A pixel is not a pixel

Peter-Paul Koch
http://quirksmode.org
http://twitter.com/ppk
MoBeers, 10 April 2012
Example site

- [http://mobilism.nl/2012/](http://mobilism.nl/2012/)
- A proper responsive site that you can use on any device
- However, for most of the presentation I’m going to pretend it’s not mobile-optimised
What we’ll discuss

- Three kinds of pixels
- Two viewports
- Two kinds of zooming
- Five JavaScript property pairs
- Two media queries
- One meta viewport to rule them all
Pixels
“The reference pixel is the visual angle of one pixel on a device with a pixel density of 96dpi and a distance from the reader of an arm's length. For a nominal arm's length of 28 inches, the visual angle is therefore about 0.0213 degrees. For reading at arm's length, 1px thus corresponds to about 0.26 mm (1/96 inch).”

Source: http://www.w3.org/TR/css3-values/#reference-pixel
Pixels according to W3C

Source: http://www.w3.org/TR/css3-values/#reference-pixel
Pixels according to W3C

This is a monkey
Laughing at W3C
Pixels according to W3C

• So the pixel is a certain angle in your view
• which means you cannot zoom it
• An inch is defined as 96 pixels
• and it gets progressively worse from there
Pixels according to W3C

• You can’t use min-height: 6mm and be certain that your element is at least 6 real mm high

• Zooming is not mentioned at all

• W3C’s definition is useless and everybody ignores it

• Especially mobile browsers
A pixel is not a pixel

- CSS pixels
- Density-independent pixels
- Device pixels

None of these have anything to do with W3C's definition.
CSS pixels

- CSS pixels are the ones we use in declarations such as width: 190px or padding-left: 20px
- They are an abstract construct
- Their size may be increased or decreased
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Device pixels

- Device pixels are the physical pixels on the device
- There’s a fixed amount of them that depends on the device
Device pixels

320px
Device pixels

<meta name="viewport"

  content="width = device-width">

• What is the device width?
• The number of device pixels
• So on the iPhone, your site is restricted to 320px
Device pixels

• But ...

• Devices get higher and higher pixel densities

• In theory this would mean that the meta viewport width also goes up

• But that would break sites
Device pixels

640px
Density-independent pixels
Density-independent pixels

• Thus device vendors created density-independent pixels (dips)
• They are another abstraction layer
• The number of dips is equal to the number of CSS pixels that is optimal for viewing a website on the device at 100% zoom
• For the iPhone that’s 320px
Density-independent pixels

<meta name="viewport"
content="width = device-width">

- What is the device width?
- The number of dips
- So on the iPhone, your site is still restricted to 320px
- even on a Retina display
What do we need?

- CSS pixels
- Density-independent pixels
- Device pixels
What do we need?

- **CSS pixels**
- **Density-independent pixels**
- **Device pixels**
Viewports
Viewports

• The viewport is the total amount of space available for CSS layouts

• On the desktop it’s equal to the browser window

• The <html> element has an implicit width: 100% and spans the entire viewport
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Viewports

• On mobile it’s quite a bit more complicated

• If the (narrow) browser window were to be the viewport, many sites would be squeezed to death

• And mobile browsers must render all sites correctly, even if they haven’t been mobile-optimized
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Mobile is becoming increasingly important to web designers and developers because users expect a site to work on their phones. Simultaneously, the web is becoming increasingly...
Viewports

- That’s why the mobile browser vendors have split the viewport into two:
  - The layout viewport, the viewport that CSS declarations such as padding-left: 34% use,
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Viewports

- That’s why the mobile browser vendors have split the viewport into two:
  - The layout viewport, the viewport that CSS declarations such as padding-left: 34% use,
  - and the visual viewport, which is the part of the page the user is currently seeing
- Both are measured in CSS pixels
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Viewports

• Initially most browsers make the visual viewport equal to the layout viewport

• by zooming the page out as much as possible
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Viewports

• Initially most browsers make the visual viewport equal to the layout viewport

• by zooming the page out as much as possible

• Although the page is unreadable, the user can at least decide which part he’d like to concentrate on and zoom in on that part
Zooming
Zooming

• On the desktop the viewport becomes less wide and the CSS pixels become larger.

