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Visualização de Informação

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

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Introduction

Introduction

Rainbow Color Scheme

Introduction

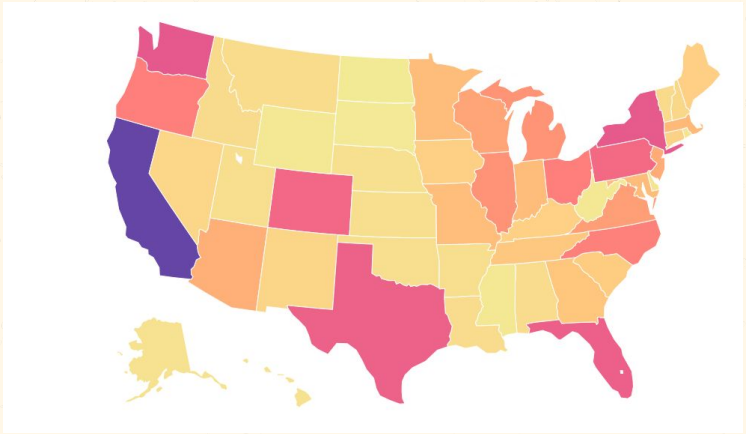
Some problems with the **RC scheme**:

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

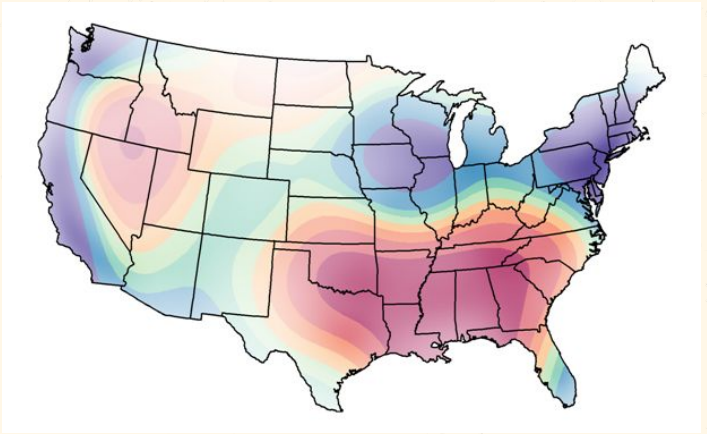
Sequencial Color Scheme

Introduction

Choropleth Map



Isarithmic Map



Introduction

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?

02

Study 1

Prevalence of the RC

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

TABLE 1
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Remote Sensing discipline	**155**	**48**

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.

03

Study 2

Comparing the RC to the SC

Comparing the RC to the SC

Hypotheses:

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

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

3. **The RC** *will be a competitive* **alternative** *in* **recall tasks**;

4. *Participants will rate the* **RC more likeable than the SC**;

5. *The expected effects will* **persist across the two map types**, *irrespective to the task type.*

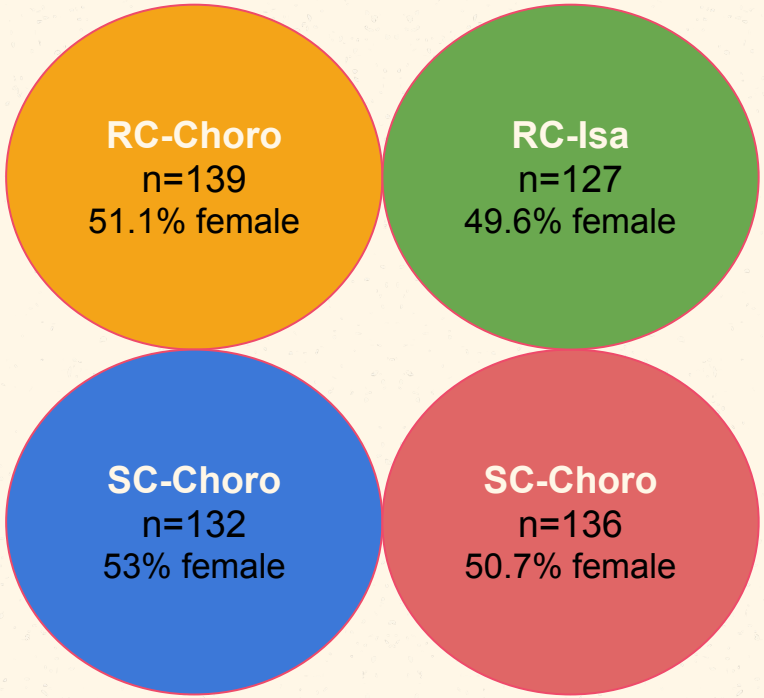
Comparing the RC to the SC

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?

