Piaget's Conservation Experiments

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When it comes to assessing the magnitude of a quantity, the mind has several options. For example, to determine the amount of juice in a glass, one could merely look at the height of the juice in the glass; or one could incorporate both the height and the width of the glass. The latter would be the correct approach: The height alone can be misleading, for example when the glass is very narrow. Thus, in order to behave rationally, one has to look past the salient dimension of height and instead focus on integrating several dimensions. According to Jean Piaget, such rational behavior takes time to develop – which he proved with the findings of the so-called 'conservation experiments'. In this essay, we describe the classical experiments as well as the conclusion Piaget drew from his findings.

The general setup for a conservation experiment starts with presenting children with two items of the same magnitude (e.g., two identical glasses with the same amount of juice inside). After confirming with the child that the two magnitudes are indeed the same (e.g., that the two classes hold the same amount of juice), one item is modified in front of the child. For example, the juice from one glass is poured into a new glass, one that is narrower than the initial glass. As a result of this transformation, the modified item *looks like* it has a different quantity (e.g., the fluid level has risen). But in reality, the amount was “conserved”: no change in magnitude. The child is then asked the initial question again: whether the two items have the same magnitude.

There are several versions of conservation tasks, depending on the kind of magnitude that is targeted. For *number* conservation, two rows of coins are being compared. At first, the coins are arranged in a one-to-one correspondence, yielding rows of the same length. The coins of one row are then spread apart. For *length* conservation, two identical sticks are presented side by side. The ends first coincide, after which one stick is moved up a bit. For *mass*, *weight*, and *volume* conservation, two identical balls of clay are presented, after which one ball is turned into a sausage-like shape. Finally, for *area* conservation, two identical pieces of cardboard, said to be farmland, are being compared. There are the same number of ‘buildings’ on each farmland, distributed evenly at first. The buildings are then rearranged randomly on one farmland, and children are asked whether the area of farmland is still the same.

Using children’s answers in conservation experiments, Piaget differentiated between those who perform successfully (labeled as “conservers”) and those who make systematic mistakes (labeled as “non-conservers”). Typically, findings show that children under the age of 7 are non-conservers: These children claim incorrectly that the two quantities are no longer of the same magnitude after the transformation. This mistake is surprising because (1) children confirmed initially that the two quantities were of the same magnitude, and (2) the transformation happened in full view of children. Children should know that the transformation merely affected the arrangement, not the quantity.

Despite reliable findings, the validity of conservation experiments is still unclear. For example, the mental processes that might be responsible for the mistaken performance of non-conservers is still up for debate. And there is no answer as to the precise developmental changes that take place when children transition from non-conservers to conservers. Piaget's intuition was that conservation mistakes are a reflection of the cognitive system at large: the combined effect of perception, attention, and memory processes. Developmental changes are triggered by a so-called 'compensation', the process by which children realize that a magnitude is conserved despite the physical alternations. It is an "Aha" effect of sorts that moves the child from being a non-conserver to being a conserver.

Follow-up research has revealed the robustness of conservation findings. For example, conservation acquisition occurs in similar patterns across countries such as Australia, Canada, and Zambia. Similarly, while there are cultural differences in the rate at which conservation acquisition occurs, formal schooling does not appear to affect this competence. Instead, there is an established relation between conservation success and math ability (e.g., conservers displayed greater fluency in addition and subtraction than non-conservers). There is even evidence of neural connections: The difference between older children (conservers) and younger children (non-conservers) was traced to activity in the parieto-frontal area of the brain (known to be involved in numerical and executive functions).

At the same time, conservation findings are modulated by strong context effects. For example, performance improved when children could either observe conservers or discuss the task with others. It might even be that the child's understanding of the purpose of the task is at issue. Children who are typically labeled non-conservers—rather than lacking a general cognitive ability to engage in rational thought, might have merely misinterpret the purpose of the task. Alternatively, conservation tasks might be nothing more but a challenging language task: Children with impaired language abilities had more trouble with the conservation experiments than children with normal language abilities. Based on these findings, Piaget's conservation experiments have been criticized, and the task is rarely used in current research.

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