

Understanding Gaze and Scrolling Strategies in Text Consumption Tasks

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Gaze-enhanced Scrolling

Implicit execution of
scrolling events based on
gaze activity

Design a new gaze-enhanced scrolling technique

- Gaze activated scrolling, akin to its manual counterpart
- Record how users scroll when consuming digital text
- Analysed their behaviour / strategies
- Applied findings to derive a technique

Region&Structure Technique

- Gaze as input
- Scrolling triggered by...
 - gaze entering specific zones of the viewport
 - gaze entering specific zones of a document's structure
- Detail the study – how we arrived at this technique

Marie Curie

Marie Curie (French:) (7 November 1867 – 4 July 1934), née Maria Salomea Skłodowska (Polish:), was a Polish physicist and chemist, working mainly in France, who is famous for her pioneering research on radioactivity. She was the first woman to win a Nobel Prize, the only woman to win in two fields, and the only person to win in multiple sciences. She was also the first female professor at the University of Paris (La Sorbonne), and in 1995 became the first woman to be entombed on her own merits in Paris' Panthéon.

Early years

Maria Skłodowska was born in Warsaw, in the Russian partition of Poland, on 7 November 1867, the fifth and youngest child of well-known teachers Bronisława and Władysław Skłodowski. Maria's older siblings were Zofia (born 1862), Józef (1863), Bronisława (1865) and Helena (1866).

New life in Paris

In late 1891 she left Poland for France. In Paris, Maria (or Marie, as she would be known in France) briefly found shelter with her sister and brother-in-law before renting a garret closer to the university, in the Latin Quarter, and proceeding with her studies of physics, chemistry and mathematics at the Sorbonne (the University of Paris) where she enrolled in late 1891. She

Trigger zones

- Techniques

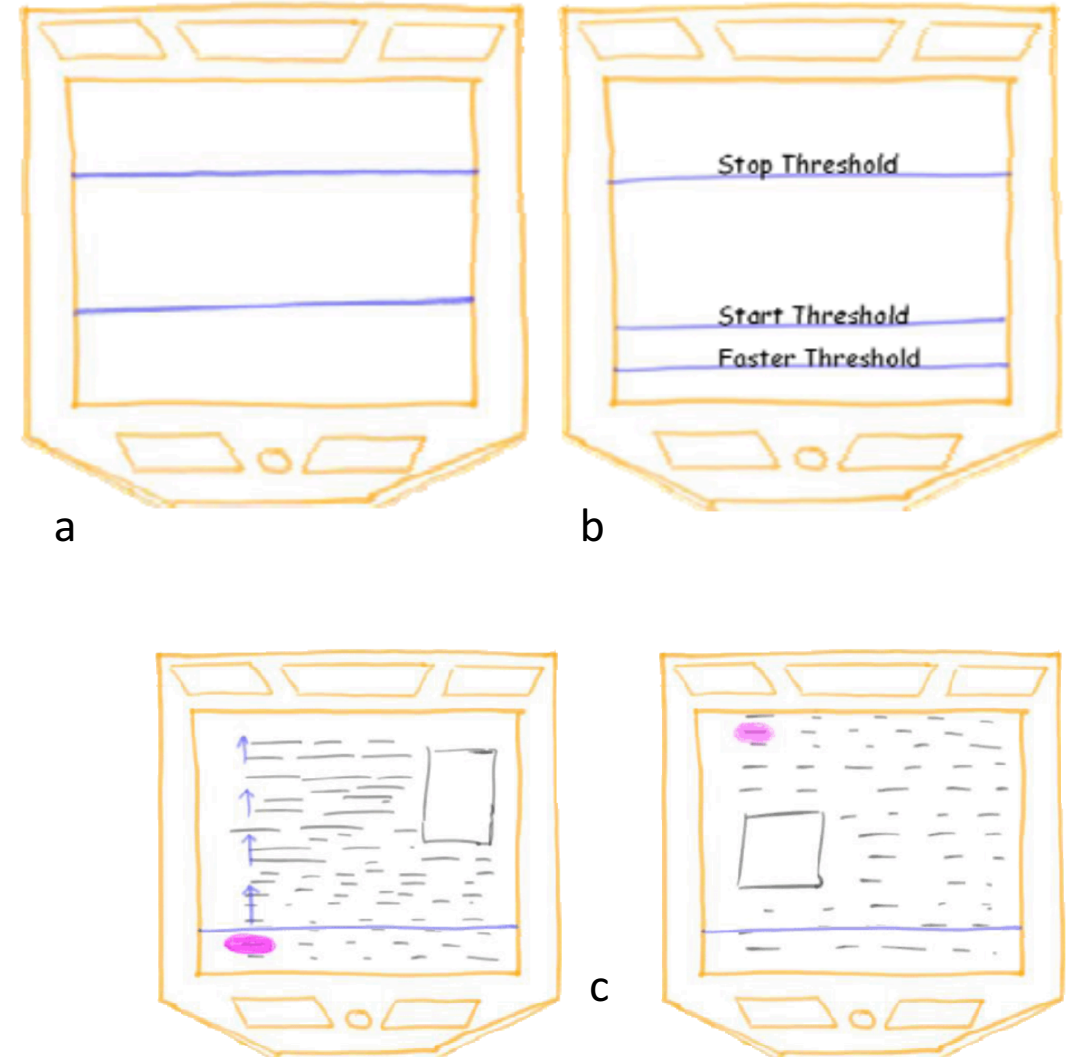
- (a) **Eye-in-the-middle** - Estimation of reading speed

