



The Reflow Success Criterion

Success Criterion 1.4.10 Reflow (Level AA):

Content can be presented without loss of information or functionality, and without requiring scrolling in two dimensions for:

- Vertical scrolling content at a width equivalent to 320 CSS pixels;
- Horizontal scrolling content at a height equivalent to 256 CSS pixels.
- Except for parts of the content which require two-dimensional layout for usage or meaning.

The intent of this criterion is twofold, to enable:

- Text enlargement up to 400%,
- Viewport shrinkage down to $\frac{1}{4}$ the screen size

Plus —Reflow for both.

Who benefits?

Why is this stated in terms of CSS pixels?

What is 2-dimensional scrolling?

When is it prohibited, and when is it OK?

What are horizontally and vertically scrolling content?

How does one criterion solve two diverse problem?

The Need

Tunnel Vision While Reading

Tunnel Vision While Reading

Case 1: True Tunnel
Vision —Loss of the
Peripheral Visual Field

Users require scrolling in the direction of long lines of text. They need eye and head movements. One must reorient many times to track one long line of text.

Tunnel Vision

While Reading

Case 2: Reduced Clarity —Low Visual Acuity, The inability to perceive fine detail, like small text.

This group must zoom text to perceive it.

This reduces the space for lines of text and forces an artificial tunnel vision.

Solving a Dual Need

Change the Metrics

Use Viewport Geometry

Measure Enlargement
and shrinkage by
pixel count and let
document
presentation adjust.

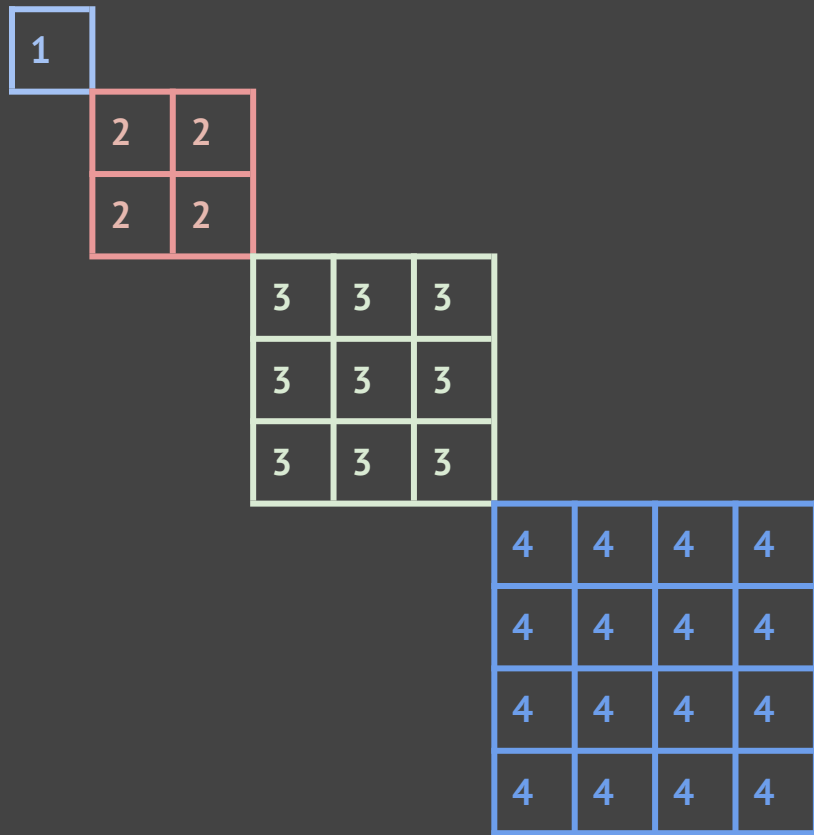
Dual Need:

- Short Lines
- Perceivable Text

Solution:

- Enable readable short lines by requiring reflow.
- Define the measurement in terms of soft pixels (CSS pixels).

