User Interfaces

EECS 3461 – Sections A & B
Fall 2021

R-Design-VIII
Perception & UX Design

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Dependencies

This resource pack assumes that you are already familiar with:

- R-Humans-III (and all previous)
- R-Design-VII (and all previous)
- R-Interaction-III (and all previous)
- R-Technosocial-I, R-Knowledge-I

Key Questions

1. How are Gestalt principles applied to visual perception in UX design?
   1b. Other factors in information presentation?

2. What is inattentional blindness and change blindness? And why are these relevant to UX design?

3. Why is attention and perception relevant to UX design?

1. How are Gestalt principles applied to visual perception in UX design?

Gestalt Principles of Form Perception

- Gestalt principles explain certain perceptual phenomena
- Law of Similarity
  - elements will be grouped perceptually if they are similar to each other; people perceive groupings on the basis of similarity
- Law of Proximity
  - when we perceive a collection of objects, we will see objects close to each other as forming a group
- Law of Prägnanz (figure-ground)
  - in perceiving a visual field, some objects take a prominent role (the figures) while others recede into the background (the ground)
- Law of Symmetry
  - when we perceive objects, we tend to perceive them as symmetrical shapes that form around their centre
- Law of Closure
  - we perceptually "close up" (i.e., complete) objects that are not, in fact, complete
  - people perceive single objects even when part of the object is obscured

The Law of Similarity

- elements will be grouped perceptually if they are similar to each other; people perceive groupings on the basis of similarity

- similarity can be based on colour, size, or shape

The Law of Similarity, Colour

Img source: "Gestalt Theory for Efficient UX: Principle of Similarity" https://uxplanet.org/gestalt-theory-for-efficient-ux-principle-of-similarity-827c20c175f5

The letters marking the days of the week on the calendar screen make use of a consistent colour.
They get visually grouped.

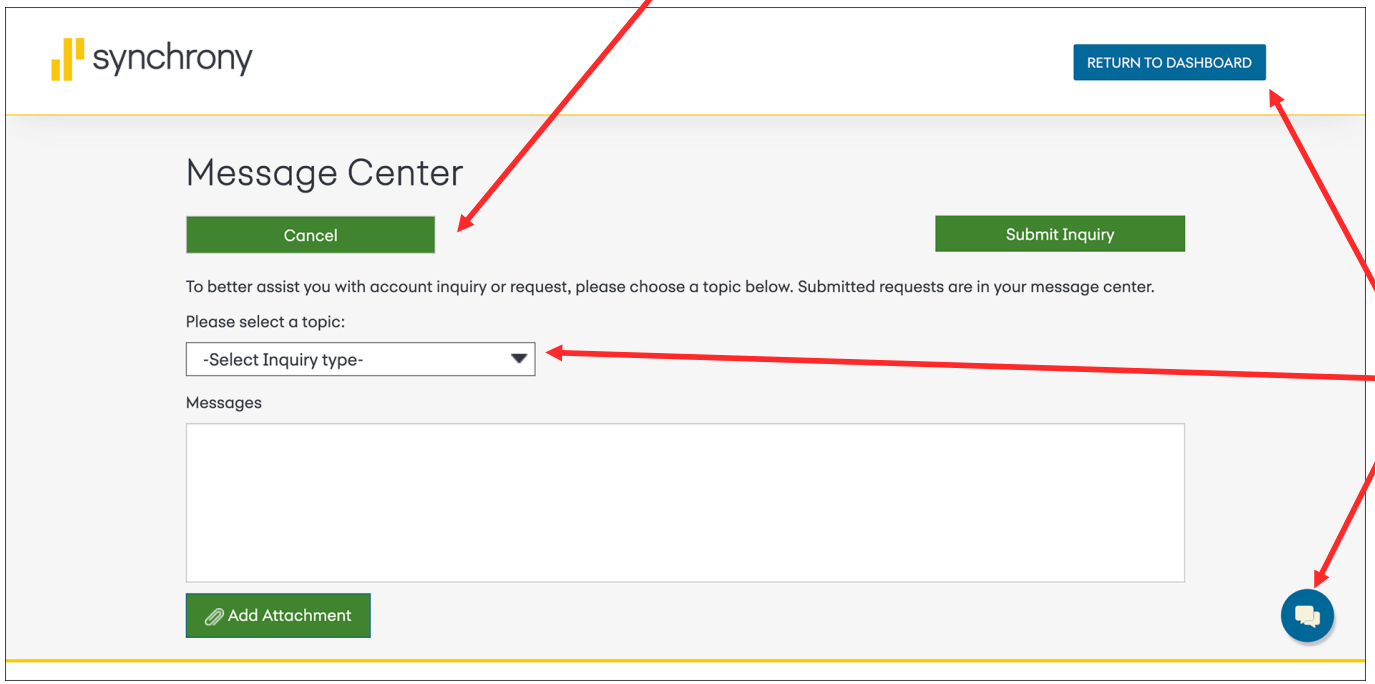
this component here uses other gestalt principles

