

Visualização de Informação

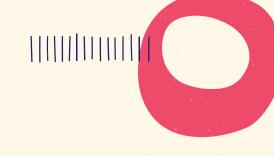
23 de novembro de 2022

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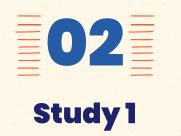
Rainbow Dash: Intuitiveness, Interpretability and Memorability of the Rainbow Color Scheme in Visualization

Isabela M. Gołebiowska e Arzu Çöltekin, 5 de novembro de 2022



















Introduction



Rainbow Color Scheme



















Some problems with the **RC scheme**:

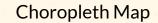
- Problems with **legibility** when visualizing **quantitative data**;
- Problems with pattern detection when visualizing quantitative data;
- Global **ordering** of the hues is **not intuitive**;

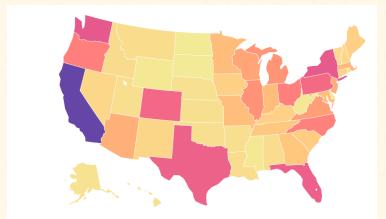
Sequencial Color Scheme



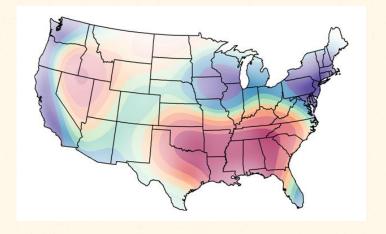
Introduction







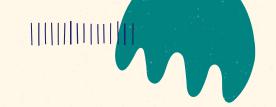
Isarithmic Map





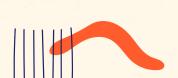


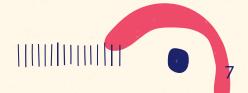


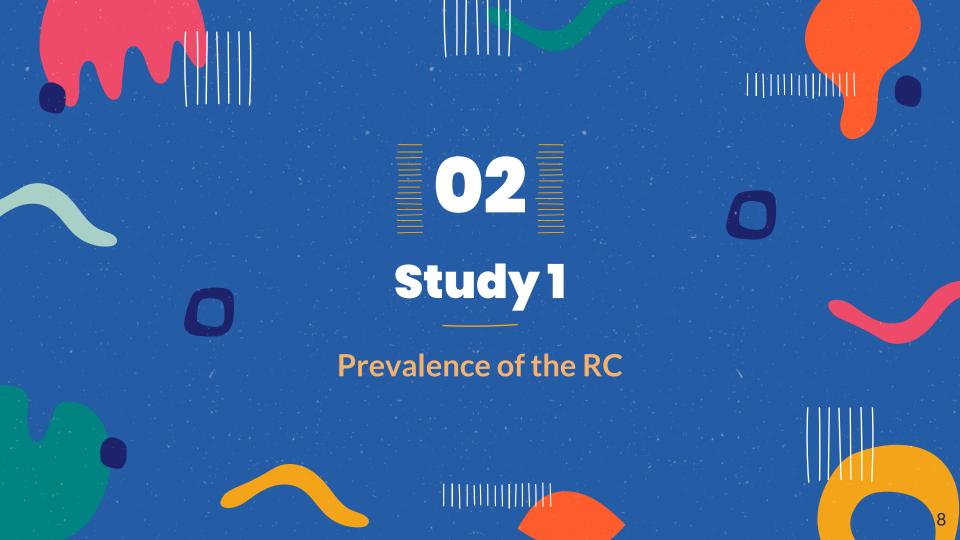


Research Questions:

- Can participants intuitively order the RC?
- Is ordering affected by exposure to a color scheme?
- Do the effects of the RC remain stable across various map readings? And across various, visuospatial recall tasks? And across the two map types?
- Do participants like the RC more than the SC?







