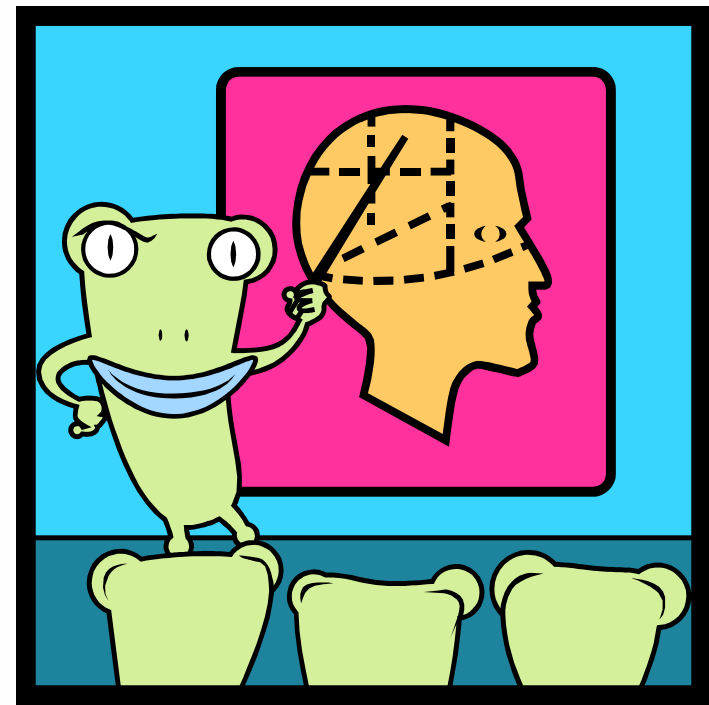


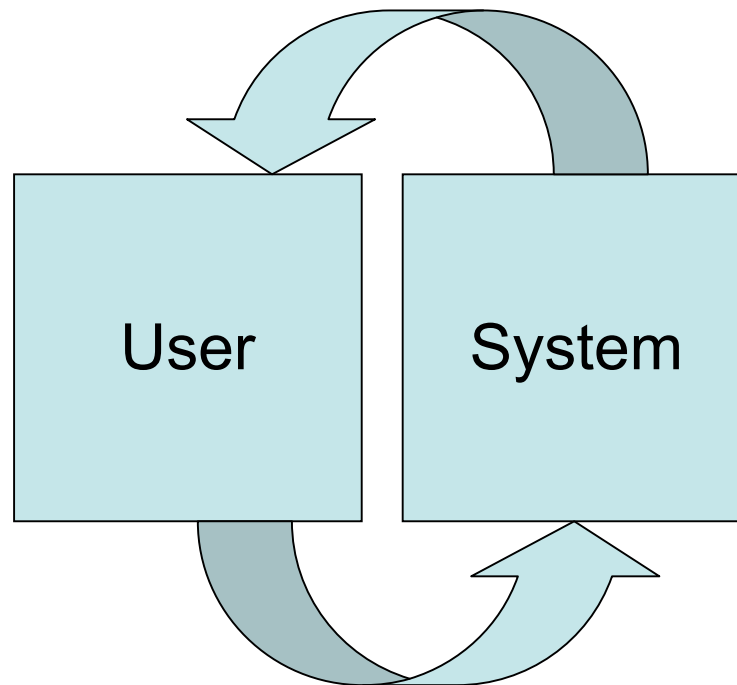
Overview of Human Cognition

and its Impact on User Interface Design (Part 2)



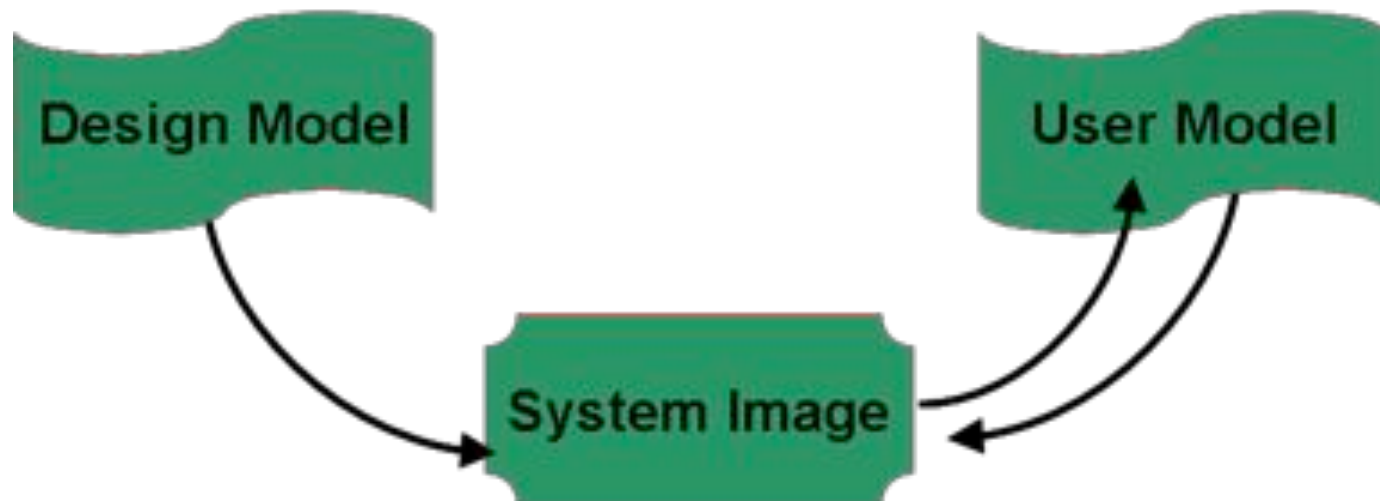
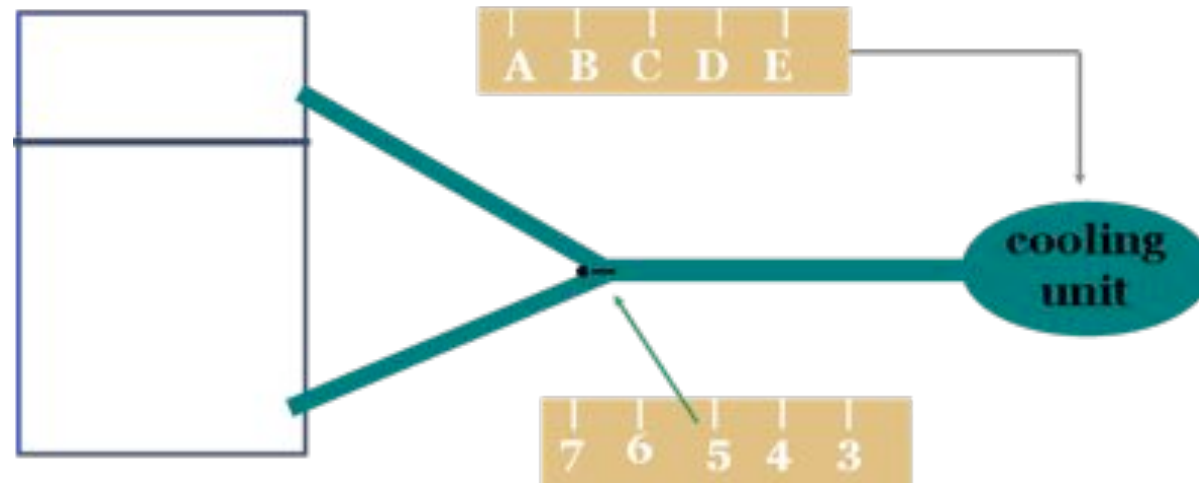
Brief Recap

- Gulf of Evaluation
 - What is the state of the system?
- Gulf of Execution
 - What specific inputs needed to achieve goals?



