

# GESTALT PRINCIPLES IN DATA VISUALIZATION

2022 UNDERGRADUATE RESEARCH & ENGAGEMENT SYMPOSIUM

AUTHORS: NATALIE TSE, DINKO BAČIĆ

AUGUST 2021-APRIL 2022

LOYOLA UNIVERSITY CHICAGO



QUINLAN SCHOOL of BUSINESS

## WHAT ARE GESTALT LAWS?

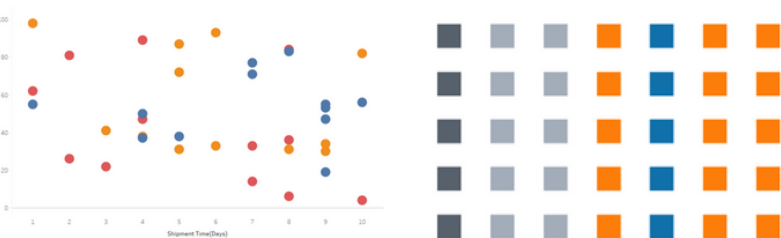
GESTALT LAWS OR PRINCIPLES ARE KNOWN TO BE A PSYCHOLOGICAL SCHOOL OF THOUGHT ON HOW WE ("HUMANS") PERCEIVE OBJECTS. AS WE OBSERVE THE WORLD AROUND US WE ARE CONSTANTLY STIMULATED WITH COMPLEX PATTERNS AND DESIGNS, GESTALT PRINCIPLES AIM TO CATEGORIZE HOW WE GROUP WHAT WE SEE IN VISUALIZATION. THERE ARE 8 GROUPING PRINCIPLES OF GESTALT: CLOSURE, COMMON FATE, CONTINUATION, SIMILARITY, FIGURE-GROUND, PROXIMITY, SYMMETRY, AND SIMILARITY

## OBJECTIVE

EXPLORE THE IMPACT OF GESTALT PRINCIPLES IN VISUALIZATION USING STIMULI TO RECORD THE PHYSIOLOGICAL RESPONSE AS INDICATORS OF THE USERS' COGNITIVE PROCESS.

## SIMILARITY

OBJECTS THAT ARE SIMILAR ARE PERCEIVED TO BE RELATED TO ELEMENTS THAT ARE NOT.



- **RQ1a:** Is there a difference in how we achieve similarity (shape, color, or label) impact our viewing behavior and performance ?
- **Task:** How many groups of related items do you see?
- **Collected data:** Eye-tracking data (fixation count, duration, fixation sequencing/direction, gaze heat map, AOIs)

## PROXIMITY

OBJECTS THAT ARE SPACED CLOSER TOGETHER CAN BE PERCEIVED AS MORE RELATED THAN THINGS THAT ARE SPACED FURTHER APART

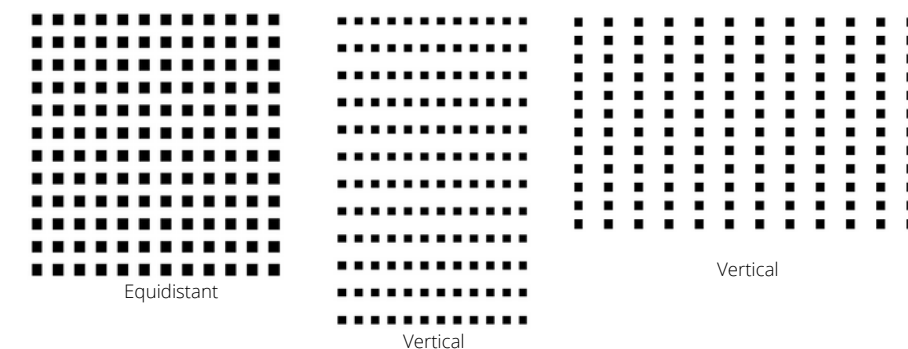
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Accessories	8.0%	9.0%	25.0%	6.0%	20.0%	8.0%	5.0%	5.0%	6.0%	11.0%	13.0%	20.0%
Appliances	21.0%	27.0%	22.0%	10.0%	28.0%	8.0%	12.0%	19.0%	11.0%	8.0%	14.0%	5.0%
Art	9.0%	15.0%	17.0%	16.0%	12.0%	15.0%	22.0%	10.0%	21.0%	18.0%	25.0%	26.0%
Binders	5.0%	7.0%	13.0%	5.0%	27.0%	8.0%	14.0%	26.0%	27.0%	13.0%	8.0%	11.0%
Bookcases	14.0%	19.0%	23.0%	22.0%	5.0%	5.0%	22.0%	21.0%	23.0%	12.0%	9.0%	9.0%
Chairs	25.0%	26.0%	14.0%	13.0%	23.0%	28.0%	10.0%	13.0%	16.0%	9.0%	22.0%	27.0%
Furnishings	22.0%	13.0%	13.0%	20.0%	9.0%	23.0%	9.0%	10.0%	6.0%	14.0%	27.0%	7.0%
Machines	28.0%	26.0%	18.0%	10.0%	6.0%	25.0%	7.0%	20.0%	23.0%	28.0%	20.0%	24.0%
Phones	8.0%	27.0%	18.0%	15.0%	16.0%	22.0%	14.0%	9.0%	22.0%	9.0%	27.0%	28.0%
Storage	19.0%	13.0%	15.0%	28.0%	16.0%	12.0%	25.0%	6.0%	28.0%	17.0%	16.0%	12.0%
Supplies	12.0%	25.0%	20.0%	23.0%	13.0%	15.0%	17.0%	18.0%	13.0%	5.0%	9.0%	
Tables	19.0%	13.0%	21.0%	10.0%	16.0%	15.0%	17.0%	16.0%	24.0%	7.0%	11.0%	