A different colour is used for the numbers in the calendar grid.
The numbers of the calendar get grouped.

The Law of Similarity, Colour

Img source: “Similarity Principle in Visual Design”
https://www.nngroup.com/articles/gestalt-similarity/

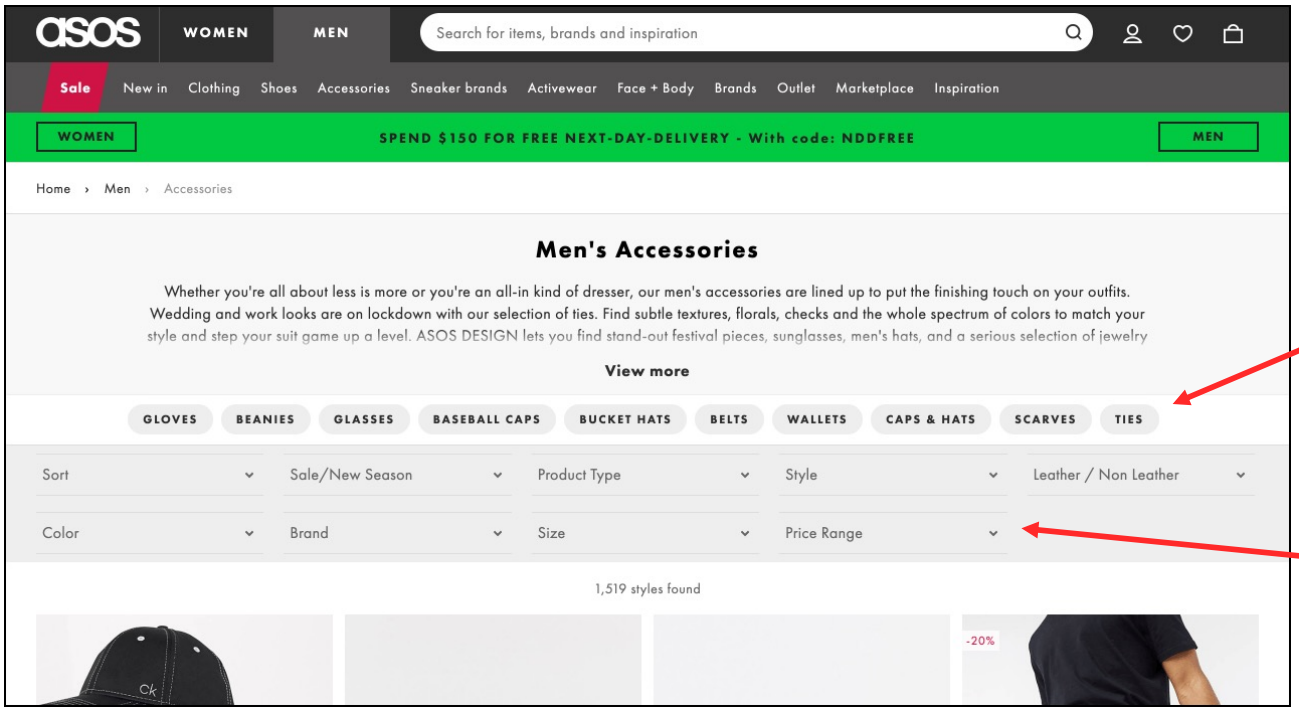
The submit, cancel, and add buttons (using the same color) buttons will be perceived as sharing the same level of importance



