SAMUEL & BRYANT (1984): then and now

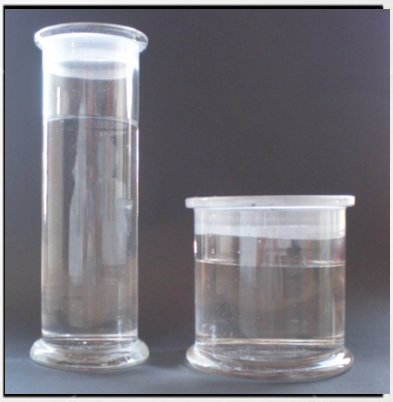
e-xtension

Dr. Julia Russell's Psychology Column

Samuel & Bryant (1984) conducted a study which evaluated the procedure Piaget had used to investigate children's understanding of physical quantities. It is the child's misunderstanding of conservation which allows parents to trick children at mealtimes - so they think that a cut-up piece broccoli is less because it's in smaller pieces…

Conservation is the understanding that if the physical appearance of a quantity changes, but nothing is taken away or added, it is still the same amount. This can apply to aspects such as volume, number, area etc. For example, Piaget & Szeminska (1952) showed that children below 7 or 8 years of age often believed that lengthening rows of counters (by spreading them out) increased the number and squashing balls of plasticine flat reduced their volume. In Piaget's standard procedure he asked the child a pre-and a post-transformation question, ie asked whether two instances (eg rows of counters or beakers of liquid) were the same or different both *before and after* a change was made to their physical appearance (eg by spreading out the counters or pouring the liquid into a taller vessel).

Rose & Blank (1974) asked only the post-transformation question and found that at six years old, children were more likely to give the correct answer when only asked one question than two. This raised doubts about the validity of Piaget's method.



Conservation of volume

Research questions:

- How does asking only one question about conservation affect the ability of children over a wide age range?
- Are conservation of mass, number and volume all affected?

Procedure:

- 252 boys and girls aged 5½ -8 years old were divided into four groups (by age).
- Each group was subdivided into three conditions: standard (pre and post transformation questions); one judgement (post transformation question); fixed array (child didn't see transformation).
- squashed cylinders were used to test mass, spread out rows of counters for number and tall/narrow glasses for volume.

Findings:

- Children performed better with only the post-transformation question (for most ages and most materials, oddities being due to chance)
- Older children were better at all tasks than younger ones.
- The standard Piagetian was harder than both the post-transformation question only and the fixed array situation.
- The number task was the easiest.

Conclusion:

- Asking both the pre and post-transformation questions causes children who can conserve to make conservation errors.

Essentially, Samuel & Bryant were investigating whether Piaget's tests of conservation were flawed because the children were responding to being asked the same question twice. Imagine being asked 'Did you eat the last biscuit? DID YOU EAT THE LAST BISCUIT?'
The chances are you'd say 'No' to the first question but 'Yes' to the second.

Uniview WORLDWIDE

Social effects of the experimenter or cognitive effects of interference?

e-xtension

Dr. Julia Russell's Psychology Column

Samuel & Bryant conclude that the problem lies with the effect of the experimenter asking a second question and unwittingly implying to the participant that a *different* answer is required.

Porpodas (1987) found that asking more than one question wasn't really the problem. This research suggested that the questions provided 'verbal interference' which prevented children from transferring information across from the pre-transformation stage. This implied that the problem was a cognitive one, but not exactly of the nature originally suggested.

In an attempt to answer the 'conservation or conversation?' question, ie whether the conservation failures are due to cognitive immaturity or the language use or power relations between the child participant and adult experimenter, Baucal & Stepanovic (2006) analysed the results of many tests of the repeated question hypothesis. They also conducted an additional test which aimed to distinguish between cognitive and social effects by using a repeated question about a 'transformation' which had *not* changed (pouring liquid back into the same glass so *only* the question and not the actual change could influence their response). Interestingly, the results were not as predicted. They expected that any child's response would be the same on the standard and modified tasks, but this was not the case. However, they were unable to conclude whether the cause was or was not repeating the question.

Research has gone on to explore the 'conversation about conservation' idea which underpins the interview method. For example, Arcidiacono & Perret-Clermont (2009) suggested that children's statements about conservation are not, as Piaget claimed, simply a product of their cognitive level but of their social interaction with the interviewer. This suggests that the child's reasoning is 'co-constructed' during the testing process. If adults 'accept' wrong (or right) answers without asking for a justification (argument about why it is so), which is what Piaget was *really* interested in.