Brief Recap

- Mental Models

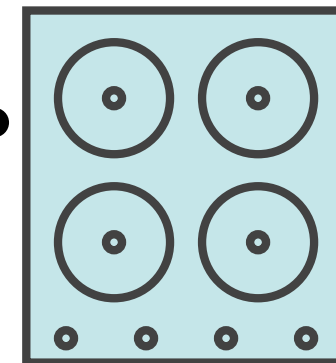


Brief Recap

- Affordances

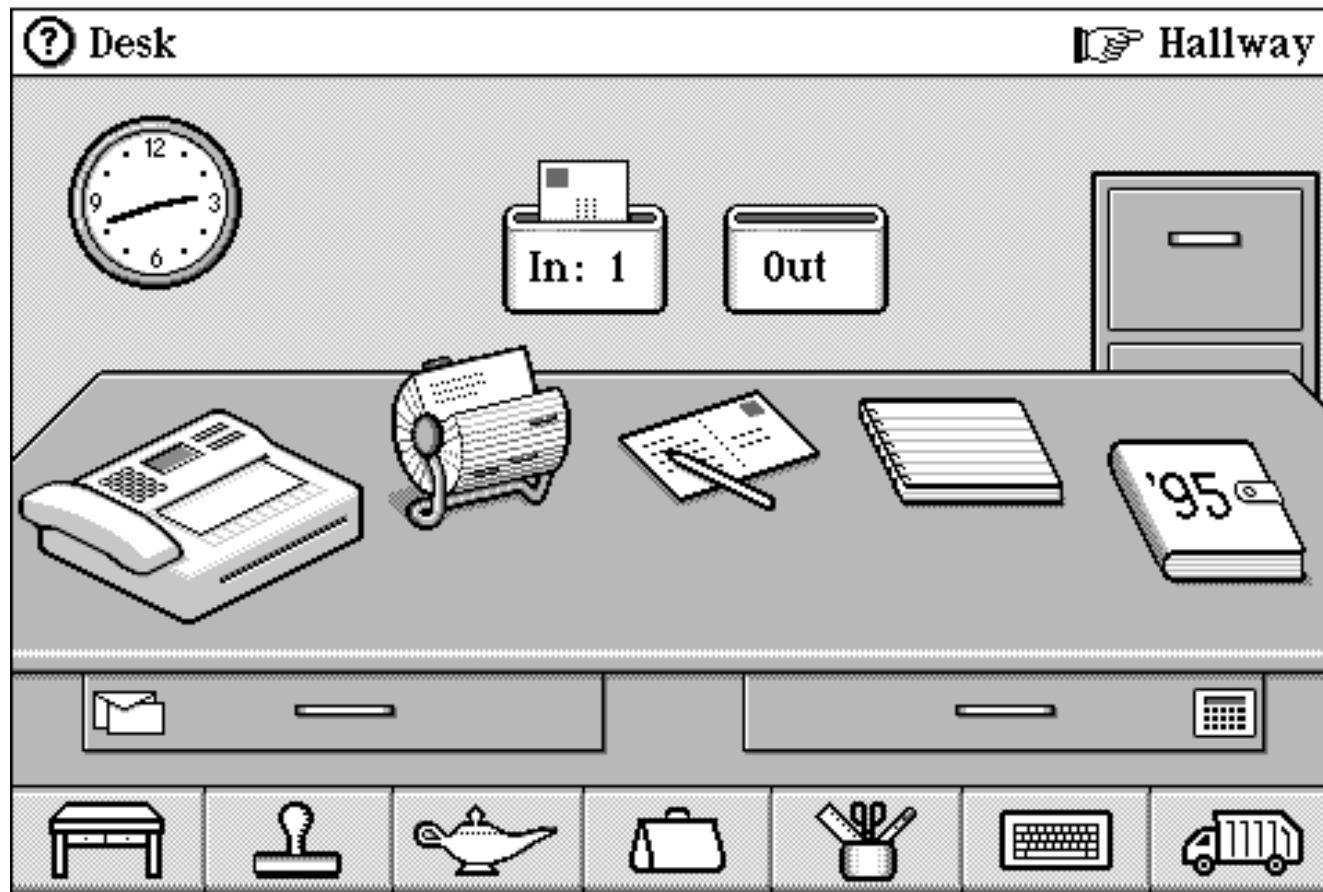


- Feedback times
 - 100 msec, 1 sec, 10 sec
- Mappings



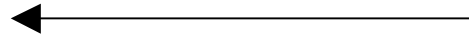
Metaphors Aren't Always Effective

- Magic Cap
 - Somewhat unwieldy, not good use of screen real estate



Outline

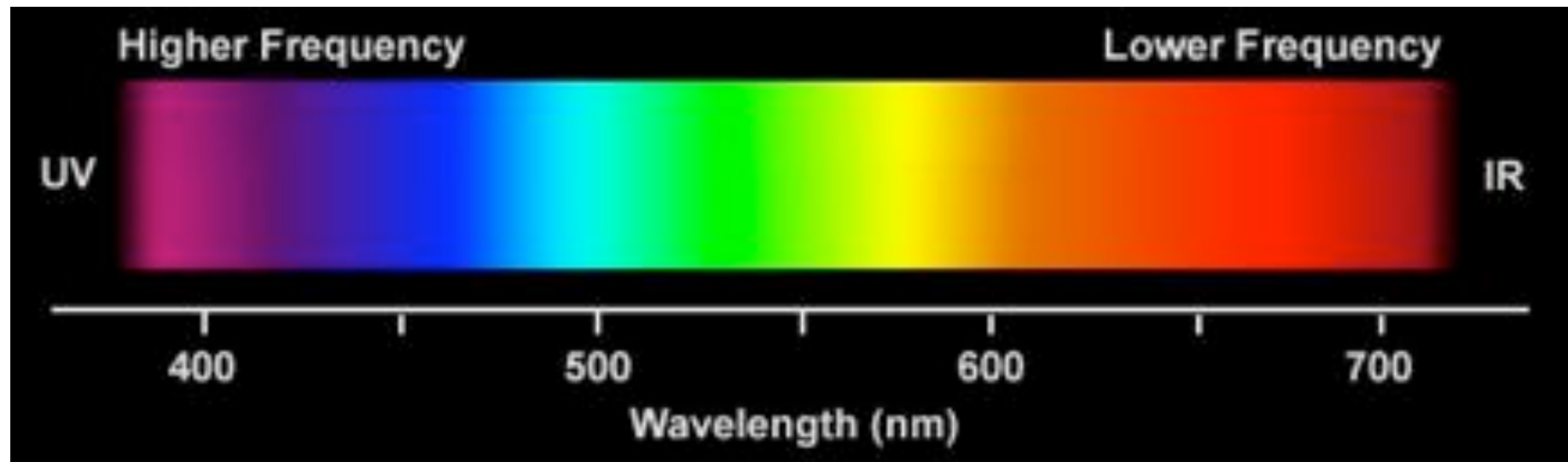
- Color
- Grouping
- Layout



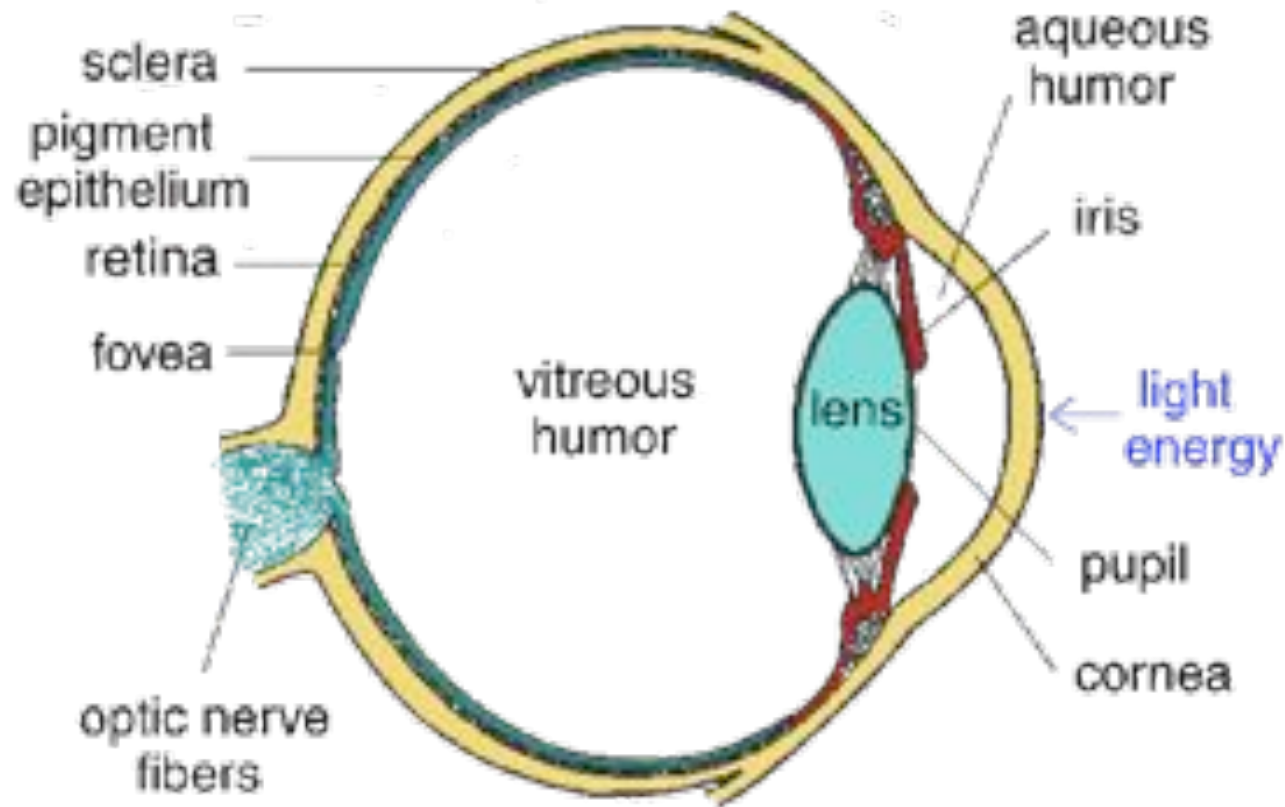
Why Study Color?

- 1) Color can be a powerful tool to *improve* user interfaces by communicating key information
- 2) Inappropriate use of color can severely *reduce the performance* of systems we build

Visible Spectrum



Human Visual System



- Light passes through lens
- Focused on retina

Retina

- Retina covered with light-sensitive receptors?
- Rods
 - primarily for night vision & perceiving movement
 - sense intensity or shades of gray
 - can't discriminate between colors
 - ~75,000,000 – 150,000,000 rods
- Cones
 - used to sense color
 - ~7,000,000 cones

Distribution of Cones and Rods

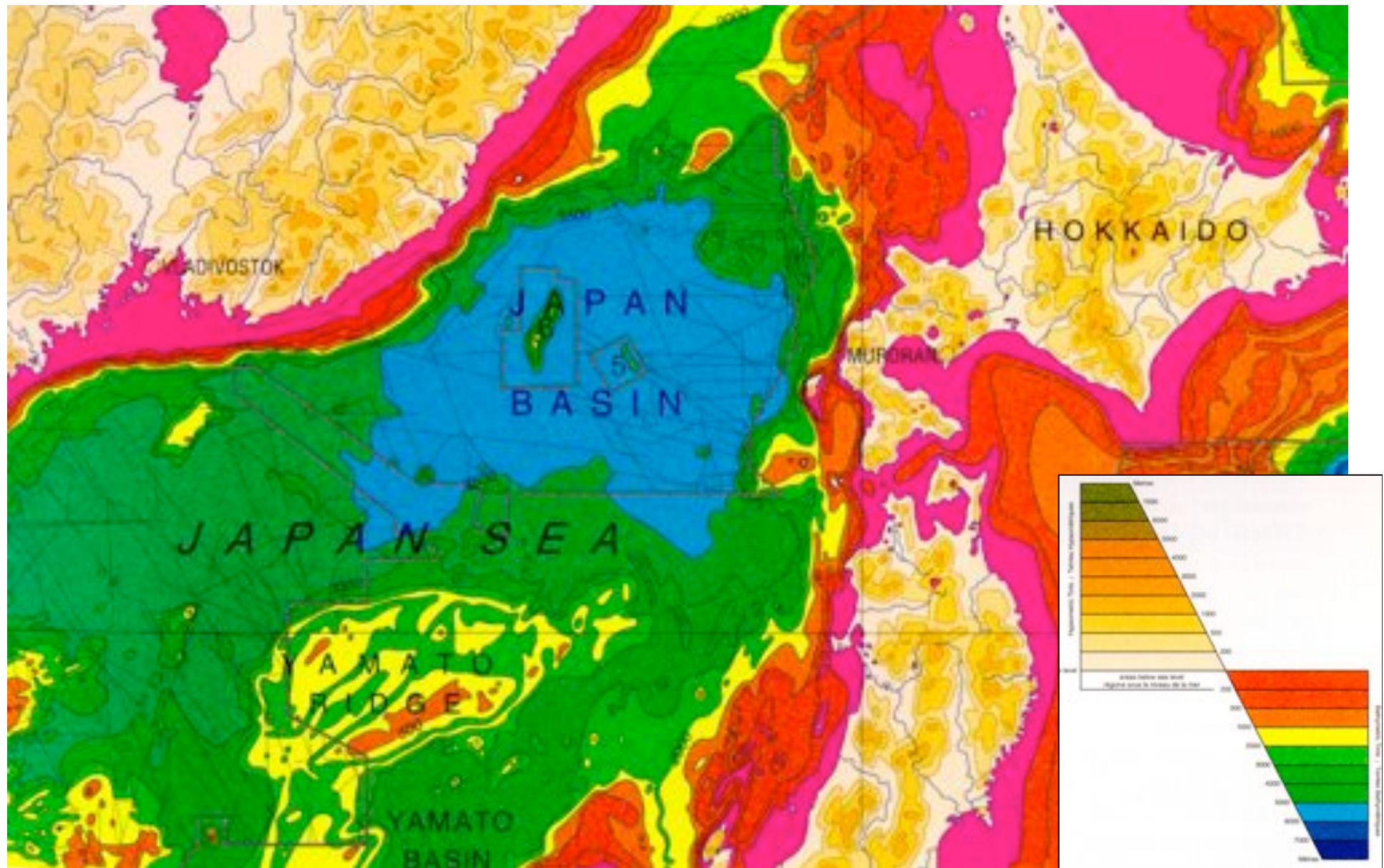
- Center of retina has most of the cones ➡
 - allows for high acuity of objects focused at center
 - Ex. if looking here, can't read text on bottom easily
- Edge of retina is dominated by rods ➡
 - allows detecting motion of threats in periphery

Some text used as an example

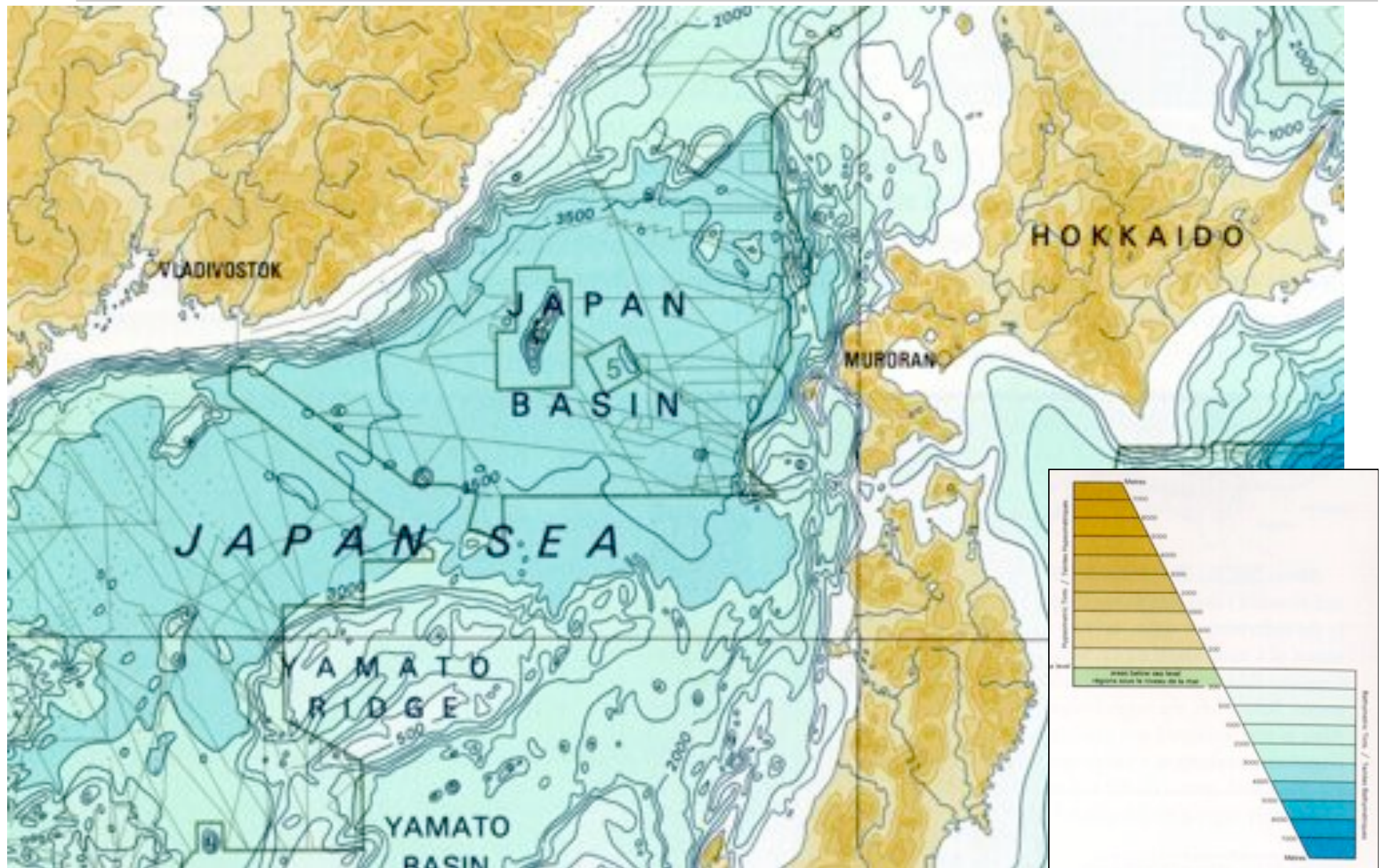
Design Implications

- Design implication #1
 - LOTS more rods than cones
 - Humans roughly 10x more sensitive to intensity than hue
 - Hue is roughly color
 - Saturation is purity of color (grey)
 - Value is intensity (roughly)
 - Easier for people to see fine differences based on intensity differences than hue

