

Proportional reasoning across formats

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Introduction

Comparing proportions is sometimes very hard! But, even infants seem to be able to do it a little bit. The purpose of this science project was to better understand how well people compare proportions when the proportions are presented in different formats. The purpose of this class assignment is to take the R-code and plots we've been generating over the last several weeks and put it all together into one poster format.

Research Objectives:

1.Does average performance vary across format type? 2.Does average performance vary across numerator congruency status? 3.Does numerator congruency vary across format type?(ie., is there an interaction)

Participants

A total of 99 adults participated in the study.

Methods

First participants were introduced to a story about a magic ball and that the outcome(ie., blue or orange) depended on the proportions. They were then asked to compare the proportions of different images.

In other words, participants were shown two images of the same kind at the same time and asked to decided which had a higher proportion of the shape (or dots) colored in blue.

Conditions There were four different conditions that changed what kinds of images the participants saw:

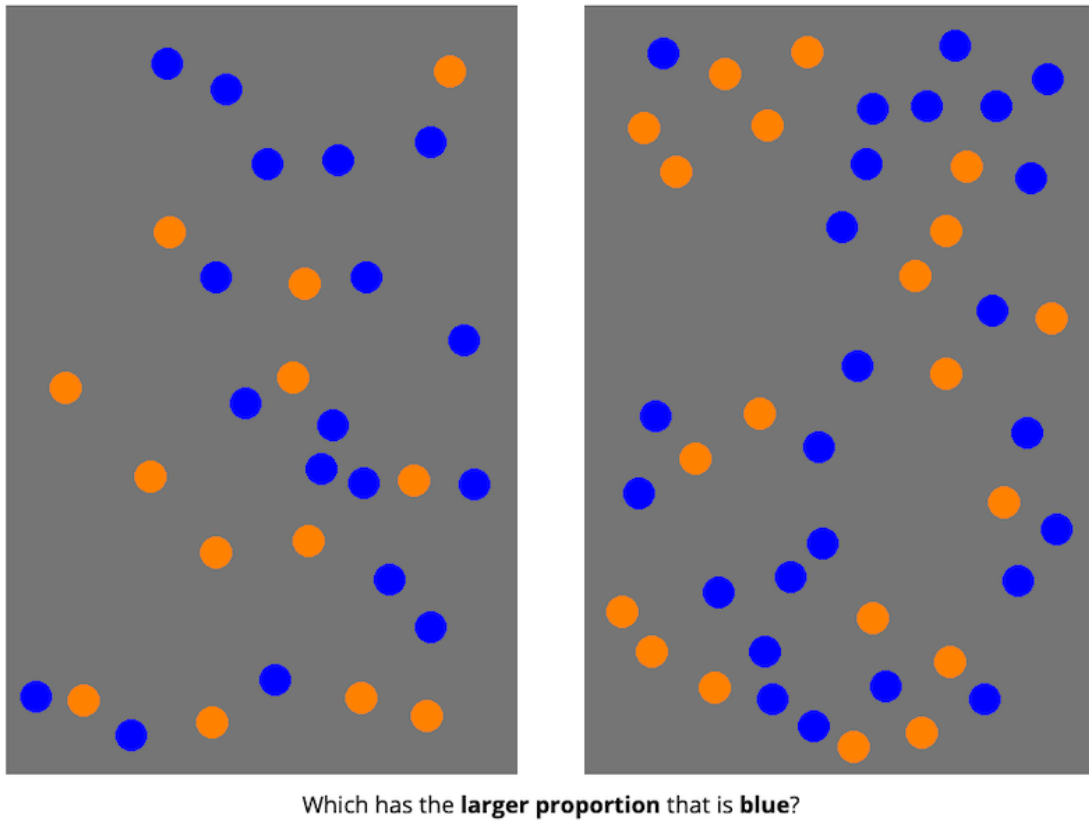


Figure 1. : An example of integrated blobs

- 25 • divided blobs: blue and orange were entirely separate.
- 26 • integrated blob: one blob, divided to be part blue and part orange.
- 27 • separated dots: blue and orange dots were on opposite sides of the image.
- 28 • integrated dots: blue and orange dots were intermixed.