Figure 1
Conservation of number

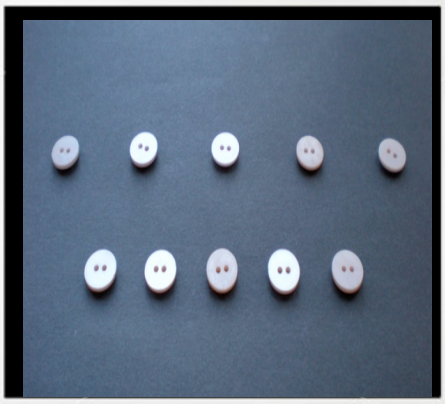


Figure 2
Conservation of number

Making waves

With interview techniques producing ever more complex findings and, in almost 70 years failing to find a definitive answer, it seems appropriate that some researchers have chosen to employ a different research method. Zhang *et al.* (2008) had a brain wave…

Event related potentials, ERPs, are brain waves (*potentials*) generated in response to (ie *related* to) specific *events* (stimuli presented to the participant). In this case, the events were conservation problems. Conservers and non-conservers differed in their ERPs. Although this doesn't help to tell us whether conservation should be tested using one or two questions, it does tell us that there is some biological difference between children who can and children who cannot – the difference isn't purely an artefact of a potentially misleading interview procedure.

Key terms

Conservation - the understanding despite changes in physical appearance if nothing is taken away or added a quantity stays the same.

Event related potential (ERP) - brain waves (*potentials*) generated in response to (ie *related* to) specific *events* (eg stimuli). They are detected using an EEG.

*ElectroEncephalograph (*EEG*)* – a machine which uses recording electrodes stuck on the scalp to produce a pattern of brain waves showing the electrical activity of groups of neurons in the brain which are working together.

Activities

Cloze exercise: Samuel & Bryant (1984)

Piaget believed that thinking in _____ differed from that of adults. One aspect of this is their lack of _____. This involves understanding that if the physical appearance of a quantity changes, but nothing is taken away or added, it is still the same _____. This can apply to aspects such as volume, number, _____ etc. For example, Piaget & Szeminska (1952) showed that children below 7 or 8 years of age often believed that lengthening rows of _____ (by spreading them out) increased the number and squashing balls of plasticine flat reduced their volume. _____ used a standard procedure to test this in which he asked the child a pre-and a post-transformation question, such as whether two rows of counters or beakers of liquid were the same or different both *before* _____ *after* their physical appearance, but not quantity, was changed. Rose & Blank (1974) asked just the _____-transformation question and found that younger children were able to do a conservation task.

Samuel & Bryant's aim was to find out whether asking only one question affected conservation by children aged 5½-8 years on tests of _____, number and volume conservation. The children were equally divided between three conditions: _____ (pre and post transformation questions); one _____ (post transformation question); _____ (no transformation seen). The apparatus used included squashed _____ to test conservation of mass, rows of counters to test conservation of _____ and glasses of water to test conservation of _____. They found, like Piaget, that _____ children were better able on all conservation tasks than _____ ones and that, in general, children performed better when only asked the post-transformation question than in the fixed array situation and worst of all with the standard Piagetian task. Overall, the children found the number task _____. Samuel & Bryant concluded that asking both a pre- and a post-transformation question can cause a child who *can* conserve to make errors because when the experimenter asks a _____ question they make the child think that a *different* answer is needed.

Porpodas (1987) suggested that asking more than one question wasn't the main problem but that extra questions caused 'verbal _____' so they failed to retain the information from the pre-transformation stage which they needed to get the post-transformation question correct. This would mean that the problem *was* a _____ one, but not of the same kind that Piaget believed. Alternatively, the _____ relationship between the child participant and adult experimenter may be the cause, such as proposed by Arcidiacono & Perret-Clermont (2009).

Zhang *et al.* (2008) measured ERPs to compare _____ activity in conservers and non-conservers. The fact that there were differences in response to conservation problems shows that children who can and children who cannot conserve really are biologically different – it isn't just a problem caused by misleading interview questions.

amount	cognitive	interference	post
and	conservation	judgement	second
area	counters	mass	social
brain	cylinders	number	standard
children	easiest	older	volume
	fixed array	Piaget	younger

Questions: Samuel & Bryant (1984)

1. Why was it necessary for the age range of children used by Samuel & Bryant to be wider than that used by Piaget & Szeminska?