• The same amount of device pixels now contains less CSS pixels, after all.

• So padding-left: 34% is recalculated,

• and width: 190px now covers more device pixels
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Zooming

- On mobile the visual viewport becomes less wide, but the layout viewport remains static. Thus CSS declarations are not recomputed.
- The visual viewport now contains less CSS pixels.
- The user sees less of the complete site.
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JavaScript properties
JavaScript properties

`screen.width` and `screen.height`

- The width and height of the screen
- In device pixels (or dips)
- Totally useless. Don’t bother reading it out
JavaScript properties

document.documentElement.clientWidth and
document.documentElement.clientHeight

• The width and height of the layout viewport

• In CSS pixels

• Useful, though mostly because of media queries
JavaScript properties

window.innerWidth and window.innerHeight

- The width and height of the visual viewport
- In CSS pixels
- Extremely important. It tells you how much the user is currently seeing
JavaScript properties

document.documentElement.offsetWidth and
document.documentElement.offsetHeight

• The width and height of the `<html>` element

• In CSS pixels

• Very occasionally useful
JavaScript properties

`window.pageXOffset` and `window.pageYOffset`

- The current scrolling offset
- In CSS pixels
- Useful. Works just as on desktop
JavaScript properties

- System pioneered by Nokia and BlackBerry
- Picked up by Apple
- Android supports it only from 3 on
- IE9 on Windows Phone does not support it
- But otherwise browser compatibility is quite decent
JavaScript properties

document.documentElement.clientWidth / window.innerWidth

• This gives the current zoom level

• You’re not interested in the zoom level, though

• You want to know how much the user is currently seeing

• The visual viewport, in other words
Media queries
@media all and (max-width: 600px) {
  .sidebar {
    float: none;
  }
}

}
There are two important media queries:
- width (min-width and max-width)
- device-width (min-device-width and max-device-width)
- width is the one you want
Media queries - device-width

• device-width gives the width of the device screen
• in device pixels
• Equal to screen.width
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Media queries - width

- width gives the width of the viewport
- in CSS pixels
- (There are a few zooming problems on desktop, though)
- Equal to `document.documentElement.clientWidth`
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Recent posts (RSS)

- Fast Track announced; session descriptions available, 13-03-2012
- James Pearce announced, 06-03-2012
- Heiko Behrens announced, 28-02-2012
Media queries - device-width

- device-width gives the width of the device screen
- in device pixels or dips
- Equal to screen.width
- On mobile the screen is far smaller than on desktop, but that doesn’t matter
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Media queries - width

- width gives the width of the viewport
- in CSS pixels
- Equal to `document.documentElement.clientWidth`
- On mobile this means the layout viewport
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Media queries

- width is the media query you want
- but at first sight it seems to be totally useless on mobile
- Usually we don’t care about the width of the layout viewport
- We need to treat one more element, though.
Meta viewport
Meta viewport

<meta name="viewport"
content="width=device-width">
Meta viewport

```css
@viewport {
  width: device-width;
}

Only Opera for now
The meta viewport tag tells the browser to set the size of the layout viewport.

- You can give a pixel value.
- Or `device-width`, which means the screen size in dips (or device pixels).
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Meta viewport

<meta name="viewport"
    content="width = device-width">

• There is little reason to use other values than device-width

• And because you tell the layout viewport to become as wide as the device

• the width media query now contains useful data
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Media queries

• In theory the device-width and width media queries would now return the same values

• but it uses device pixels or dips, which is not what you want

• This is a frighteningly complicated area

• Don’t go there

• Use width
Responsive design

- So the trick for creating a responsive design
- is using `<meta name="viewport" content="width=device-width" />`
- in combination with width media queries
- You probably already knew that
- but now you also understand why
Thank you

I’ll put these slides online

Questions?

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