Map #1

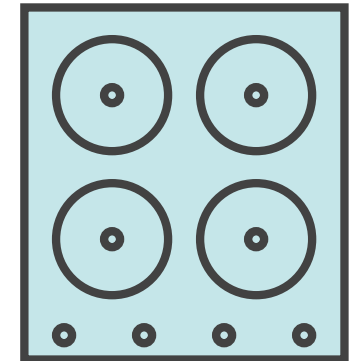


Map #2



Maps Discussion

- Example of intensity being more useful than hue for fine differences
 - If you want to vary color, vary the intensity
 - Ways of measuring intensity include luminance (HSL), value (HSV), brightness (HSB) (though not equivalent)
- Example of mapping (good and bad)
 - 1st map – ordered by hue (bad)
 - 2nd map – ordered by intensity (good)
- Example of minimalist aesthetics
 - 1st map is just plain ugly 😊



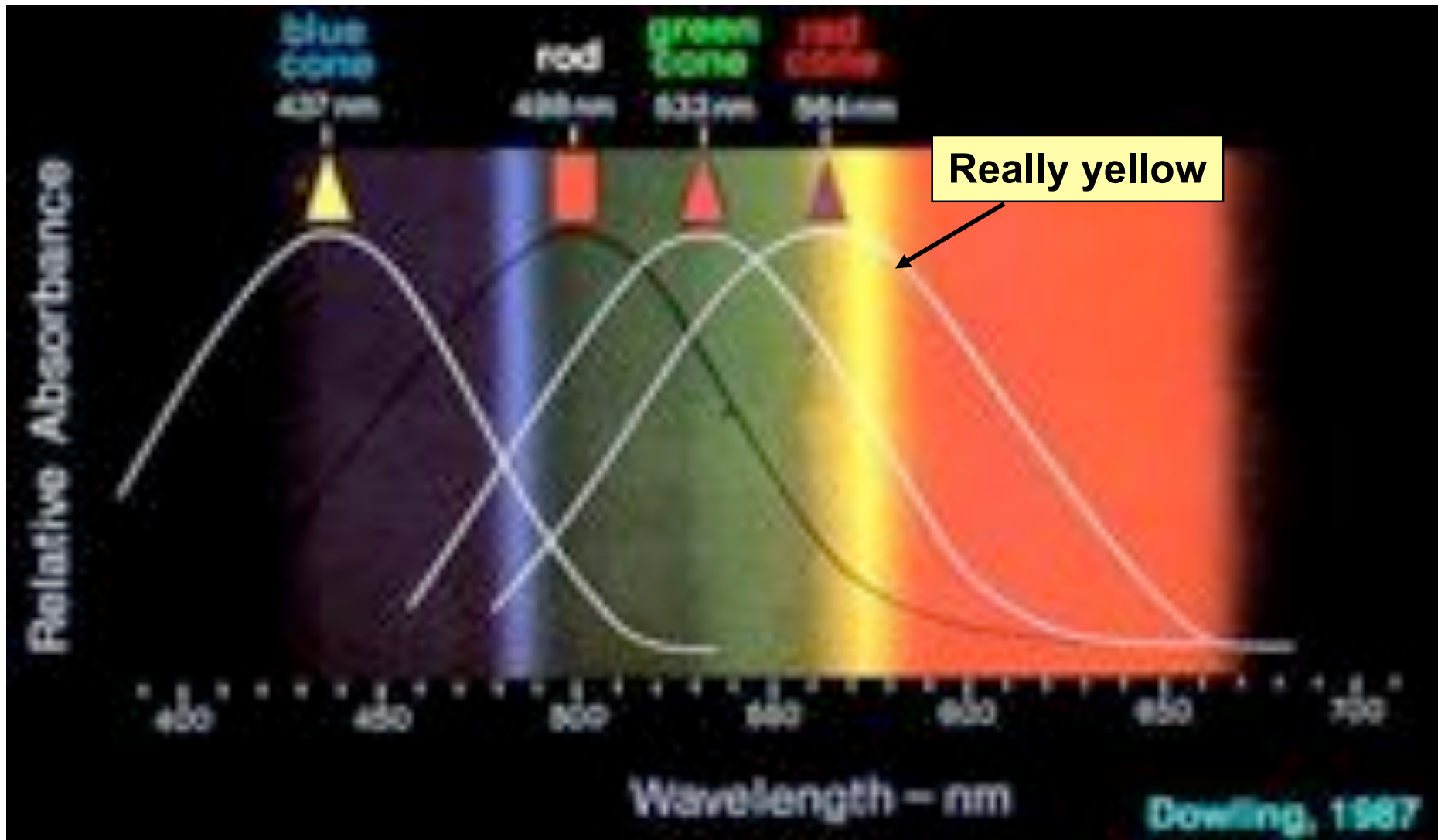
How to Get Color Right

- Design Tip #1
 - Design in grayscale first
 - Forces you to focus on intensity
 - Can use a photocopier to help here
 - Keep luminance (intensity) values from grayscale when moving to color
 - Helps ensure everything remains clear

Color Perception via Cones

- “Photopigments” used to sense color
- 3 types: blue, green, “red” (really yellow)
 - each sensitive to different band of spectrum
 - ratio of neural activity of the 3 → color
 - other colors are perceived by combining stimulation

Color Sensitivity



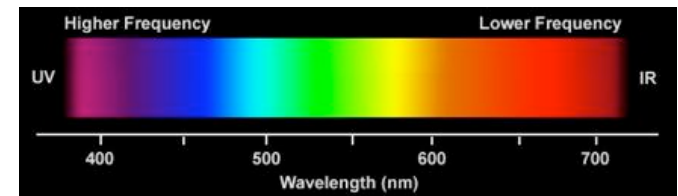
from <http://insight.med.utah.edu/Webvision/index.html>

Distribution of Photopigments

- Photopigments not distributed evenly
 - Mainly reds (64%) & few blues (4%)
 - Less sensitive to short wavelengths (blue)
- Few blue cones in retina center (high acuity) (?)
- As we age our lens yellows & absorbs shorter wavelengths (?)

Focus

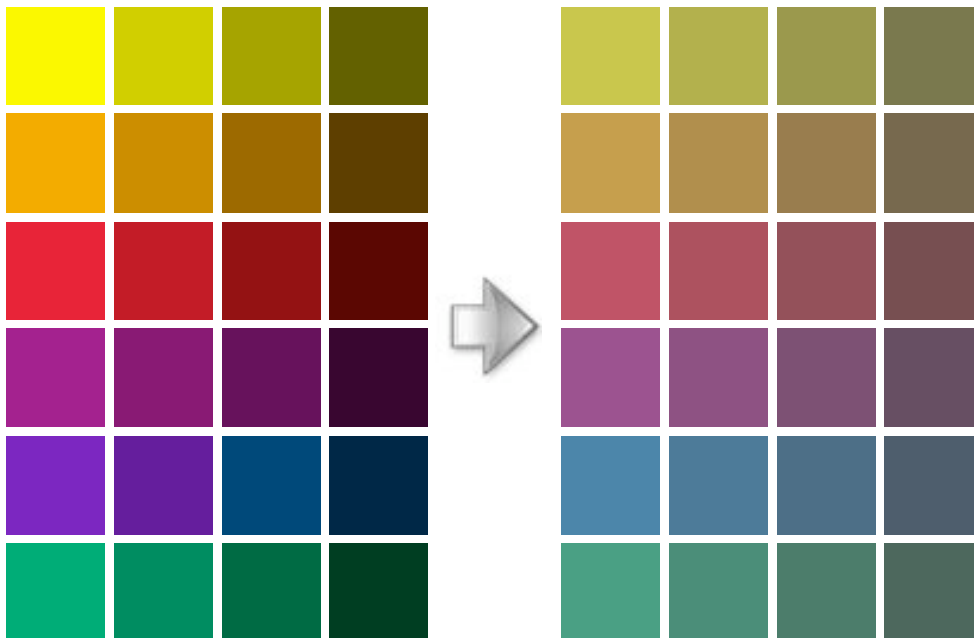
- Different wavelengths of light focused at different distances behind eye's lens
 - If your UI has lots of colors (?)
 - Need for constant refocusing (?)



- Design Implication #4
 - Pure (saturated) colors require more focusing than less pure (desaturated, pastels)
 - Don't use saturated colors in UIs unless you really need something to stand out (stop sign)

Color Guidelines

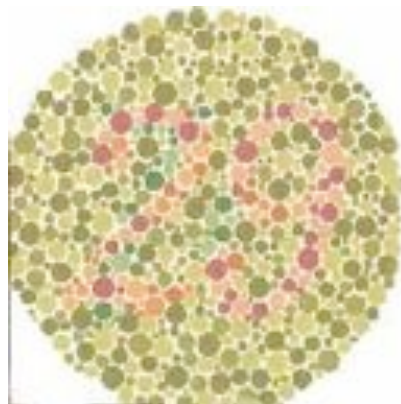
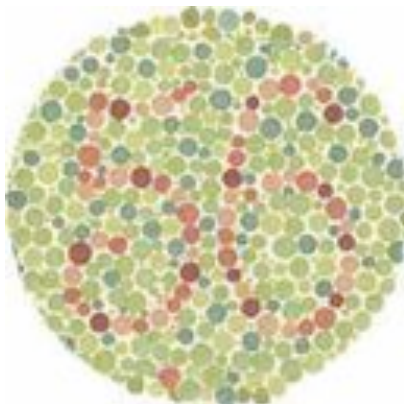
- Avoid simultaneous display of highly saturated, spectrally extreme colors
 - e.g., minimize cyans/blues at the same time as reds, why?
 - refocusing!
 - desaturated combinations are better → pastels



Color Deficiency

(AKA “color blindness”)

- Trouble discriminating colors
 - besets about 9% of males, 0.5% of females
- Two main types
 - *different photopigment response* most common
 - reduces capability to discern small color diffs
 - *red-green deficiency* is best known
 - lack of either green or red photopigment →
can't discriminate colors dependent on R & G



Color Deficiency Example

Add/Update Shipping Information

We found an error while verifying your shipping address.

We've marked the problem in red for you.

Update the address book of

Required information is marked in **GREEN CAPS**.

HELP for questions about shipping.

NICKNAME:

Please assign a "nickname" for the person you're shipping to.
You may change or delete this information at any time.

FIRST NAME:

MIDDLE INITIAL:

LAST NAME:

ADDRESS:

Design Implications

- Design Implication #5
 - Don't rely solely on hue b/c of potential color deficiencies
 - Use mixtures of colors (red / green issues)
 - Also good to have contrast in intensity (+ redundant cues)



Color Summary

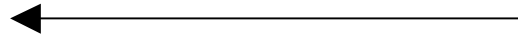
- Design implication #1
 - Humans more sensitive to intensity than hue
- Design Implication #2
 - Don't rely on blue for text or small objects
- Design Implication #3
 - As we age our lens yellows, sensitivity to blue reduced
 - Need more intensity for older users
- Design Implication #4
 - Minimize use of saturated colors, causes refocusing
- Design Implication #5
 - Use mix of colors, contrast in intensity, & redundant cues

The image features a large, glowing yellow lightbulb in the center, set against a teal background. A second, smaller lightbulb is visible in the lower-left foreground, but it is out of focus. The text "1 minute break" is centered over the main lightbulb.

