

Why Factor Analyses with Negatively Keyed Items Fail

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The Problem

Negatively keyed items

- ▶ load on separate factors or fail to load

Two Reasons

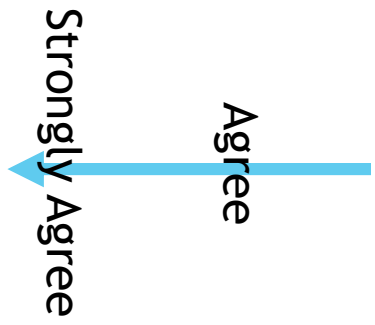
- ▶ Item response scales are often ambiguous.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
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▶ I like cats

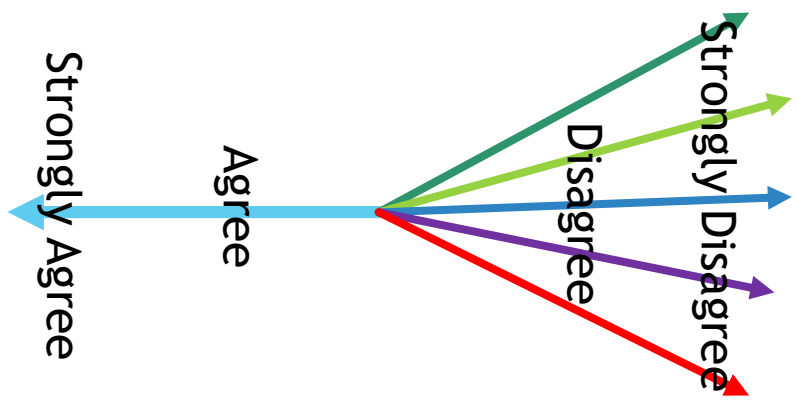
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- ▶ I like cats
 - ▶ Greater agreement = greater liking



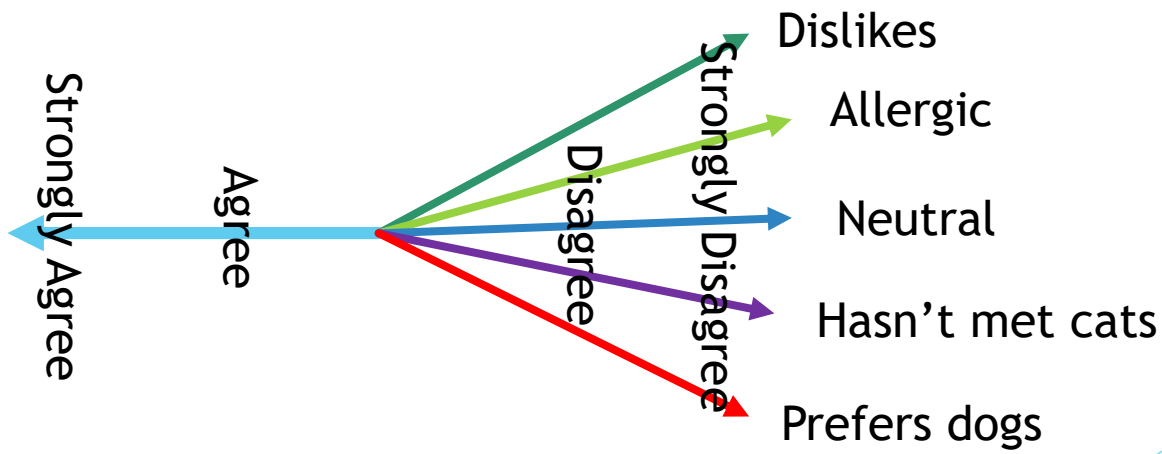
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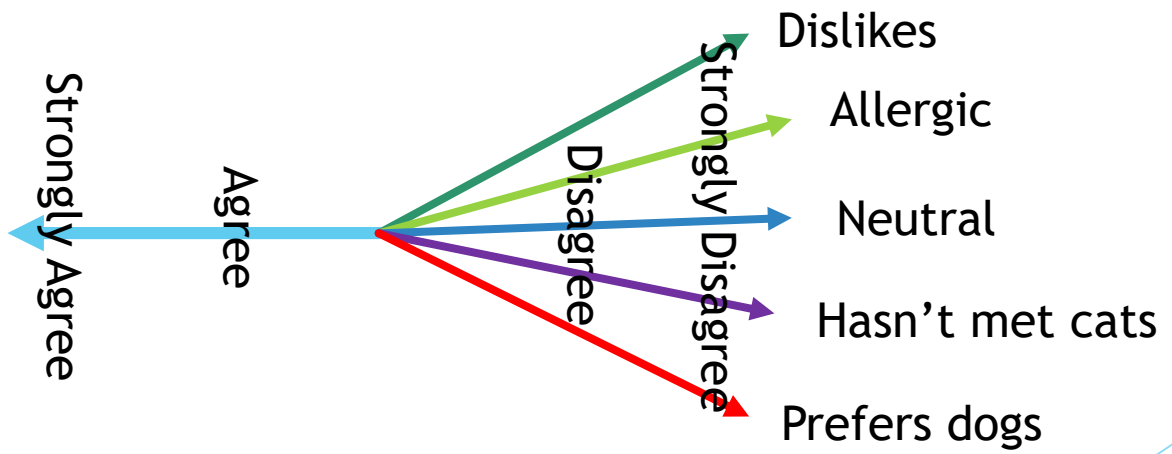
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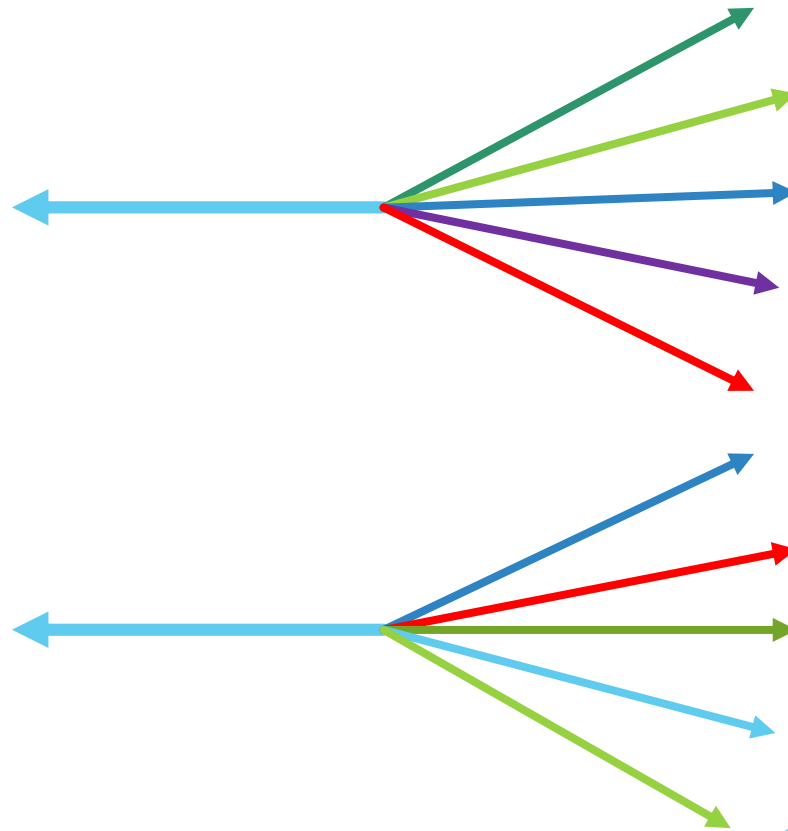
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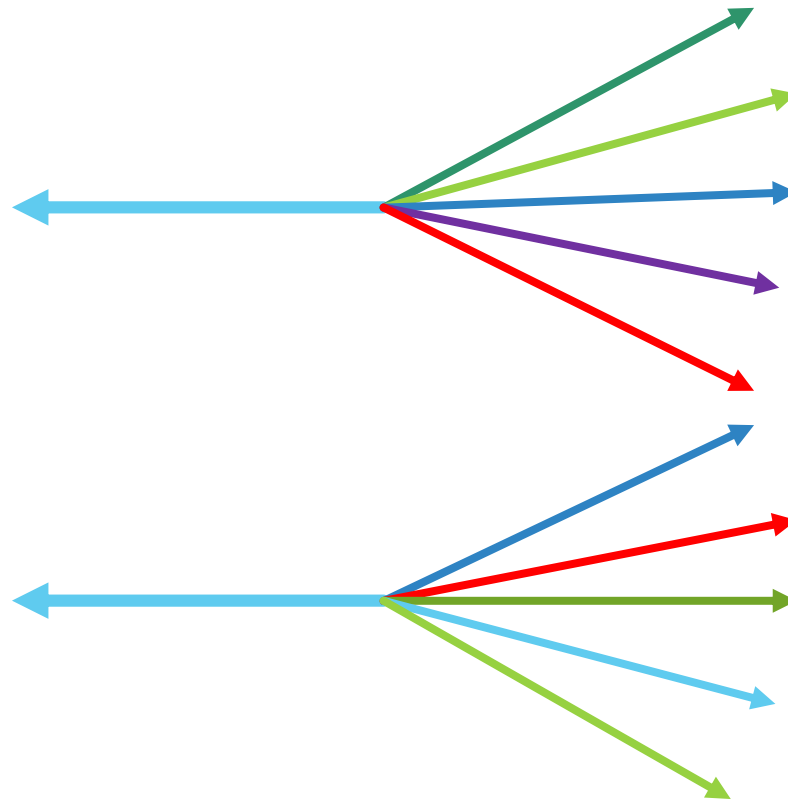
- ▶ Greater agreement = greater liking
- ▶ Great disagreement ≠ more of any one particular thing



