The Psychology of *Speed*

Simon Hearne

Web Performance Solutions Engineer @ Akamai

simonhearne.com/presentations/psych-speed/

We've all seen the studies...

Walmart sees 1% increase in revenue for every 100ms improvement

wpostats.com/tags/conversion/

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Staples saw a 10% increase in conversion rate when reducing homepage load time by one second

wpostats.com/tags/conversion/

We've all seen the studies...

Walmart	Walmart sees 1% increase in revenue for every 100ms improvement
STAPLES	Staples saw a 10% increase in conversion rate when reducing homepage load time by one second
AliExpress	AliExpress saw 10.5% increase in conversions when reducing load time by 36%

wpostats.com/tags/conversion/

We've all seen the studies...

The BBC loses an additional 10% of users for every additional second it takes to load

wpostats.com/tags/engagement/

We've all seen the studies...

BBC

The BBC loses an additional 10% of users for every additional second it takes to load

Pinterest

Pinterest improved load time by 40% and saw 15% increase in SEO traffic and 15% increase in conversions

wpostats.com/tags/engagement/

We've all seen the studies...

BBC

The BBC loses an additional 10% of users for every additional second it takes to load

Pinterest

Pinterest improved load time by 40% and saw 15% increase in SEO traffic and 15% increase in conversions

FT.com FINANCIAL TIMES

The Financial times increased user engagement by 30% when they released the new, performance focused FT.com

wpostats.com/tags/engagement/

What do we mean by speed?

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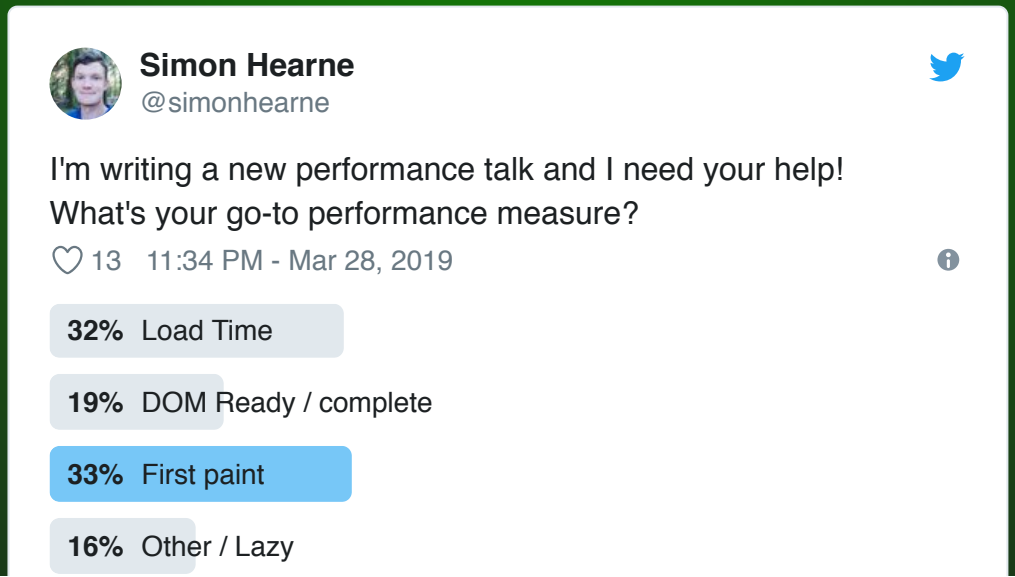
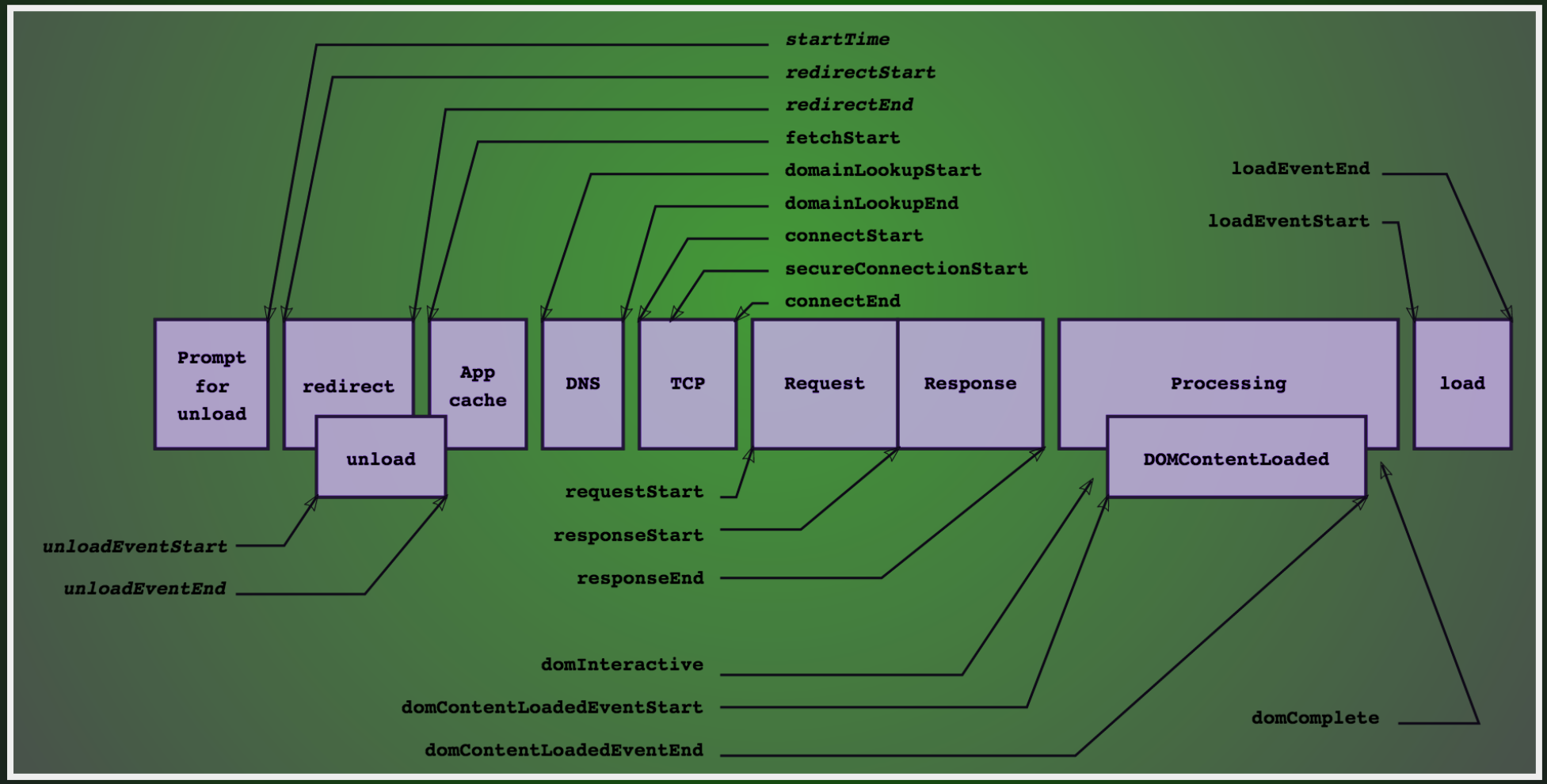