2. Would participants' perceived task difficulty match the actual task difficulty?

Participants



Apparatus and Materials

“ Percentage of high school students working paid jobs”

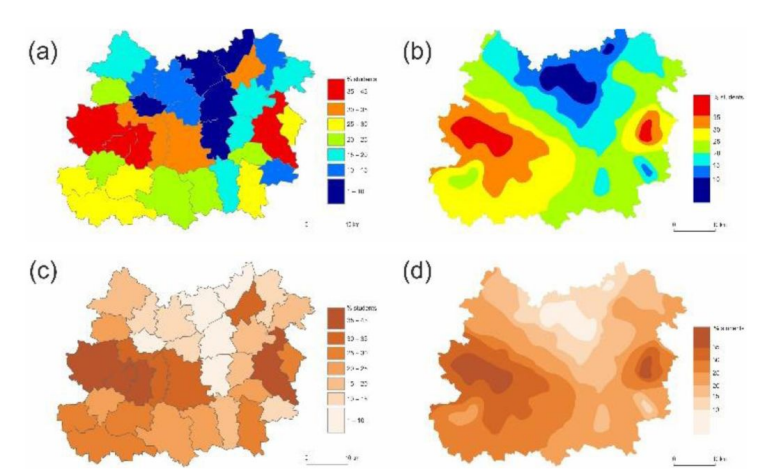


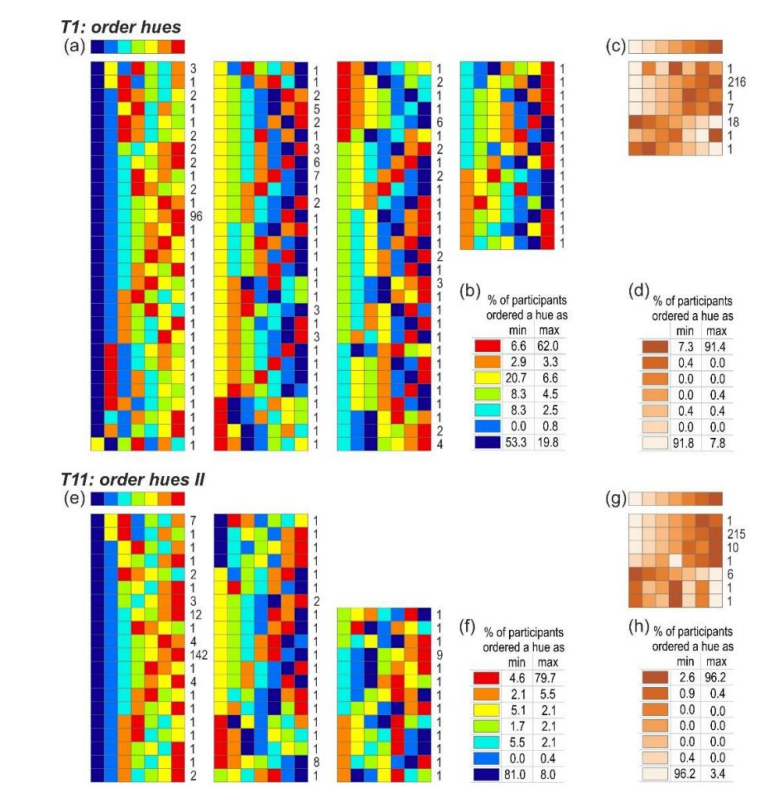
Fig. 2. The stimuli: Rainbow (a: RC-Choro, b: RC-Isa) and sequential schemes (c: SC-Choro, d: SC-Isa) on two map types.

Procedure

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).
T3	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?
T8	Which region (A/B/C) features the lowest average values?
T9	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.