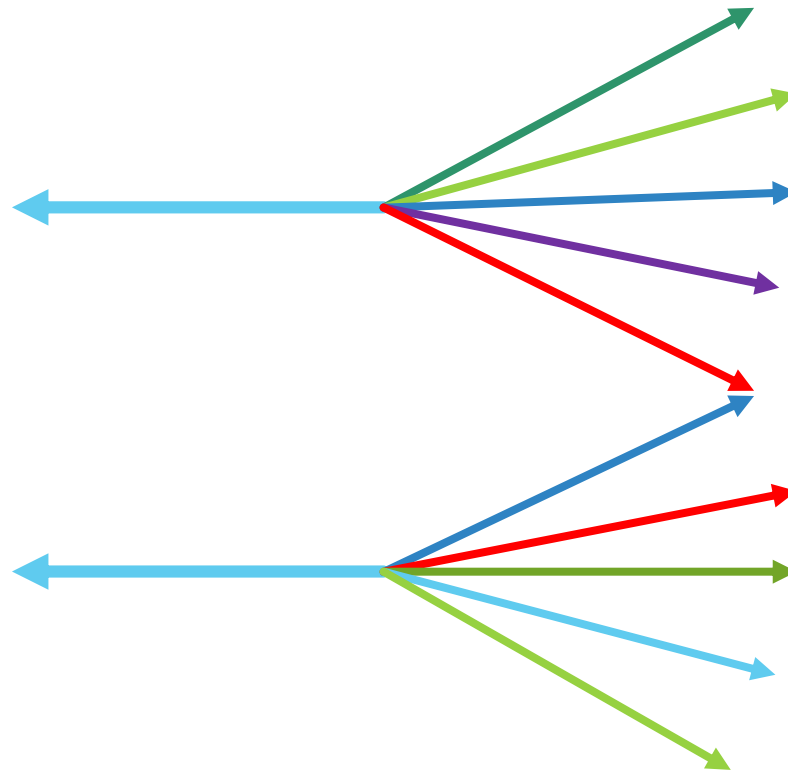
Items Keyed in the Same Direction



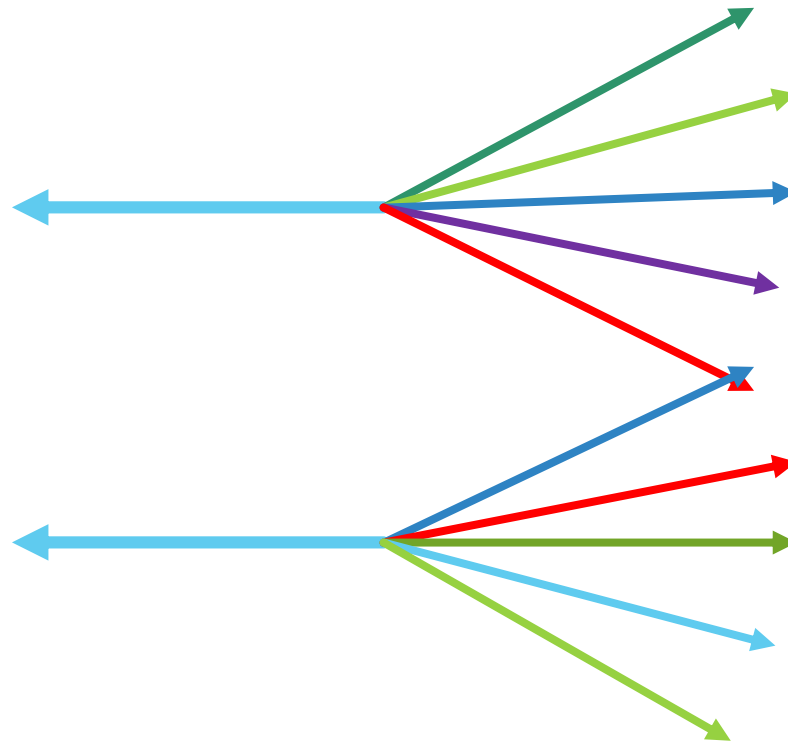
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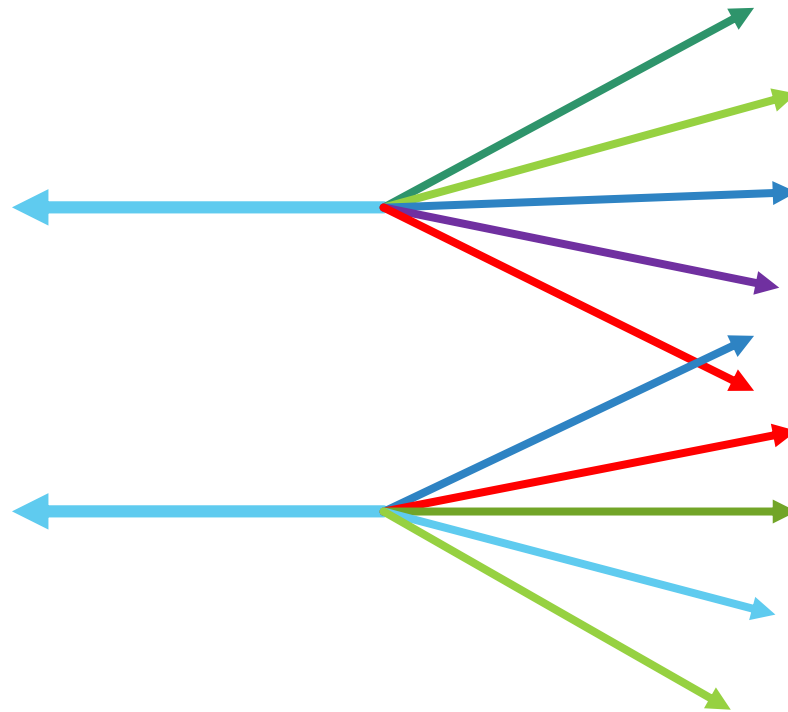
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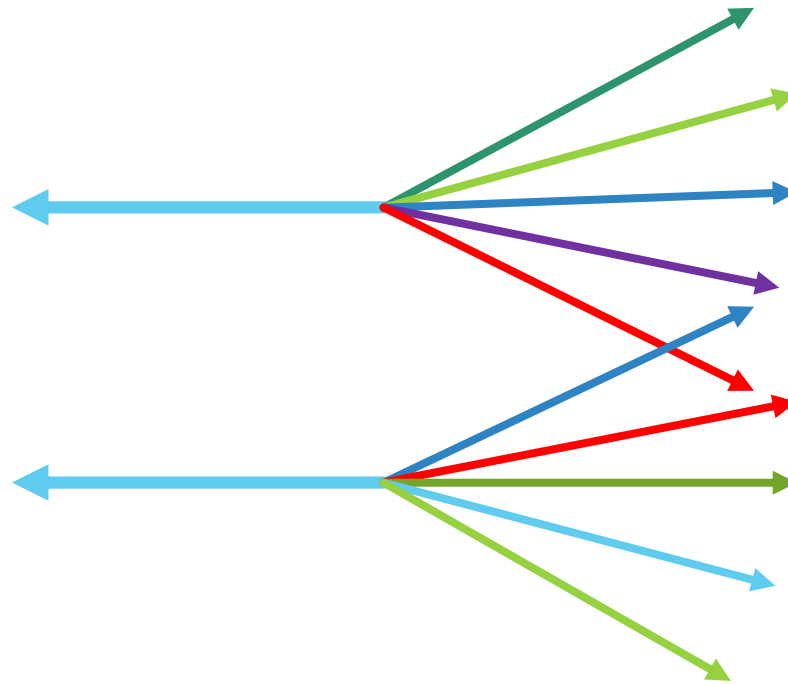
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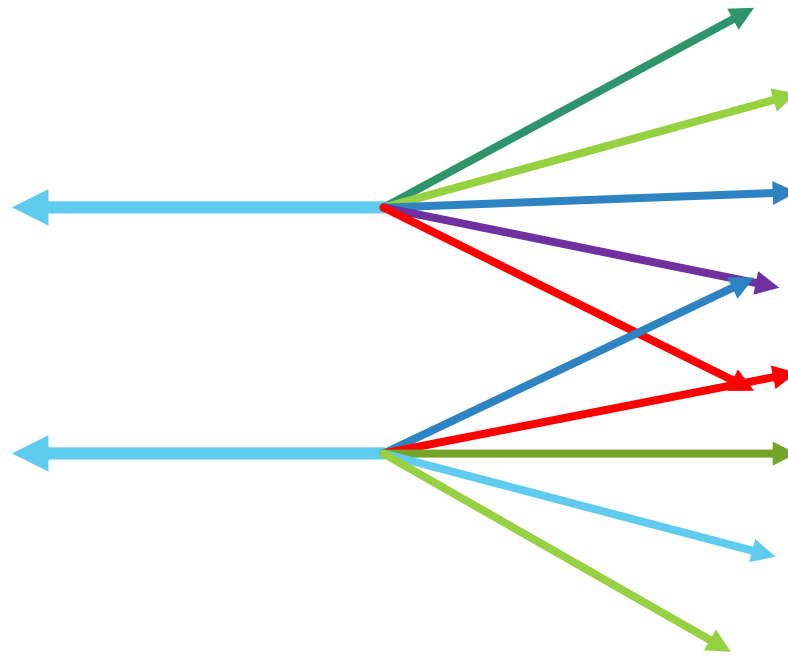
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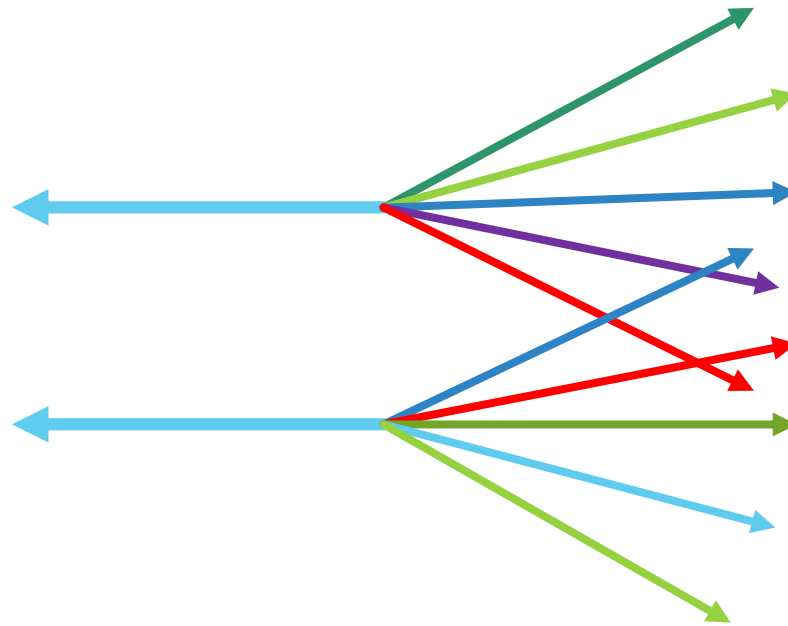