- (b) **Smooth scrolling** - variable speed

- (c) **Discrete scrolling** - page-by-page

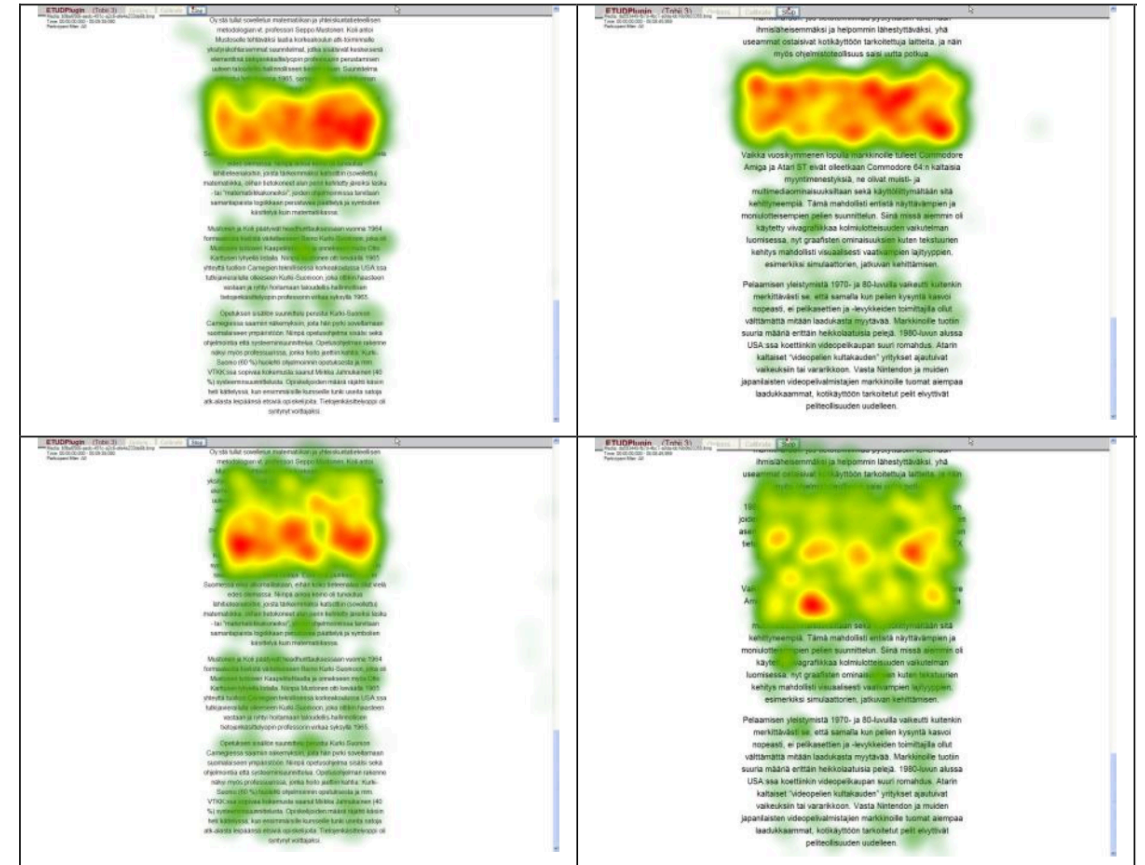
- Gaze Marker to aid orientation

- Middle, or page by page reading



Preferred Regions

- Preferred reading regions
- Distribution of gaze activity on screen throughout reading (heat maps)
- Technique to recognise preferred region and auto-scroll within that region
- Smooth auto-scrolling



Where do users look as they scroll during reading?

- Analyse input from
 - Gaze
 - Scroll Wheel
- Gaze position at the moment of a scroll action
- Commonality in gaze points
- Used cues for gaze-only auto-scrolling

Regardless of the type of arthritis, the common symptoms for all arthritis disorders include varied levels of pain, swelling, joint stiffness, and sometimes a constant ache around the joint(s). Arthritic disorders like lupus and rheumatoid can also affect other organs in the body with a variety of symptoms.