Horizontal Equidistant

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Accessories	8.0%	9.0%	25.0%	6.0%	20.0%	8.0%	5.0%	5.0%	6.0%	11.0%	13.0%	20.0%
Appliances	21.0%	27.0%	22.0%	10.0%	28.0%	8.0%	12.0%	19.0%	11.0%	8.0%	14.0%	5.0%
Art	9.0%	15.0%	17.0%	16.0%	12.0%	15.0%	22.0%	10.0%	21.0%	18.0%	25.0%	26.0%
Binders	5.0%	7.0%	13.0%	5.0%	27.0%	8.0%	14.0%	26.0%	27.0%	13.0%	8.0%	11.0%
Bookcases	14.0%	19.0%	23.0%	22.0%	5.0%	5.0%	22.0%	21.0%	23.0%	12.0%	9.0%	9.0%
Chairs	25.0%	26.0%	14.0%	13.0%	23.0%	28.0%	10.0%	13.0%	16.0%	9.0%	22.0%	27.0%
Furnishings	22.0%	13.0%	13.0%	20.0%	9.0%	23.0%	9.0%	10.0%	6.0%	14.0%	27.0%	7.0%
Machines	28.0%	26.0%	18.0%	10.0%	6.0%	25.0%	7.0%	20.0%	23.0%	28.0%	20.0%	24.0%
Phones	8.0%	27.0%	18.0%	15.0%	16.0%	22.0%	14.0%	9.0%	22.0%	9.0%	27.0%	28.0%
Storage	19.0%	13.0%	15.0%	28.0%	16.0%	12.0%	25.0%	6.0%	28.0%	17.0%	16.0%	12.0%
Supplies	12.0%	25.0%	20.0%	23.0%	13.0%	15.0%	17.0%	18.0%	13.0%	5.0%	9.0%	
Tables	19.0%	13.0%	21.0%	10.0%	16.0%	15.0%	17.0%	16.0%	24.0%	7.0%	11.0%	