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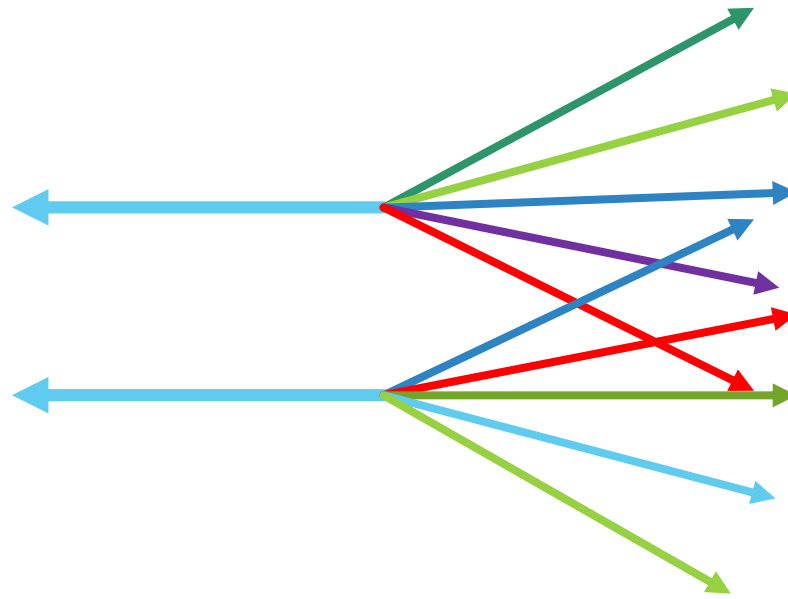
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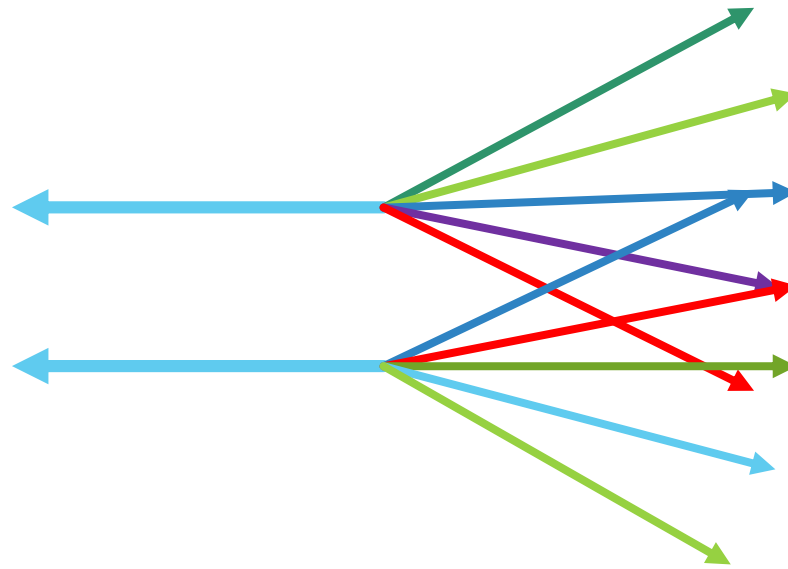
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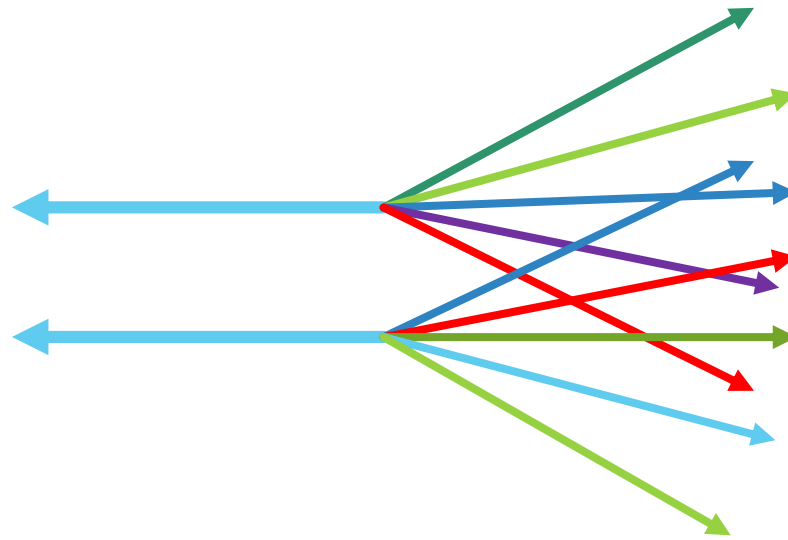
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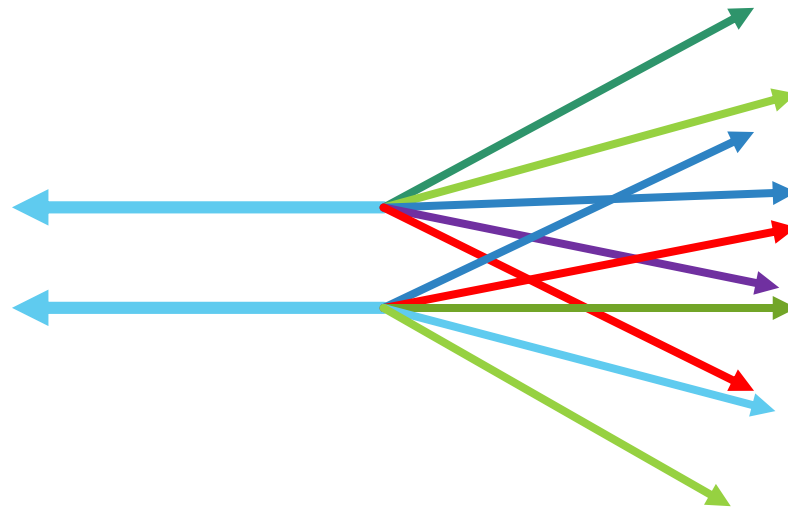
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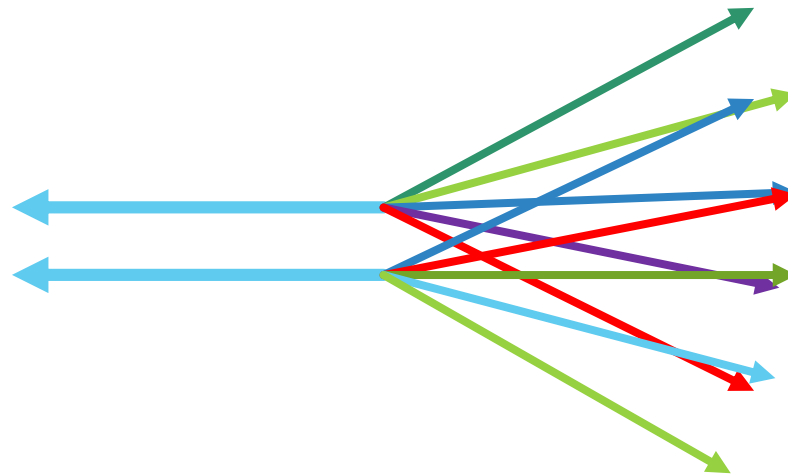
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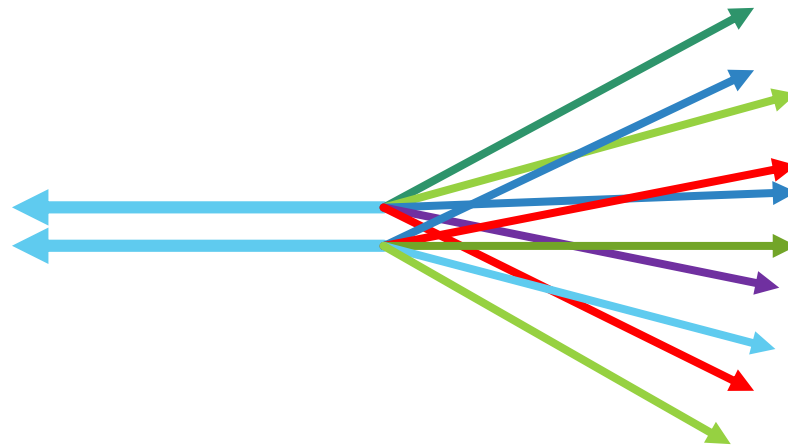