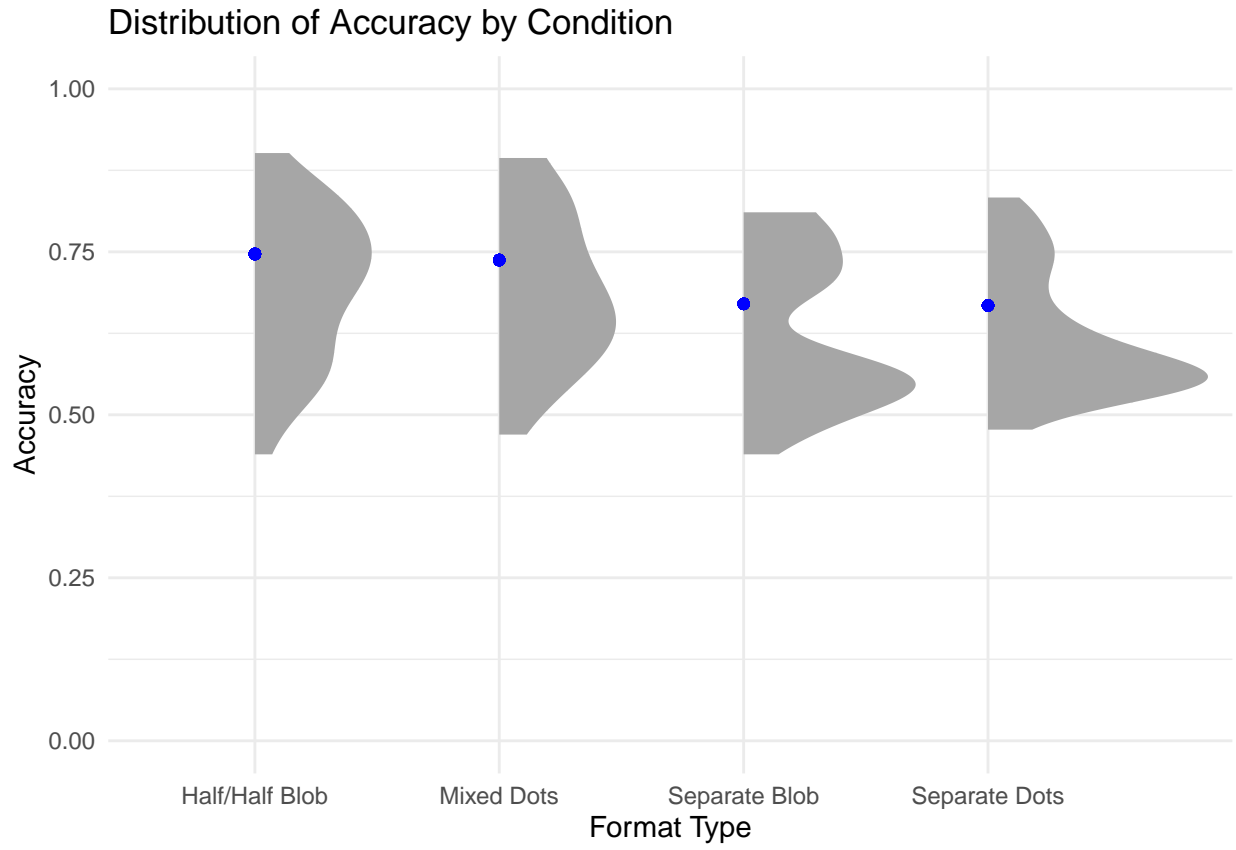


Figure 3. Plot of Distribution of Accuracy by Condition

45 "blob_stacked", "blob_stacked", "blob_stacked", "blob_stacked", "blob_stacked",
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[illegible]

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[illegible]

