The effect of confidence hysteresis on numerical discrimination

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Number discrimination ability depends on prior history of easy or hard discriminations.

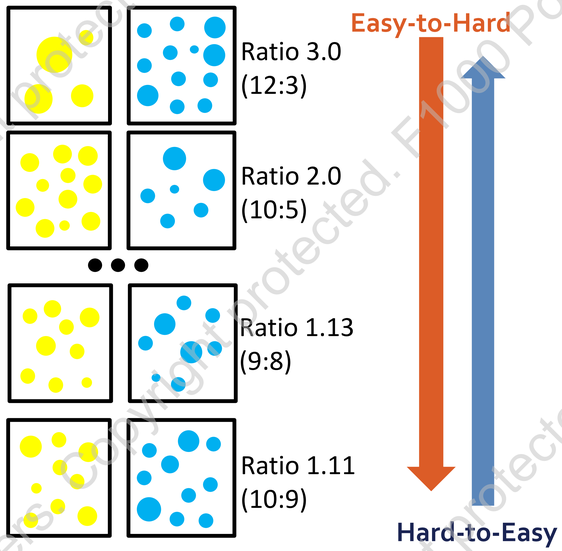
INTRODUCTION

Perceptual discrimination depends not only on the information sampled, but also on one's confidence in their ability to make the required discriminations. Consistent with dynamical psychophysics[1], prolonged exposure to either difficult or easy discriminations may affect one's confidence and result in improved or diminished performance. We term this effect *confidence hysteresis.*

METHODS

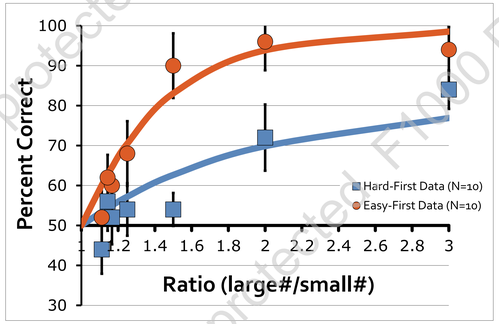
Children (ages 4-6) and adults were given a simple numerical discrimination task that varied in difficulty (ratio). They participated in either the Easy-to-Hard condition or the Hard-to-Easy condition.

Ratios: 3.0, 2.0, 1.5, 1,25, 1.17, 1.13, 1.11.



EXPERIMENT 1

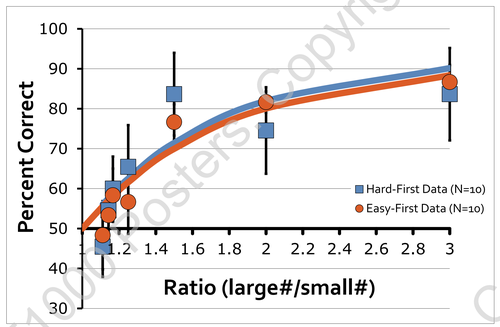
Children given Valid Feedback



Easy-to-Hard children performed better than children in Hard-to-Easy condition ($p < .01$). The Hard-to-Easy performance resembled the discrimination abilities of 9-month-old infants[2].

EXPERIMENT 2

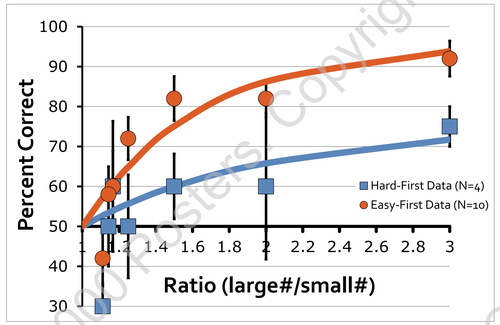
Children without Feedback



Hard-to-Easy children performed as well as the Easy-to-Hard children ($p > .30$). The effect of confidence hysteresis in children may depend on feedback, or may arise from a combination of feedback and trial difficulty/confidence.

EXPERIMENT 3

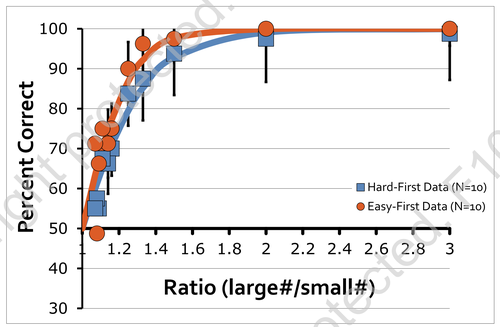
Children given Invalid Feedback



Easy-to-Hard children performed as well as without feedback. Hard-to-Easy children are performing poorly. Thus, confidence hysteresis may depend on a combination between feedback and trial order, regardless or feedback validity.

EXPERIMENT 4

Adults without Feedback



Adults given a more difficult set of ratios without feedback also show confidence hysteresis. Adults with feedback (not shown) do not ($p < .05$). There may be a developmental shift in how confidence and external feedback combine to produce confidence hysteresis.

CONCLUSIONS

Our results demonstrate an effect of confidence hysteresis – discrimination on any given trial depends on the history of previous discriminations.

These effects are consistent with confidence as state dependent and an important factor in perceptual decision making.

In children, confidence hysteresis depends on a combination of confidence and feedback. However, the validity of feedback does not appear to impact children's subsequent performance.

Adults, unlike children, demonstrate confidence hysteresis when no feedback is provided. Adults, unlike children, may not require feedback as a measure of their own performance.

Our results also suggest that feedback and trial order are important factors in child tasks that should be controlled for.

REFERENCES

1 - Hock, H. S., & Schoner, G. (2010). Measuring Perceptual Hysteresis with the Modified Method of Limits: Dynamics at the Threshold. *Seeing and Perceiving*, *23*(2), 173–195.
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3 - Halberda, J., & Feigenson, L. (2008). Developmental change in the acuity of the "number sense": The approximate number system in 3-, 4-, 5-, and 6-year-olds and adults. *Developmental Psychology*, *44*(5), 1457-1465.