Chapter 12

Integrative Visual Projects for Cognitive Learning

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ABSTRACT

This chapter comprises integrative studies on selected processes, events, and related technologies associated with several science categories. Learning projects are designed around themes drawn from events existing in everyday life, yet they familiarize the readers with complex disciplines and their applications. Complexity of apparently simple topics is presented in projects about familiar objects or actions. They are aimed at broadening the readers’ general knowledge and experience rather than the technical or professional training. Topics and projects present nature- and science-related themes in terms of concept visualization including selected subjects pertaining to the basic sciences such physics, chemistry, biology, geography, or biology-inspired computing and modeling. The reader is encouraged to approach learning holistically and present concepts by creating technology based projects about visual presentation of information.

INTRODUCTION

When looking at nature we experience many concepts coming from various areas categorized as particular sciences. When examining particular action, process, or a product present in Nature, we may notice presence of descriptions belonging to various disciplines that are actually intertwined. This chapter focuses on few general concepts that have in common the merging of disciplines. Learning projects represent some multi-function tasks, possibilities, and operations, so they involve many scientific disciplines and describe and their role in everyday experiences. Tail characteristics and functions and related biological and physical concepts described in the following text may result in creating a learning project “The tail.” Egg features and related concepts may support a creating learning project “An egg as a hotel.” Next, this chapter offers a project “The beach and the ocean” followed by a project “Nanostructures and bioimaging.” This chapter is illustrated with works of a group of students from the Computer Graphics area run by the author at the University of Northern Colorado.

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1. THE TAIL STORY

Some comments about the role of a tail in animal life introduce the reader to this learning experience. They are followed by basic information about biological and physical factors that may determine the use of a tail and the tail’s presence in a verbal and visual culture. A learning project is aimed at motivating the reader to create a story involving a tailed creature, and develop its representation. A vehicle for this story may be presented in 2d, 3d, or 4d in order to convey a positive, constructive motif or message.

Language of a Tail Communicating Mental and Emotional Situation

An animal tail may convey information and emotions, such as people used to verbalize. One may say that for a lack of tails, people lost a useful means of communication. Beyond verbal communication, they still can use the facial and body expression of their emotions, feelings, or passions, as well as they may convey an idea or meaning through the posture, or head and hand gestures. As they say, music started with hands and legs of a person. For example, while watching a TV program set to silent mode one can guess who is talking by viewing who vividly moves one’s hands. A game could involve adding words and text to the person’s gestures and expressions. Position or movement of a tail tells about the animal’s physical and emotional state. In many cases tail movement may help to scare the opponent, support flight, landing, and balancing on a twig or a wire.

Animal tails often serve for social signaling. Distinct species of animals convey information with their tail in different ways; they announce possible dangers, feelings and emotions, or show superiority and dominance. For example, a rattlesnake uses its tail when it tries to threaten and deter its many predators such as hawks, weasels, or king snakes by shaking the noisemaker (rattle) placed at the end of its tail. A tail of a horse, if it’s not braided, serves for brushing flies and other insects away.

A dog wags its tail to express love, joy, the sense of belonging, a need for attention, but also aggression, anxiety, or fear, for example of vaccination. A Japanese breed of a dog Akita wags a curved tail when is happy, but puts it straight when is feeling sick. Many of hunting dogs keep their whip-like tails straight when they follow the trail with a scent. An initial exploratory wagging of the two dogs’ tails may later change either into play or into a dogfight.

A cat does it in a somewhat different way, still using its tail including its tip, which may twitch slightly during the hunting or playing, yet move stronger signaling aggression. Cat’s vertically held tail signals good feelings, confidence, and happiness, for example when greeting its owner. In psychological terms, a cat may send a threatening signal by ruffling the hairs on its tail and back to increase its apparent size, along with arching its tail and back. In biochemical terms, experiments conducted long ago revealed the pilomotor action on the hairs of the cat’s tail of adrenaline, acetylcholine (von Briicke, 1935, confirmed by Coon & Rothman, 1940), and nicotine (Burn, Leach, Rand, & Thompson, 1959) originating from within an organism. Pilomotor reaction means hair erection caused by activation of muscles placed at the base of each hair and controlled in this case by the sympathetic nervous system. Adrenaline is one of substances involved in transmission of messages that travel through this system. Ruffling of the cat’s tail could be observed both after substance injection, as a response to cold – by creating a layer of insulation, or in response to the perceived stimuli causing anger or fear. For this reason the angle of the cat tail’s hair has been considered a measure of the level of adrenaline in the blood.