Navigation Timing API



What *actually* matters?

What *actually* matters?

- Is it working?

What *actually* matters?

- Is it working?
- Is it useful?

What *actually* matters?

- Is it working?
- Is it useful?
- Is it interactive?

Is it working?

Google

akamai real user monitoring

All | News | Images | Videos | Maps | More | Settings | Tools

About 358,000 results (0.25 seconds)

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Security Threat Intelligence That
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Real User Monitoring for Improved Web Experience | Akamai
https://www.akamai.com/uk/en/resources/real-user-monitoring.jsp
Akamai's real user monitoring solution provides the critical intelligence you need to provide users with the highest quality web experience.

0:00 / 0:03

Is it working?

- Time to First Byte
- First Paint

Is it useful?

Google

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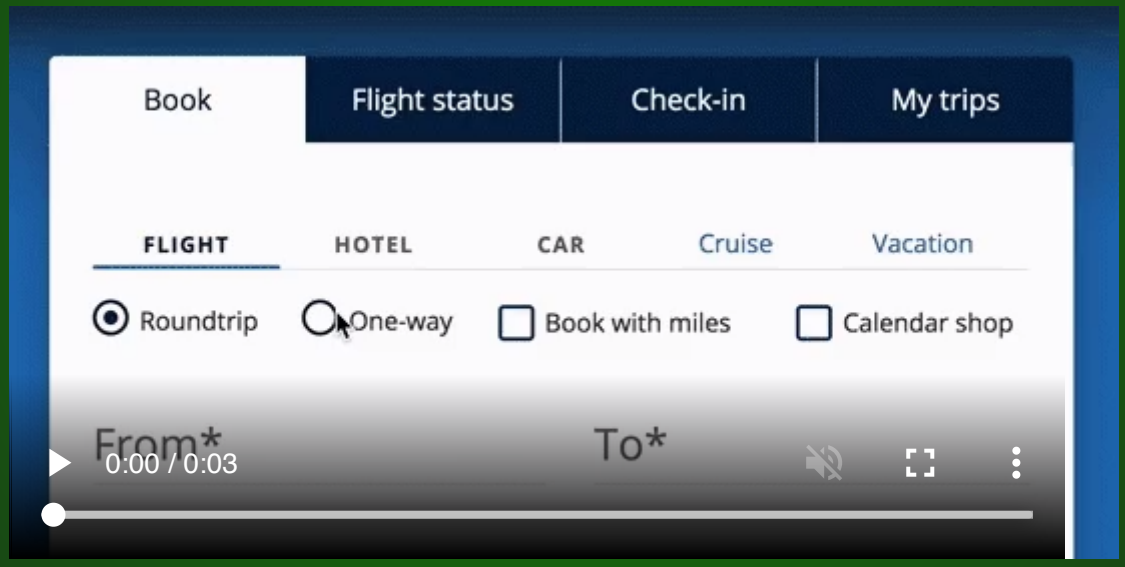
0:00 / 0:04

Is it useful?

- DOM Content Loaded
- DOM Complete
- First Contentful Paint
- Time to Visually Ready*

*mPulse only

Is it interactive?



