Defining Creativity

Sometimes I'm going to post some old notes here. This is one of them.

There are many different attempts to define creativity, and work on automating creativity is often inhibited by the authors' own definitions. The process of creativity has been divided into several stages. Hadamard's description of Poincare's four stages is used by Boden amongst others: these are

- preparation define the problem, and attempt to solve it by rational means.
- incubation generate novel patterns or concepts.
- inspiration recognise a creative solution.
- verification rationally compare the solution to the problem.

The preparation and verification stages may not exist because there may not always be a given aim to creative work. Incubation and inspiration are however central to creativity: it always contains a two part process of generation of concepts then evaluation of how creative those concepts are.

Defining the problem

The act of finding a problem is usually part of the creative process. Some creativity systems are very focussed on this: for example, in flexible meansend analysis (Jones+Langley) the problem is defined as a current world state and a set of goal conditions. This part of creativity is very closely related to conventional learning theory: Thornton (C.Thornton, 1998) has argued that the bias inherent in any recursive learning algorithm can be viewed as a form of creativity.
Although I have stated that preparation and verification are not necessarily essential to creativity, they are very important: perhaps the difference between creativity and randomness, between human creativity and madness is in its connection to a purpose or communication (for example, even in describing art, we speak of its expression).

Generating novel concepts

Three main types of creativity are Boden's (M.Boden, 1990) improbabilist and impossibilist creativity, and a chaotic form of creativity seen in many of the neural network based approaches.

- improbabilist creativity is the construction of new concepts from existing ones, often combining previouslyunconnected information to solve a previously unseen problem. The lightbulb puzzle (including the information that lightbulbs are hot just after they are on) is an example. Improbabilist creativity was explored by Koestler (his 'bisociation of matrices' (A.Koestler, 1964)) and discussed by Perkins (DN.Perkins, 1981).
- impossibilist creativity transforms the space in which a concept can exist. This includes widening the frame of information around a concept being examined, and the removal of

assumptions or constraints from the environment in which a concept exists. Jackson Pollock putting his paintings on the floor (removing the assumption that paintings need to be vertical) is an example of this. There are many constraints at play in creation. For instance, in the creation of prose, the pattern of stresses in a line is as important as the meanings and rhymes and hidden meanings within a stanza. We work within unspoken rules: creativity can work within these rules (using them as guidelines) or on those rules them selves (to create new forms or categories of art or science).

- chaotic creativity is where a small mutation of an existing concept is allowed. Beethoven's minute reworking of his musical themes until he hit one which was acceptable to him, and Thaler's creativity machine are examples of this.

This seems a reasonable division to work with, although it would be interesting to see whether, when these three forms of creativity are finally modelled, other forms of creative act and process become apparent.

Measuring creativity

Creativity is often confused with the creation of new things. Creativity is not novelty: while generation of concepts is important, it is not effective without their evaluation. Evaluation consists of deciding which solutions are creative, either by clustering them or by using a measure of surprise. To be creative, we need some sense of the difference between what is truly creative and what is just new. We need to have a sense of how to cluster the mutations generated and how to define the boundaries between those clusters: we need a sense of taste or discrimination. Much of this, we can take from work on concept clustering and information fusion, and work on the difference between creative solutions and novel nearmiss solutions to a problem, and the change in process that leads to them. As an example, take the humble paperclip. I can bend a paperclip into dozens of minutely different and new shapes, but only a few could be seen (without an explaining context, which is in itself a creative act) as creative mutations of its original shape.

Comparing the solution to the problem

If the creative process is used to solve a specific problem, then the problem and its potential solutions need to be matched. Again, this process is closely related to the process of assessing the output from conventional learning algorithms.