The Clay Hand Illusion and the Embodiment of Unfeasible Objects

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Abstract
In an artistic exploration, clay hands and nonhand-like, unfeasible clay objects were created by the participant and used to perform an alternative version of the rubber hand illusion. Most participants felt ownership even over these unfeasible objects, raising questions about the embodied experience of objects that we make.

Keywords
rubber hand illusion, embodiment, ownership, artistic research

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Recent studies based on the rubber hand illusion have shown it is possible to convince participants that a replica stone hand, or even an empty space, is their own, by placing it in front of them while stroking it simultaneously with their hidden real hand. However, attempts at performing the illusion with an entirely unfeasible object such as a plank of wood or a spoon (Ehrsson et al., 2013; Tsakiris et al., 2010), or a balloon (Kalckert et al., 2019) have proved less successful, suggesting that a body-like form is critical. Despite the suggested futility of the endeavour, the idea of embodying an entirely unfeasible object created by the person was too fascinating a prospect not to investigate. In this experiment, participants were first asked to make a clay hand, before making unfeasible nonhand objects with which to try out two new versions of the rubber hand illusion: the “clay hand illusion” and the “unfeasible object illusion.”
Ten participants took part. Five were artists, who had some experience with clay or who had arts training, while the other five were not formally educated in the arts. After creating the clay hand, they were asked to make blind drawing of their hand (without looking at the paper). During the illusions, the hand or object (see Figure 1) was situated on a raised platform (10 cm), under which their real right hand was placed slightly to the right of the midline. The hand or object was placed centrally, offset 10 cm to the left and 10 cm forward from the real hand. The process of simultaneously tapping and stroking the object or hand then took place over 5 to 10 minutes until a sense of ownership was achieved.

Figure 1. A Selection of Unfeasible Clay Objects. The full sequence of objects created by one participant (P1) the initial clay hand (K1) followed by two unfeasible objects (K2) and (K3).
*Objects made by nonartists. Drawings by Antony Hall.
The participants gave running commentary on their experiences, guided by prompts where necessary. When using a non-hand-like object, discussions about how to “remap” the hand over the surface took place, with participants suggesting a specific area to resemble their thumb, for example (Figure 2). At the point where a “connection” or sense of ownership over the object was reported, distortions were made to the clay by the experimenter; for example, the finger was squashed or stretched, or dents were made.

The perceived level of embodiment was measured through a self-report questionnaire (rated from $-3$ strongly disagree to $+3$ strongly agree; Figure 3A) based on the questions used in the original study (Botvinick & Cohen, 1998). After each illusion, participants were asked to make another blind drawing (Figure 4) and to indicate the perceived location of their index finger under the platform and the distance from the real location was calculated (Figure 3B).

Only one participant was unable to make any connection to the clay hand or object whatsoever. One participant created an ear (Figure 1C) and asked that his real ear be used instead of his hand, though he was unable to feel any ownership over this object. Seven agreed that the clay object felt like their own hand ($Q3 > +1$) of these, five felt strong ownership over their unfeasible object(s) ($Q3 > +3$). Participants mislocalised their real hand, with both the clay hand and unfeasible objects (Figure 3B). However, anecdotal observations suggested that participants took longer to establish a connection with the objects. Participants who reported a high degree of connection to the clay object described physical sensations when the object was distorted, such as a “buzzing in the arm” (of the real hand). Indeed, two specifically mentioned the “hairs standing up on the back my neck,” reminiscent of the previously reported shock response, when the rubber hand is threatened with a knife (Riemer et al., 2015).

The blind drawings seemed to become distorted (see Figure 4) showing their potential utility as an outcome measure of the illusion. Drawings became wider or thinner. On two occasions, the participants lost count of fingers on the second or third attempts, and several
Q 4 It felt as if my hand was drifting towards the clay.
Q 5 It seemed as if I had more than one right hand.
Q 6 It seemed as if the touch I was feeling came from somewhere between my own hand and the clay hand/object.
Q 7 It felt as if my hand was turning into clay.
Q 8: It appeared as if the clay hand/object was drifting towards my hand.
Q 9: I felt I had some agency over the clay hand/object.
Q 10: It seemed as if I were feeling the touch in the location where I saw the clay hand/object being touched.
Q 11: It seemed as though the touch I felt was caused by the touch to the clay hand/object.
Q 12: I felt as if the clay hand/object was my hand.
Q 13: It felt as if my hand was drifting towards the clay.
Q 14: It seemed as if I had more than one right hand.
Q 15: It seemed as if the touch I was feeling came from somewhere between my own hand and the clay hand/object.
Q 16: It felt as if my hand was turning into clay.
Q 17: It appeared as if the clay hand/object was drifting towards my hand.
Q 18: I felt I had some agency over the clay hand/object.

Figure 3. Questionnaire Results (A) and Proprioceptive Mislocalisation (B) Showing That After the Illusion Participants Mislocalised the Position of Their Hand for Both the Clay Hand and Slightly More With the Unfeasible Clay Objects.

Figure 4. Blind Drawings Produced by Participant (P1) Showing Increasing Distortion as Experiments Progress From the Illusion With Clay Hand (P1A Object K1) to Illusions With Clay Objects (P1B Object K2, and P1C Object K3). Note. P1 loses count of fingers (P1C) after experiment with object (K3).
drawings took on elements of the objects such as more pointed fingertips after embodying a claw-like hand. Future research could explore ways to capture these changes more systematically.

This experiment demonstrates that most participants could achieve some level of connection with the clay hands they created, and a significant, often surprising connection, with an unfeasible object. One even felt strongly “maternal” feelings over the objects (Figure 1 K1 K2 K3). Two participants reported residual sensations of their hand feeling “the same weight as the object” which was large and heavy, or “fingers feel bent over, just like the clay” after the illusion with a spider-like object. This challenges the body-like appearance rule. Although intended to be “unfeasible,” it became apparent that these objects inherently retained some relationship to the hands through the act and traces left from the process of making. This merits further scientific investigation, in particular establishing the time-course of the object illusion and whether it is reliant upon earlier experience with the clay hand (both creating and the illusion), creating the object and artistic training. The clay allows for the gradual and immediate morphing of forms and for the participant to build a sensory connection with the object. Some seemed proud with their results, spending some time looking and smoothing the surface of the forms before deciding that it was finished. Moreover, the remapping of the object and therefore the location of visual stimuli to the hand were directed in collaboration with the participants. From an artistic perspective, this illusion can be seen as a reflexive experiential tool for the exploration of both creativity and imagination, around which discussions about our own perceptual experiences can take place.

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