Methods: Prevalence Study

TABLE 1
Papers Visualizing Quantitative Data With the RC

Journal	# Papers analyzed	% Using the RC
Icarus	74	55
JGR Planets	76	70
Planetary Science discipline	150	64
ISPRS JPRS	80	46
Remote Sensing	75	50
Remote Sensing discipline	155	48

Results: Prevalence Study

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Results: Prevalence Study

Planetary Science

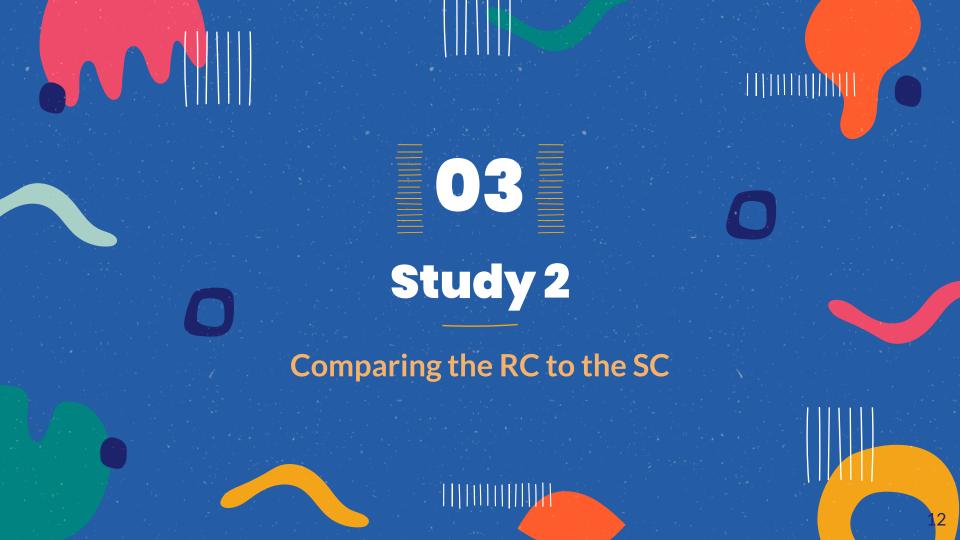
- Atmospheric characteristics (e.g., wind stress)
- Physical indices (e.g., gravity, mass)
- Specific indices (e.g, motion correction, methane abundance)
- etc.

Remote sensing

- Camera-scene distance
- Estimation errors
- Vegetation mass change
- etc.











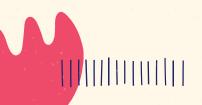
Hypotheses:

- 1. The RC will be overall inferior to the SC in color ordering tasks across the tested conditions;
- 1. In map reading, RC will be superior for extracting specific values and SC for general pattern interpretation;
- 1. The RC will be a competitive alternative in recall tasks;
- 1. Participants will rate the RC more likeable than the SC;
- 1. The expected effects will **persist across the two map types**, irrespective to the task type.



Questions:

- 1. Would participants learn and remember the way the colors were used in the other experimental tasks *more* with the SC or the RC?
- 1. Would participants' perceived task difficulty match the actual task difficulty?





Participants



RC-Choro

n=139

51.1% female

RC-Isa

n=127

49.6% female

SC-Choro

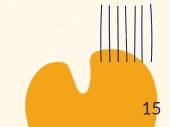
n=132

53% female

SC-Choro

n=136

50.7% female





Apparatus and Materials

"Percentage of high school students working paid jobs"

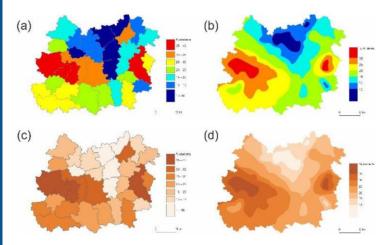


Fig. 2. The stimuli: Rainbow (a: RC-Choro, b: RC-Isa) and sequential schemes (c: SC-Choro, d: SC-Isa) on two map types.

No	Task instruction
T1	Order hues starting from the one that should symbolize min values and finishing with hues symbolizing max values.
T2	Select an example unit representing the max values (map presented without legend).
Т3	Select an example unit representing the min values (map presented without legend).
T4	Which of the marked units (A or B) features the higher value of the presented phenomenon?
T5	What is the value range in the marked unit?
T6	Select an example unit featuring value range 10-15%
T7	Which profile (A/B/C) shows the values correctly along the marked black line?
Т8	Which region (A/B/C) features the lowest average values?
Т9	On the black-and-white map, all units that fall into a particular color category (on the color map you have just studied) are marked in black. Using the legend below, match the color with the marked units.
T10	On the black-and-white map, all units that fall into a particular color category (on the color map you have just studied) are marked in black. Indicate which value range is presented with marked units.
T11	Order hues starting from the one that should symbolize min values and finishing with hues symbolizing max values.