Other colours used for other buttons, not perceived as belonging to the same group as the green buttons

The Law of Similarity, Shape

Img source: "Similarity Principle in Visual Design"
https://www.nngroup.com/articles/gestalt-similarity/



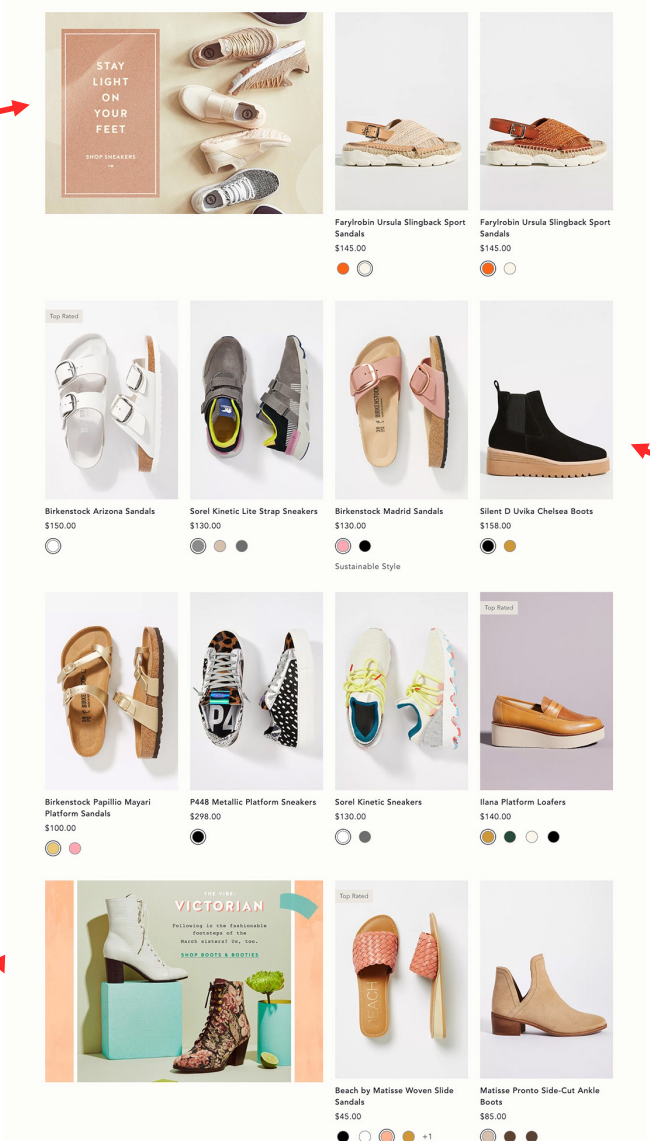
The rounded buttons ("pills") will be perceived as a group (all are product subcategories)

Other shapes are perceived as not belonging to the same group

Img source: “Similarity Principle in Visual Design”
https://www.nngroup.com/articles/gestalt-similarity/