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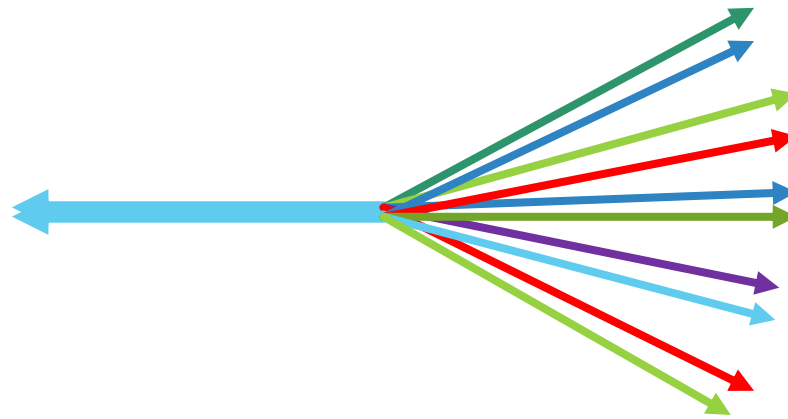
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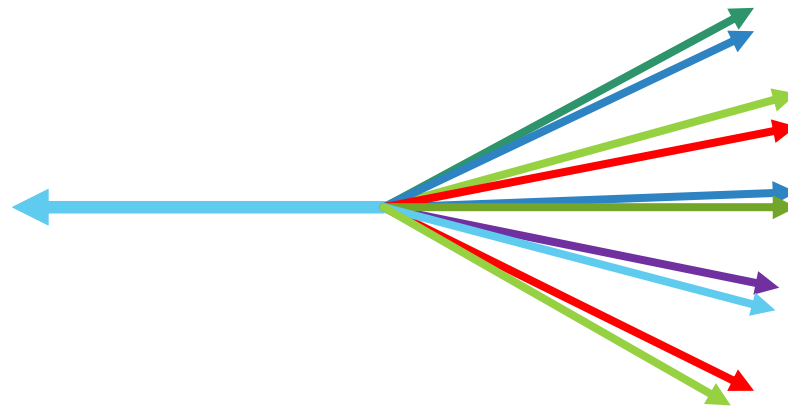
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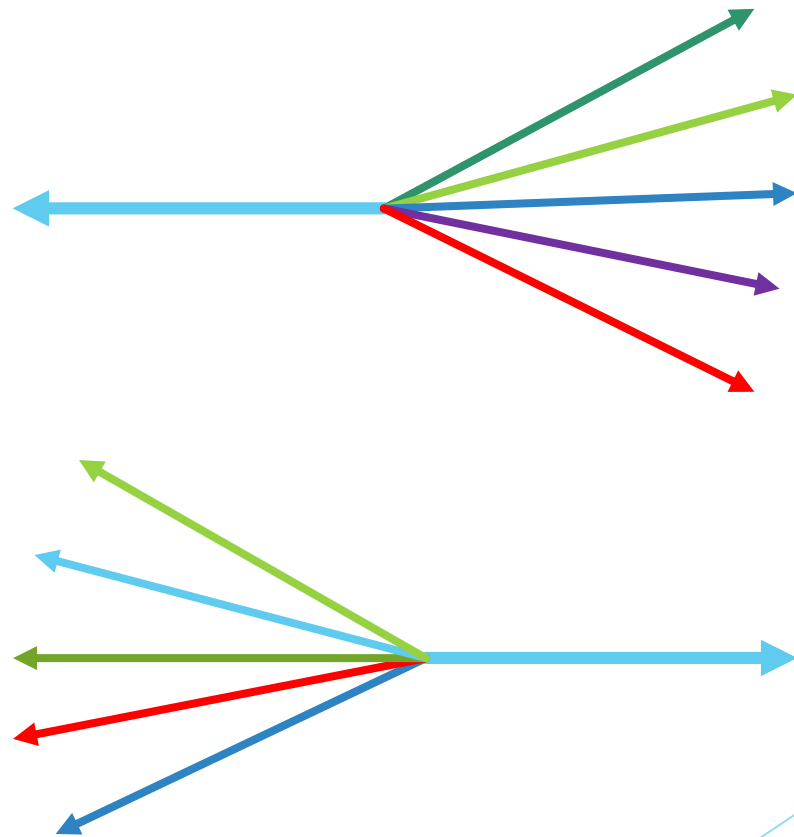
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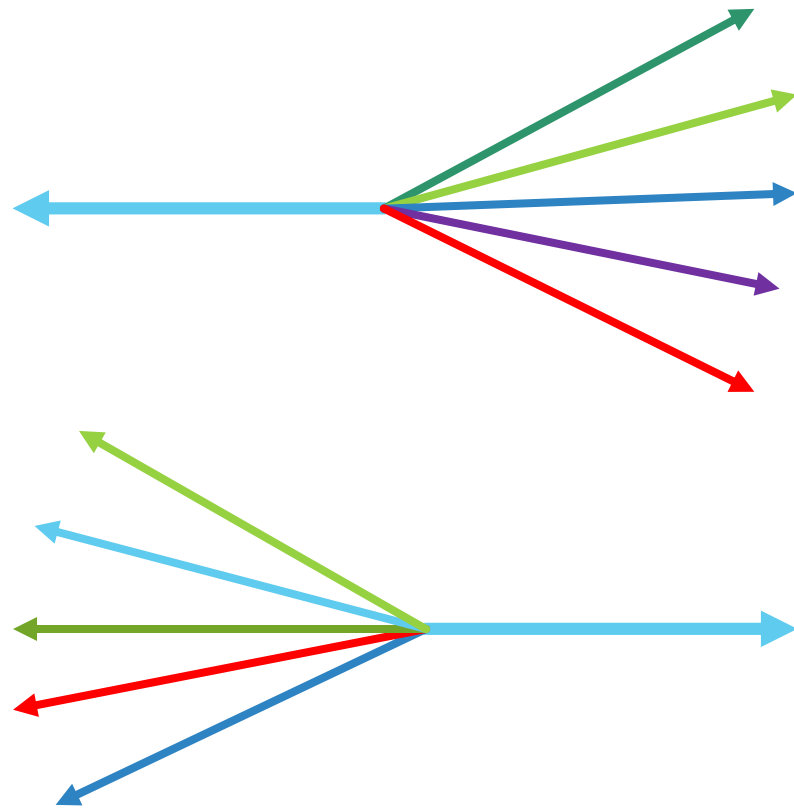
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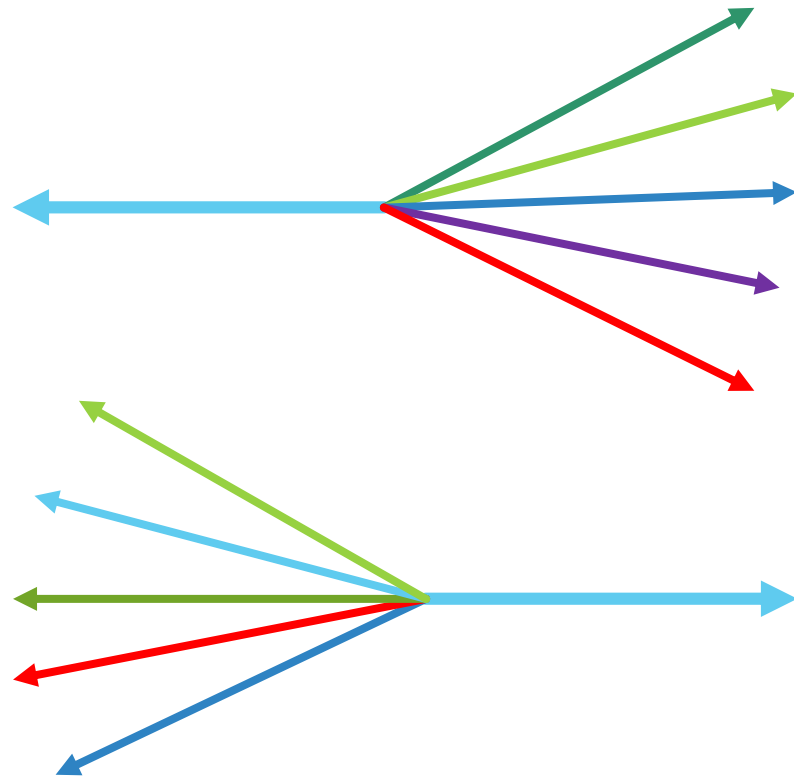
Items Keyed in Opposite Directions