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272 Dots", "Separate Dots", "Separate Dots", "Separate Dots", "Separate Dots")), list(, ), , ,
273 list(x = ~condition_name, y = ~prop_corr), list(line = list(colour = "black", linewidth =
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275 = "white", colour = "black", linewidth = 0.5, linetype = 1, inherit.blank = TRUE), text =
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277 = 0, lineheight = 0.9, margin = c(0, 0, 0, 0), debug = FALSE, inherit.blank = TRUE), title
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282 NULL, vjust = 0, angle = NULL, lineheight = NULL, margin = c(0, 0, 2.75, 0), debug =
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305 = NULL, axis.ticks.y.right = NULL, axis.ticks.theta = NULL, axis.ticks.r = NULL,
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307 NULL, axis.minor.ticks.y.right = NULL, axis.minor.ticks.theta = NULL, axis.minor.ticks.r =
308 NULL, axis.ticks.length = 2.75, axis.ticks.length.x = NULL, axis.ticks.length.x.top = NULL,
309 axis.ticks.length.x.bottom = NULL, axis.ticks.length.y = NULL, axis.ticks.length.y.left =
310 NULL, axis.ticks.length.y.right = NULL, axis.ticks.length.theta = NULL, axis.ticks.length.r
311 = NULL, axis.minor.ticks.length = 0.75, axis.minor.ticks.length.x = NULL,
312 axis.minor.ticks.length.x.top = NULL, axis.minor.ticks.length.x.bottom = NULL,
313 axis.minor.ticks.length.y = NULL, axis.minor.ticks.length.y.left = NULL,
314 axis.minor.ticks.length.y.right = NULL, axis.minor.ticks.length.theta = NULL,
315 axis.minor.ticks.length.r = NULL, axis.line = list(), axis.line.x = NULL, axis.line.x.top =
316 NULL, axis.line.x.bottom = NULL, axis.line.y = NULL, axis.line.y.left = NULL,
317 axis.line.y.right = NULL, axis.line.theta = NULL, axis.line.r = NULL, legend.background =
318 list(), legend.margin = c(5.5, 5.5, 5.5, 5.5), legend.spacing = 11, legend.spacing.x = NULL,
319 legend.spacing.y = NULL, legend.key = list(), legend.key.size = 1.2, legend.key.height =
320 NULL, legend.key.width = NULL, legend.key.spacing = 5.5, legend.key.spacing.x = NULL,
321 legend.key.spacing.y = NULL, legend.frame = NULL, legend.ticks = NULL,
322 legend.ticks.length = 0.2, legend.axis.line = NULL, legend.text = list(family = NULL, face
323 = NULL, colour = NULL, size = 0.8, hjust = NULL, vjust = NULL, angle = NULL,
324 lineheight = NULL, margin = NULL, debug = NULL, inherit.blank = TRUE),
325 legend.text.position = NULL, legend.title = list(family = NULL, face = NULL, colour =

```

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326 NULL, size = NULL, hjust = 0, vjust = NULL, angle = NULL, lineheight = NULL, margin
327 = NULL, debug = NULL, inherit.blank = TRUE), legend.title.position = NULL,
328 legend.position = "right", legend.position.inside = NULL, legend.direction = NULL,
329 legend.byrow = NULL, legend.justification = "center", legend.justification.top = NULL,
330 legend.justification.bottom = NULL, legend.justification.left = NULL,
331 legend.justification.right = NULL, legend.justification.inside = NULL, legend.location =
332 NULL, legend.box = NULL, legend.box.just = NULL, legend.box.margin = c(0, 0, 0, 0),
333 legend.box.background = list(), legend.box.spacing = 11, panel.background = list(),
334 panel.border = list(), panel.spacing = 5.5, panel.spacing.x = NULL, panel.spacing.y =
335 NULL, panel.grid = list(colour = "grey92", linewidth = NULL, linetype = NULL, lineend =
336 NULL, arrow = FALSE, inherit.blank = TRUE), panel.grid.major = NULL,
337 panel.grid.minor = list(colour = NULL, linewidth = 0.5, linetype = NULL, lineend = NULL,
338 arrow = FALSE, inherit.blank = TRUE), panel.grid.major.x = NULL, panel.grid.major.y =
339 NULL, panel.grid.minor.x = NULL, panel.grid.minor.y = NULL, panel.ontop = FALSE,
340 plot.background = list(), plot.title = list(family = NULL, face = NULL, colour = NULL,
341 size = 1.2, hjust = 0, vjust = 1, angle = NULL, lineheight = NULL, margin = c(0, 0, 5.5, 0),
342 debug = NULL, inherit.blank = TRUE), plot.title.position = "panel", plot.subtitle =
343 list(family = NULL, face = NULL, colour = NULL, size = NULL, hjust = 0, vjust = 1,
344 angle = NULL, lineheight = NULL, margin = c(0, 0, 5.5, 0), debug = NULL, inherit.blank
345 = TRUE), plot.caption = list(family = NULL, face = NULL, colour = NULL, size = 0.8,
346 hjust = 1, vjust = 1, angle = NULL, lineheight = NULL, margin = c(5.5, 0, 0, 0), debug =
347 NULL, inherit.blank = TRUE), plot.caption.position = "panel", plot.tag = list(family =
348 NULL, face = NULL, colour = NULL, size = 1.2, hjust = 0.5, vjust = 0.5, angle = NULL,
349 lineheight = NULL, margin = NULL, debug = NULL, inherit.blank = TRUE),
350 plot.tag.position = "topleft", plot.tag.location = NULL, plot.margin = c(5.5, 5.5, 5.5, 5.5 ),
351 strip.background = list(), strip.background.x = NULL, strip.background.y = NULL,
352 strip.clip = "inherit", strip.placement = "inside", strip.text = list(family = NULL, face =

