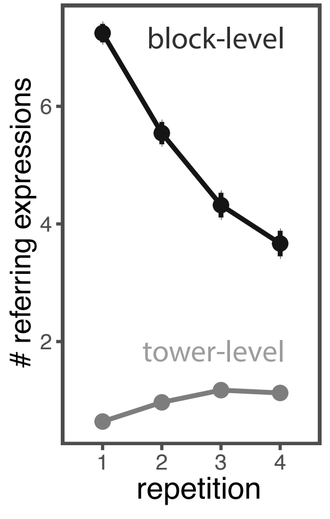
repetition 4

```
upside down u one
spot from the left
```



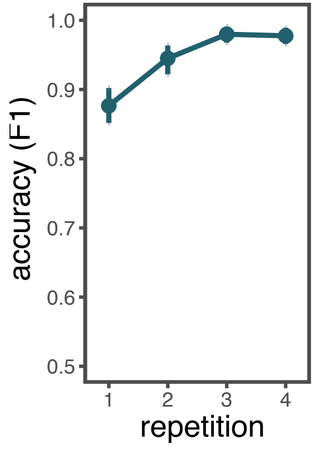


Later instructions referred more to towers and less to individual blocks

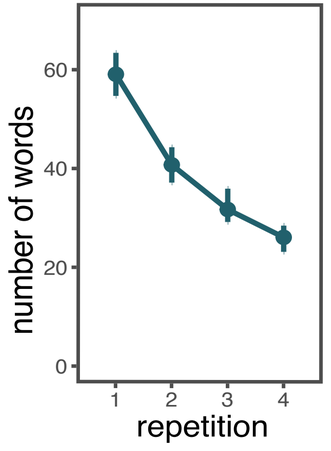


Dyads used fewer block-level expressions, but more tower-level expressions

Dyads collaborated more efficiently over time



Builders built more accurately



Architects sent shorter instructions

Summary and future directions

Collaborative assembly task for examining the emergence of communicative conventions.

Humans developed more abstract language to refer to higher-level goals.

Future work to develop artificial agents that emulate human behavior and generalize to more complex environments.