0. Background
- vision is carried out via separate pathways
- how is this integrated?
- integration process not well understood, but appears to involve attention

1. Preattentive Processing

1.1 Initial Stages of Visual Processing
- what properties are determined at this level?
  - colour: photoreceptors in retina, each sensitive to a particular colour
    - red, green, or blue:
    - colour is coded at each location in visual field
  - orientation: cells in visual cortex, each sensitive to a particular orientation
    - orientation is coded at each location in visual field
1.2 Visual Search
- How does this show up in visual perception?
  - unique colour or orientation “pops out” among other items:

```
[Image of multiple items with one highlighted]
```

- visual search: measure time to detect the presence (or absence) of a given target item
  - measure reaction time as a function of number of items
    - search slope = (change in reaction time) / (change in number of items)

```
<table>
<thead>
<tr>
<th>Reaction time (ms)</th>
<th>Number of items (set size)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td></td>
</tr>
<tr>
<td>400</td>
<td></td>
</tr>
<tr>
<td>500</td>
<td></td>
</tr>
<tr>
<td>600</td>
<td></td>
</tr>
</tbody>
</table>
```

- doesn’t take much time to detect unique colour or orientation
  - pop-out corresponds to slope that is low ≈ 0 ms/item)
- proposal: pop-out indicates existence of a unique visual primitive (feature)
  - unique value automatically draws attention
- properties for which this works include:
  - colour
  - orientation
  - length
  - motion
- cells in striate or extrastriate cortex respond selectively to these properties

2. Selective Construction
2.1. Feature Binding
- unique items are not always easy to notice
  - e.g., a T-shaped item among L-shaped items
  - a blue vertical item among blue horizontal and red vertical items
  - in general, slow search whenever target is distinguished by a particular combination (or conjunction) of features
- here, reaction time depends linearly on the number of items
  - slope is steep (usually 30 ms/item or greater)
  - finding the target requires effort
- two types of response patterns (rapid and slow search) correspond to two types of accuracy patterns (constant and deteriorating accuracy)
2.2 Possible Explanation (Treisman)

- **Rapid search** (constant accuracy):
  - visual primitives calculated without attention (preattentive features)
    - no attention involved: *preattentive processing*
  - calculated rapidly and in parallel across the visual field
  - unique preattentive feature draws attention

- **Slow search** (deteriorating accuracy):
  - combination (conjunction) of features requires a *spotlight of attention*
    - “welds” the preattentive features at a rate of c. 30 ms/item
    - serial process: attention travels from one item to another in turn

- these two types of visual process correspond to two types of response patterns
- also accounts for texture boundaries
  - boundaries are perceived exactly when there exists a difference in features
  - no boundaries are perceived when there exists only a difference in conjunction
Summary
- need attention to combine (bind) properties of an object
  o combination is not automatic
  o “spotlight of attention” welds properties together
  o moves from item to item at c. 30 ms/item
- if something is not attended, its properties are not completely combined, and so it is not completely(?) seen.

REAL-WORLD SEGMENT: Writing III – Composition

1. The paragraph is the basic unit of composition.
   A paragraph corresponds to a unit of thought.
   Could be an argument, a reason, an introduction, a conclusion, …
   Usually about 7-14 lines. (Range is typically 4-20 lines.)
   Each paragraph should make one point. No more.
   Each paragraph should make a complete point. No less.
   When a reason is complex (common in science), paragraph = reason
   - when a reason is very complex, paragraph = one component of the reason

2. Order your points.
   a. Introduction. Set the stage.
      • Make your intentions clear
      • No need to explain all the steps (at least here)
        • just enough to give the general idea (set up the schema)
      • keep it brief
   b. Give your points one at a time
      • Don’t mix reasons
      • Don’t return to previous points
      • Keep terms consistent
   c. Conclusion. What your reader (listener) should believe.
      • Implications about other aspects

3. More Generally: Tell a Good Story
   As much as possible, write as if telling a story
   • Set up the scene (introduction)
   • Get things moving (action)
      • lay out the beliefs you want people to adopt
      • convince them (argument)
   • Wrap up the situation (resolution)
      • take-home message
      • connections to other areas

      • Ideally, just a very rough outline
      • Don’t worry about content
      • Don’t worry about style
b. Rewrite: Focus locally (and evolve) - sentence level
   • Could each sentence be improved?
     o Could it better capture your thought?
     o Could terms be improved (less ambiguous, more consistent)?
     o Could the style be improved?
     o Could the sentence be moved to a different location?
   • Do the words work together?
     o Don’t be afraid to throw out a word if need be
   • Once this is done, examine again
   • Goals: - clarity and conciseness
     o Economy (good signal-to-noise ratio) – how you say it

c. Rewrite: Focus at a higher level (and evolve) - paragraph level
   • Could each paragraph be improved?
     o Could it better capture your thought?
     o Could terms be improved (less ambiguous, more consistent)?
     o Could the style be improved?
     o Could the paragraph be moved to a different location?
   • Do the sentences work together?
     o Don’t be afraid to throw out a sentence if need be
   • Once this is done, examine again
   • Goals: - clarity and conciseness

d. Rewrite: Focus at a higher level (and evolve) - section level
   • Could each section be improved?
     o Could it better capture your thought?
     o Could terms be improved (less ambiguous, more consistent)?
     o Could the style be improved?
     o Could the section be moved to a different location?
   • Do the paragraphs work together?
     o Don’t be afraid to throw out a paragraph if need be
   • Once this is done, examine again
   • Goals: - clarity and conciseness

e. Set aside, and re-examine later
   • Gives you better perspective