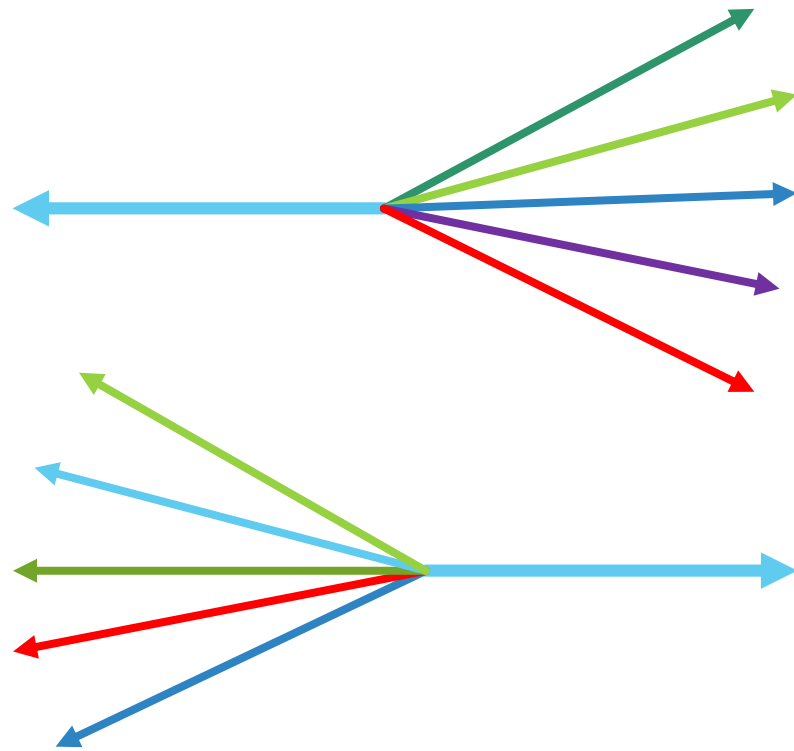
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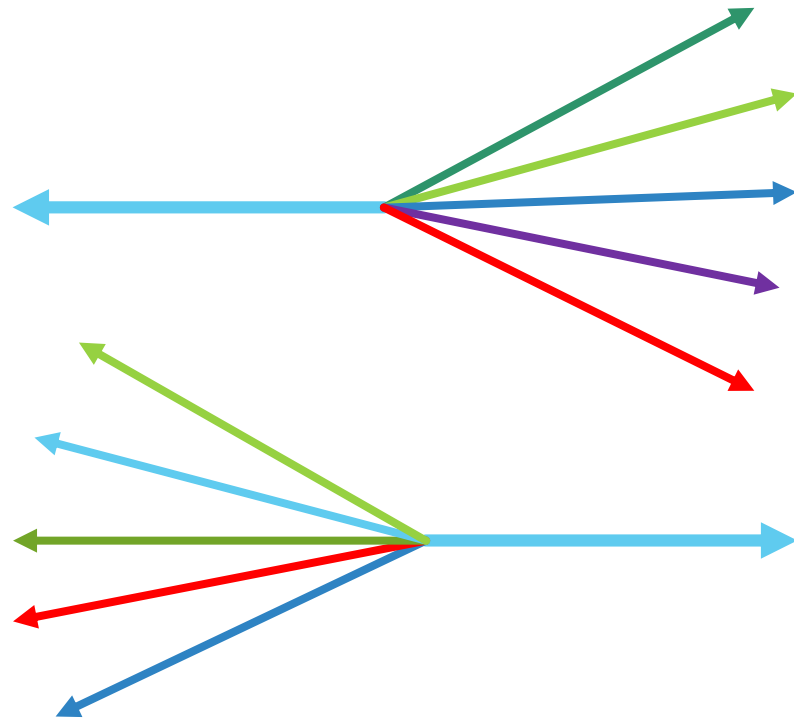
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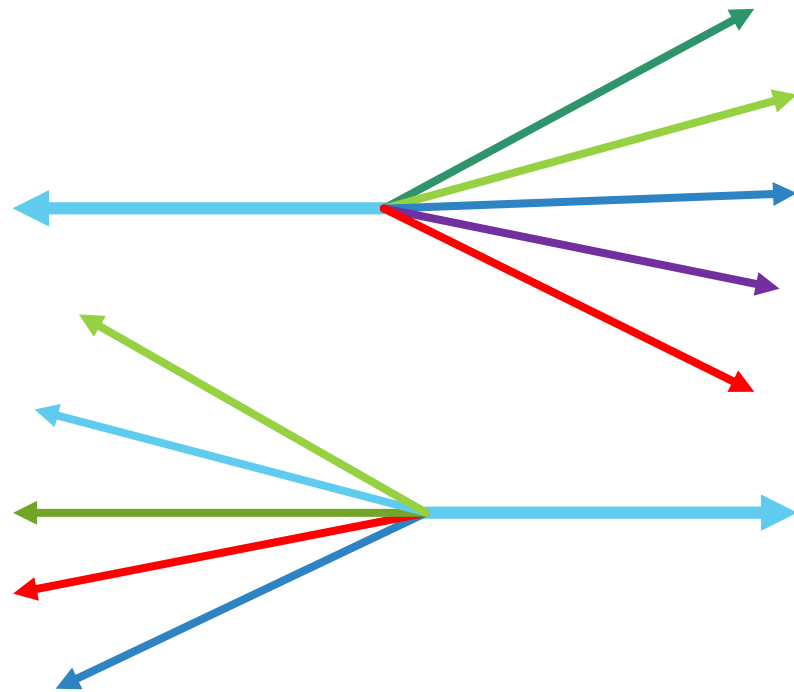
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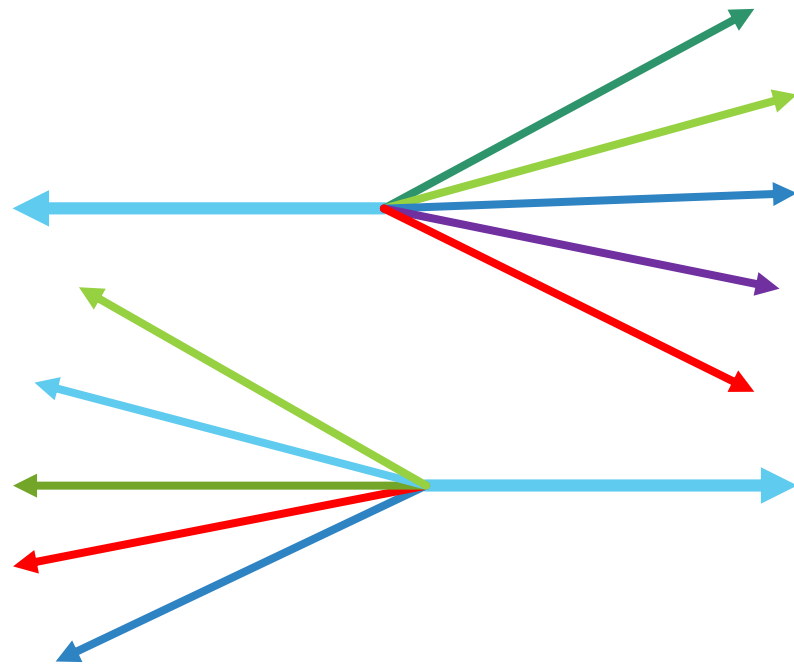
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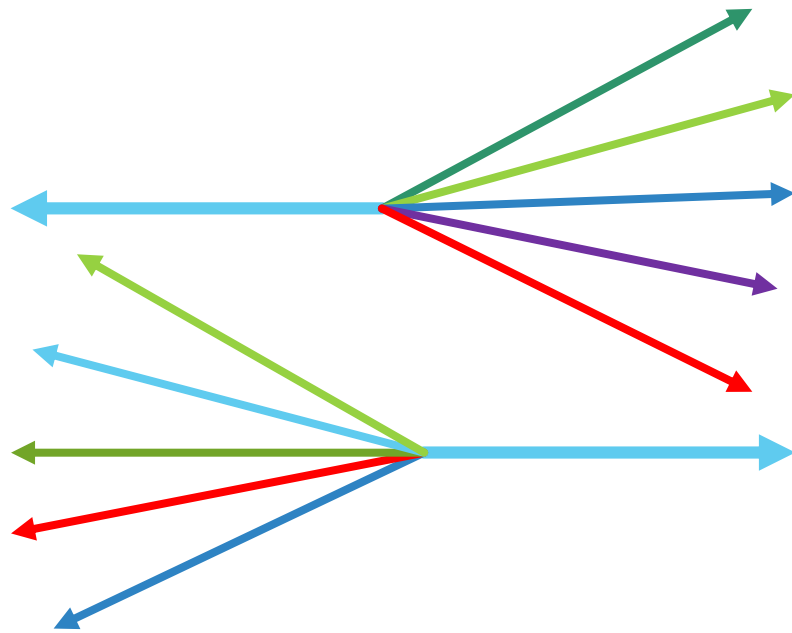