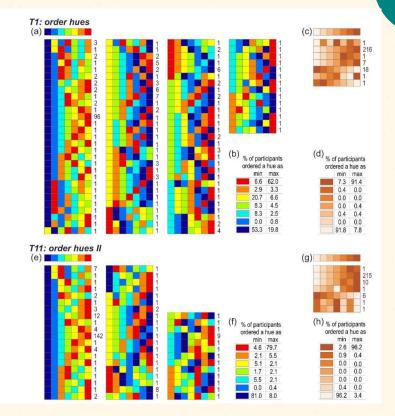








T1	Order hues starting from the one that should symbolize min values and finishing with hues
	symbolizing max values.
T11	Order hues starting from the one that should symbolize min values and finishing with hues symbolizing max values.

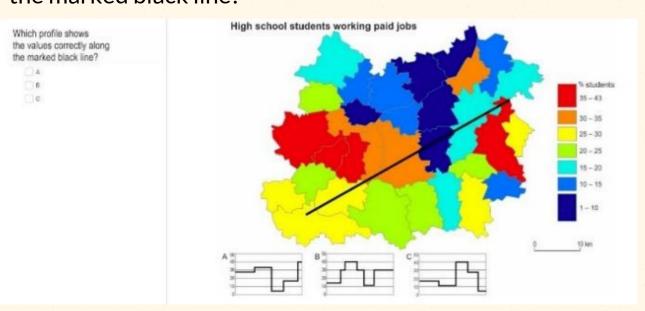








T7. Which profile (A/B/C) shows the values correctly along the marked black line?



On the black-and-white map, all units that fall into a particular color category (on the color map you have just studied) are marked in black. Using the legend below, match the color with the marked units.

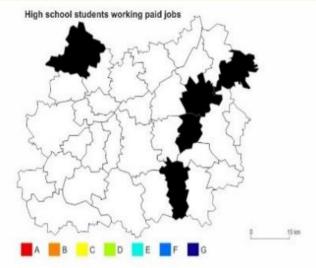
On the black-and-white map, all units that fall into a particular color category (on the color map you have just studied) are marked in black. Indicate which value range is presented with marked units.

On the black-and-white map, all units falls into a particular color category (on the color map you have just studied) are marked in black. Using the legend below, match the color (A-G) with the marked units.

- 0.
- 0
- -

- 0















Color ordering tasks

Sequencial color scheme win

With SC:

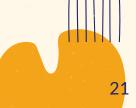
- Intuition or subconsciously learned association
- Dark is more bias

With RC:

- High variation
- Not a specific bias







Results and Discussion

- Color ordering tasks
- Map based ordering tasks

→ SC wins

SC wins

With SC:

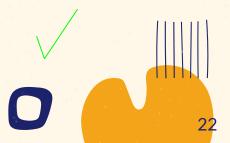
Changes from T1 to T11 are negligible

With RC:

- Observe some learning
- Many still do not associate the RC colors to a specific order.

H1. The RC will be overall inferior to the SC in color ordering tasks across the tested conditions;





Results and Discussion



Color ordering tasks

- SC wins
- Map based ordering tasks

Map reading (T5: retrieve value)

RC can compete with SC

Map reading (T6: locate)

RC wins

Map reading (T7: associate pattern)

SC wins

SC wins

Map reading (T8: rank regions)

RC can compete with SC

H2. In map reading, RC will be superior for extracting specific values and SC for general pattern interpretation;





Results and Discussion



- Color ordering tasks
 - Map based ordering tasks SC wins

SC wins

- Map reading (T5: retrieve value)
 RC can compete with SC
- Map reading (T6: locate)

 RC wins
- Map reading (T7: associate pattern)
- Map reading (T8: rank regions)
 RC can compete with SC
- Recall (T9: recall hues)

 RC wins
- Recall (T10: recall values) SC wins

H3: The RC will be a competitive alternative in recall tasks;



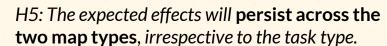














H4: Participants will rate the RC more likeable than the SC;









Conclusions

- RC is still very popular;
- RC harms performance for tasks that require ordering colors;
- the context matters.