The Law of Similarity, Size

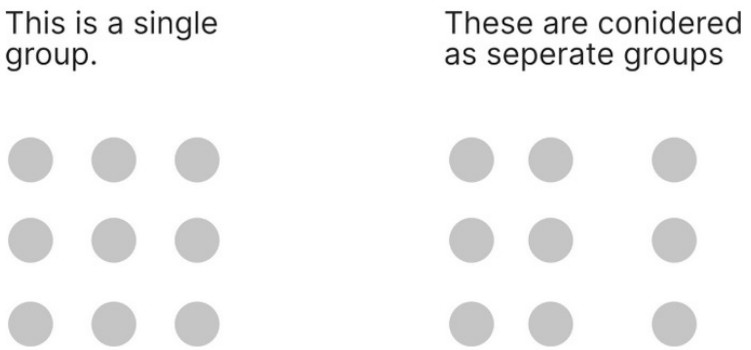
The other elements of a different size are perceived as belonging to another group (e.g., “promotions”)



The elements of one size are perceived as belonging to one group (e.g., “products”)

The Law of Proximity

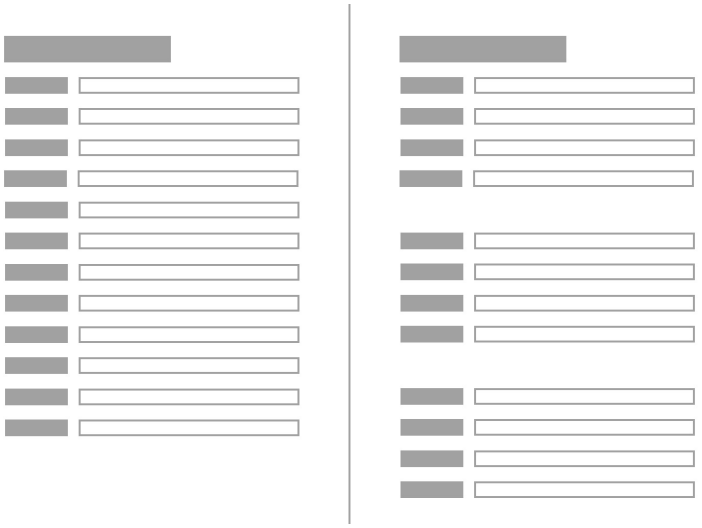
- when we perceive a collection of objects, we will see objects close to each other as forming a group [1]



Img source: [2]

Example:

- the label are placed near to the field text, so that user can perceive it as a single element [2]
- the relative spacing creates the perception of two different elements



Img source: [3]

1b. Other factors in information presentation?

Information Presentation

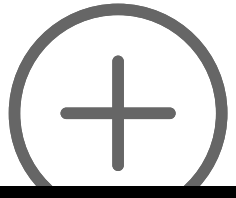
- The way information is displayed can greatly influence how easy or difficult it is to comprehend appropriate pieces of information

- The next two activities will illustrate the impact of information organization on task

Task #1

from [Sharp et al, 2019]

- on the next slide,
  - find the price for a double room at the Quality Inn in Columbia, South Carolina
  - find the phone number of the Days Inn in Charleston, South Carolina



South Carolina

City	Motel/Hotel	Area code	Phone	Rates Single	Rates Double
Charleston	Best Western	803	747-0961	$126	$130
Charleston	Days Inn	803	881-1000	$118	$124
Charleston	Holiday Inn N	803	744-1621	$136	$146
Charleston	Holiday Inn SW	803	556-7100	$133	$147
Charleston	Howard Johnsons	803	524-4148	$131	$136
Charleston	Ramada Inn	803	774-8281	$133	$140
Charleston	Sheraton Inn	803	744-2401	$134	$142
Columbia	Best Western	803	796-9400	$129	$134
Columbia	Carolina Inn	803	799-8200	$142	$148
Columbia	Days Inn	803	736-0000	$123	$127
Columbia	Holiday Inn NW	803	794-9440	$132	$139
Columbia	Howard Johnsons	803	772-7200	$125	$127
Columbia	Quality Inn	803	772-0270	$134	$141
Columbia	Ramada Inn	803	796-2700	$136	$144
Columbia	Vagabond Inn	803	796-6240	$127	$130