Vertical

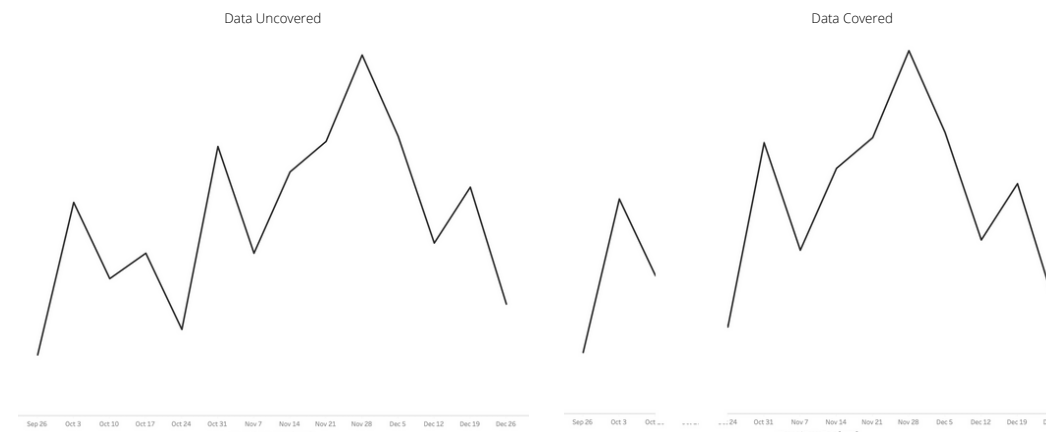
- **RQ2a:** Does the principle of proximity influence our viewing behavior when using *various table designs* without a specific task?
- **Task:** Observe each stimuli for 6 seconds
- **Collected data:** Eye-tracking data (fixation count, duration, fixation sequencing/direction, gaze heat map, AOIs)



- **RQ3a:** Does the principle of proximity influence our viewing behavior (basic shapes) ?
- **Task:** Observe each stimuli for 6 seconds
- **Collected data:** Eye-tracking data (fixation count, duration, fixation sequencing/direction, gaze heat map, AOIs)

## CLOSURE

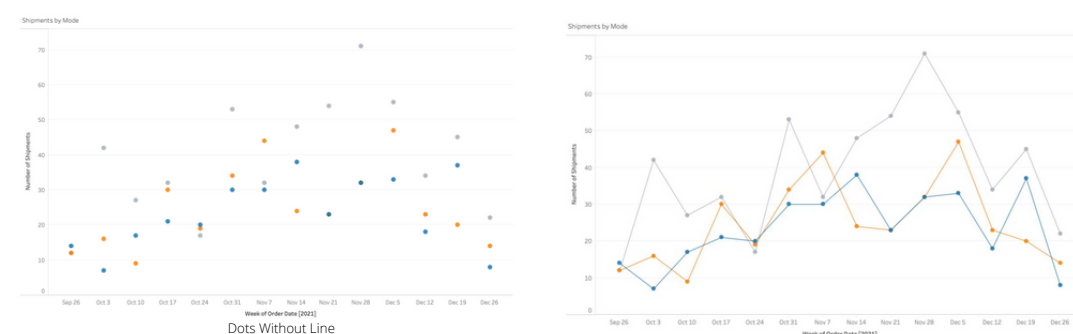
COMPLEX PATTERNS OR ELEMENTS WILL BE REARRANGED INTO A SINGLE AND RECOGNIZABLE PATTERNS



- **RQ4a:** Does the principle of closure influence our viewing behavior and performance when reading line charts with missing data (without a specific tasks)?
- **Task:** Look at this trend line for 6 seconds
- **Collected data:** Time, Eye-tracking data (fixation count, duration, fixation sequencing/direction, gaze heat map, AOIs)

## CONNECTEDNESS

OBJECTS THAT ARE ARRANGED IN A LINE WILL BE PERCEIVED AS MORE RELATED



- **RQ5a:** Does the principle of connectedness influence our viewing behavior and performance in a grouping task?
- **Task:** How many groups of related dots do you see?
- **Collected data:** Accuracy, Time, Eye-tracking data (fixation count, duration, direction, gaze heat map, AOIs)

## METHODOLOGY

SUBJECTS WILL OBSERVE STIMULI REPRESENTING ALL GESTALT PRINCIPLES AND RESPOND TO A GIVEN TASK. THE FOLLOWING STEPS WILL BE AS FOLLOWED:

- 1.) WELCOME AND CONSENT FORM COLLECTION
- 2.) CALIBRATION OF EQUIPMENT
- 3.) DEMOGRAPHIC SURVEY
- 4.) EX1- GESTALT LAW OF PROXIMITY
- 5.) EX2- GESTALT LAW OF CLOSURE
- 6.) EX3 - GESTALT LAW OF CONTINUITY
- 7.) EX4- GESTALT LAW OF SIMILARITY
- 8.) GESTALT LAW OF CONNECTEDNESS
- 9.) END

## NEXT STEPS

- LITERATURE REVIEW
- IRB APPROVAL
- STIMULI CREATION
- DATA COLLECTION
- ANALYSIS OF RESULTS
- PUBLICATION & PEER REVIEWED