Disability

Arthritis is the most common cause of disability in the USA. More than 20 million individuals with arthritis have severe limitations in function on a daily basis. Absenteeism and frequent visits to the physician are common in individuals who have arthritis. Arthritis makes it very difficult for individuals to be physically active and many become home bound.

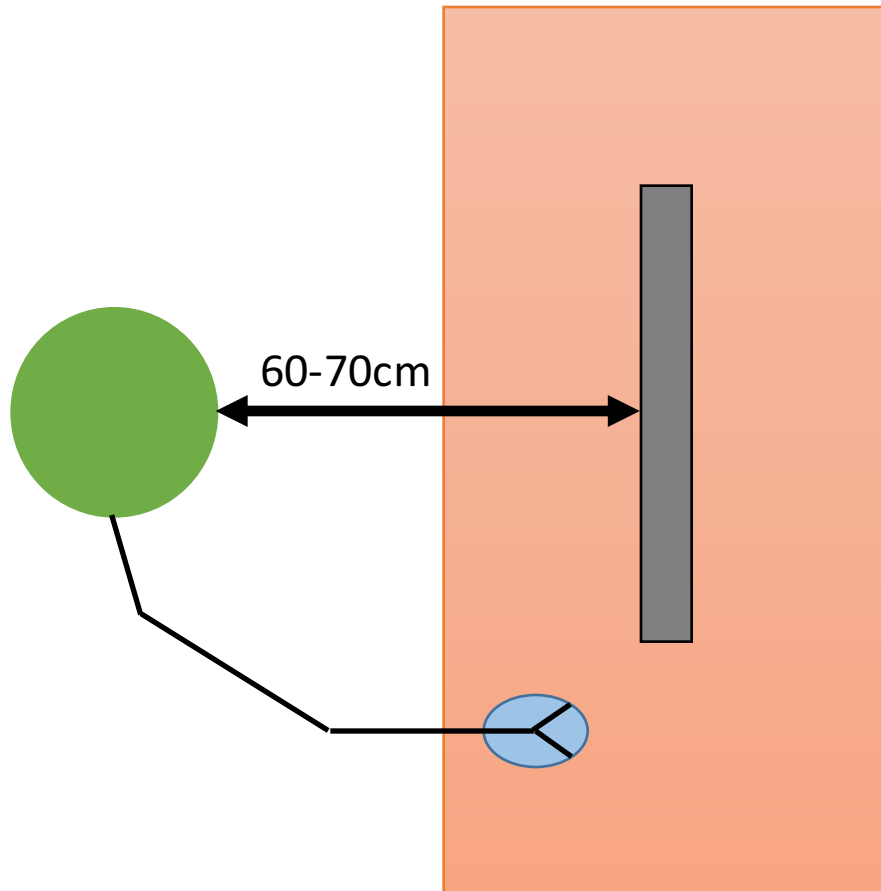
Diagnosis

Diagnosis is made by clinical examination from an appropriate health professional, and may be supported by other tests such as radiology and blood tests, depending on the type of suspected arthritis. All arthritides potentially feature pain. Pain patterns may differ depending on the arthritides and the location. Rheumatoid arthritis is generally worse in the morning and associated with stiffness; in the early stages, patients often have no symptoms after a morning shower. Osteoarthritis, on the other hand, tends to be worse after exercise. In the aged and children, pain might not be the main presenting feature; the aged patient simply moves less, the infantile patient refuses to use the affected limb.

Osteoarthritis

Data Collection

Setup



Tobii TX 300



Mouse with
Scroll Wheel

- 18 Participants
- 6 Female, 12 Male
- Age 24-55 (M=30 SD=8.9)

Text Consumption Types

Reading

- Entire document
- Complete Understanding
- ~250 words per minute

Skimming

- Gist
- Key words
- ~650 words per minute

Visual Search

- Not analysed

Tasks

Reading

- Articles of ~500 words
- No time limit (~2mins)
- Fully comprehend

Skimming

- Articles of ~500 words
- 60 seconds
- Comprehend as much as possible

1 training trial + 10 recorded trials per task

2 Comprehension Questions

All scrolling with scroll wheel

Reading Material

- Stripped down Wikipedia articles
 - Text-only
 - Various topics
- 1 heading and 1 paragraph from each original section
- Font 2em (due to eye-tracking inaccuracy)

Twerking

Twerking is a type of dancing in which an individual, usually a female, dances to popular music in a sexually provocative manner involving thrusting hip movements and a low squatting stance. Though the term seems to be of uncertain origin with common assumptions suggesting it is a contraction of "footwork" and a portmanteau of the words "twist" and "jerk", there is evidence from ethnographic interviews in New Orleans that the term began as street language in New Orleans with the rise of the local hip-hop music known as Bounce. Since the late 1990s, twerking was associated with Bounce music of the Dirty South and was disseminated via mainstream hip hop videos and popular video-sharing sites since the mid 2000s. In 2013, twerk was added to the Oxford Dictionary Online. The dictionary said the word had been around for 20 years. The word was a runner-up in the Oxford Dictionaries Word of the Year 2013.