1 minute break

Outline

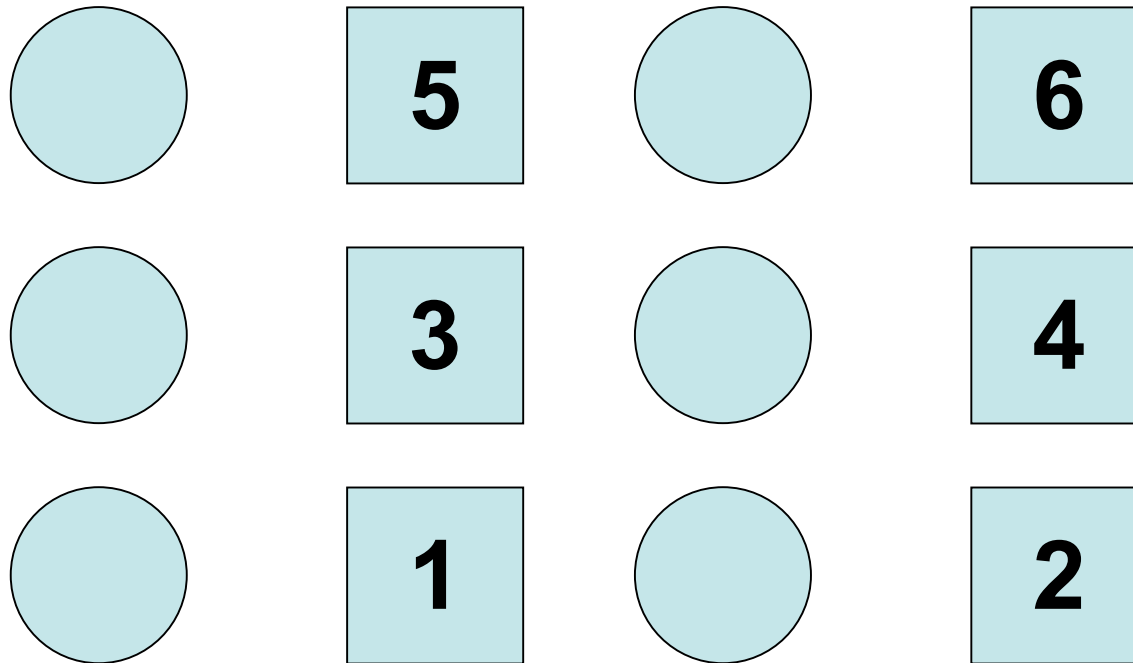
- Color
- Grouping
- Layout



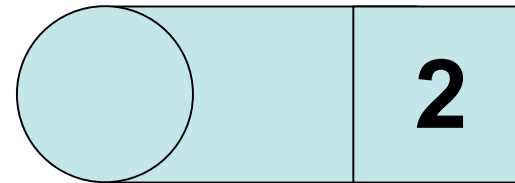
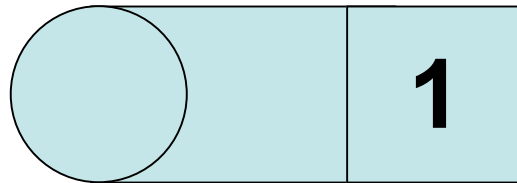
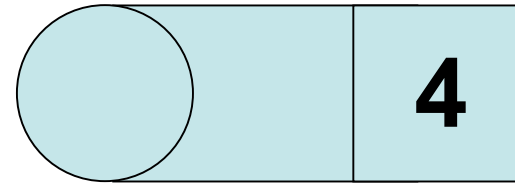
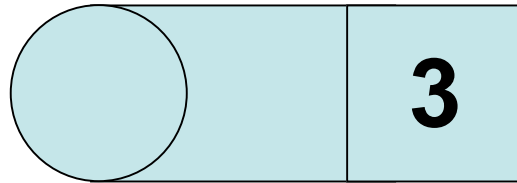
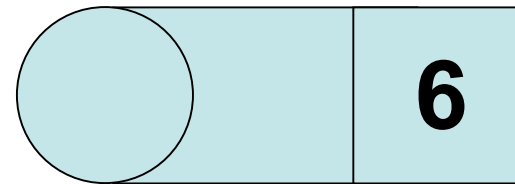
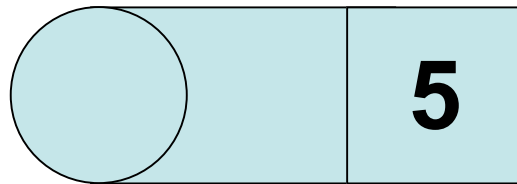
Visual Grouping



Visual Grouping



Visual Grouping



Visual Grouping



Visual Grouping



Visual Grouping



Amazon Has Grouping Problems

1 of 3 people found the following review helpful:

★★★★☆ = Durability ★★★★★ = Fun ★★★★★ = Educational ★★★★★ = Overall

Has a place in my collection, April 29, 2002

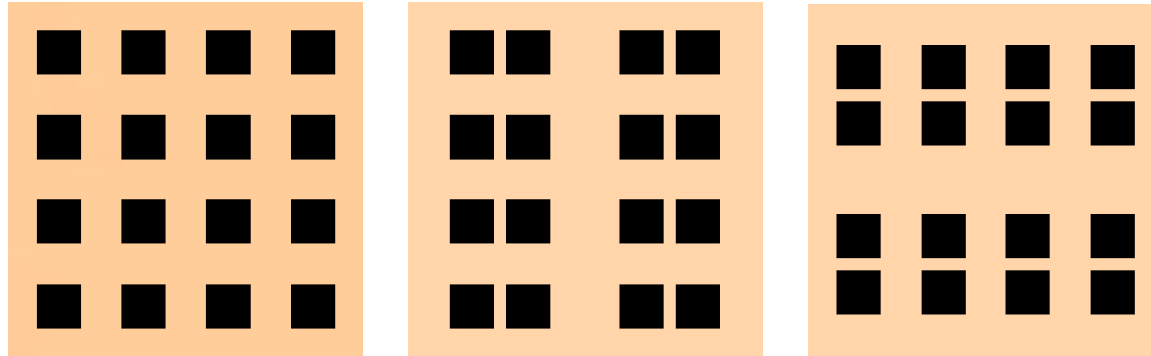
Reviewer: [Andrew Graves](#) (Lafayette LA) - [See all my reviews](#)

Tigris and Euphrates is a keeper in my game collection. It is easy for new players to learn the deviousness of the game. The game is difficult to describe, however the maneuvering in the game, will turn a seeming early win to a defeat. After you learn the ropes, it's months or so.

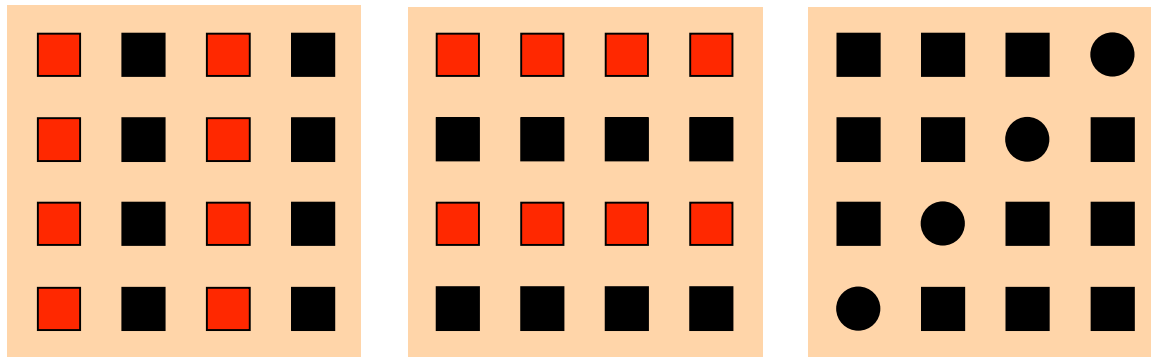
 [Comment](#) | Was this review helpful to you? ([Report this](#))

Visual Grouping

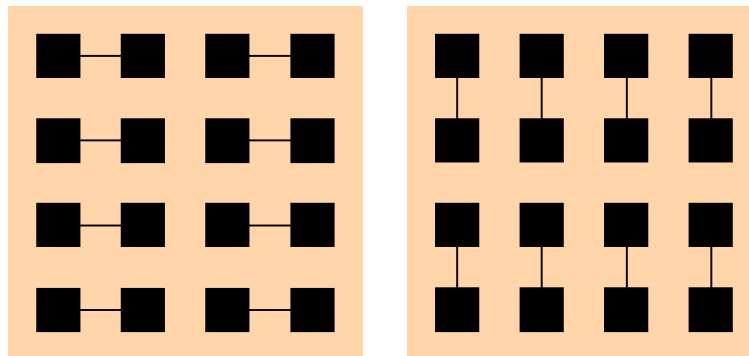
Proximity



Similarity



Connected



Visual Grouping

Continued



Symmetric



Visual Grouping

News Sport Weather World Service Languages **البحث**

شؤون العالم

BBC ARABIC.com [الاستماع إلى إذاعة بي بي سي العربية](#)

آخر الأخبار: "صعوبات" في المفاوضات بين -
آخر تحديث: الأربعاء 15 يناير 2006 GMT 01:30

صفحة الرئيسية
الشرق الأوسط
أخبار العالم
علوم وتكنولوجيا
اقتصاد وأعمال
أخبار الرياضة
الصحف البريطانية
شارك برأيك
تقارير خاصة
تعليم الإنترنت

بي بي سي العربية
برامجنا الإذاعية
استقالات البث

خدمات
شراكة وتعاون
نحن وموقعنا
اتصل بنا
مساعدة

شارك برأيك
شارك في منتديات الحوار
واقل برأيك حول: فوز
ميشيل عون

جولات مصورة
لقطات من التحقيق مع صدام
بالصور: دورية في الطلوجة
وخوارها
أوسكار الفيلم الهندي

عنان تحت "ضغوط جديدة"
بسبب النفط مقابل الغذاء
لجنة التحقيق في برنامج النفط مقابل
الغذاء تقول إنها تحلق في مظلة جديدة
تفيد بالجماع ثم بين عنان ومسؤولي
شركة حصلت على عقد في البرنامج.

**الأمم المتحدة تسعى لكسر
المسود مع مونجيانج وشهران**

**الوكالة الدولية للطاقة الذرية تحت
كوريا الشمالية على التخلي عن
برنامجها النووي، وإيران على العمل
بهدية لعلماء العالم بأنها لا تسير على
خطى بيرنجيتاج.**

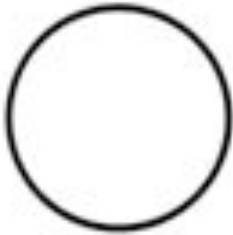














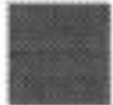
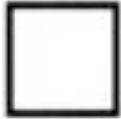
**فضيلة المحكمة العليا في بريطانيا «
قضاة بشروعة عقد جلسات جنسية
للتسوية قضية التعويض والنقطة التي
رفعتها سيدة في بريطانيا ضد الملكة فهد.**

**قضية بظلة ضد التعاون
السعودي في بريطانيا**

Making Things Distinct

- Grouping looks at how to make things look related
- Now, how to make things look different?

Making Things Distinct

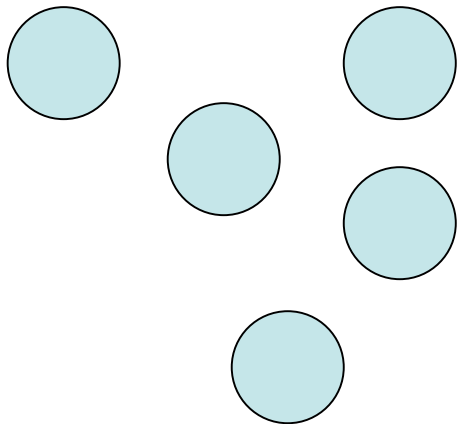
Size	Value	Orientation	Texture	Shape	Position (2D / 3D)
					
					
					

52: Bertin's "retinal variables" form the basis for all forms of visual coding. A visual code can be based on (from left to right) contrasts in *size*, *value*, *orientation*, *texture*, *shape*, or *position* in 2D or 3D space. *Hue* (chromatic color) provides an additional dimension not pictured here.

