

Developmental Construction of Intentional Agency in Communicative Eye Gaze

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We focus on behavior of communicative eye gaze which consists of joint visual attention and gaze alternation. The joint visual attention is to look where someone else is looking. The gaze alternation is to gaze at a caregiver and at particular objects alternately. Tomasello [1] points out the importance of a viewpoint that the infant understands others' intentions in the communicative eye gaze. Further, he claims that understanding other's intention is based on an infant's intentional agency that the infant separates a desired goal from intermediate actions. This intentional behavior may be able to develop into more communicative use of the eye gaze, that is, social referencing and utilizing of the gaze alternation.

In this paper, we construct a model capable of the joint visual attention and the gaze alternation with the intentional agency to separate goals from actions. And we investigate how the intentional agency can detect the caregiver's gaze point through the construction and the operation of the model with computer simulations. First, we construct an agent model to acquire a visual orientation by the conditional learning, which is similar to the existing models [2], [3]. Secondly, we realize the intentional agency by introducing internal states which are operated through two functions, to memorize the sensory information and to recall its relation.

The visual orientation function that is an ability to gaze at the caregiver and at the objects on the center of the visual field consists of three modules: selector, evaluator, and motion learner. In order to realize the intentional agency as the internal states, we add two modules: discriminator and associator, to the visual orientation system (Fig.1).

The agent experienced 50000 training phases. The trajectories of the gaze point after the training phases moved as Fig.2. We confirmed that the constructed agent model can acquire the joint visual attention and the gaze alternation outside the visual field. In the results, the agent can modify the moving direction of the gaze point according to an associated goal when the agent finds the visual stimulus in the different direction from the moving direction of the gaze

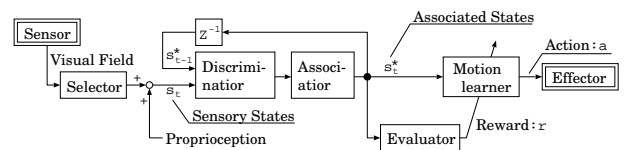


Fig. 1. System block diagram of the gaze alternation.

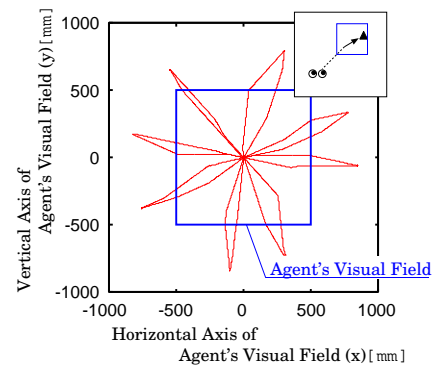


Fig. 2. Trajectory of the gaze point outside the agent's visual field after the 50000th training phase.

point. We consider that the agent can resolve ambiguous situations according to the associated goals, and the method is fundamentally different from the existing models [2], [3].

In conclusion, we suggest that acquiring the two functions, which consists of the discriminator and the associator, is important in the developmental process of the intentional agency.

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