```



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353 NULL, colour = "grey10", size = 0.8, hjust = NULL, vjust = NULL, angle = NULL,
354 lineheight = NULL, margin = c(4.4, 4.4, 4.4, 4.4), debug = NULL, inherit.blank = TRUE),
355 strip.text.x = NULL, strip.text.x.bottom = NULL, strip.text.x.top = NULL, strip.text.y =
356 list(family = NULL, face = NULL, colour = NULL, size = NULL, hjust = NULL, vjust =
357 NULL, angle = -90, lineheight = NULL, margin = NULL, debug = NULL, inherit.blank =
358 TRUE), strip.text.y.left = list(family = NULL, face = NULL, colour = NULL, size = NULL,
359 hjust = NULL, vjust = NULL, angle = 90, lineheight = NULL, margin = NULL, debug =
360 NULL, inherit.blank = TRUE), strip.text.y.right = NULL, strip.switch.pad.grid = 2.75,
361 strip.switch.pad.wrap = 2.75), , , , list(x = "Format Type", y = "Accuracy", title =
362 "Distribution of Accuracy by Condition", xdist = "xdist", ydist = "ydist", dist = "dist", args
363 = "args", arg1 = "arg1", arg2 = "arg2", arg3 = "arg3", arg4 = "arg4", arg5 = "arg5", arg6
364 = "arg6", arg7 = "arg7", arg8 = "arg8", arg9 = "arg9", weight = "weight", datatype =
365 "datatype", thickness = "f")

```

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366 2.

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Data analysis

We used R (Version 4.4.1; R Core Team, 2024) and the R-packages *dplyr* (Version 1.1.4; Wickham, François, Henry, Müller, & Vaughan, 2023), *forcats* (Version 1.0.0; Wickham, 2023a), *ggdist* (Version 3.3.2; Kay, 2024), *ggplot2* (Version 3.5.1; Wickham, 2016), *lubridate* (Version 1.9.3; Grolemund & Wickham, 2011), *papaja* (Version 0.1.3; Aust & Barth, 2024), *purrr* (Version 1.0.2; Wickham & Henry, 2023), *readr* (Version 2.1.5; Wickham, Hester, & Bryan, 2024), *stringr* (Version 1.5.1; Wickham, 2023b), *tibble* (Version 3.2.1; Müller & Wickham, 2023), *tidyr* (Version 1.3.1; Wickham, Vaughan, & Girlich, 2024), *tidyverse* (Version 2.0.0; Wickham et al., 2019) and *tinylabels* (Version 0.2.4; Barth, 2023) for all our analyses.

Discussion

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use r_refs(file = “references.bib”)

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