experimentation, and artistic expression which can be used not just by adults but also by "children of all ages."[50] Kay was strongly influenced by the theory of the cognitive psychologist Jerome Bruner. Bruner developed his theory by redefining the ideas of Jean Piaget who postulated that children go through a number of distinctive intellectual stages as they develop: a kinesthetic stage, a visual stage, and a symbolic stage. But while Piaget thought that each stage only exists for a particular period during a child's development only to be completely replaced by a new stage, Bruner suggested that separate mentalities that correspond to these stages continue to exist as the child grows. That is, the mentalities do not replace each other but are added. Bruner gave slightly different names to these different mentalities: enactive, iconic, and symbolic. While each mentality has developed at different stages of human evolution, they continue to co-exist in an adult.

Kay's interpretation of this theory was that a user interface should appeal to all these three mentalities. In contrast to a command-line interface, which is not accessible for children and forces the adult to use only symbolic mentality, the new interface should also make use of emotive and iconic mentalities. Kay also drew on a number of studies on creativity in math, science, music, art and other areas which suggested that initial creative work is done mostly in iconic mentality and also in enactive.[51] This provided additional motivation for the idea that if computers were to function as a dynamic medium for learning and creativity they should allow their users to think not only through symbols but also through actions and images.

Following Kay's interpretation of Bruner's work, the group at PARC mapped Bruner's theory of multiple mentalities into the interface technologies in the following way. *Mouse* activates enactive mentality (know where you are, manipulate). *Icons and windows* activate iconic mentality (recognize, compare, configure.) Finally, *Smalltalk programming language* allows for the use

[50] Alan Kay, "A Personal Computer for Children of All Ages," *Proceedings of the ACM National Conference*, Boston, 1972, http://www.mprove.de/diplom/gui/kay72.html

[51] Alan Kay, "User Interface: A Personal View," p. 195.