Background

Comparisons have been made with traditional African dances, for instance the Mapouka from West Africa which was banned from Ivory Coast's television due to its suggestive nature. Twerking can carry both gendered and racialized connotations. In the United States, twerking was introduced into hip-hop culture by way of the New Orleans bounce music scene. In 1982 the twerk was first performed on live television in the Top of the Pops show by the group Haysi Fantayzee while performing their song John Wayne Is Big Leggy. In 1993, DJ Jubilee recorded the dance tune "Do The Jubilee All" in which he chanted, "Twerk baby, twerk baby, twerk, twerk, twerk." The video for the song increased the popularity of twerking. In 1995 New Orleans-based rapper Cheeky Blakk recorded the song "Twerk Something!" a call-and-response dance song dedicated to twerking. In 1997 DJ Jubilee recorded "Get Ready, Ready" in which he encouraged listeners to "Twerk it!".

Entertainment industry

Results

Scrolling Strategies

- Last fixation before scroll
- Discrete scroll events
 - Classified by greater than 1s scrolling pause
- Scroll Distance
- Viewport
- Document

Last fixation before scroll

Arthritis

Arthritis (from Greek arthro-, joint + -itis, inflammation; plural: arthritides) is a form of joint disorder that involves inflammation of one or more joints. There are over 100 different forms of arthritis. The most common form, osteoarthritis (degenerative joint disease), is a result of trauma to the joint, infection of the joint, or age. Other arthritis forms are rheumatoid arthritis, psoriatic arthritis, and related autoimmune diseases. Septic arthritis is caused by joint infection.

Classification

There are several diseases where joint pain is primary, and is considered the main feature. Generally when a person has "arthritis" it means that they have one of these diseases.

Signs and symptoms

Regardless of the type of arthritis, the common symptoms for all arthritis disorders include varied levels of pain, swelling, joint stiffness, and sometimes a constant ache around the joint(s). Arthritic disorders like lupus and rheumatoid can also affect other organs in the body with a variety of symptoms.

Disability

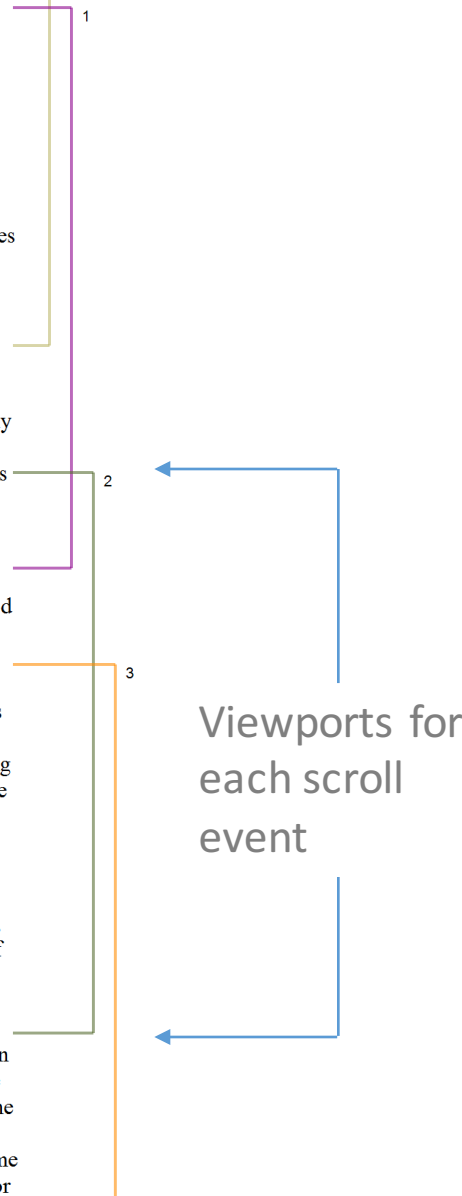
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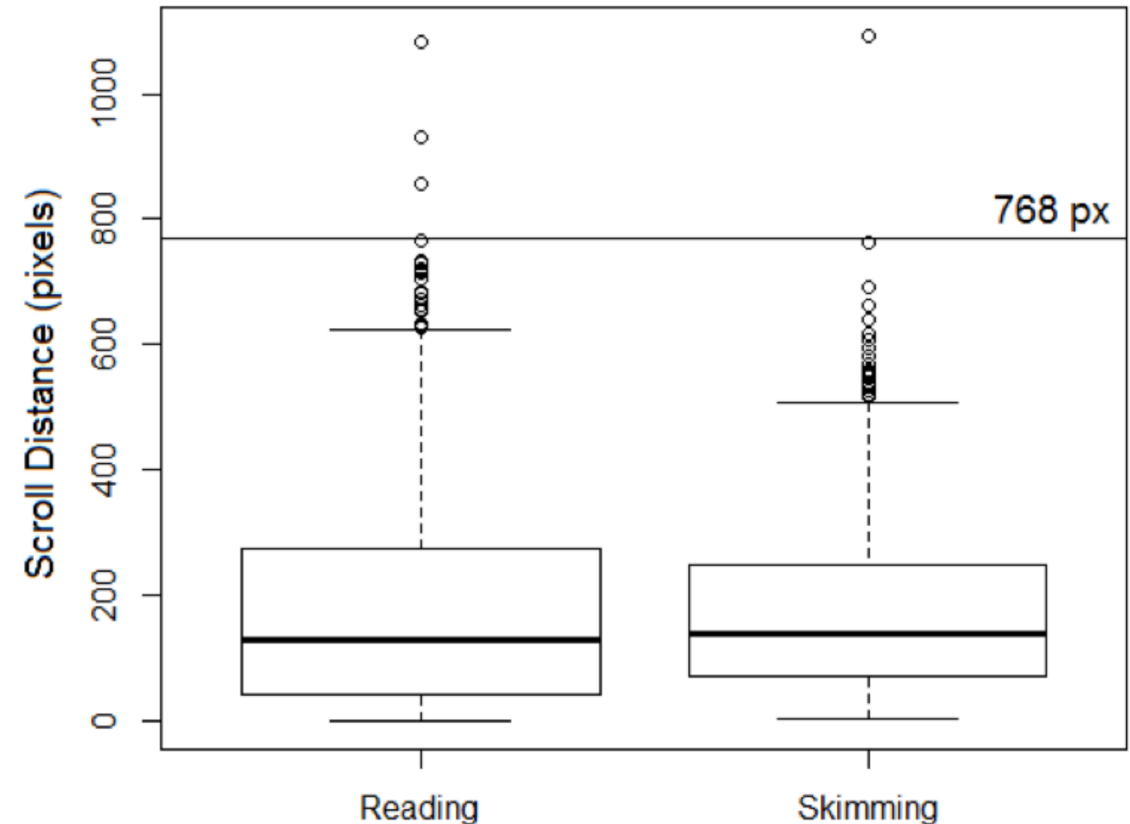
Osteoarthritis