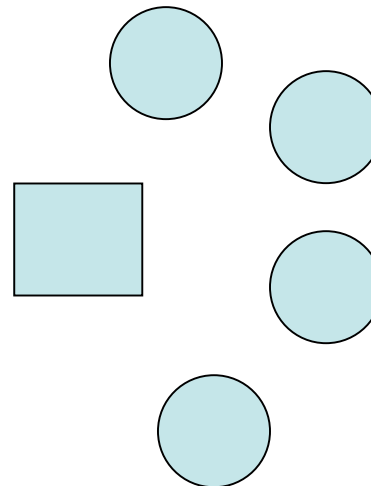
Kevin Mullet and Darrell Sano, *Designing Visual Interfaces*

Let's Play a Game

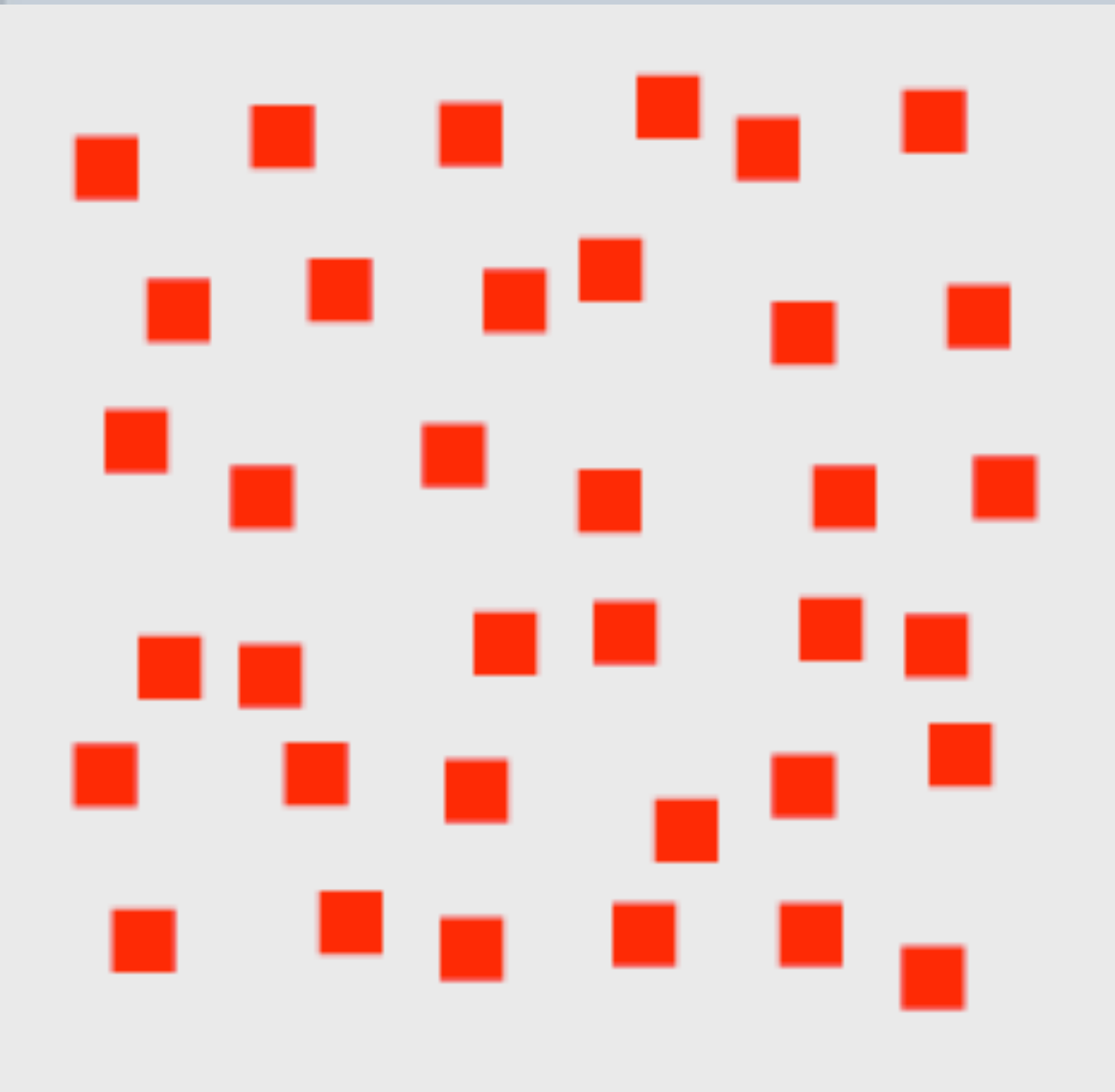
- I'll show you a series of pictures
- Say out loud:
 - Same if every object is the same
 - Different if at least one object is different