Is it interactive?

- Time to Interactive
- First Input Delay
- Time to First Interaction
- Rage Clicks*

*mPulse only

POLL 1

What do you measure?

User Timing API 

```
window.addEventListener(
  'scroll',
  ()=>{
    performance.mark('first-scroll');
  },
  {once: true, capture: false, passive: true}
);
```

*probably don't use this in production

User Timing API
94.23%
global browser support
caniuse.com

Timer Summary

Timer Summary

Time to First Byte (TTFB) ⇨ The speed of the delivery stack

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DOM Content Loaded (DCL)	⇨	The speed of critical dependencies

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Time to First Interaction (TTFI)	⇨	When a user first tries to interact

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developer.akamai.com/mpulse/whats-in-a-beacon/

My requirements
(for multi-app analysis)

My requirements
(for multi-app analysis)

1. Available in *most* browsers

My requirements
(for multi-app analysis)

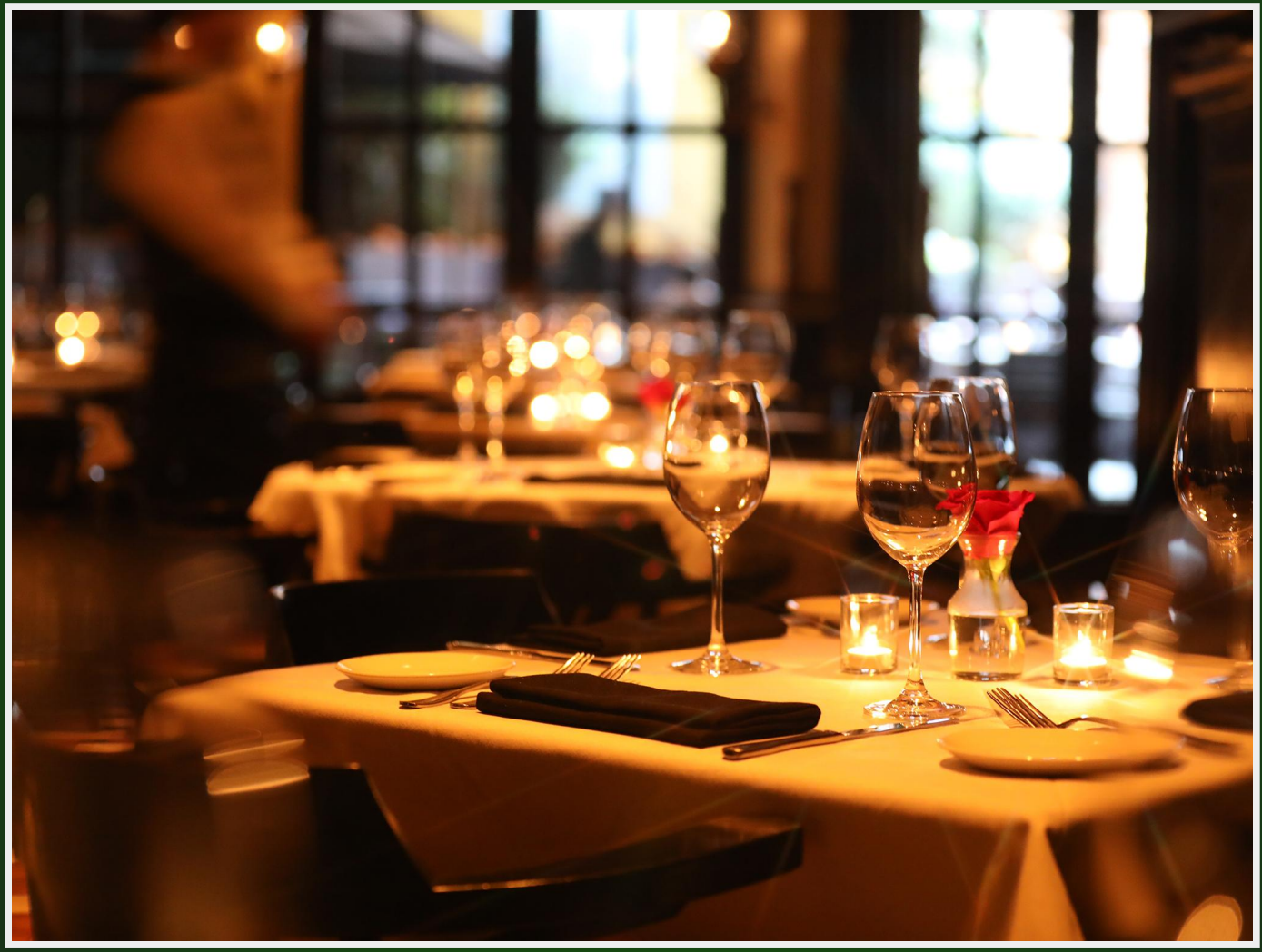
1. Available in *most* browsers
2. Representative of user experience