Osteoarthritis is the most common form of arthritis. It can affect both the larger and the smaller joints of the body, including the hands, feet, back, hip, and knee. The disease is essentially one acquired from daily wear and tear of the joint; however, osteoarthritis can also occur as a result of injury. Osteoarthritis begins in the cartilage and eventually causes the two opposing bones to erode into each other. Initially, the condition starts with minor pain during activities, but soon the pain can be continuous and even occur while in a state of rest. The pain can be debilitating and prevent one from doing some activities. Osteoarthritis typically affects the weight-bearing joints, such as the back, spine, and pelvis. Unlike rheumatoid arthritis, osteoarthritis is most commonly a disease of the elderly. More than 30 percent of women have some degree of osteoarthritis by age 65. Risk factors for osteoarthritis include prior joint trauma, obesity, and a sedentary lifestyle.



Scroll Distance

- Viewport 1024x768 / 22 lines
- Reading
 - M = 182px / 5 lines (SD = 4 lines)
 - Median = 3.5 lines
- Skimming
 - M = 174px / 4.8 lines (SD = 3.8 lines)
 - Median = 3.8 lines
- Keeping previously read content visible
- Rarely full page
- No significant difference



Viewport Regions of Interest

Top 1/3

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Middle 1/3

Bottom 1/3

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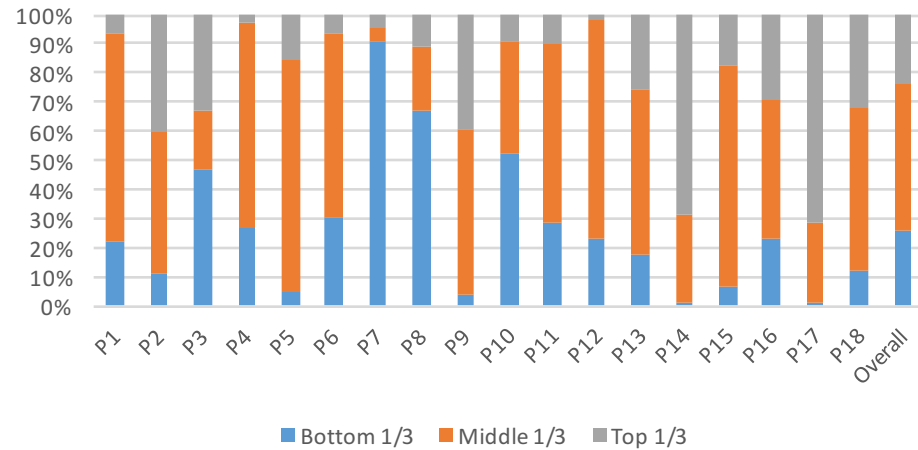
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Top 1/2