2. Complete the following in relation to Samuel & Bryant's findings:
   a) Pair up the task names and descriptions below:

task
standard
one judgement
fixed array

description
post transformation question
pre and post transformation questions
child didn't see transformation

b) i) Tick one box in each column in the table below to show which age children performed best on each task.

ages	Tick the box corresponding to the age group which performed best on each of the three tasks.		
	standard	*one judgement*	*fixed array*
older children			
younger children			

ii) On which of the tasks in the table above did most children perform the best in most situations?

c) Different situations and materials were used to test conservation in three ways. Pair up the tasks and the materials.

task
mass
number
volume

materials
glasses of different heights
rows of counters
squashed cylinders of Plasticine

3. A teacher in a primary classroom asks a child their opinion about something, such as which they think is heavier, a ton or feathers or a ton of bricks. The child gives an answer, then the teacher asks the same child again. How are they likely to answer, and why, according to Samuel & Bryant?

Stretch & Challenge

Read the original Zhang *et al.* (2008) article then answer the following questions. The free full text is available at:
http://psychbrain.bnu.edu.cn/teachcms/res_base/teachcms/upload/channel/file/2010_2/5_21/n1xug9gfjlrw.pdf

1. Describe how the children were divided into 'conservers' and 'non-conservers'.

2. Zhang *et al.* identified a possible problem with interpreting the relationship they found between brain activity during conservation is children's ages. Identify the problem and explain why it could be an issue.

Stretch References

Arcidiacono F & Perret-Clermont AN (2009) Revisiting the piagetian test of conservation of quantities of liquid: argumentation within the adult-child interaction. *Культурно-историческая психология*, 3: 25-33.

Baucal A & Stepanovic I (2006) Conservation or conversation: a test of the repeated question hypothesis. *Psihologija*, 39(3): 257-75.

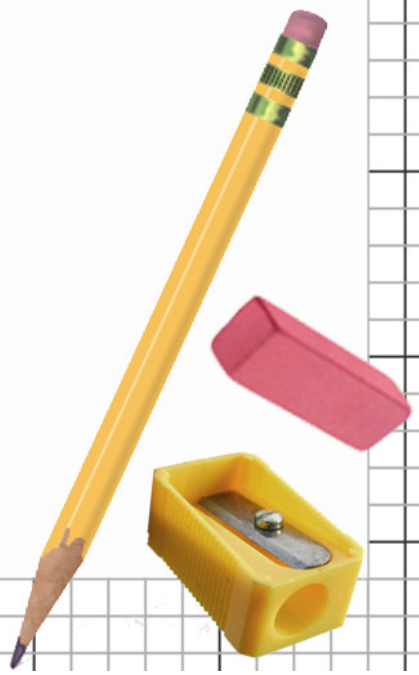
Piaget J & Szeminska A (1952) *The Child's Conception of Number*. Routledge & Kegan Paul: London.

Porpodas CD (1987) The one-question conservation experiment reconsidered. *Journal of Child Psychology & Psychiatry, 28*: 343-349.

Rose SA & Blank M (1974) The potency of context in children's cognition: an illustration through conservation. *Child Development*, 45: 499-502.

Samuel J & Bryant P (1984) Asking only one question in the conservation experiment. *Journal of Child Psychology & Psychiatry*, 25(2): 315-8.

Zhang Q, Shi J, Fan Y, Liu T, Luo Y, Sang H & Shen M (2008) An event-related brain potential study of children's conservation. *Neuroscience Letters*, 431: 17–20.



Answers

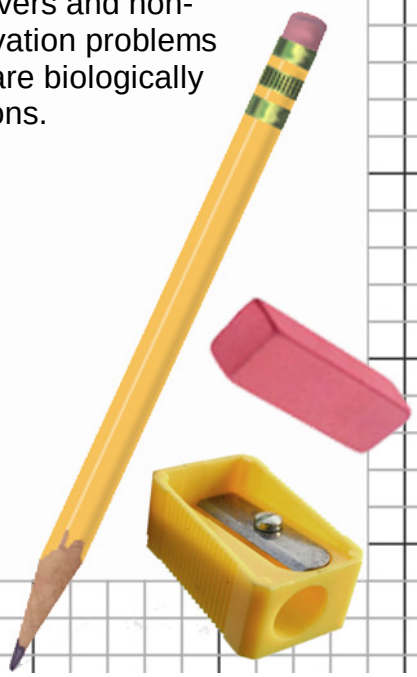
Cloze exercise: Samuel & Bryant (1984)

Piaget believed that thinking in **children** differed from that of adults. One aspect of this is their lack of **conservation**. This involves understanding that if the physical appearance of a quantity changes, but nothing is taken away or added, it is still the same **amount**. This can apply to aspects such as volume, number, **area** etc. For example, Piaget & Szeminska (1952) showed that children below 7 or 8 years of age often believed that lengthening rows of **counters** (by spreading them out) increased the number and squashing balls of plasticine flat reduced their volume. **Piaget** used a standard procedure to test this, in which he asked the child a pre-and a post-transformation question, such as whether two rows of counters or beakers of liquid were the same or different both *before* **and** *after* their physical appearance, but not quantity, was changed. Rose & Blank (1974) asked just the **post**-transformation question and found that younger children were able to do a conservation task.

