Chapter 8

How We Hear and Experience Music: A Bootstrap Theory of Sensory Perception

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ABSTRACT

This chapter examines occurrences and events associated with the experience of composing, playing, or listening to music. First it examines virtual music, and then recounts an experiment on the nature of pitch and psychoacoustics of resultant tones. The final part discusses the prenatal origins of musical emotion as the case for fetal imprinting.

INTRODUCTION

It is typical of us to assume that when we perceive things with our senses, we just take in things as they are, and we understand them using their nature as a basis. We just perceive things as they are and then we work with them, and lead our lives with them. The problem with this concept is that the nature of the things we perceive never reaches our brains. Our senses convert incoming sensations into neural impulses and then the neural impulses carry information about the world to our brains. There are various codes that stand for the characteristics of things, and the neurons are set up to detect things and then send information to our brains by means of these various codes. Neural impulses that travel up to our brains resemble the pulses that travel around in computers. They are not the same, however, because they are not digital in the sense that they do not code for numbers. They code for various things: edges, shapes, colors, pitch, loudness, saltiness, etc.

Learning before birth and also immediately after birth is traditionally called Imprinting, to distinguish it from the intellectual type of learning that will take place years later. Imprinting has been extensively studied in animals and birds and has been extensively documented. Konrad Lorenz (1937), probably the best-known researcher on imprinting, defined imprinting in his classic studies on graylag geese and other animals as the rapid learning occurring in early stales of life. Obviously, animals, and humans too,
are capable of learning some things around the time of birth and before. This type of learning is usually said to be subcortical because it takes place in lower parts of the brain than the cerebral cortex, which is rather undeveloped at this stage of life.

This chapter tells about the ways we experience music, how our brain perceives pitch, and discusses the role of its early development in the perinatal period.

**BACKGROUND**

At the end of the 19th century, Ernst Haeckel summarized the biogenetic law in a phrase, ‘ontology recapitulates phylogeny’ and posed that the fetal growth and development goes through stages resembling the stages of animals in evolutionary history. In his 1871 book, *The Descent of Man* Charles Darwin (2004) proposed a view, confirmed later by the evolutionary developmental biology, that early embryonic stages resemble embryonic stages of previous species but not the adult stages of these species. Charles Darwin’s theory has been extensively discussed and attacked.

In 1960s Paul McLean (1990) formulated the triune brain model of the vertebrate forebrain evolution and behavior. According to then acclaimed model, the triune brain comprises three sequentially evolved structures. First was the primitive reptilian complex, and then followed the paleomammalian complex including the limbic system consisting of a number of separate components: the thalamus, the hypothalamus, the hippocampus, and the amygdala, among them. Further on, the neomammalian complex (neocortex) was added to the forebrain. The parts of Maclean’s triune brain develop sequentially in the human fetus or child; specifically before birth, a human being does not yet have a developed cerebral cortex but is able to learn general sensory and emotional things in their limbic system. The limbic system along with the sense organs is said to have begun to function in the third trimester of gestation and so is available to do this task. Jaak Panksepp and Lucy Biven (2012) presented in *The Archaeology of Mind* the neural mechanisms of affective expression in mental processes, brain functions, and emotional behaviors characteristic of all mammals to locate.

There were controversies related to the theories about the prenatal imprinting, with a great number of research conducted, mostly at the beginning of this century. Imprinting is primarily determined by basal forebrain structures (including the cerebral hemispheres, the thalamus, and the hypothalamus), to which the hypothalamus is integral (Keverne, 2015). Developmental changes occur in neocortical (concerned with sight and hearing) forebrain. After birth, development of the neocortex lets free the child’s behavior from hormonal mechanisms and the dependence on pheromonal cues. Nicolaïdis (2008) examined the role of under- or over-nutrition in the pregnant mother in postnatal regulation of feeding preferences and fat reserves in offspring, predisposing the offspring, in case of over-nutrition, to later development of obesity and the type 2 diabetes mellitus. Merlot, Courret, & Otten (2007) suggested that prenatal and early life events, such as stress experienced by the pregnant mother may cause future disorders of the child’s immune system. Richard Parncutt (2011/1989) asserted in his *Music Theory, A Psychoacoustics Approach*, that a newborn child recognizes its mother’s voice. Having extensive knowledge of sheep, Parncutt described how a newborn lamb could identify its mother’s bleat, which seems to be a trait common in mammals.

At the TED Global 2011 Conference (TED – Technology, Entertainment, Design: Ideas worth spreading is a global set of conferences), Annie Murphy Paul (2011) delivered a talk, *What babies learn*
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