Task #2

from [Sharp et al, 2019]

- on the next slide,
  - find the price of a double room at the Holiday Inn in Bradley, Pennsylvania
  - find the phone number of the Quality Inn in Bedford, Pennsylvania

Pennsylvania
Bedford Motel/Hotel: Crinaline Courts
(814) 623-9511 S: $118 D: $120
Bedford Motel/Hotel: Holiday Inn
(814) 623-9006 S: $129 D: $136
Bedford Motel/Hotel: Midway
(814) 623-8107 S: $121 D: $126
Bedford Motel/Hotel: Penn Manor
(814) 623-8177 S: $119 D: $125
Bedford Motel/Hotel: Quality Inn
(814) 623-5189 S: $123 D: $128
Bedford Motel/Hotel: Terrace
(814) 623-5111 S: $122 D: $124
Bradley Motel/Hotel: De Soto
(814) 362-3567 S: $120 D: $124
Bradley Motel/Hotel: Holiday House
(814) 362-4511 S: $122 D: $125
Bradley Motel/Hotel: Holiday Inn
(814) 362-4501 S: $132 D: $140
Breezewood Motel/Hotel: Best Western Plaza
(814) 735-4352 S: $120 D: $127
Breezewood Motel/Hotel: Motel 70
(814) 735-4385 S: $116 D: $118

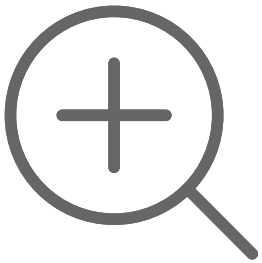
Discussion: Impact of organization on task

[Sharp et al, 2019]

- Which task took longer to do?
- Tullis (1997) found that the two screens produced quite different results:
  - for task #1, it took an average of 3.2 seconds
  - for task #2, it took an average of 5.5 seconds
- Why is this so, considering that both displays have the same density of information relative to the background?
- for task #1,
  - strong use of gestalt principles
  - groups are perceived, by place, type of accommodation, phone number, and rates
- for task #2:
  - weak use of the gestalt principles
  - result: information is "bunched together"
  - difficult to search

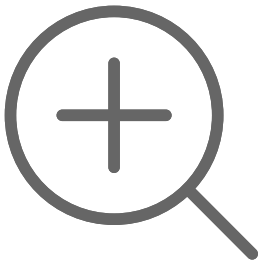
Comparing Visual Presentations

- an information display can be structured using different graphical methods (e.g., colour, line, negative space)
- given two information displays, each with the same amount and type of information, the graphical method will have an impact on visual search times
- for example, in the following pair of designs, visual search was completed faster when borders were used (design #2) than with contrasting colours (design #1)



Design #1: Find 'Italian'

Black Hills Forest	Peters Landing	Jefferson Farms	Devlin Hall
Cheyenne River	Public Health	Psychophysics	Positions
Social Science	San Bernardino	Political Science	Hubard Hall
South San Jose	Moreno Valley	Game Schedule	Fernadino Beach
Badlands Park	Altamonte Springs	South Addision	Council Bluffs
Juvenile Justice	Peach Tree City	Cherry Hills Village	Classical Lit
Results and Stats	Highland Park	Creative Writing	Sociology
Thousand Oaks	Manchesney Park	Lake Havasu City	Greek
Promotions	Vallecito Mts.	Engineering Bldg	Wallace Hall
North Palermo	Rock Falls	Sports Studies	Concert Tickets
Credit Union	Freeport	Lakewood Village	Public Radio FM
Wilner Hall	Slaughter Beach	Rock Island	Children's Museum
Performing Arts	Rocky Mountains	Deerfield Beach	Writing Center
Italian	Latin	Arlington Hill	Theater Auditions
Coaches	Pleasant Hills	Preview Game	Delaware City
McKees Rocks	Observatory	Richland Hills	Scholarships
Glenwood Springs	Public Affairs	Experts Guide	Hendricksville
Urban Affairs	Heskett Center	Neff Hall	Knights Landing
McLeansboro	Brunswick	Grand Wash Cliffs	Modern Literature
Experimental Links	East Millinocket	Indian Well Valley	Studio Arts
Graduation	Women's Studies	Online Courses	Hughes Complex
Emory Lindquist	Vacant	Lindquist Hall	Cumberland Flats
Clinton Hall	News Theatre	Fisk Hall	Central Village
San Luis Obispo	Candlewood Isle	Los Padres Forest	Hoffman Estates



