

Infants' perception from the physical relations between objects

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Abstract

Learning to use a tool is a critical step in human development. Recent work has identified the developmental steps leading to the emergence of tool-using in infants (e.g. [2], [4]). These longitudinal and cross-sectional studies show evidence for the beginning of tool-using in infants from the age of 18 months. The tool use studied in these studies refers to the retrieving of an out-of-reach toy with a rake-like tool, when there is a spatial gap between the toy and the tool.

It is surprising that the ability to use a tool to retrieve an out-of-reach toy appears so late in the development, whereas infants are able to combine two objects starting from the age of 10 months, and achieve more and more complex object combination during their second year of life (see for example [1]). Why does tool-use emerge so late? One possible explanation is the change in infants' ability to attend to more than one item in the environment at the same time [3]. This raises the question of what infants perceive in their environment when trying to solve a task like retrieving an out-of-reach object, and in particular what infants perceive from the physical relations between the toy and the tool.

We explored this question using the string paradigm: infants were presented with an out-of-reach object connected to a string that was within reach. Infants are known to be able to pull a string to retrieve an object attached to it starting from the age of 10 months [6]. However, when 16-month-olds are presented with four strings, only one of them connected to the toy, they often fail to pull the connected string and instead pull any string at random [5]. To check infants' attentional behaviour toward the connection, we used a Tobii eye tracker with a scene camera to see which string the infants looked at when they saw someone preparing to do the task. We tested infants aged 16, 20 and 24 months.

The preliminary results show that infants older than 16 months looked at the correct string prior to the adult's movement. Gaze analyses are still in progress, but we expect that infants who failed to pull the correct string (mostly 16 month-olds) will have different attentional strategies than successful infants. This attentional mechanism might be directly correlated with the strategies used for the tool task around the period where infants start to succeed in using a tool. The aim of the whole research program is to understand more deeply the mechanisms underlying tool-use learning in infants, in the view of implementing them in a computational model that might be of relevance to autonomous learning of tool-use in robots.

1. References

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