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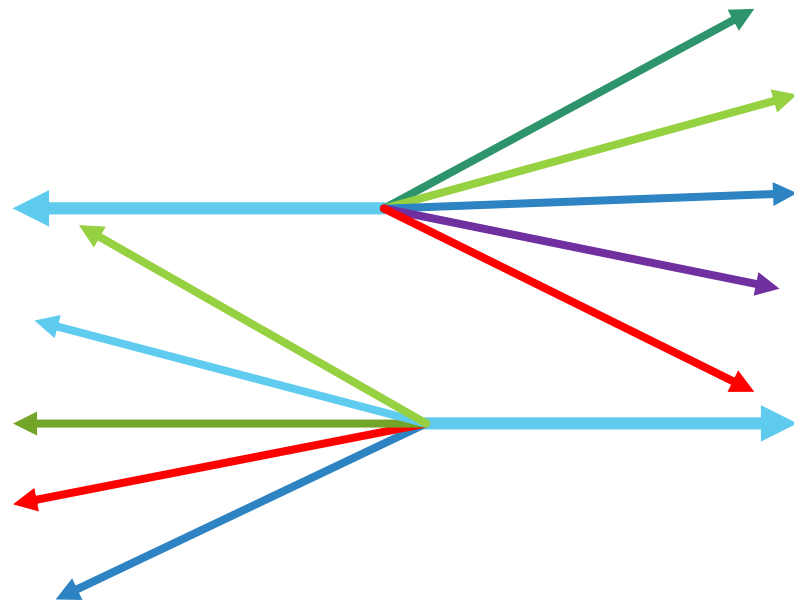
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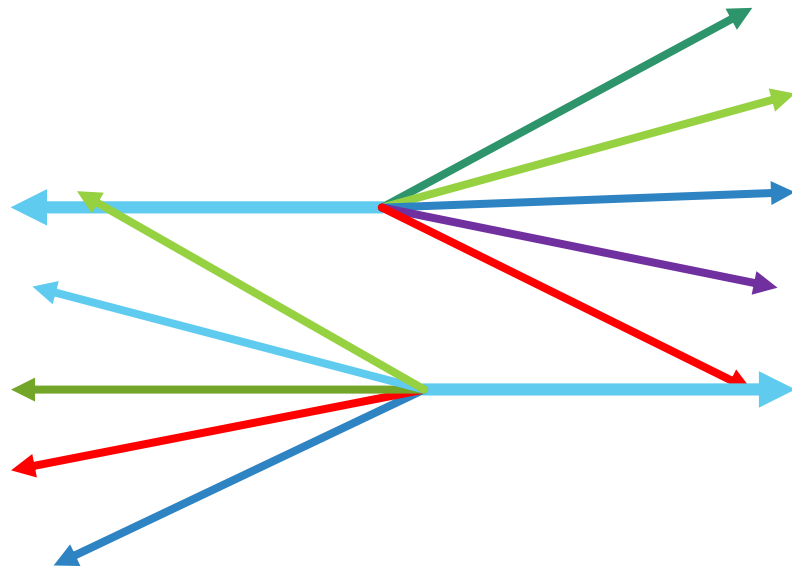
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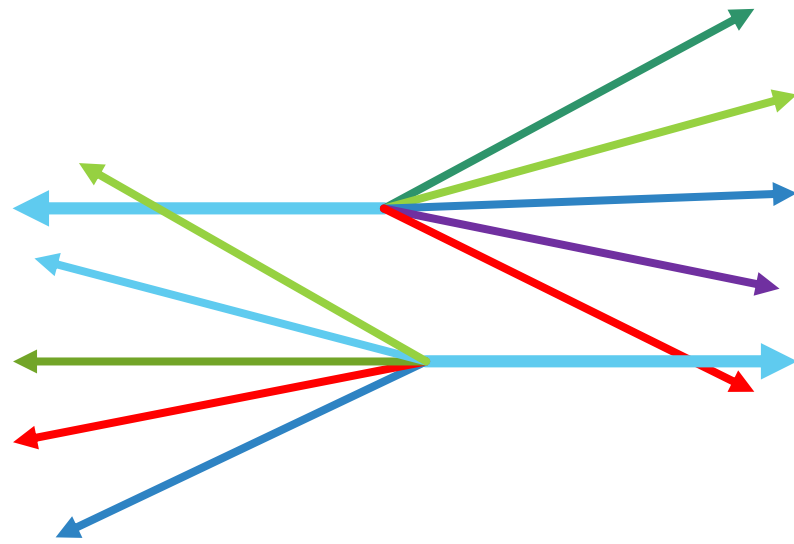
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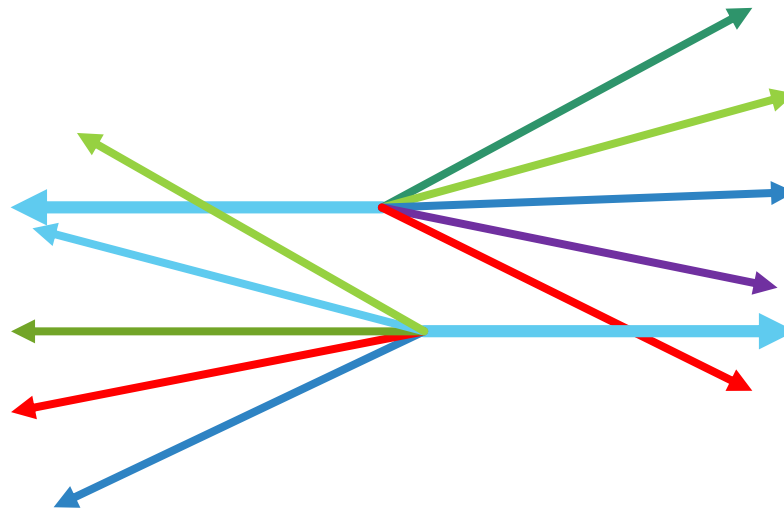
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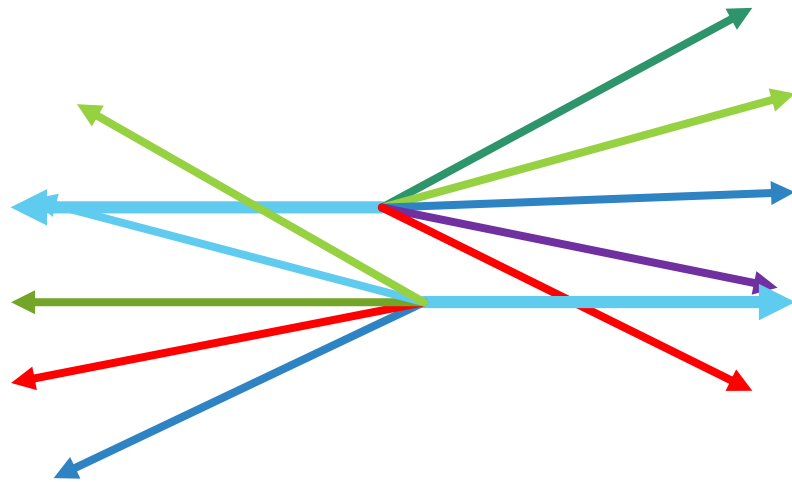
