Perceptual stimuli with difficult-to-trade-off attribute values show a positive attraction effect

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Summary

This study examines how attribute trade-off difficulty influences the attraction effect. Our main studies include one with a novel star stimulus to test for higher-than-null RST values and another using a mixed design to demonstrate that low attribute trade-off difficulty reduces the attraction effect by breaching asymmetric dominance of the decoy. As part of manipulation check, a separate pair of experiments respectively confirm that star stimuli create higher task difficulty than rectangles and that bottom-aligned pairs in a triangular arrangement are easier to compare.

Introduction

• **Attraction Effect:** Adding a decoy—a third option similar but inferior to one of two main options—increases preference for the dominating option (target) (Huber et al., 1982).
• **Prior Findings:** Studies by Choplin et al. (2005) and Trueblood et al. (2013) demonstrated attraction effects in perceptual tasks, challenging value-based models. However, recent perceptual studies (Spektor et al., 2018, 2022) report inconsistent results, questioning the effect's generality.
• **Hypothesis:** Building on a pair-wise comparison model (Srivastava & Schrater, 2015) and theories on attribute trade-off difficulty (Walasek & Brown, 2023), we predict that low attribute trade-off difficulty will reduce the attraction effect by breaching the decoy's asymmetric dominance.
• **Experiments:**
• **Experiment1:** Using perceptual stimuli with a harder task, we anticipated a positive attraction effect.
• **Experiment2:** A mixed-design study manipulating task difficulty (between-subject) and salient pair (within-subject) to test for an interaction effect. This would imply the task difficulty is in trading-off attributes.

Methods

Main Studies

• **Experiment 1** (N = 38)
• **Design:** Single factor using triplet star stimuli to assess higher-than-null RST values.
• **Stimuli:** Star shapes created by modifying rectangles; four inward isosceles triangles (bases equal to the rectangle sides) were removed, forming a star shape, thereby increasing the task difficulty.
• **Attributes:** Height of the removed triangles and width of the base rectangle.
• **Task:** Choose 1 out of 3 shapes made on sand that requires the least amount of extra sand to form a square.

• **Experiment 2** (N = 38)
• **Design:** Between-subject factor: Task Difficulty (low vs. high); Within-subject factor: Salient Pair (TD vs. CD).
• **Stimuli:** Rectangle stimuli with width and height as attributes for low difficulty; star stimuli for high difficulty, arranged in a triangle. The bottom-aligned pair in each triangle was the salient pair.
• **Task in Low difficulty:** Choose the shape appearing largest in area.
• **Task in High difficulty:** Choose 1 out of 3 shapes made on sand that requires the least amount of extra sand to form a square.
• **Measure:** Relative Share of Target (RST-equal-weight) as effect index (Katsimpokis et al., 2022).

Manipulation Checks

• **Check 1** (N = 43)
• Objective: Confirm that star stimuli pose higher task difficulty than rectangles.
• Stimuli: Horizontal **pairs** from each category with stimulus-specific instructions.

• **Check 2** (N = 42)
• Objective: Validate that bottom-aligned pairs are easier to compare in triangular arrangements.
• Stimuli: Rectangle **pairs**, presented horizontally (aligned) or obliquely. Task: Choose the larger shape. Participants rated perceived difficulty on a 7-point scale after each trial.