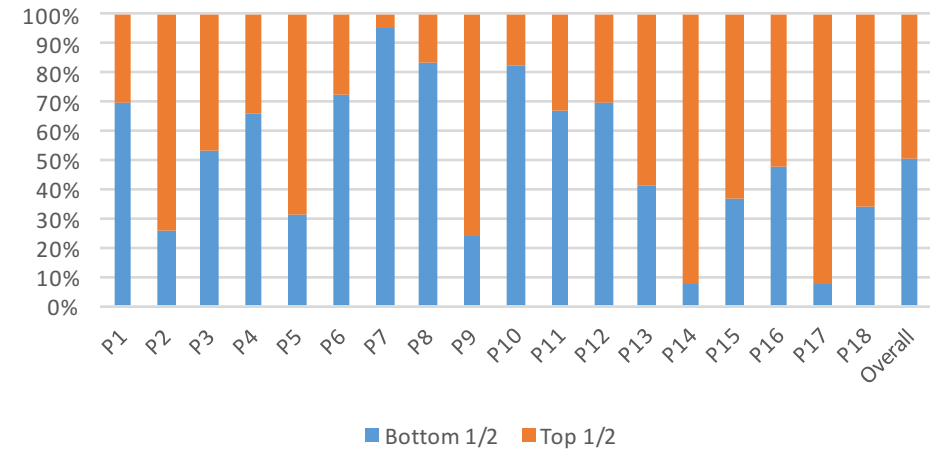
Bottom 1/2

Viewport Regions of Interest (Reading)

1/3 - 1/3 - 1/3



1/2 - 1/2

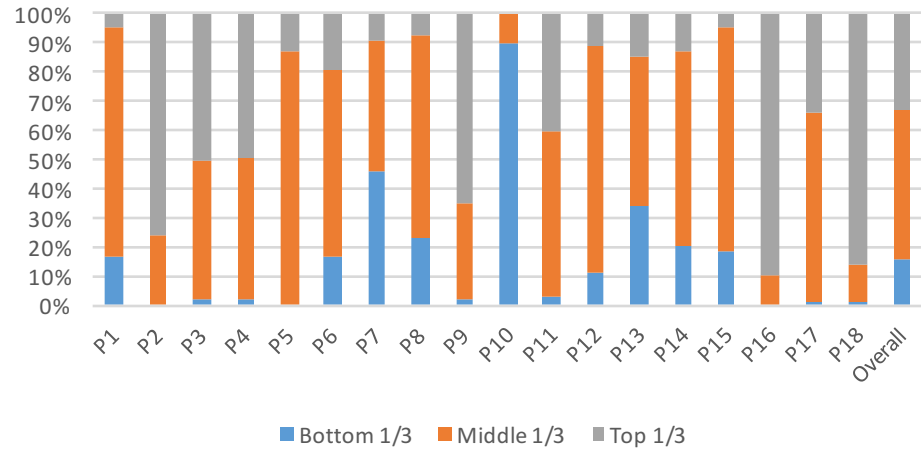


- 50% middle region
- 26% top region
- 24% bottom region

- 51% top region
- 49% bottom region

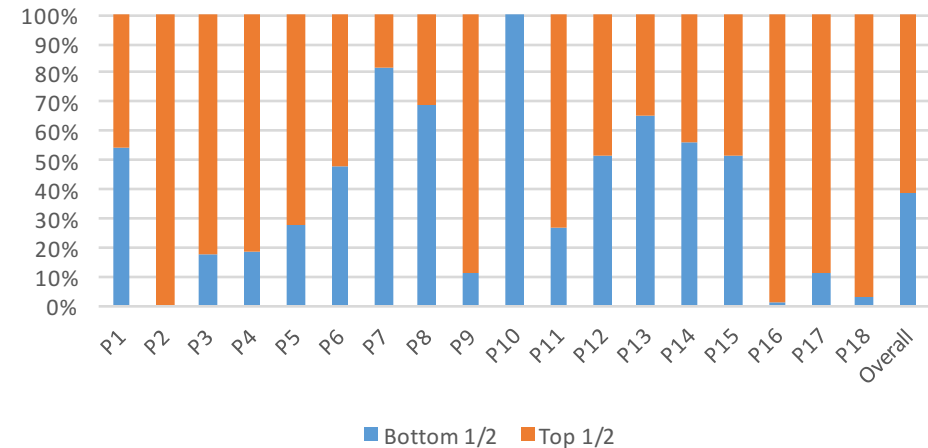
Viewport Regions of Interest (Skimming)