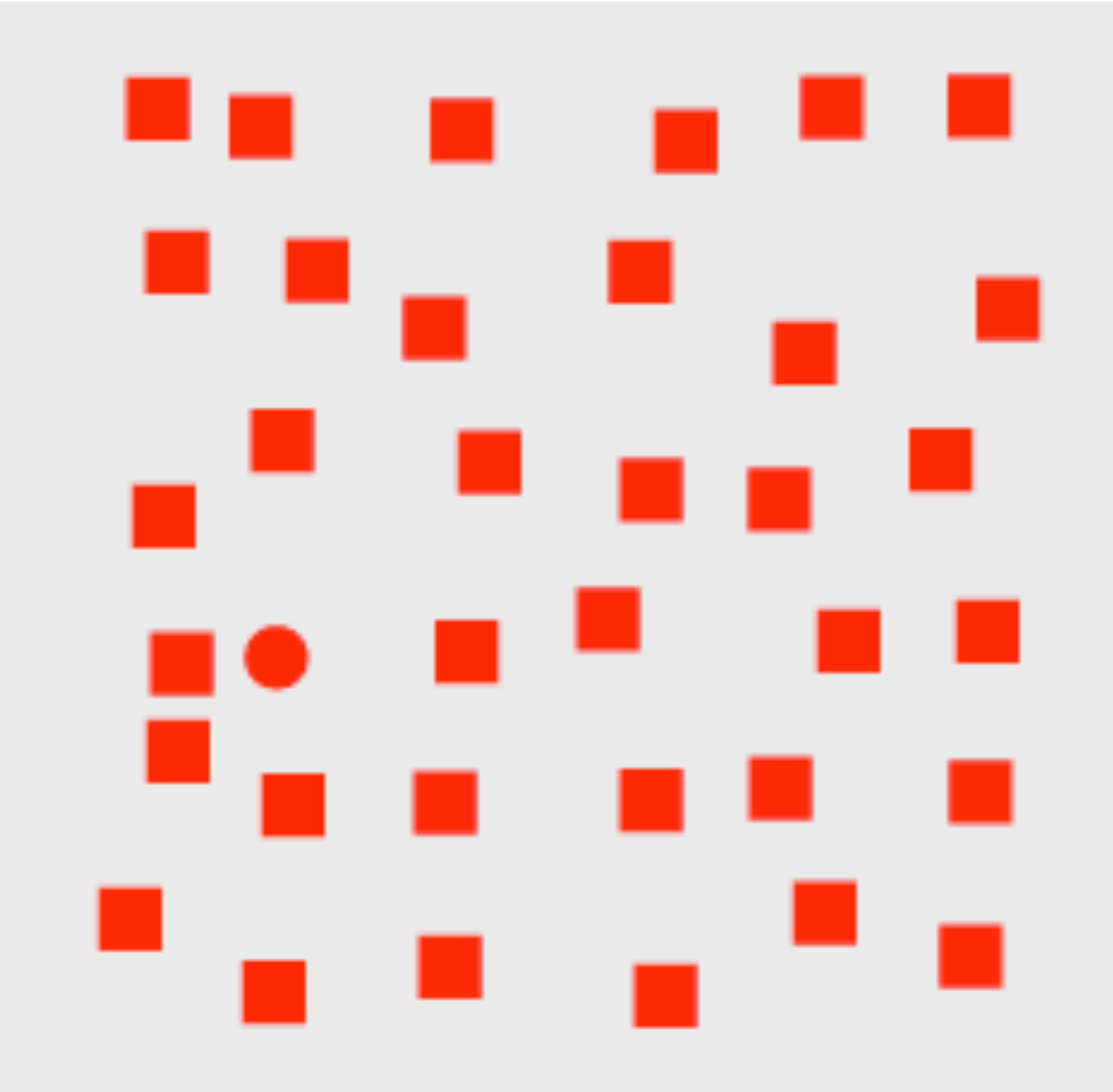


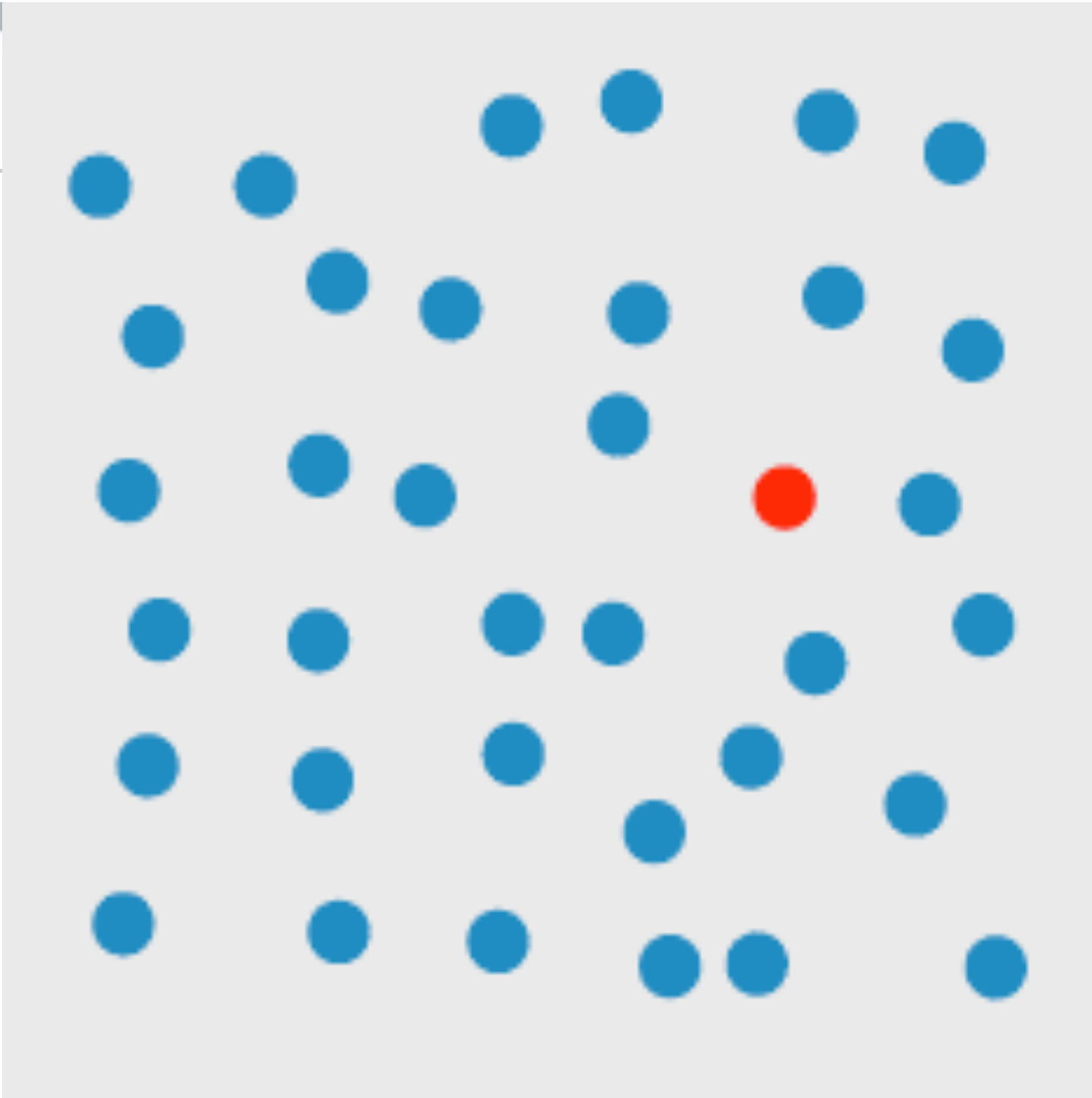
Same

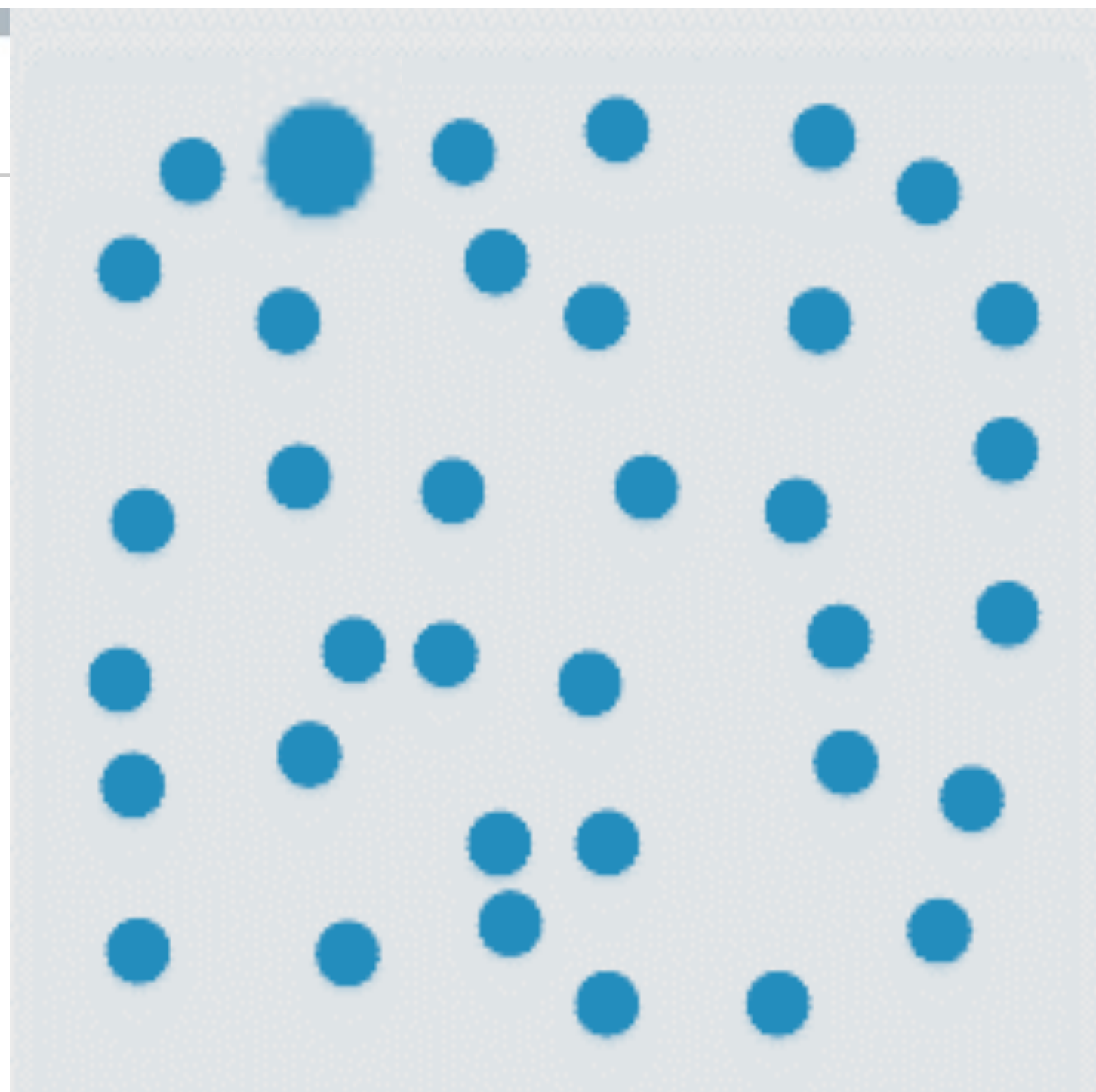


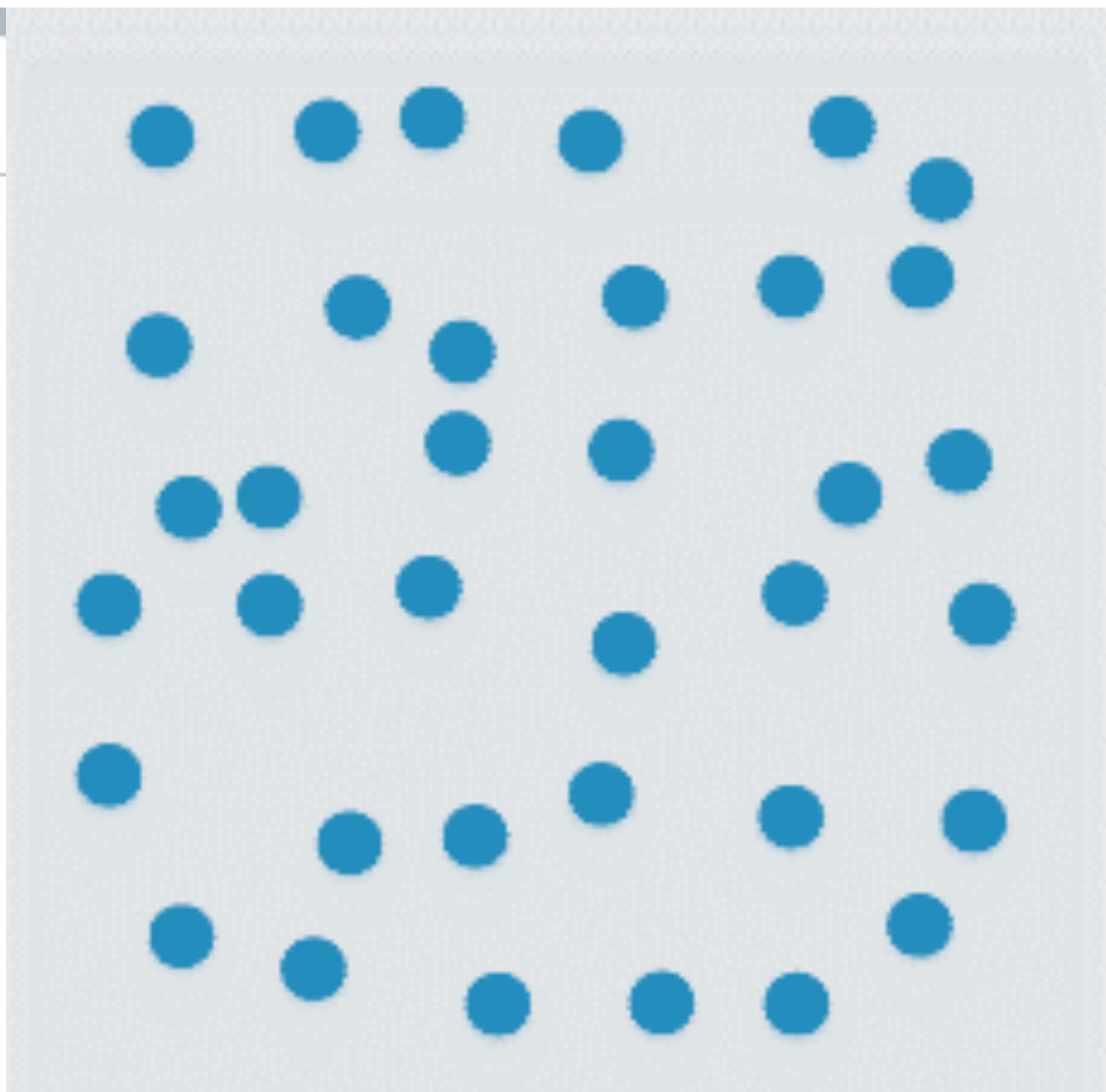
Different





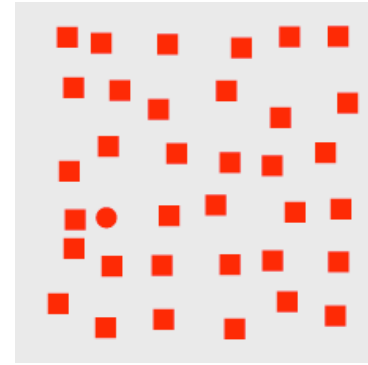
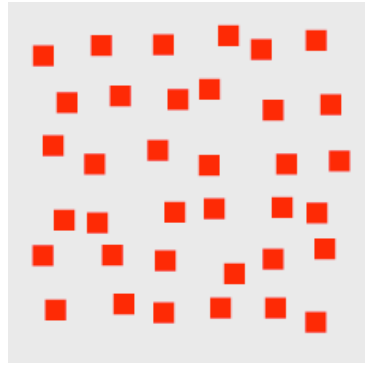
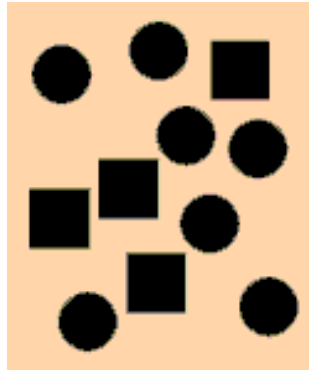




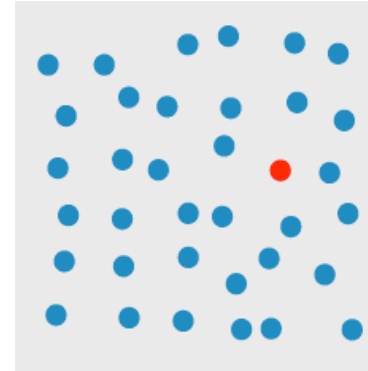
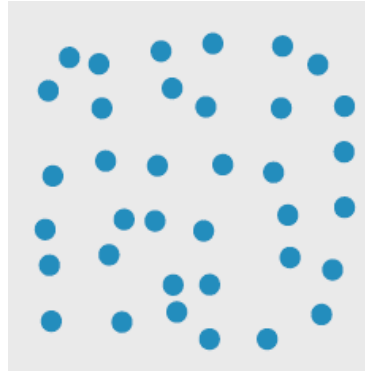
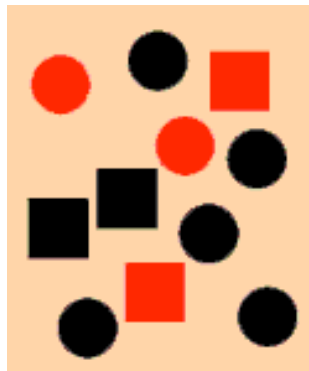


Making Things Distinct

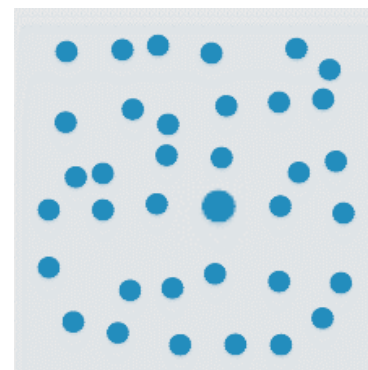
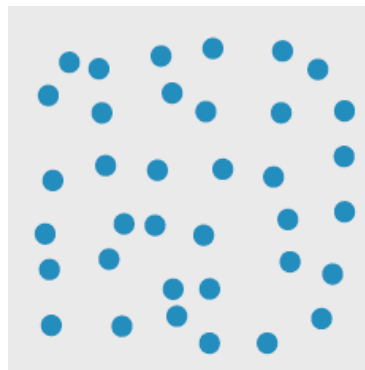
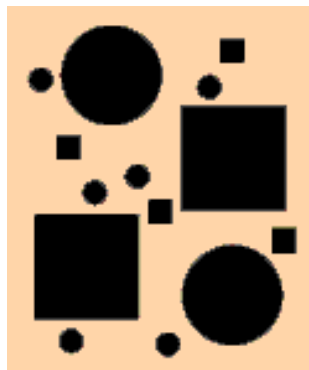
Shape