Each Square is
One CSS Pixel at:
100%,
200%,
300% &
400%,
respectively.



Containers:

- Screen
- Browser Window
- Viewport

The Reflow
Criterion only
constrains the
viewport size.

The Screen

The Browser Window

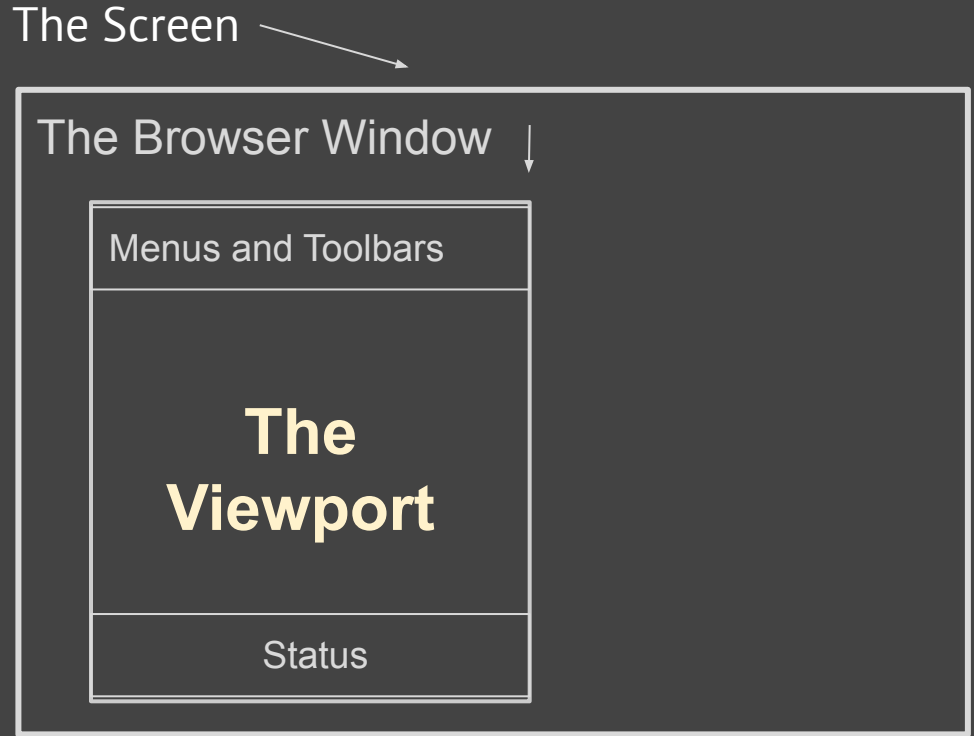
Menus and Toolbars

The Viewport

Status

How it works for Tunnel Vision.

- The Browser Window shrinks.
- This forces the Viewport to shrink.
- Lines get shorter
- Text reflows.



How it works for Reduced Clarity

- Pixels get bigger.
- Viewport size stays the same.
- Lines get shorter
- Text Reflows

The Screen

The Browser Window

Menus and Toolbars

**The
Viewport**

Status

How do we use this insight to make a criterion for WCAG?

1. Use **browser operations**.
2. Give the user sufficient **flexibility**
3. Use **reliable development tools to support this flexibility**

1. Use **browser zoom**. It uses CSS pixels to enlarge and shrink,
2. Enable users to enlarge content by **400%** or shrink the content by **1/4**.
3. Apply the **responsive design** to desktops and laptops using CSS Pixels for breakpoints.

1. **Why 320 or 256 CSS Pixels?**
2. **When is 2-Dimensional scrolling a problem?**
3. **When 2-Dimensional Scrolling is OK?**
4. **What is loss of functionality or information?**

1. $320 = \frac{1}{4}(1280)$, $256 = \frac{1}{4}(1024)$, standard horizontal and vertical measurements.
2. If you scroll in 2 dimensions then one dimension is in the direction of lines of text.
3. If you have a multi column presentation, you will need to scroll from column to column (or row to row in a vertical language.)
4. Controls don't work or text gets smashed up or squeezed out.