1/3 – 1/3 – 1/3



- 51% middle region
- 33% top region
- 16% bottom region

1/2 – 1/2



- 61% top region
- 39% bottom region

Document Structure Regions

- Divided each page in to regions of interest
 - Section Title
 - Paragraph
 - Start
 - Middle
 - End

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← Section Title

← Paragraph Start

← Paragraph Middle

← Paragraph End

Content Regions of Interest

- Reading

- 18% section title
- 33% para start
- 17% para middle
- 32% para end

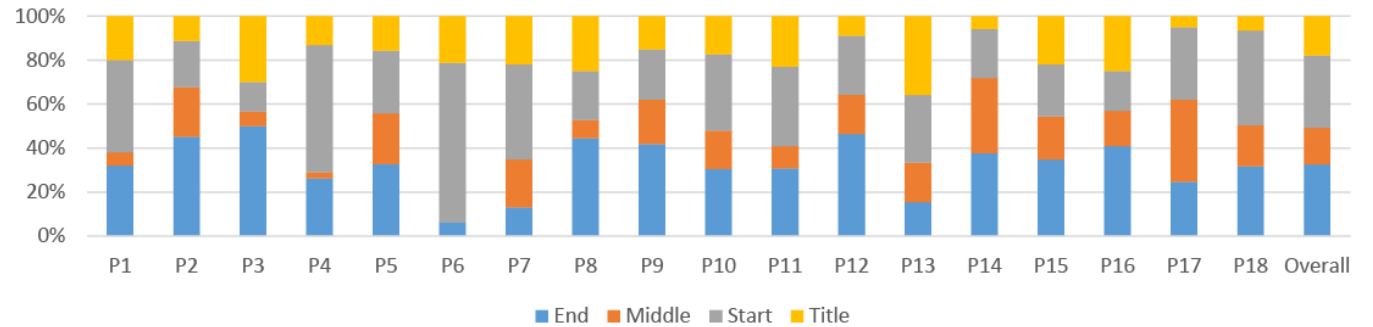
- Skimming

- 16% section title
- 32% para start
- 23% para middle
- 29% para end

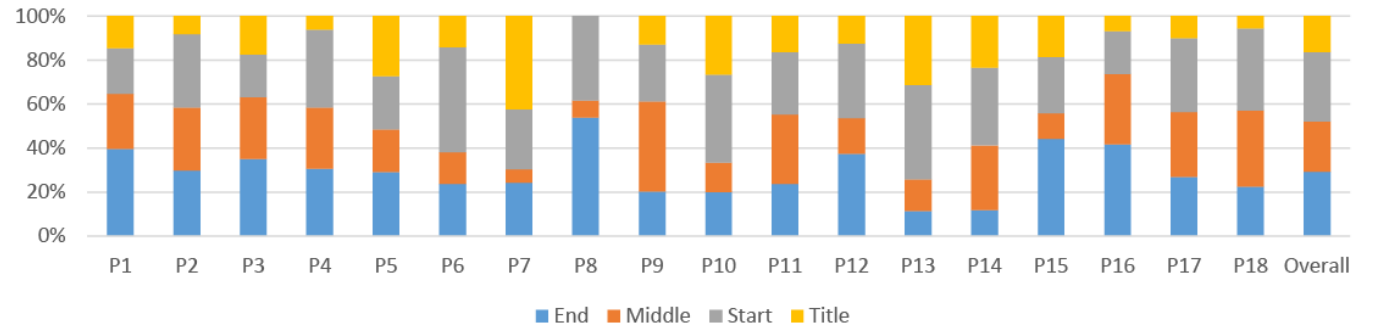
- No clear preference for specific ROI

- Intersection between paragraphs

Structure Regions (Reading)



Structure Regions (Skimming)