Samuel & Bryant's aim was to find out whether asking only one question affected conservation by children aged 5½-8 years on tests of **mass**, number and volume conservation. The children were equally divided between three conditions: **standard** (pre and post transformation questions); one **judgement** (post transformation question); **fixed array** (no transformation seen). The apparatus used included squashed **cylinders** to test conservation of mass, rows of counters to test conservation of **number** and glasses of water to test conservation of **volume**. They found, like Piaget, that **older** children were better able on all conservation tasks than **younger** ones and that, in general, children performed better when only asked the post-transformation question than in the fixed array situation and worst of all with the standard Piagetian task. Overall, the children found the number task **easiest**. Samuel & Bryant concluded that asking both a pre- and a post-transformation question can cause a child who *can* conserve to make errors because when the experimenter asks a **second** question they make the child think that a *different* answer is needed.

Porpodas (1987) suggested that asking more than one question wasn't the main problem but that extra questions caused 'verbal **interference**' so they failed to retain the information from the pre-transformation stage which they needed to get the post-transformation question correct. This would mean that the problem *was* a **cognitive** one, but not of the same kind that Piaget believed. Alternatively, the **social** relationship between the child participant and adult experimenter may be the cause, such as proposed by Arcidiacono & Perret-Clermont (2009).

Zhang *et al.* (2008) measured ERPs to compare **brain** activity in conservers and non-conservers. The fact that there were differences in response to conservation problems shows that children who can and children who cannot conserve really are biologically different – it isn't just a problem caused by misleading interview questions.



Questions

1. Why was it necessary for the age range of children used by Samuel & Bryant to be wider than that used by Piaget & Szeminska?
   To include younger children as they anticipated that the change in questioning would facilitate apparently earlier conservation.

2. Complete the following in relation to Samuel & Bryant's findings:

b) Pair up the task names and descriptions below:

task	description
standard	post transformation question
one judgement	pre and post transformation questions
fixed array	child didn't see transformation

c) i) Tick one box in each column in the table below to show which age children performed best on each task.

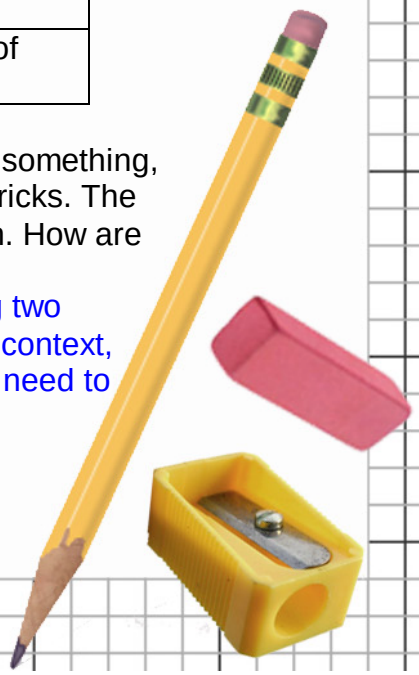
ages	Tick the box corresponding to the age group which performed best on each of the three tasks.		
	standard	*one judgement*	*fixed array*
older children	✓	✓	✓
younger children			

ii) On which of the tasks in the table above did most children perform the best in most situations? Number

d) Different situations and materials were used to test conservation in three ways. Pair up the tasks and the materials.

task	materials
mass	glasses of different heights
number	rows of counters
volume	squashed cylinders of Plasticine

3. A teacher in a primary classroom asks a child their opinion about something, such as which they think is heavier, a ton or feathers or a ton of bricks. The child gives an answer, then the teacher asks the same child again. How are they likely to answer, and why, according to Samuel & Bryant?
   They will give a different answer the second time, because asking two questions causes errors because the child responds to the social context, in this case the teacher's second question makes them think they need to change their answer.



Stretch & Challenge

1. Describe how the children were divided into ‘conservers’ and ‘non-conservers’ Prior to the experiment, the children were tested on liquid quantity and weight in a standard Piagetian way. Those children completing both the liquid quantity and weight conservation tasks successfully and were able to give an explanation were ‘conservers’ and children those failing to give either a correct answer or a correct explanation (or both) were ‘non-conservers’.

2. Zhang *et al.* identified a possible problem with interpreting the relationship they found between brain activity during conservation is children’s ages. Identify the problem and explain why it could be an issue. Children of different ages may be using different strategies in the conservation task, which ERPs cannot detect, so it is difficult to interpret differences between ages and even apparent similarities.