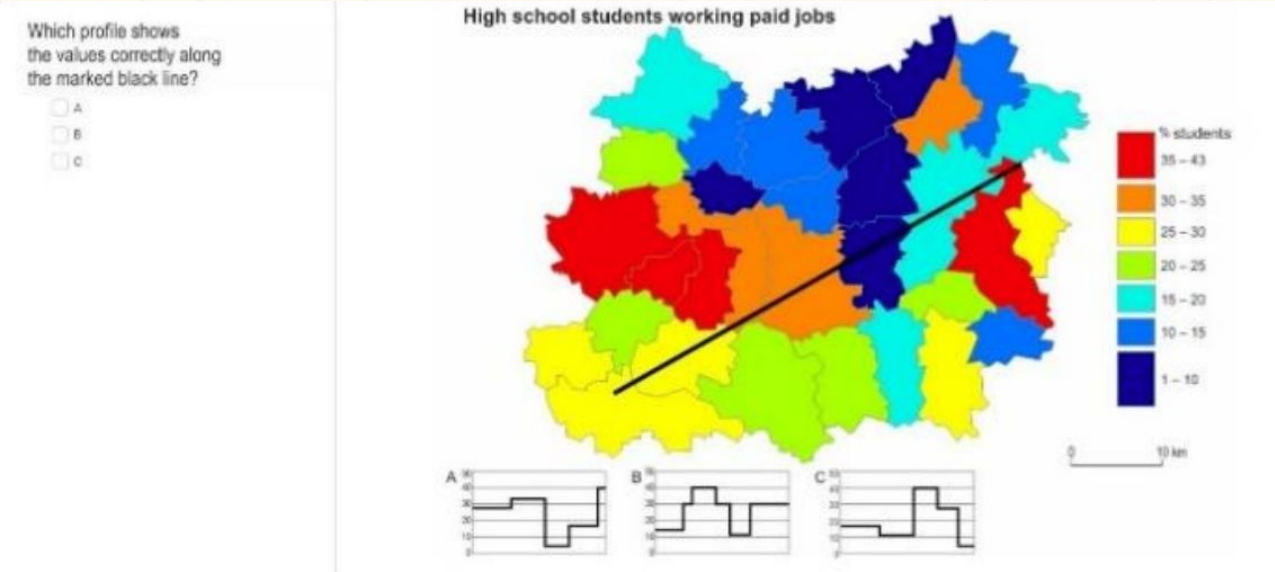
Procedure

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.



Procedure

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

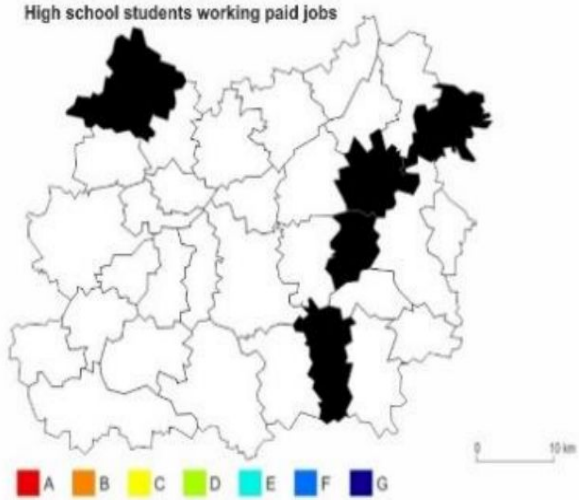


Procedure

T9	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.

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.

- A
- B
- C
- D
- E
- F
- G



Results and Discussion

- 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 → SC wins
- Map based ordering tasks → 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 → SC wins
- Map reading (*T5: retrieve value*) → RC can compete with SC
- Map reading (T6: *locate*) → RC wins
- Map reading (T7: *associate pattern*) → 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 → SC wins
- Map based ordering tasks → SC wins
- Map reading (*T5: retrieve value*) → RC can compete with SC
- Map reading (T6: *locate*) → RC wins
- Map reading (T7: *associate pattern*) → SC wins
- 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**;

Results and Discussion

H5: The expected effects will **persist across the two map types**, *irrespective to the task type.*

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

04

Conclusions

Conclusions

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