Rigid Content – Image

Translate



Close



Viewport

assumed it was a great
white shark. As his boat



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Why Reflow Is Important?

That is, why prohibit 2-dimensional scrolling for reading text?

Reflow supports:

- Tracking
- Comprehension
- Signal to Noise Ratio
- Tractability

Without Reflow

- User must scroll within lines of text to see all the content.
- Moving from line to line requires scrolling way back.
- Only one line holds meaning; The rest are noise.
- It takes a **huge** amount of scrolling

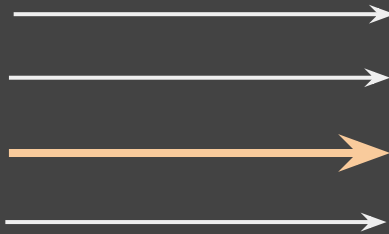
When There Is No Reflow

Viewport No-Scroll

When reflow is not support multiple viewports. The us the all the text. This breaks causing only one line per p

It is hard to track to the be from the end of line .

People forget content whe



Viewport One-Scroll

ed lines are broken across ers must scroll right to see the logical flow of the text age to be meaningful.

ginning of the next line

n it is hidden.

A Rule of Thumb to Count Scrolls.

If a person with low vision wants to read 100 lines of text and some lines of text require N screens to read them after enlargement, then for N= 1, 2, 3

Screens / Line

1

2

2

3

3

3

Scrolls

1 - 2

>50

>100

By Wayne E. Dick

**Operational
Overhead of
Horizontal Scrolling**

<https://noasetothepage.org/Fitz/2dScroll.html>

Easier to Read

**Usability of Enlargement
Methods: How Enlargement
Method Influences the Amount
of Scrolling Actions Needed to
Read Publications**

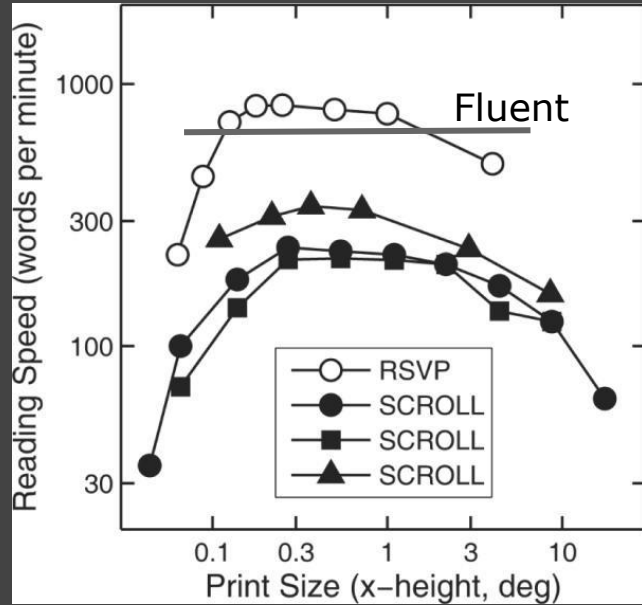
Harder to read.

<https://books.google.com/books?isbn=3319604929>

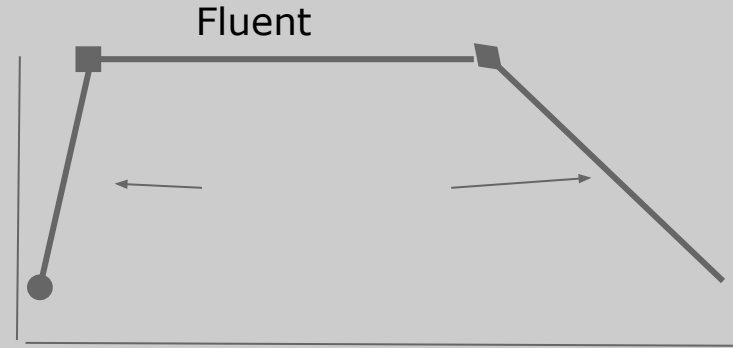


Why Font Size Matters

Font size is important for all people who read. There are readable sizes and unreadable sizes. These sizes are well known and dangerous for publishers to ignore.