Color

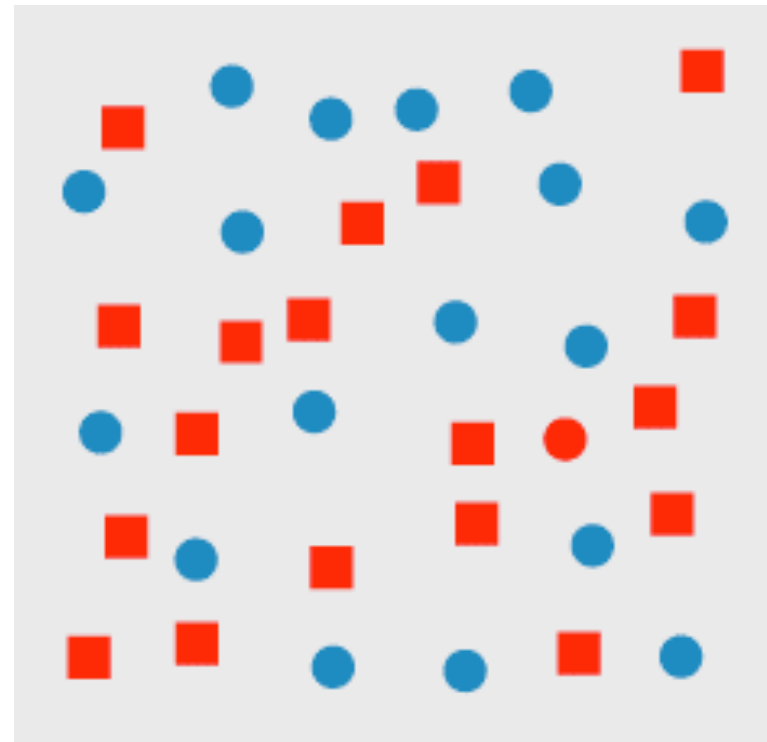


Size

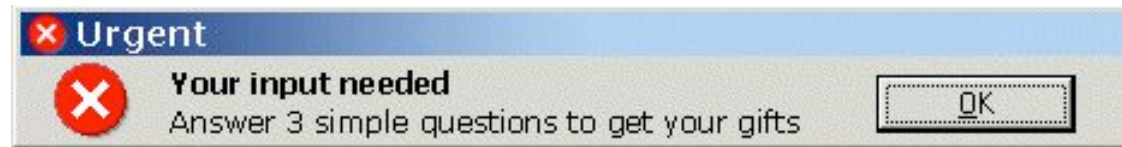


Preattentive Processing

- Some things easy for low-level visual processing to automatically handle
 - It just pops out at you
- Preattentive processing
 - ~200 msec to see differences
 - Based on simple diffs
 - Is there a red circle? →



Animation Useful for Making Things Distinct



- Remember, rods sensitive to motion in periphery
- Can be very useful, but easy to overdo it
 - Motion distracting if in peripheral vision, hard to read
 - Simple is better here



Small Multiples for Making Things Distinct

- “Information consists of differences that make a difference.”

– Edward Tufte, *Envisioning Information*



SMALL MULTIPLES

International Women's Day



Echeverria, Heriberto 1971
March 8 - International Women's Day



Diaz, Estela 1974
March 8 - International Women's Day

Cuban Poster Art Gallery, <http://www.sims.berkeley.edu/~lcush/GenCat.html/>

SMALL MULTIPLES

Reid Miles, Blue Note Cover



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San Francisco 25th Ethnic Dance Festival

FILM CLIPS
Also opening today
Friday, June 13, 2003
San Francisco Chronicle
[CHRONICLE SECTIONS](#)
[Mick LaSalle](#), [Edward Guthmann](#), [C.W. Nevius](#)

RESPIRO'
 Drama. Starring Valeria Golino and Francesco Casisa. Directed by Emanuele Crialese. (PG-13, 90 minutes. In Italian and Sicilian with English subtitles. At Bay Area theaters.)
"Respiro" is partly of interest for what it doesn't do. It's set on an Italian island south of Sicily, but it doesn't try to imbue the setting with romance. It's about a sexy young wife and mother who doesn't fit in with her neighbors, but the movie is not an indictment of village provinciality. She may be the prettiest and liveliest person on her island, but she is also a bit crazy.

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"Manito" [Low-budget wonder.](#)

"Respiro" [Haunting.](#)



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"Hollywood Homicide"
[Appealing.](#)

"Manito"
[Low-budget wonder.](#)

"Respiro"
[Haunting.](#)

- Not having clear differences makes it hard to understand

- Versus...



Repetition

- Reinforcing structure through repetition
 - Repeat design elements across the program
 - Helps people understand what is basic, what is unique



Example Repetition – Amazon (1/3)

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Example Repetition – Amazon (2/3)

amazon.com

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Music

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Browse Styles

Classical

Top Sellers

New & Future Releases

Free Downloads

Essential CDs

Used Music

Search  Advanced Search 

AD Web Search 

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Essentials of Stem Cell Biology

#1 in [Early Adopter Books](#)

Early Adopter Audio & Video



- 1 [Apple 6 GB iPod Mini Silver M9801LL/A](#)
- 2 [Apple 4 GB iPod Mini Blue M9802LL/A](#)
- 3 [Apple 6 GB iPod Mini Blue M9803LL/A](#)
- 4 [Apple 60 GB iPod Photo M9830LL/A](#)
- 5 [Apple 30 GB iPod](#)

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Aside: Change Blindness

- People are bad at noticing some kinds of changes
 - Subtle changes over time
 - Distractors
 - Discontinuities (ex, in movies)
 - http://viscog.beckman.uiuc.edu/djs_lab/demos.html
- On web site, errors displayed on same page, but new page looks too similar
 - Can't easily tell that a new page loaded
- Unfortunately, design implications currently unclear

Change Blindness

Create an account today! Receive the latest Dell product information, price drops, a checkout with pre-populated forms. [Already have an account?](#)

Sign Up

Note: Dell supports privacy protection for children online. You must be at least 14 on services.

* - Indicates required fields

* First Name MI * Last Name

* Email Address

☒ Yes, send me exclusive offers and specials by e-mail.

* Address (Dell cannot ship to a P.O. Box)

* City * State

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Note: Dell supports privacy protection for children online. You must be at least 14 or over.

* - Indicates required fields



Please address the 8 item(s) indicated on this page.

* First Name MI * Last Name

Barney



Fido



Email address is missing or unrecognizable

* Email Address

☐

Yes, send me exclusive offers and specials by e-mail.

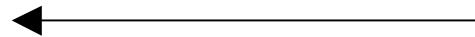


Please enter your street address

* Address (Dell cannot ship to a P.O. Box)

Outline

- Metaphor
- Color
- Grouping
- Layout

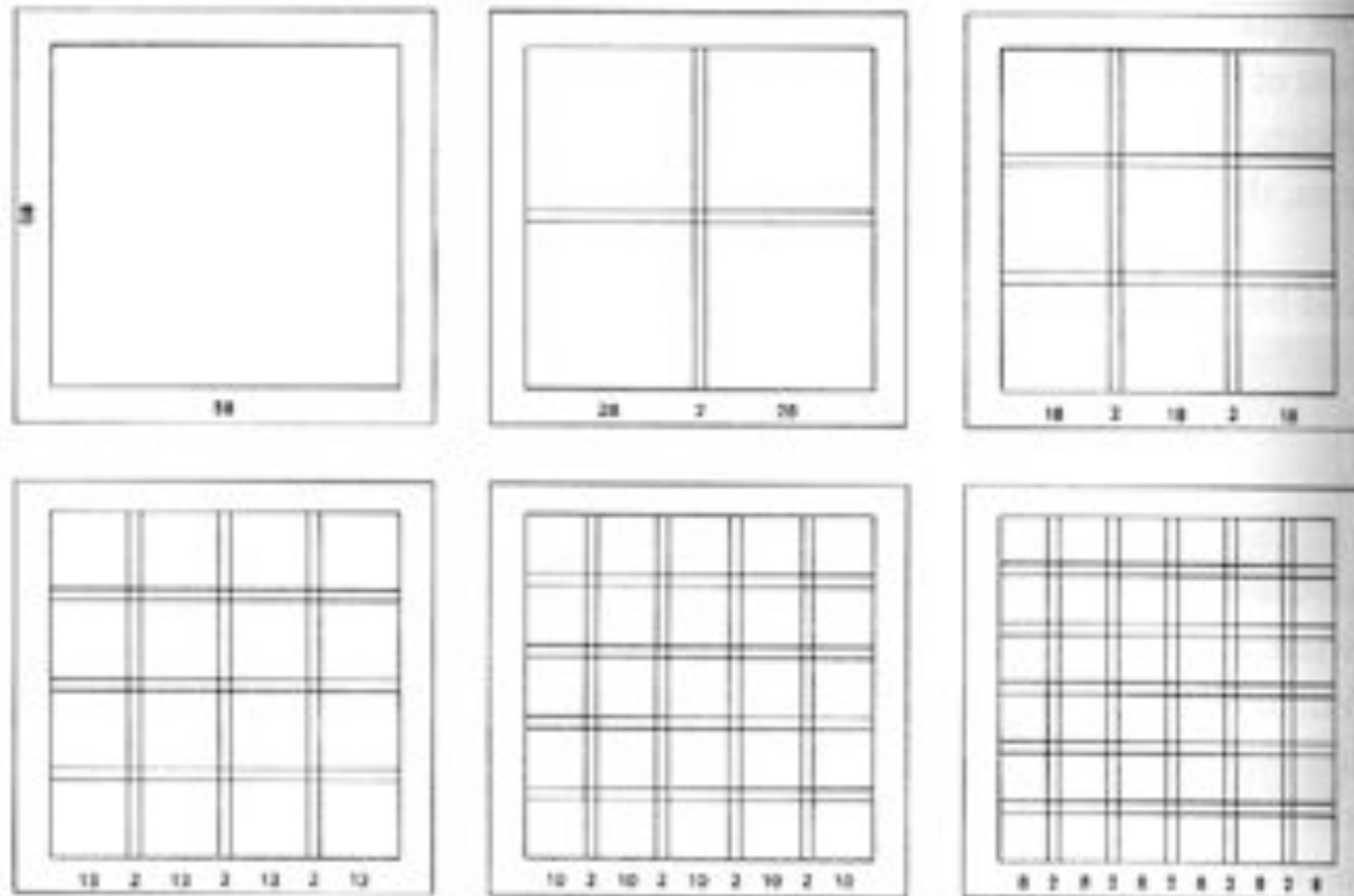


Grid Systems



143: Each of the grids in Figure 142 leaves a distinct imprint on the resulting layout. When the same grid is used throughout a book – or user application – this imprint becomes a unifying element for the entire work. From *Basic Typography: Design with Letters*, by Ruedi Rüegg, ABC-Verlag, Zurich, 1987.

Grid Systems



142: These typographic grids for book design subdivide the page uniformly into one to six columns. Grids for GUI design have important differences, but the goal of providing systematic structure is the same. From *Basic Typography: Design with Letters*, by Ruedi Rüegg, ABC-Verlag, Zurich, 1987.