Design #2: Find 'French'

Webmaster Russian Athletics Go Shockers Degree Options Newsletter	Curriculum Emergency (EMS) Statistics Award Documents Language Center Future Shockers	Student Life Accountancy McKnight Center Council of Women Commute Small Business	Dance Gerontology Marketing College Bylaws Why Wichita? Tickets
Geology Manufacturing Management UCATS Alumni News Saso	Intercollegiate Bowling Wichita Gateway Transfer Day Job Openings Live Radio	Thinker & Movers Alumni Foundations Corbin Center Jardine Hall Hugo Wall School	Career Services Doers & Shockers Core Values Grace Wilkie Hall Strategic Plan Medical Tech
Educational Map Physical Plant Graphic Design Non Credit Class Media Relations Advertising	Beta Alpha Psi Liberal Arts Counseling Biological Science Duerksen Fine Art EMT Program	Staff Aerospace Choral Dept. Alberg Hall French Spanish	Softball, Men's McKinley Hall Email Dental Hygiene Tenure Personnel Policies
English Graduate Complex Music Education Advising Center Medical School Levitt Arena	Religion Art Composition Physics Entrepreneurship Koch Arena Roster	Parents Wrestling Philosophy Wichita Lyceum Fairmount Center Women's Museum	Instrumental Nursing Opera Sports History Athletic Dept. Health Plan

2. What is inattentional blindness and change blindness? And why are these relevant to UX design?

Inattentional Blindness

[Goldstein, 2011]:

- we may fail to perceive things that are clearly visible in our field of view
- experiments demonstrate that when observers are attending to one sequence of events, they can fail to notice another event, even when it is right in front of them
- ➔ experiment with two teams passing the ball

Change Blindness

- change blindness is an inability or difficulty in detecting changes in scenes
- View:
  - Change blindness demonstration
  - https://www.youtube.com/watch?v=bh_9XFzbWV8

Change blindness and UX design

- in some UX designs, a new element may appear on the screen as a result of user action
- in many cases, the user will demonstrate change blindness (and will not perceive the new element)

Example of Change blindness in UX design

- To illustrate, we can refer to two examples
- examples from https://www.nngroup.com/articles/change-blindness-definition
- on the next screen, there will be two interfaces
- both of them are mobile sites for newpapers
- each one has some degree of change blindness (significant, medium)

Example #1: New York Times mobile site

- this example require demonstration of dynamic behaviours
- the mobile site will be shown, with multiple scroll-up and scroll-down gestures shown in sequence
- watch for the change blindness - Did you notice it?

- for the example from the New York Times mobile site
  - https://media.nngroup.com/media/editor/2018/05/17/nytimes.gif

Example #2: Chicago Tribute mobile site

- this example require demonstration of dynamic behaviours
- the mobile site will be shown, with multiple scroll-up and scroll-down gestures shown in sequence
- watch for the change blindness - Did you notice it?

- for the example from the Chicago Tribute mobile site
  - https://media.nngroup.com/media/editor/2018/05/17/chicago-tr.gif

Examples

- Did you notice the change blindness?