< psychology >

Objective vs Subjective time

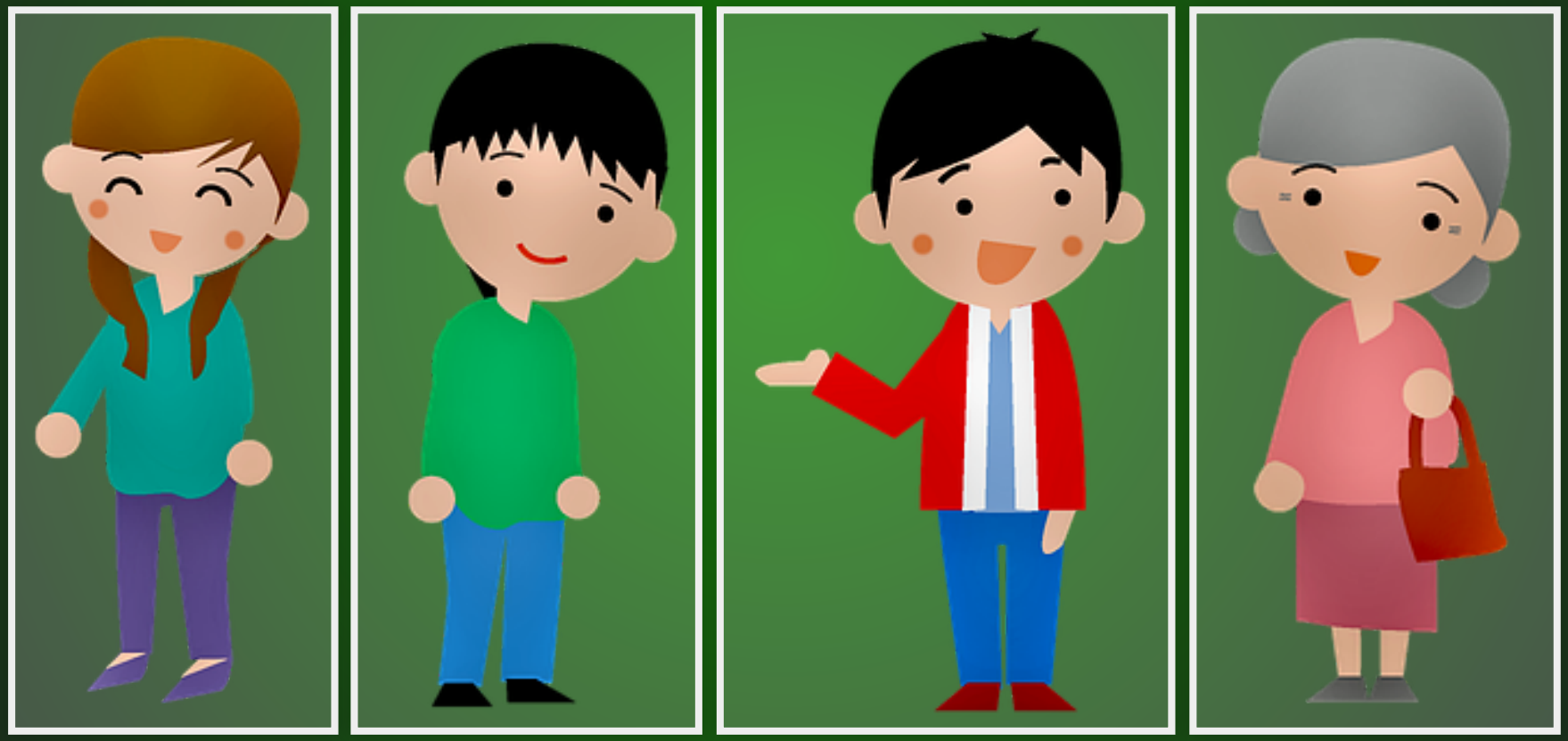
Users don't measure your speed with a stopwatch

