

THE EMERGENCE OF STRUCTURES IN VISUAL IMAGES

Ernest Edmonds
 LUTCHI Research Centre
 Department of Computer Studies
 Loughborough University of Technology
 Loughborough
 Leicestershire, LE11 3TU
 UK
 e.a.edmonds@lut.ac.uk

Emergence is a significant aspect of the creative process where, starting from an initial structure that represents certain intentions, new (emergent) structures may be perceived. In design and the visual arts, drawing and sketching have traditionally been used as the primary mechanism for externalising the ideas and subsequently for analysis and reconsideration of these ideas. Recent studies of design (e.g. Neilson and Lee 1994; Lee 1994) suggest that design proceeds through half-formed and ill-articulated concepts. According to Fish and Scrivener (1990), an important feature of sketches is that they contain uncertainties important to their function and play the role of preserving alternatives. In line with the same view, Mitchell (1990) states that "drawings are valuable precisely because they are rich in suggestions of what might be.... thus the meaning of a drawing is not adequately captured by imposing one structure on it".

Edmonds and Soufi (1992) proposed a computational approach to modelling the creative perception of tentative drawings. Based on the three-stage process of action-perception-reflection, a computational model of the perception of drawings can be used to generate emergent shapes. Edmonds et al (1994) considered the implications of emergence for collaborative design and group support systems. This paper draws specifically upon the report by Soufi and Edmonds (1995) and then draws out some of the implications for the visual arts and the related tensions between chaos and symmetry.

Psychological theories can help us to understand emergence. One concern of the study of perception is understanding the way in which sensory information is transformed into an organised model of the world. The information gained from the optical array is not, by itself, sufficient to give a meaningful description of the scene. In other words, the visual system constructs a model of the world that exceeds, in its information content, the proximal stimulus. This phenomenon has been extensively studied by psychologists and different accounts have been motivated (Rock, 1986). Another concern is the study of how mental images are represented and synthesised. Reed (1974) conducted experiments the findings of which supported the notion of structural descriptions. Thus a given pattern may have a number of

associated interpretations. Further work in this area showed that humans synthesise and combine mental images in a variety of ways (Kosslyn et al, 1983; Finke et al, 1992).

It is suggested that emergent shapes are not only the result of perception constructing a model of the world but also a consequence of transforming the world. Since this view of emergence has commonalities with accounts of creativity based on transformation of conceptual spaces (e.g. Boden, 1990), it supports the assertion that emergence is creative (Gero, 1994; Mitchell, 1993). Two processes are implied:

- (1) An interpretative, perceptual, process concerned with arriving at (alternative) entity descriptions of a pattern and,
- (2) A transformational process that uses the existing pattern as a prompt for generating new structures in a variety of ways.

To illustrate the difference between emergent shapes that arise as a result of the two processes, consider the pattern shown in Fig. 1, which was formed from two squares. Emergent shapes associated with the interpretative process are shown in Fig. 2, those associated with the transformational process in Fig. 3. In the figures emergent shapes are drawn with thick lines.

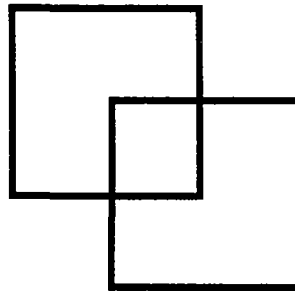


Fig. 1: Original shape: formed from two squares

Thus it can be seen that even in the case of the simple example of Fig. 1. there are various ways in which emergent shapes associated with a transformational process can arise. They may be parts of a shape (Fig. 3c), they may be a result of extending the shapes' boundaries (Fig. 3a, 3f), they may also arise as a result of constructing shapes from existing or new end points (Fig. 3b, 3d, 3e). Examples of new end points are those that can be obtained by intersections of extended boundaries.

The issues discussed above are central to many activities in the visual arts. The specific interest, or content, of many works can be seen to be in the emergent structures perceived, or

available for perception. They provide the additional layers of interpretation that provides the vital richness of the work. In the authors own computer generated video construct, Rotterdam, for example, four distinct changing forms provide the first level of the piece. However, as it progresses, the space between the forms emerges as a strong new structural element. This and other related examples are discussed in the paper in relation to the earlier discussion.

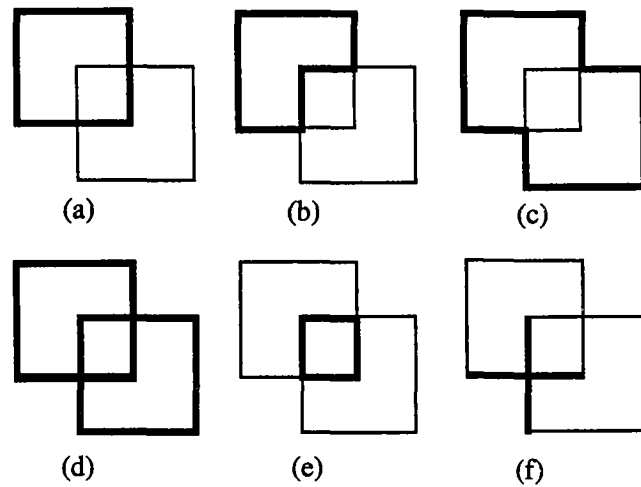


Fig. 2: Emergent shapes associated with an interpretative process

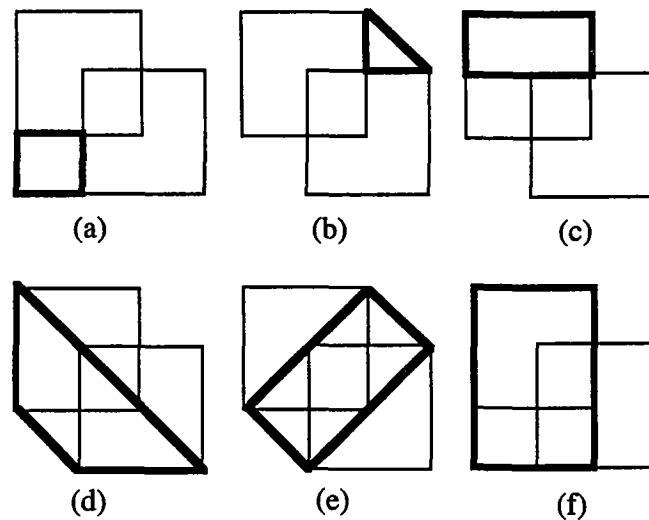


Fig. 3: Emergent shapes associated with a transformational process

Our almost unavoidable inclination to find new emergent structures in visual images mitigates against our perception of pure chaos. We are very capable of imposing ordering emerging structure upon it. This fact alone is both a challenge and an opportunity that is exploited, explicitly or implicitly, by many visual artists.

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