- each one has some degree of change blindness (significant, medium)
  - for the New York Times mobile site -> significant change blindness
  - for the Chicago Tribute mobile site -> smaller change blindness effect

6. What is divided attention? And why are these relevant to UX design?

Relevance of Attention to UX Design

- the use of many interactive systems requires divided attention by users
  - divided attention can be achieved with practice
  - distraction can be modelled

Divided Attention

- divided attention refers to the distribution of attention among two or more tasks
- **automatic processing** is a type of processing that occurs without intention and at a cost of only some of a person's cognitive resources
- **controlled processing** is the type of processing that requires close attention
- Divided attention can be achieved with practice, if many trials of practice can result in **automatic processing**
- Divided attention becomes difficult; instead controlled processing is required when the task is difficult

Driving Example

[Goldstein, 2011]:

- it may be easy to drive and talk at the same time if traffic is light on a familiar road.
- it may be difficult to drive and talk at the same time if traffic increases, flashing "Construction Ahead" signs appear, and the road suddenly becomes rutted
  - you might have to stop your conversation to devote all of your cognitive resources to driving

Q: when we perform multiple tasks, what is the impact, if any on the task outcomes?

are you better off doing one thing at a time in sequence?

Multitasking

- There has been much research on the effects of multitasking on memory and attention (Burgess, 2015).
- The general findings are
  - it depends on the nature of the tasks and how much attention each demands
  - it depends on the individual
    - degree to which a person is distractable

Are some people more distractable than others?

- [Sharp et al, 2019]: the results of a series of experiments comparing heavy with light multitaskers showed that heavy media multitaskers were more prone to being distracted by the multiple streams of media they are viewing than those who infrequently multitask.
- Infrequent multitaskers were found to be better at allocating their attention when faced with competing distractions (Ophir et al, 2009)

What does it mean to be good at multitasking?

- A study of completion rates of coursework found that students who were involved in instant messaging took up to 50 percent longer to read a passage from a textbook compared with those who did not instant message while reading (Bowman et al., 2010).
- Multitasking can also result in people losing their train of thought, making errors, and needing to start over.

Driving and talking on the phone

when engaged in phone conversations (even hands free)

- drivers' reaction times are longer to external events (Caird et al., 2018).
- drivers are much poorer at staying in their lane and maintaining the correct speed (Stavrinos et al., 2013)
- talking requires processing resources that are otherwise needed to enable the driver to notice and react to what is in front of them on the road
- the driving task received competition from the driver's visual imagery from the phone call
  - imagines what is being talked about, the facial expression of the person to whom they are speaking
  - conversational questions can trigger cognition
    - e.g., "Where did you leave the spare set of keys?" will caused the driver mentally to search for them in their home

Driving and Passenger Conversations

- drivers who engage in conversation with their passengers experienced similar negative effects as phone
- Important differences:
  - if the passenger is co-present, then the conversation will be moderated or will cease, depending on context

Driving and Texting

- evidence shows a strong connection between cell phone use and traffic accidents

Driving and Texting

A photo of the fatal text message, the interrupted text message that a 22-year-old was typing when he lost control of his car, was released by his parents and police yesterday. The fatal text message serves as a warning of the consequences of texting while driving.

http://www.digitaljournal.com/article/347777

Driving and Texting

- evidence shows a strong connection between cell phone use and traffic accidents
- the risk of a collision was four times higher when using a cell phone than when a cell phone was not being used (Redelmeier & Tibshirani, 1997)
- hands-free cell phone units offered no safety advantage over handheld units
  - the issue isn't isn't driving with one hand, but rather driving with fewer cognitive resources available to focus attention on driving

Summary

- Gestalt visual processing explains to a large degree the way users visually parse screens
- The way information is displayed can greatly influence how easy or difficult it is to comprehend appropriate pieces of information
- Change blindness is a relevant issue for visual presentations with dynamic behaviours
- Tasks requiring divided attention are difficult due to cognitive processing demands