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NodeBox 2

The Experimental Media Group is a research group at the Sint Lucas School of Arts in Antwerp, Belgium. Our ongoing effort is to produce computer graphics software that allows more people to express themselves visually and creatively without being restricted by a lack of expertise or user interface limitations. We draw inspiration from domains such as artificial intelligence, cognitive science, linguistics, biology, toys, in an attempt to define the nature of creativity.

Traditionally, software applications for computer graphics have been based on real-world analogies. Each icon in the application's user interface represents a concrete object – a pen, an eraser, scissors, etc. This model raises creative limitations. For one, you can only use the features as the software developers implemented them; creative recombination of tools is impossible when not foreseen. The classical solution, adding more features, is a cat-and-mouse game that complicates the software with each version. Furthermore, the software's possibilities are also its limitations: users will tend to think along the lines of what is possible and not about what they want (Cleveland, 2004).

Combinatory software

In 2002 we released NodeBox (<http://nodebox.net>), an open-source application that creates 2D visuals based on Python programming code. In 2009 we released the beta version of NodeBox 2 (<http://beta.nodebox.net>), an application that generates visual output based on programming code, a node-based interface (Lee & Parks, 1995) or natural language (i.e. English). In the user interface, building blocks (or *nodes*) can be connected to produce interesting visual effects. A node is “concise”, it represents a single operation: rotate something, adjust a colour, create an ellipse. However, a node has

no fixed purpose. Or rather it has many purposes that depend on the other nodes attached to it. Creativity is playfully encouraged by allowing users to combine nodes in different ways.

New nodes can be created by bundling a network of existing nodes into a group or by writing the Python code from scratch. This essentially means that each existing node can be the starting point (or prototype) of a new node.

Semantic network for creativity

A principal component in the NodeBox 2 project was the development of a set of algorithms to simulate human creativity. Using a memory-based shallow parser (Daelemans & van den Bosch, 2005), a semantic network of commonsense (Sowa, 1991) and heuristic search techniques, the system is able to perform conceptual brainstorming based on natural language input. Essentially, we use a database of what things look and feel like, called “Perception” (<http://nodebox.net/perception?bat>). Concepts are related to each other in a semantic network. For example, a few rules that describe a concept named “rose”: rose is-a flower, red is-property-of rose, rose is-related-to romance. Techniques from graph theory (Dijkstra's algorithm, 1959, Brandes' betweenness centrality, 2001) are used to retrieve specific clusters of concepts and the pathways between them.

Some concepts are properties of other concepts. For example: dark is-property-of evil, evil is-property-of Darth Vader, fuzzy is-property-of cat, romantic is-property-of France. For a given property (e.g. creepy) and a range of concepts (e.g. animals) the system is able to select those concepts from the range that best resemble the property (i.e. the creepiest animals): octopus, bat, crow, locust, mayfly, termite, tick, amphibian, arachnid... No fluffy bunnies or frolicking ponies there!

Interestingly, the Perception module describes a bat using a *black* property and some relations to *cave*, *evil*, *night* and *radar* – but there is no explicit *is-creepy* property for this animal. Instead, the system infers a causal chain (Schank & Abelson, 1973) where bat is a *dark* thing and where dark is pretty creepy. But where does *dark* come from? For the bat, its direct relations to black, cave, evil, night and radar implicitly lead to other concepts such as Darth Vader, dark, dangerous, pessimistic, cat, airplane, sky, ... even though no one has explicitly defined any kind of relation between bats and Darth Vader (someone did however add relations from black and evil to Darth Vader). All of these concepts together make up the bat-cluster. It is the “conceptual halo” (Hofstadter, 1996) that the system takes into account when thinking about bats. This flexibility allows for a wide range of possible solutions when analyzing bats in different situations. The module will inspect all the properties of the entire bat-cluster (dark, black, evil, negative, brown, sad, deep, bad, ...) and measure each of their distances to *creepy* using Dijkstra's shortest path algorithm. The total score is an indicator of the bat's creepiness.

We think this method can assist users in acquiring inspiration for creative ideas. For example, by collecting images of bats and octopuses for a *creepy* artwork, suggest Underware's "Sauna" typeface when the user needs an *elegant* font, make a sketch of a logo for the city of Brussels that resembles a *toad*, and so on.

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