Example Grid – Amazon (1/3)

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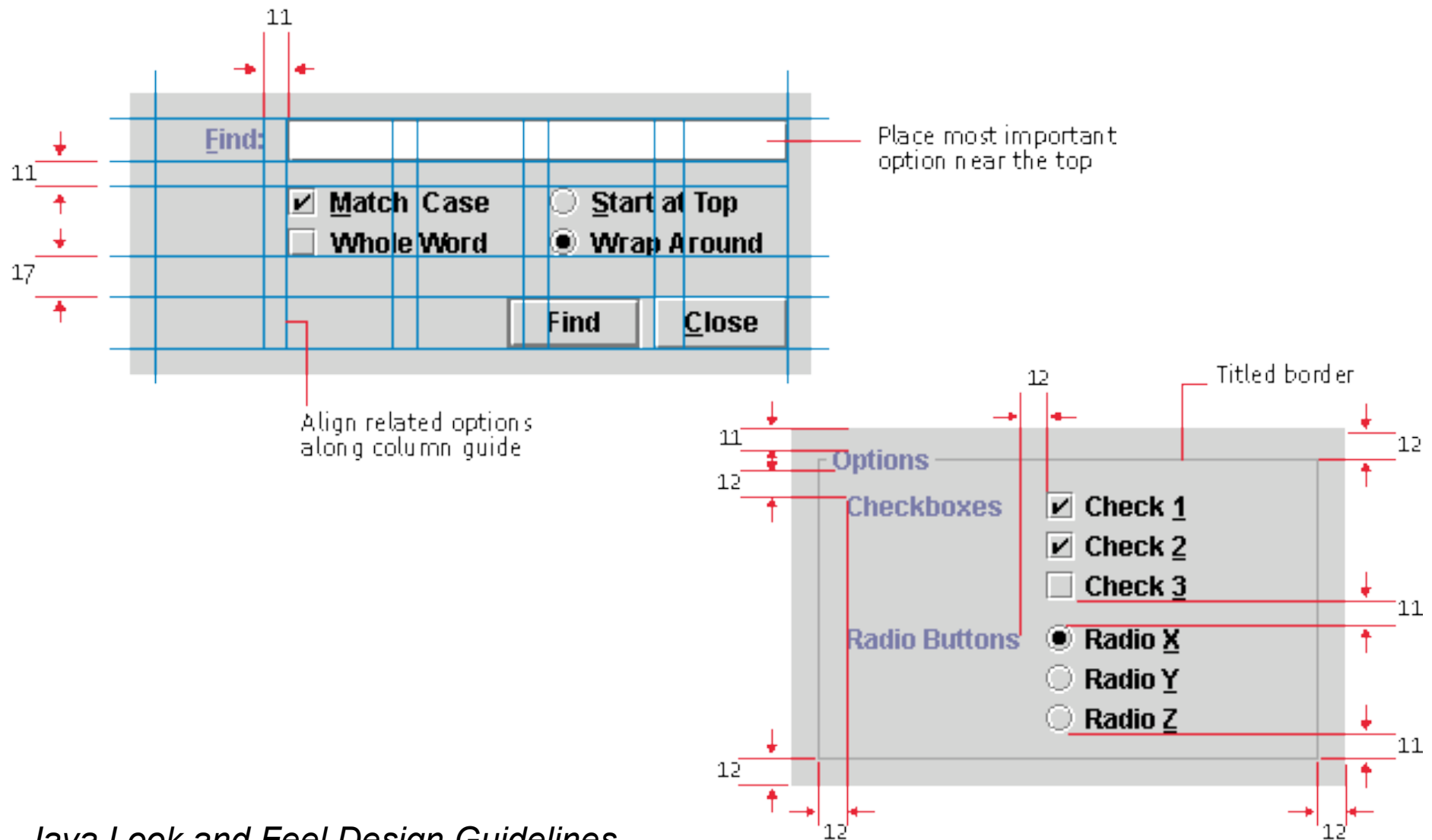
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Grid Systems



Java Look and Feel Design Guidelines

<http://java.sun.com/products/jlf/ed2/book/HIG.Visual2.html>

Canonical Grid (2 Columns)

Mode: Search on Query Filter on Query

Name: SQLmaster™

Type:

Vendor:

Note:

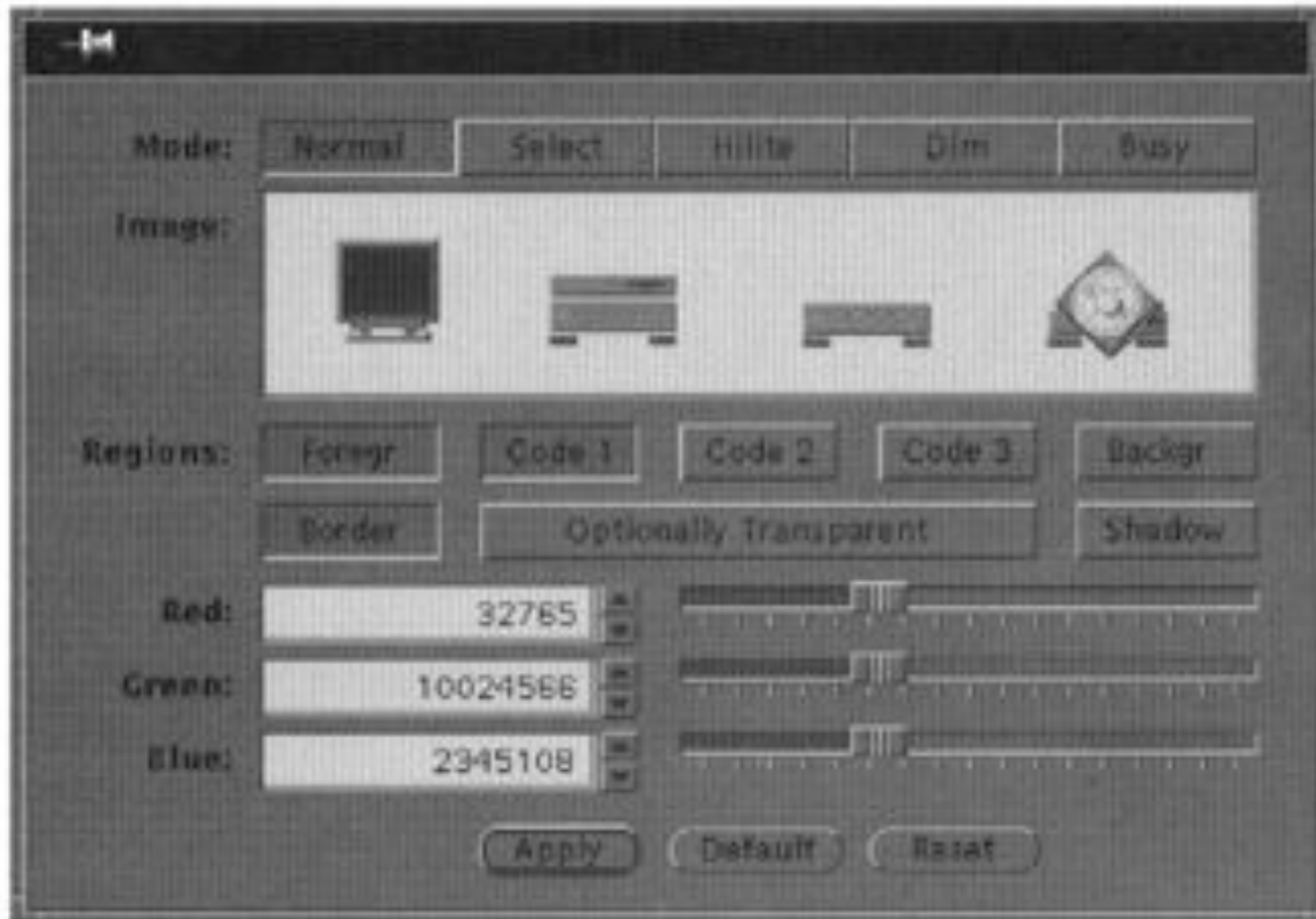
Progress: schema/usr/dist

Scope: ☒ Current Library ☒ Local Machine
☒ Referenced Libraries ☐ Network Storage
☐ Additional Libraries ☐ Unlicensed Components

Search Clear

177: This two-column layout is based on the canonical grid (in our first three examples, the grid is not used for the labels in the left-hand column). To visualize this grid, ignore all but the middle three lines of Figure 176. The Name, Type, Vendor, and Note fields span both of the columns that remain, while the items in the Mode setting, Progress indicator, and Scope options span one column each.

Canonical Grid (6 Columns)



180: In this example, the full six-column grid is used to lay out the left-most label column as well as five columns of controls. Note the presence of controls spanning one, two, three, and five columns. Note too that elements of different widths can be placed in the same row without problems.

No Grid (ie, Don't Do This!)

Datascan Clarity [ERP] For :Tata Yazaki Autocomp Limited - User : [VSK]

File Activity Tools Help

Proc.Sheet **Drawing...** ItemLed Relevel WhereUsed ReqPlan Full Ledger Prod EnQ Led.Sum ?A

Item Master Bill of Mat. Prod. Plan CA Sales Plan CA Stocks FG Stocks Tab 6

Item Code: 000045B Descript.: AV 8.00 BLACK\$ Status: ☐

Pu.Unit: MT Stk Unt: MT Pu.Conv: 1.00 Pu Ld Dys: 45 Re Ord Lvl: Order Qty: Buffer.Stk: Buyr Cd: L Exc.Pu%: 11 SCer: 0

Ost.Dys: Sh.Tl.Day: Std.Specf: Max.Pur.Rt: Std.Rate: Balance Qty: 2000.000 R.Rate1: Location: 000000 Pur.A/c:

Flg: 1 Lvl: 2 Abc Cls: 0 Xyz Cls: 0 Proc.Mtd: B Lst.Rv#: Prv PO#: 000010 Prv PO Rt: 100.00 Prv Supplier: F001 Src: 0 Rej.%:

P	635	Item Cd	Descript	PU.I	Stk.I	Ord.Qty	Bal.Qty	Pu.L.Dys	Sta
		000045B	AV 8.00 BLACK\$	MT	MT		2000.000	45	
		000047B	AV20B\$	MT	MT		1942.500	42	
		000047R	AV20R\$	MT	MT		1886.280	42	
		000059R	AV10R\$	MT	MT		11849.000	83	
		057039B	AEX0.5B\$	MT	MT		400.000	90	
		057039B/R	AEX0.5B/R\$	MT	MT		1031.000	90	
		057039B/w	AEX0.5B/w\$	MT	MT		1917.000	90	

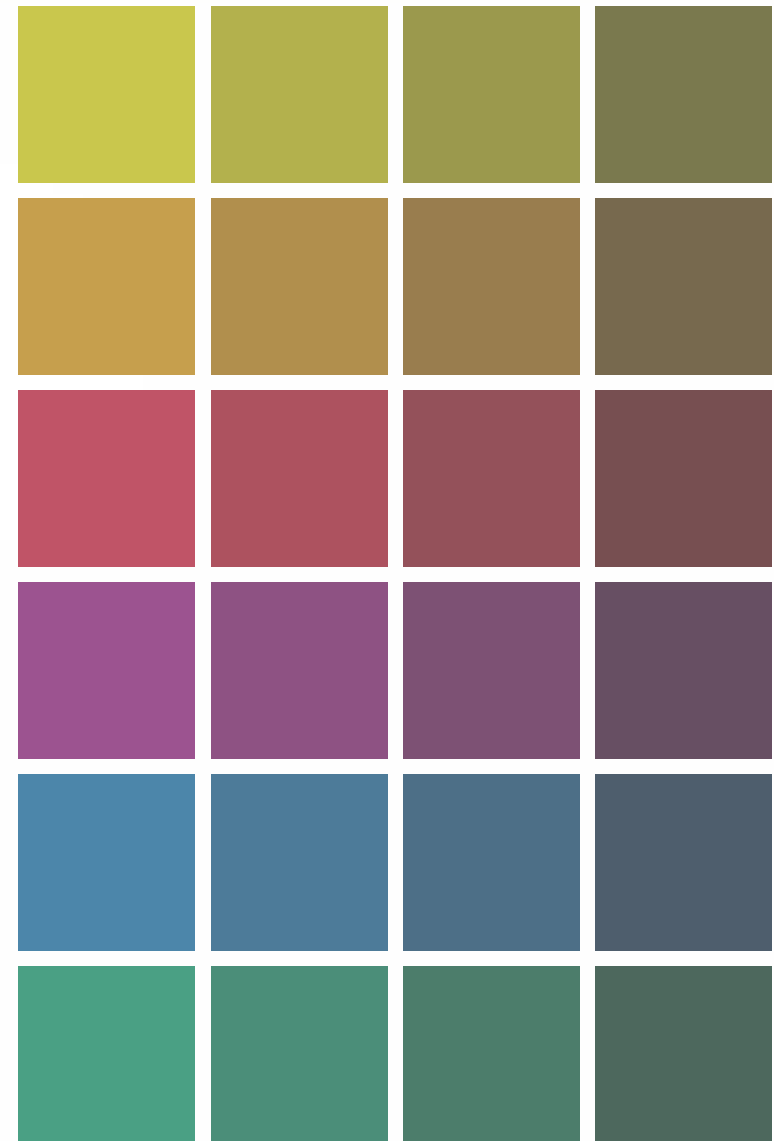
1 **Numberwise Items**

Home PgUp PgDn LnUp LnDn End /+

Jump G Link Scan Off Grid Off

Summary

- Metaphors
 - Appropriate ones can make UI easier
- Color
 - Rods, cones, distribution
 - Design guidelines
- Grouping
 - How to make things look related
 - How to make things distinct
 - Repetition useful
- Layout
 - Grids useful



Administrativa

- Reading assignment due next time
 - In current syllabus
 - What is the Document Object Model?
<http://www.w3.org/TR/WD-DOM/introduction.html>
 - Wikipedia entry on Cascading Style Sheets
 - ~4 sentence summaries (x2)
 - 1 highlight (point of discussion, noteworthy, they did it wrong, etc)

P3

- Progress?