Summary

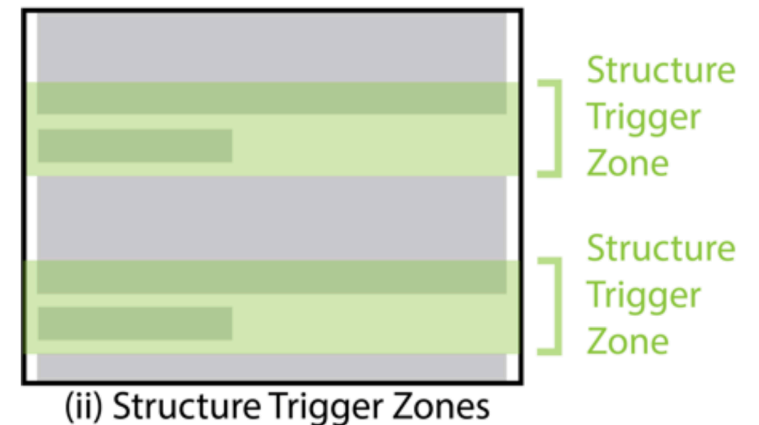
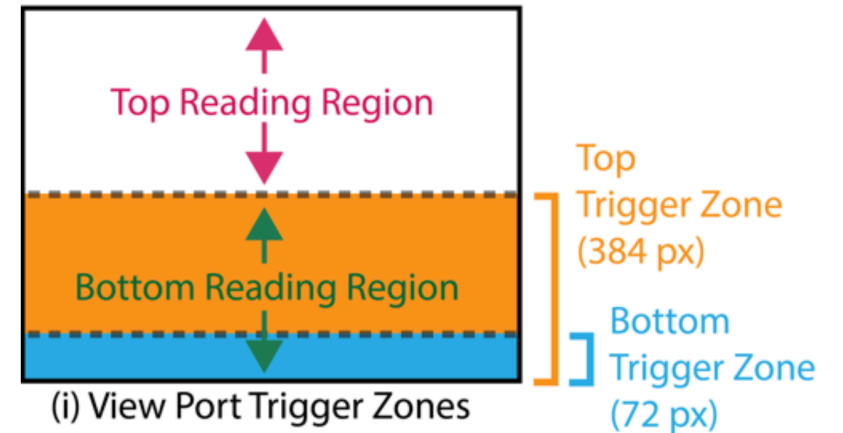
- No difference in scroll distance for Reading and Skimming
- Users scroll just enough to bring in new chunks of text
 - Rarely by page
 - Not smooth
- There are individual differences with regard to preferred reading regions
 - i.e., users have a preferred region
 - New information is brought to the preferred region
- Scroll at the intersection between paragraphs
- Leave some previous context in new viewport

Region&Structure

A Gaze-enhanced Scrolling Technique

Region&Structure

- Support preferred read regions
 - Fixed – Top / Bottom
 - Set as parameter
- Trigger scrolling based on
 - Gaze position within the view port (top or bottom)
 - Gaze position within the document (para end, section title)
- Leave previous context for orientation
 - 1 line (36px) from top of preferred region



Preferred Top Region



Marie Curie

Marie Curie (French:) (7 November 1867 – 4 July 1934), née Maria Salomea Skłodowska (Polish:), was a Polish physicist and chemist, working mainly in France, who is famous for her pioneering research on radioactivity. She was the first woman to win a Nobel Prize, the only woman to win in two fields, and the only person to win in multiple sciences. She was also the first female professor at the University of Paris (La Sorbonne), and in 1995 became the first woman to be entombed on her own merits in Paris' Panthéon.

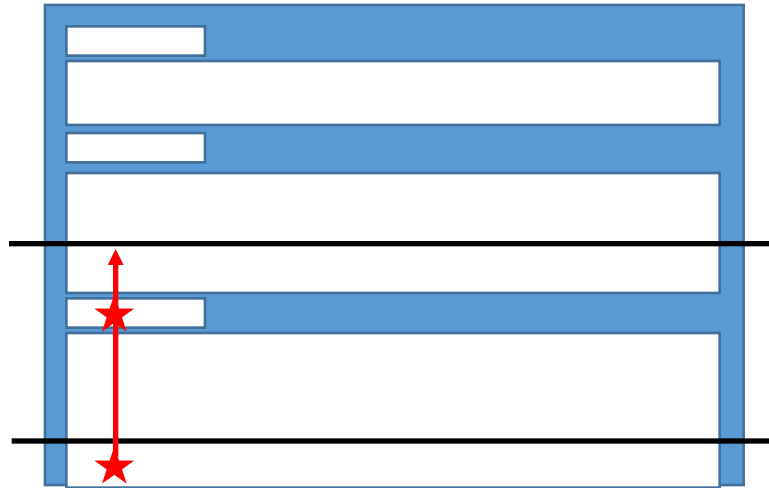
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New life in Paris

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Preferred Bottom Region



Microscope

A microscope (from the Ancient Greek: μικρός, mikrós, "small" and σκοπεῖν, skopeîn, "to look" or "see") is an instrument used to see objects that are too small for the naked eye. The science of investigating small objects using such an instrument is called microscopy. Microscopic means invisible to the eye unless aided by a microscope.

History

The first microscope to be developed was the optical microscope, although the original inventor is not easy to identify. An early microscope was made in 1590 in Middelburg, Netherlands. Two eyeglass makers are variously given credit: Hans Lippershey (who developed an early telescope) and Zacharias Janssen. Giovanni Faber coined the name microscope for Galileo Galilei's compound microscope in 1625 (Galileo had called it the "occholino" or "little eye").

Rise of modern light microscopy

The first detailed account of the interior construction of living tissue based on the use of a microscope did not appear until 1644, in Giambattista Odierna's *L'occhio della mosca*, or *The Fly's Eye*.

Future

- Run user study
- How does Region&Structure compare to manual scrolling?
- Different reading material
 - Varied structures
 - Full multi-media web pages
 - Column layouts

Questions?