Results

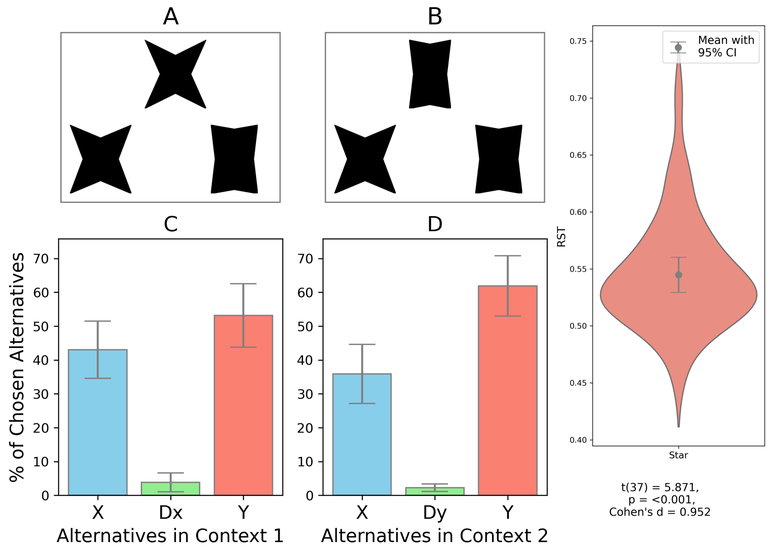
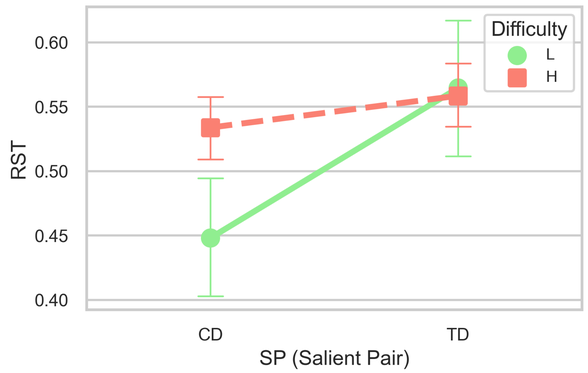
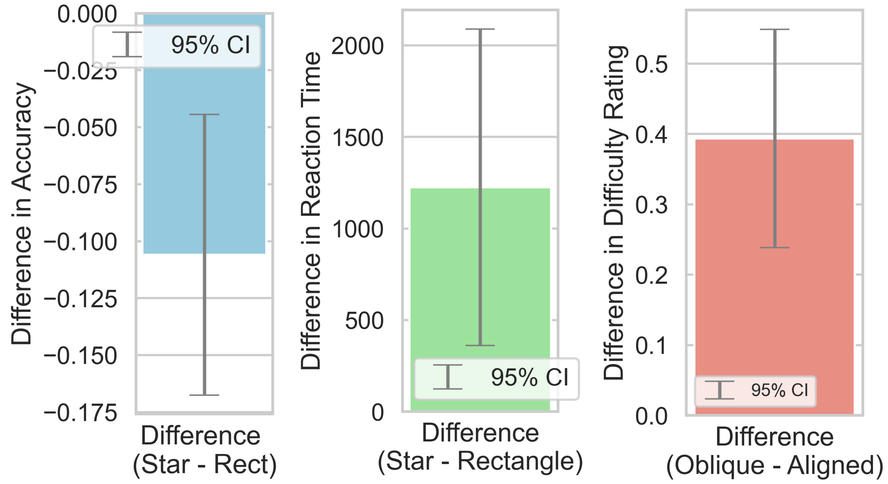


Fig 1. Example trials, Choice Shares and RST (right most) in Exp1.
Panel A shows a trial with the wider stimulus as the target, while panel B shows the narrower stimulus as the target. Panels C and D display choice shares for two contexts, with X and Y as core options, and Dx and Dy as decoys favouring X and Y, respectively. Error bars are 95% confidence intervals.



C(Difficulty): F(1, 144) = 3.96, p = 0.048, η² = 0.027
C(SP): F(1, 144) = 12.01, p = 0.001, η² = 0.077
C(Difficulty):C(SP): F(1, 144) = 5.26, p = 0.023, η² = 0.035

Fig 2. Interaction plot in Exp2



t(42) = -3.472, p = 0.001,
Cohen's d = -0.529

t(42) = 2.863, p = 0.007,
Cohen's d = 0.437

t(41) = 5.129, p = <0.001,
Cohen's d = 0.791

Fig 3. Results in Manipulation Check Studies, 1 and 2.
Left and middle plots correspond to Manipulation Check1, the right most belong to Manipulation Check2

Additionally, for Manipulation Check1, we ran a repeated measures ANOVA for Stimulus Type (Star vs Rectangle) * Pair (CD vs TD). Results revealed significant effects for Stimulus Type ($F(1, 42) = 12.055$, $p = 0.001$, $\eta^2 = 0.801$), Pair ($F(1, 42) = 32.269$, $p < 0.001$, $\eta^2 = 0.915$), and their interaction ($F(1, 42) = 6.646$, $p = 0.014$, $\eta^2 = 0.689$).

Discussion

1. Role of Task Difficulty: Our manipulation checks show that star stimuli induce higher task difficulty (lower accuracy, longer RTs) than rectangles. The salience of bottom-aligned pairs in a triangular arrangement highlights the impact of alignment on comparison ease.
2. Task Difficulty as Attribute Trade-Off Difficulty: The interaction effects in Experiment 2 and Manipulation Check 1 support interpreting task difficulty as attribute trade-off difficulty. TD (target-decoy) comparisons differ by one attribute, while CD (competitor-decoy) comparisons vary in both.
• **Asymmetric Dominance:** In high difficulty (star stimuli), decoys maintain asymmetric dominance: dominated in TD but not CD comparisons. In low difficulty (rectangles), the decoy is dominated in both, reducing the attraction effect.
3. Linear Arrangements Yield Attraction Effects: Despite the low attribute trade-off difficulty of rectangle stimuli, a standard attraction effect was observed (Trueblood et al., 2013; Spektor et al., 2018). We propose that the matched stimulus orientation ensures consistent salience of target-decoy pairs, as assumed by the Multiattribute Linear Ballistic Accumulator (MLBA) model (Trueblood et al., 2014) to explain same positive effects.
4. Future Research: Replicating Trueblood et al. (2013) with controlled stimulus presentation order and investigating eye-fixation dynamics with stimuli involving difficult attribute trade-offs.

References

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