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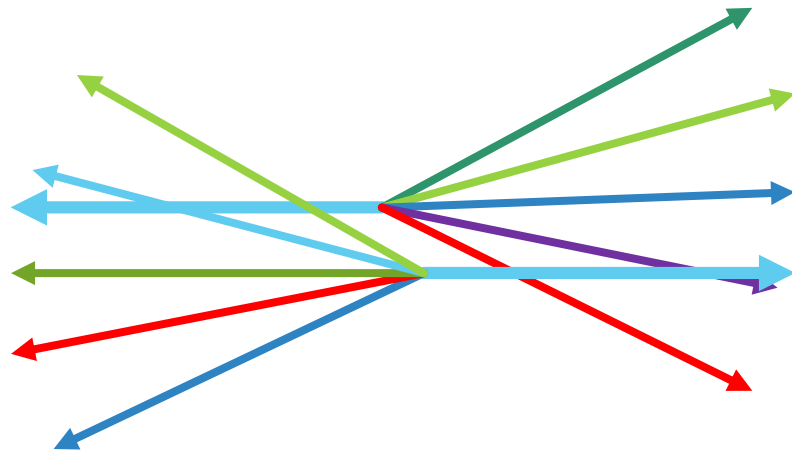
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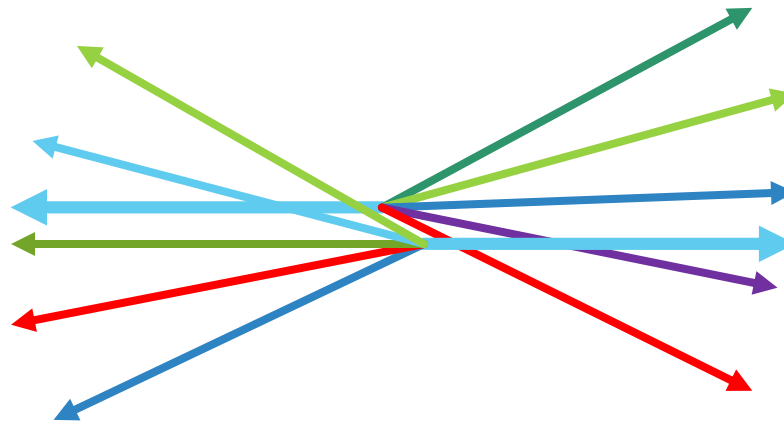
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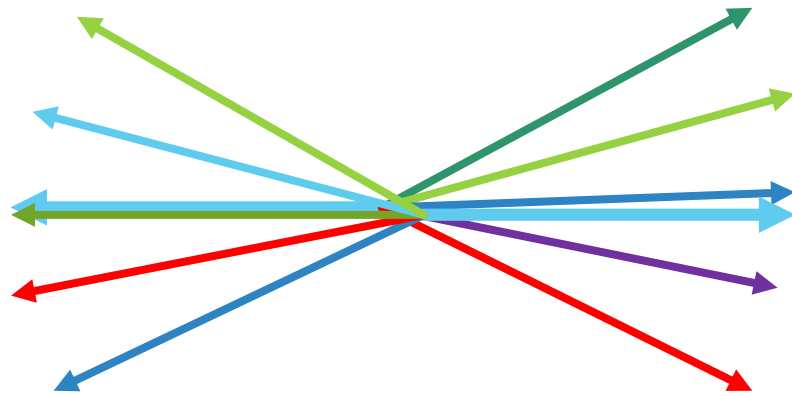
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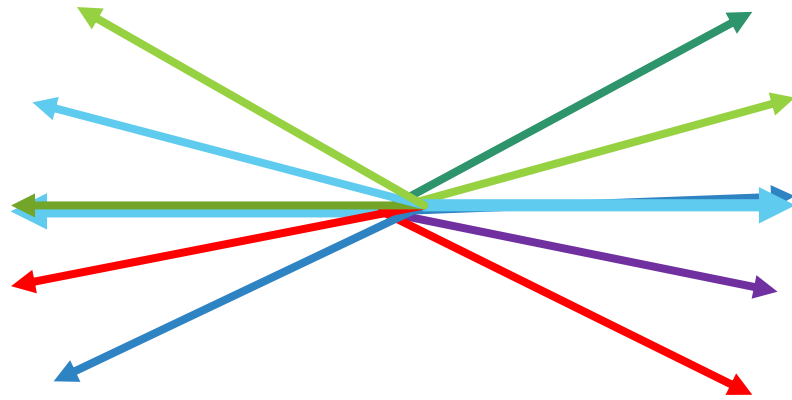
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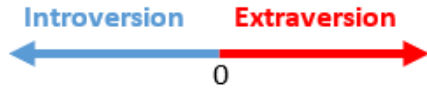


