物体間の予測可能性が生き物らしさの知覚に及ぼす効果の実験的検討

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Recent advances in robot technology and CG technology have been remarkable, and the appearance and movement of robots and CG characters are approaching the appearance and movement of actual living things. In the entertainment industry such as movies, animations, and games, developers often make a character look like creatures in order to give viewers and users a sense of familiarity with the character. However, no matter how realistic the appearance and movement of a living thing may be, it is the observer who actually feels that the object is a living thing. In fact, it is known that people feel like a living thing even for the movement of geometric figures.

People perceive some degree of life-likeness of a given object, which is not apparently a living thing such as a geometric shape, based on its movement. This phenomenon is called animacy perception. The previous psychological studies of animacy perception have investigated several factors that may be related to animacy perception, such as the speed of motion of the objects (e.g., geometric shapes), the angle and frequency of change in moving direction, and the relative relationship between the objects in space and time. Above all, one has proposed that, in scenes with two objects, their movements showing so-called “temporal contingency” between their movements is related to perception of animacy of those objects. “Catch and run” of two objects is a typical example of a pair of movements with a high degree of temporal contingency. However, to our knowledge, the concept of temporal contingency has not been defined clearly, and thus has not been studied quantitatively. Indeed, ”synchronization” can be seen as a special kind of ”temporal contingency” movements, but it has been reported that ”perfectly synchronized” movements reduce the degree of animacy. From this, it can be seen that the findings on temporal contingency and synchronization are partially inconsistent in psychological studies of animacy perception. Temporal contingency and synchronization are similar as interdependent movements, but may be different concepts. Therefore, We aimed to obtain knowledge on contingency and animacy perception by making an attempt to quantitatively treat temporal contingency.

In this study, we examine our hypothesis that animacy perception is correlated to the degree of improvement in predicting the movement of the object A by knowing the movement of the object B on top of the object A ’ s past movement. Among two moving objects A and B, predicting A ’ s future position from the past movements of both A and B may improve the prediction ability than predicting the A ’ s own future position from A ’ s own

past movement alone. To quantify temporal contingency in this sense, we define temporal contingency by Granger causality in multivariate analysis. To test our hypothesis, we created various movies of moving two geometric objects and asked human participants to rate the degree of animacy of the pair of movements in each movie. In this study, we employed Vector AutoRegressive (VAR) models to generate various one-dimensional movements for each of the two geometric objects. In the movie, a couple of circles is used to indicate the two objects in a display in order not to suggest biological characteristics from the shape. Each circles is presented at a fixed position in the horizontal direction on the two-dimensional plane, and moves in the vertical direction according to the VAR model. After watching a movie clip, the participants rated the degree of animacy of the pair of movements of the two objects in the movie. Our hypothesis states that if the Granger causality is higher, the observer's degree of animacy would be higher. We conducted a preliminary experiment and a main experiment of two experiments using this experimental stimulation movie clips.

In the preliminary experiment, we manipulated the Granger causality as a parameter and set the conditions to investigate the animacy, intention, and contingency perceived by the observer. As a result of the preliminary experiment, the observer highly rated the contingency when the Granger causality was high, suggesting that it is possible to measure a certain kind of contingency by Granger causality. Regarding animacy, it was suggested that the observer attributed the explanation of the movement to the observation target and perceived animacy when there were few clues to predict the movement of the observation target.

Next, in main experiment, we manipulated not only Granger causality but also the correlation between objects as parameters. In main experiment, we did not obtain results that support the hypothesis raised in the preliminary experiment. On the other hand, regarding contingency, it is newly suggested that the observer may perceive contingency not by Granger causality but by the correlation between objects. Regarding animacy, it is newly suggested that the observer may have been able to roughly estimate the potential Granger causality existing in the movement pattern of a single object without looking at multiple objects.

We conducted a preliminary experiment and main experiment to test our hypothesis that the degree to which the past movement of one object contributes to the prediction of the future movement of the other object characterizes animacy perception. From the results of the two experiments, our hypothesis was not rejected from the results of this study, and some results supported the hypothesis. On the other hand, the result of main experiment suggested that the observer might have estimated the Granger

causality from the potential information present in the pattern of motion of the object.