

## Does a synesthetic mechanism aid robot's language learning?

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Synesthesia is an involuntary experience that the stimulation of one sensory modality causes a perception in one or more different senses<sup>1</sup>. A few adults are reported to have the capability whereas all newborns are synesthetic<sup>2</sup>. They do not keep sensations separate from one another, but rather mix them and respond to the total amount of energy. Ramachandran and Hubbard<sup>3</sup> suggest that synesthesia may have evolved language. When people perceive an object in the vision, they evoke an equivalent perception in the auditory sense, which could be a prototype of symbols. Inspired by this idea, I suggest that a synesthetic mechanism helps a robot to learn language. Compared to the existing statistical approach to language learning<sup>4,5</sup>, a robot that can detect equivalent relationships between different senses will efficiently acquire language.

On the other hand, caregivers' scaffolding, called motherese and motionese<sup>6</sup>, is also an important factor in language learning based on synesthesia. Caregivers are known to modify their speech and actions when interacting with infants so that the infants easily detect the visual and auditory inputs and extract important information from the inputs. I suppose, in addition, when modifying speech and actions they add some sort of equivalent information to the inputs. When teaching the meanings of "large/small," for example, caregivers will pronounce "large" loudly with showing a large gesture while pronounce "small" softly with a small gesture. In the cases of "long/short" and "up/down," they may change the length of the speech and action or the pitch and the moving direction of the action according to the meanings of the words. I thus suggest that the interaction between a synesthetic mechanism of a robot and caregivers' motherese/motionese facilitate language learning by the robot.

I am currently developing a robotic learning model based on synesthesia and designing psychological experiments to examine the quantitative characteristics of motherese/motionese.

### References

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**Fig. 1.** The idea for a language learning model of a robot.