Experimental data that results from different measurement methods..



Reading Speed —Vertical Axis

Print Size —Horizontal Axis

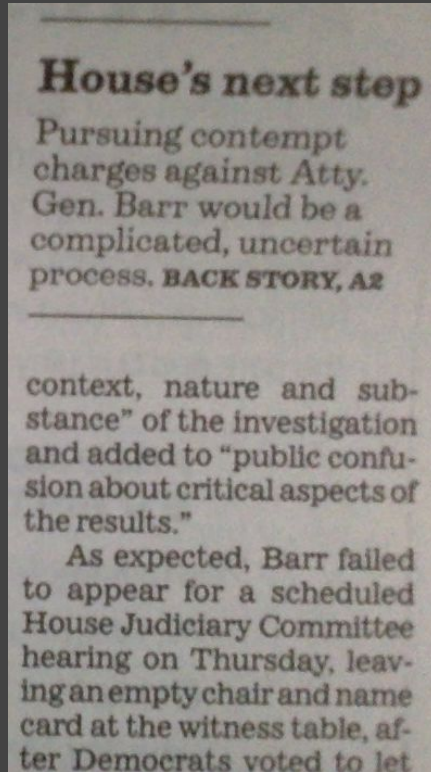
Dot marks **Acuity Limit**

Square marks **Critical Print Size**

Size

Diamond marks end of **fluent range**

Critical Print Size



Top of Fluent Font Size



Text in the range from newsprint to the 20 dollar bill is very readable by normal readers.

The Common Features of All Measurements

- Critical Print Size
- Fluent Range
- Degradation on both ends.

- Below the critical print size reading degrades very rapidly
- Reading speed is almost constant within the fluent range
- Above the fluent range reading degrades but much less quickly

Take Away

Reading outside of the fluent range is impractical for everyone.

