Do 3-4 year old children differ in their expectancies after experiencing physical possible and impossible feedback on a balance scale?

**Introduction**

Previous studies (1,2) have shown that children have little understanding of the balance scale before 5 years of age in terms of integrating information about weight and distance from the fulcrum. However, an understanding based on weight alone is assumed to be present even in 2-year-olds (3). In all these studies, this variable was varied by the number of equally weighted objects. This leaves open the possibility that children's decisions were based on visual features (size, number) without taking weight into account. The present study investigated whether younger children are able to correctly encode the relevance of weight as a force in influencing the behaviour of balance scales. For that purpose, we studied how well 3- to 4-year-old children learn to use one of two given weights (similar appearance) to make a balance beam move. In one condition (causal), the heavy weight produced the effect; in the other condition (inverse), the light weight was effective. Only 4-year-olds learned more effectively in the causal than in the inverse condition, suggesting that younger children have not yet developed clear expectations regarding the role of weights for movements of a balance beam.

**Methods**

Participants were 60 children (3, 3.5 and 4-year-olds) divided in two groups: group 1 received the causal condition; and group 2 participated in the inverse condition. All subjects were presented with a total of 12 trials. Materials consisted of a balance scale and two identical boxes varying in weight only (20 g versus 320 g). The balance scale was presented behind a Plexiglas panel with two holes in the panel's upper end. On each trial, the experimenter first placed a reward on one arm of the scale resulting in disequilibrium. This allowed the children to place an object through one of the holes of the apparatus. If children's choices were “correct”, the reward on the opposite side moved upwards and could be gained through the second hole.

![Causal condition: Placement of the heavy box exerts downward pull of the balance scales arm](image1)

![Inverse condition: Placement of the light box exerts downward pull of the balance scales arm](image2)

**Results**

![Graph showing no difference in errors between age groups for causal condition](image3)

![Graph showing difference in errors between age groups for inverse condition](image4)

**Conclusion**

- Younger children learned the inverse sequence as readily as the causal sequence.
- Older children learned relationships that are in accordance with their expectancies (causal) but inhibited the learning of relations that are contradictory to their predictions (inverse).
- An understanding of weight as a force that influences the behaviour of balance scales does not seem to develop before the age of 4 years.

**References**


**Fig 1:** Participant placing an object on the balance scale's arm