Two Reasons

- ▶ Item response scales are often ambiguous.
- ▶ Opposites may divide a dimension in half
 - ▶ If X and Y divide a dimension in half, they cannot correlate -1 .

Figure 1

Two items that measure opposite halves of a bipolar dimension



$$r = -.467$$

Figure 2

Two items that measure the same half of a bipolar dimension



$$r = +1$$

Factors tend to consist of items that are keyed in the same direction.

The Two-Part Solution

Part 1: Avoid ambiguity at the disagreement end of response scales

How many cats do you own?

Do you like cats at all? Yes or no? If yes, how much?

1 = a little, 2 = moderately, 3 = a lot, 4 = extremely

I like cats a lot more than dogs	I like cats more than dogs	I like cats and dogs equally	I like dogs more than cats	I like dogs a lot more than cats
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The Two-Part Solution

Part 2: Use censored data analysis methods

Dozens of censored data analysis methods exist (e.g., Allignol & Laouche, 2020; Josse et al., 2020). Most only allow censoring on one variable: They can be used for univariate statistics or when there is censoring on either the predictors or the criterion variable - but not both. Therefore, they cannot be used when both variables are censored and cannot be the foundation for exploratory and confirmatory factor analysis.

R Package *lava* allows censoring on all variables.

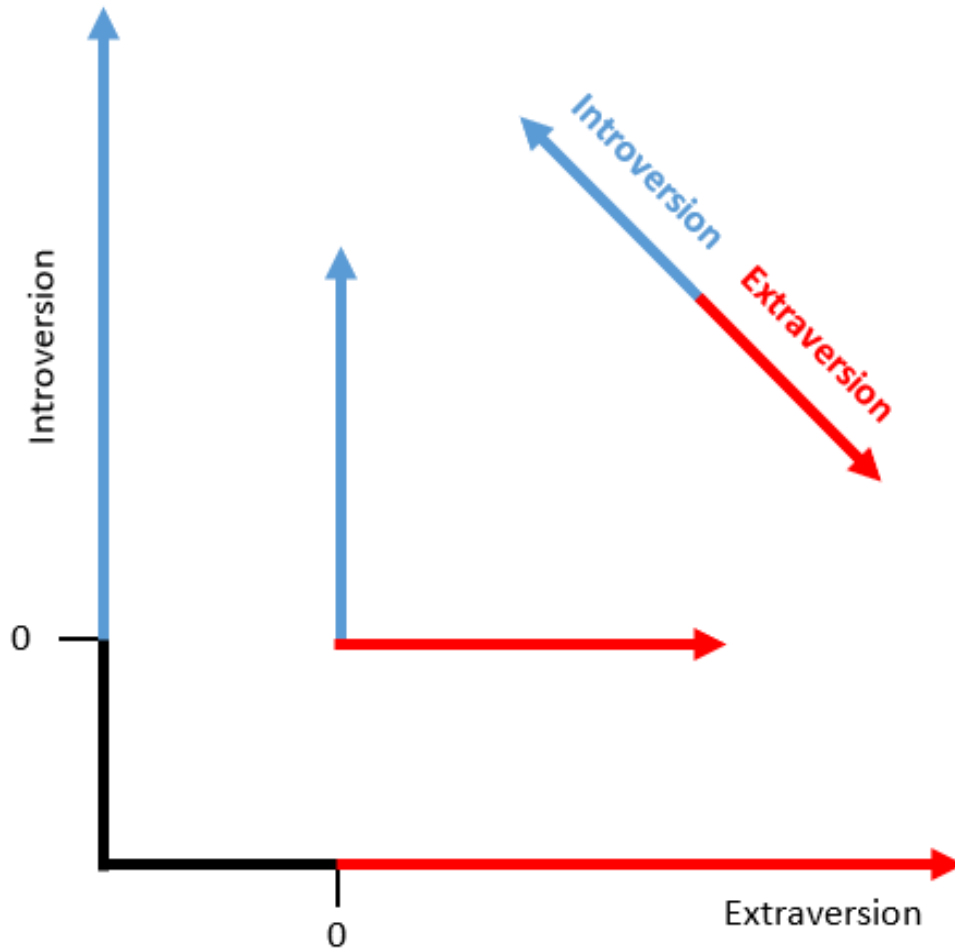
The Details

- ▶ <http://barchard.faculty.unlv.edu/examining-opposites/>



Figure 1

Opposites that each measure a part of a bipolar dimension



Keyed same direction

$$r = +1$$

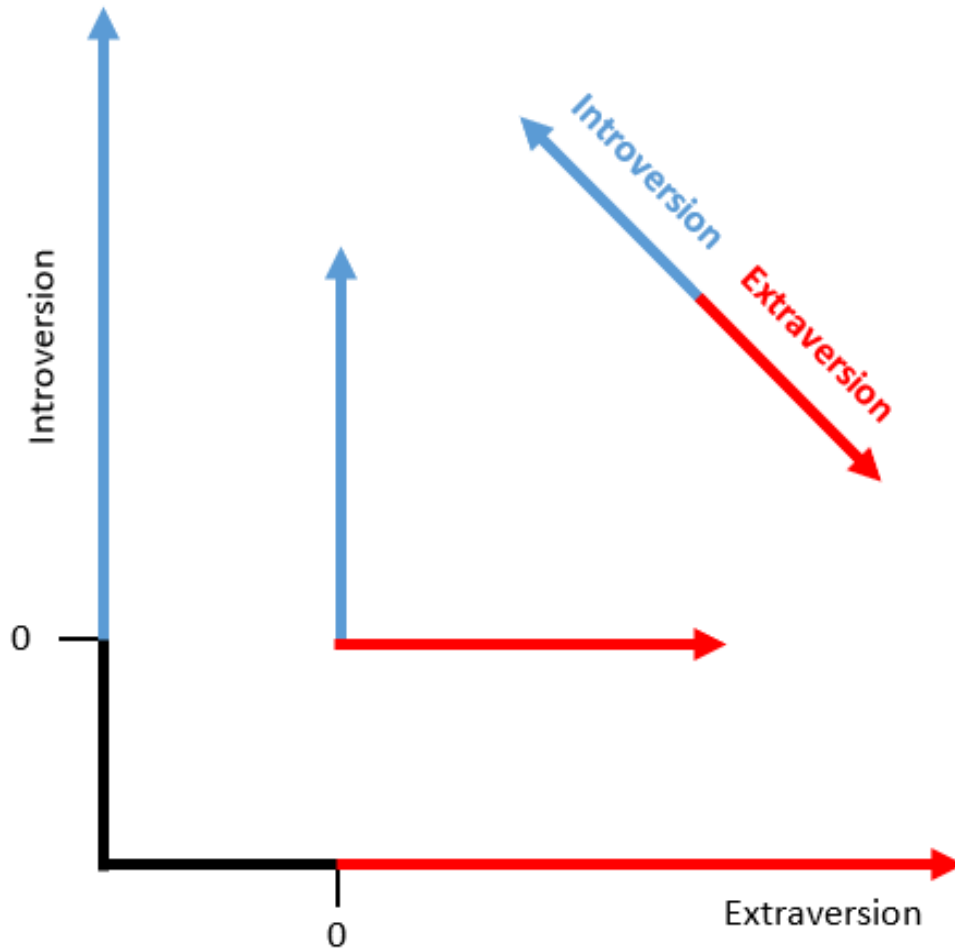
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▶ I like cats

▶ Strongly Agree vs. Agree

▶ Greater agreement = greater liking

▶ Strongly Disagree vs. Disagree

▶ Great disagreement ≠ more of any one particular thing