Reduced Clarity and Normal Vision Differ in Only One Way

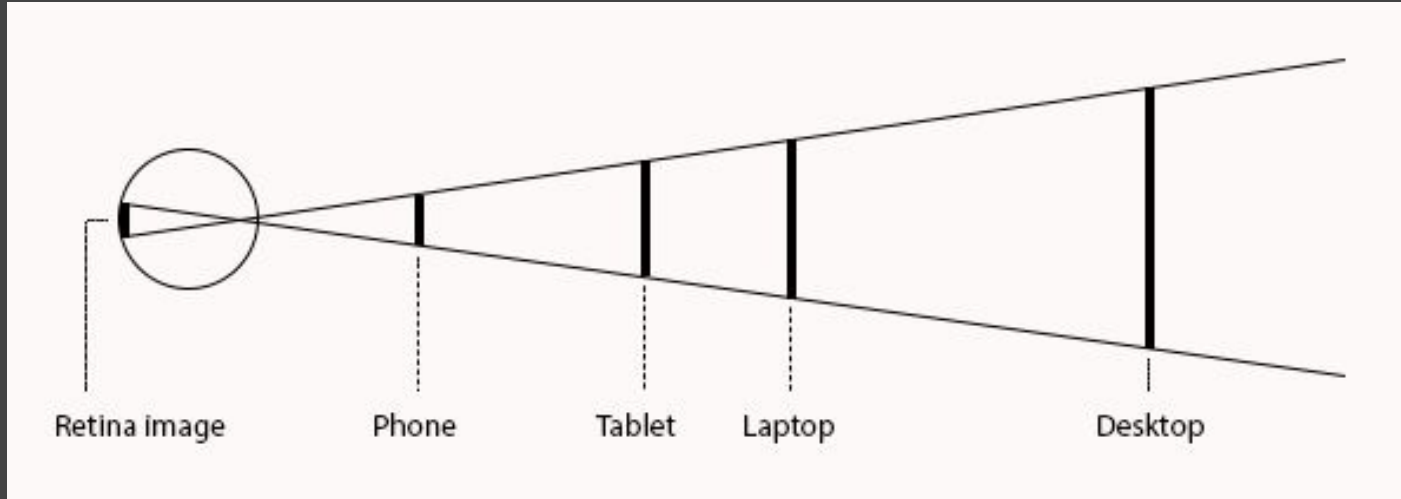
**The font size must
be bigger.**

- Acuity limit it larger
- Critical print size is larger
- Fluent range is about the same length (if words fits)



16 Pixel font is the Sweet Spot

16 Pixels is built to be fluent



Hardware is designed so that 16px is equivalent to 12 points at the intended reading distance.

How the Reflow SC Should Work

- Use Responsive Design
- Make sure reflow of all text occurs at each breakpoint
- Use 16 pixels for running text at all levels
- Never shrink running text size

What the User Gets

- 400%+ enlargement or $\frac{1}{4}$ line length with reflow.
- All intermediate values: (300%, $\frac{1}{3}$), (200%, $\frac{1}{2}$)...
- A fluent font size at all enlargements and whenever the viewport shrinks.
- Never need to scroll in the direction of lines of text just to see content.

Is 400% Enough? Yes.

- 400% of 16 pixels is a fluent size for someone with 20/80 acuity.
- For a person with 20/160 acuity, 400% of 16 pixels at $\frac{1}{2}$ the intended distance is 800%.

- Half of the desktop distance is about laptop distance
- Half of laptop distance is about cell phone distance

By adjusting zoom level and viewing distance, a sufficient enlargement range is available for most users.



Exceptions and Weaknesses

Exceptions:

- Data Tables
- Rigid Content:
images, diagrams,
Video
- Toolbars
- Typewriter Art

Very few exceptions are necessary

Data tables only need to fit one column at a time.

Images and **diagrams** can be cropped and **video** can be shrunk

Toolbars can wrap or have extension indicators like [...]

Typewriter Art just cannot wrap

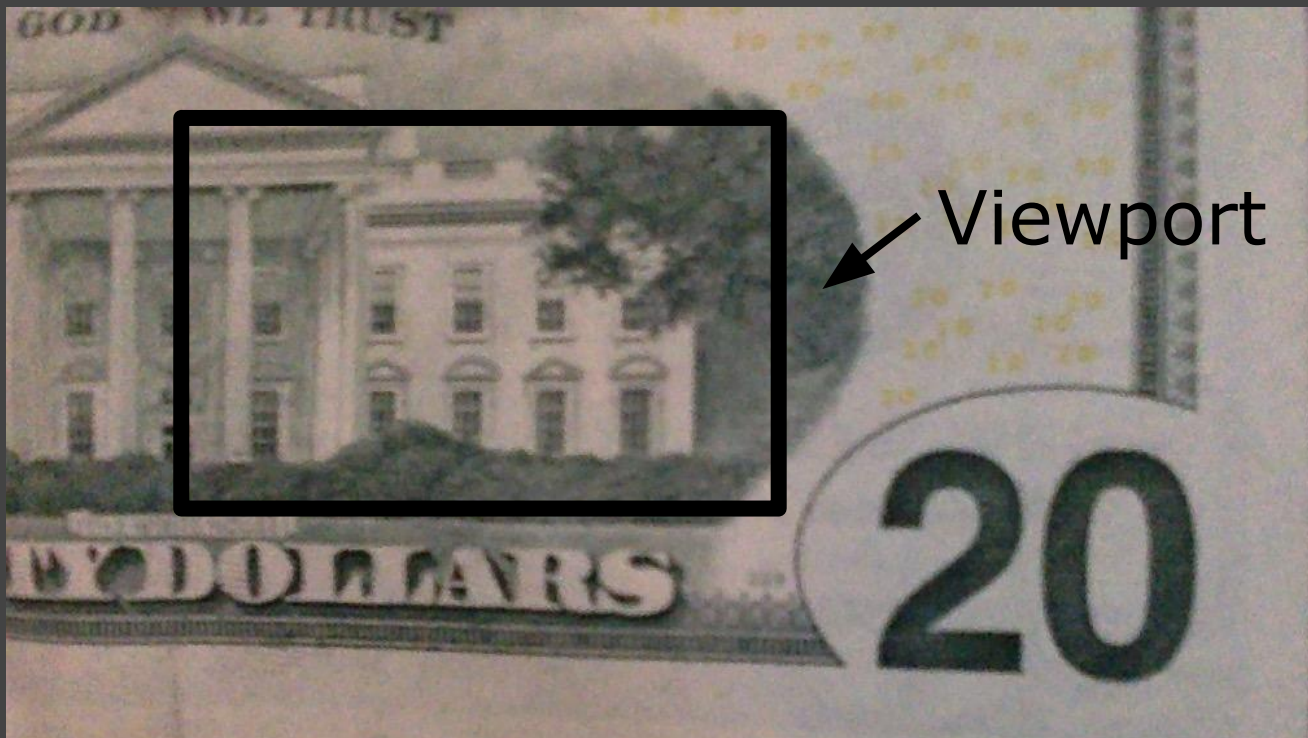
Data Tables

Viewport

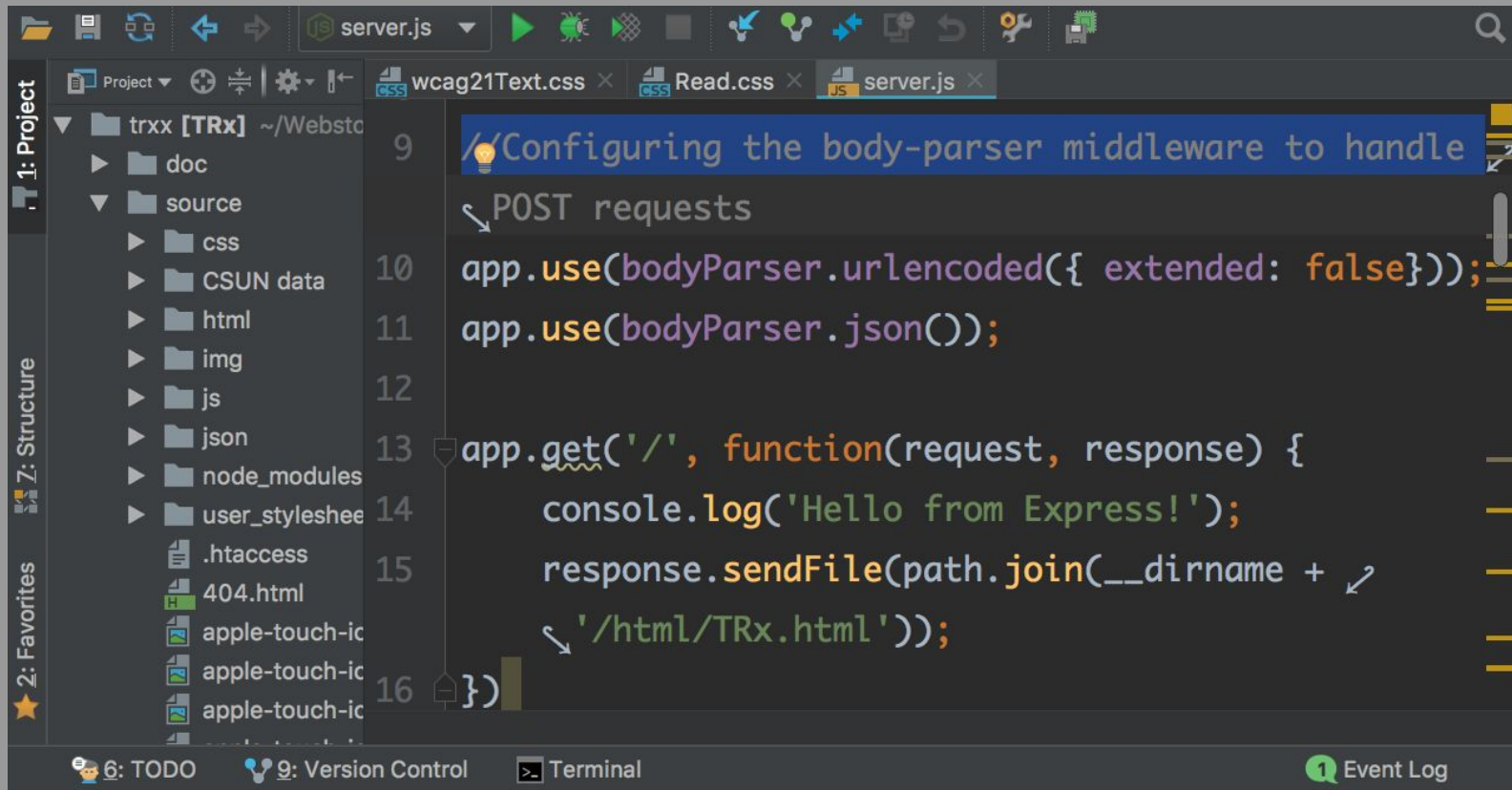


Document	Quotation
Grand by Ron Chernow	The speed, daring, and sophistication of the Vicksburg Campaign eclipsed anything Grant had accomplished before. More than thirty-one thousand southern soldiers fell under his control, joining six thousand captured during the siege and six thousand more in earlier battles after the river crossing. Adding to this bountiful harvest, Grant collected seventeen rebel cannon and sixty thousand muskets and rifles. By contrast, he had sacrificed fewer than ten thousand of his own men, prompting Bruce Catton to remark: "The legend of Grant as the heedless, conscienceless butcher finds nothing to feed on in the story of the Vicksburg campaign."
The New Bill James Historical Baseball Abstract by Bill James et. al.	A cork-center baseball was invented by Ben Shibe in 1909 and marketed by the Reach company, which supplied baseballs for the American League, in 1911. Spalding followed, developing a cork-center ball for the National League. This caused batting levels to jump in 1911 and 1912. Runs scored per game in the American League in 1911 went from 3.6 to 4.6.

Rigid Content – Image



Toolbars



Typewriter Art

[Buffalo Bill 's]

BY E. E. CUMMINGS

Buffalo Bill 's
defunct

who used to
ride a watersmooth-silver

stallion

and break onetwothreefourfive pigeonsjustlikethat

Jesus

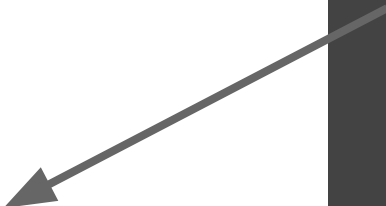
he was a handsome man

and what i want to know is

how do you like your blue-eyed boy

Mister Death

Viewport



Weaknesses - You can cheat

- It is not prohibited to shrink print to enable reflow
- You only are required to reflow at 320 or 256 CSS pixels

A New Use Case for Responsive Design - Landscape Mode on Small Screens:

When headers, footers or other fixed position elements grow they block out text.

This is a **failure** because the page has information is lost, but it **occurs a lot**.



NEW



0



I am creating a spreadsheet for a future wedding and populating Sheet1 with names (Column A), RSVPs (Column B), and Column C as dropdown menus with options