How long does ten minutes feel?



How long does ten minutes feel?

Does an hour feel longer to some people?



Our perception of time is subjective...

...but our measures are objective

What about web performance?

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User perception is ~*15% slower* than objective measures

(more *waiting room* than *romantic evening*)

What about web performance?

User perception is ~*15% slower* than objective measures

(more *waiting room* than *romantic evening*)

Find the metric closest to user perception*

*this depends entirely on your app!

First Law of Service

```
satisfaction = perception - expectation
```

The Psychology of Waiting Lines by David Maister

Speed? 🚀

How can we measure speed?

How can we measure speed?

- Synthetic Tests

How can we measure speed?

- Synthetic Tests
- Application Monitoring

How can we measure speed?

- Synthetic Tests
- Application Monitoring
- Analytics

How can we measure speed?

- Synthetic Tests
- Application Monitoring
- Analytics
- Real User Monitoring

POLL 2

How do you measure speed?

- Synthetic Tests
- Application Monitoring
- Analytics
- Real User Monitoring

< psychology >

Just Noticeable Difference

Faster, slower or the same?

reset | all

Faster, slower or the same?

The 20% Rule: "Designing and Engineering Time" by Steven C. Seow, Ph.D.

reset | all

So what?

So what?

Get *20% faster* for existing customers to notice

So what?

Get *20% faster* for existing customers to notice

Be *20% faster* than your peers & competitors

Engagement? 😑

What do you do when you **feel** engaged?

What do you do when you feel engaged?

- Hang around

What do you do when you feel engaged?

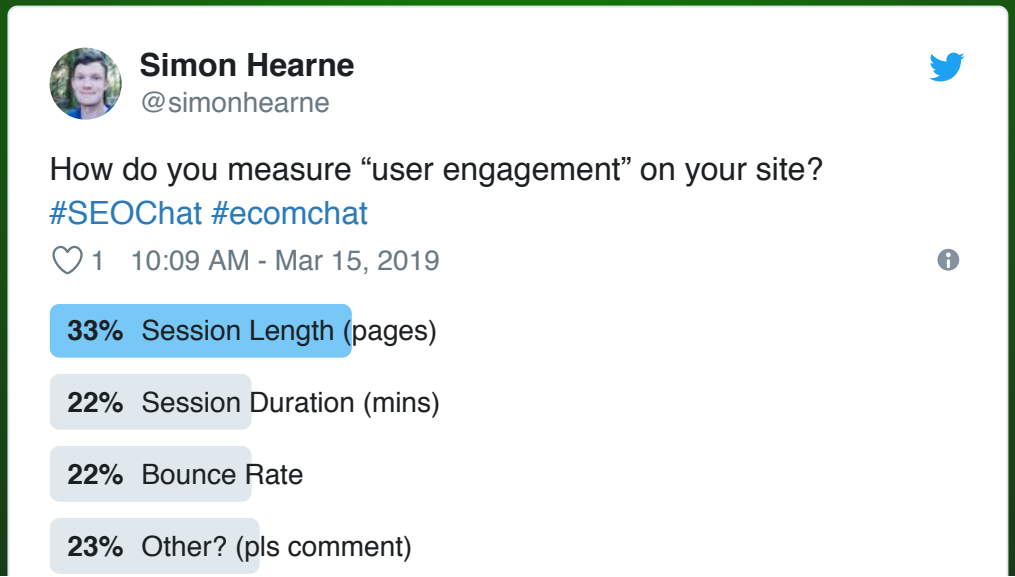
- Hang around
- Click on things

What do you do when you feel engaged?

- Hang around
- Click on things
- Complete an action

How can we measure engagement?

How can we measure engagement?

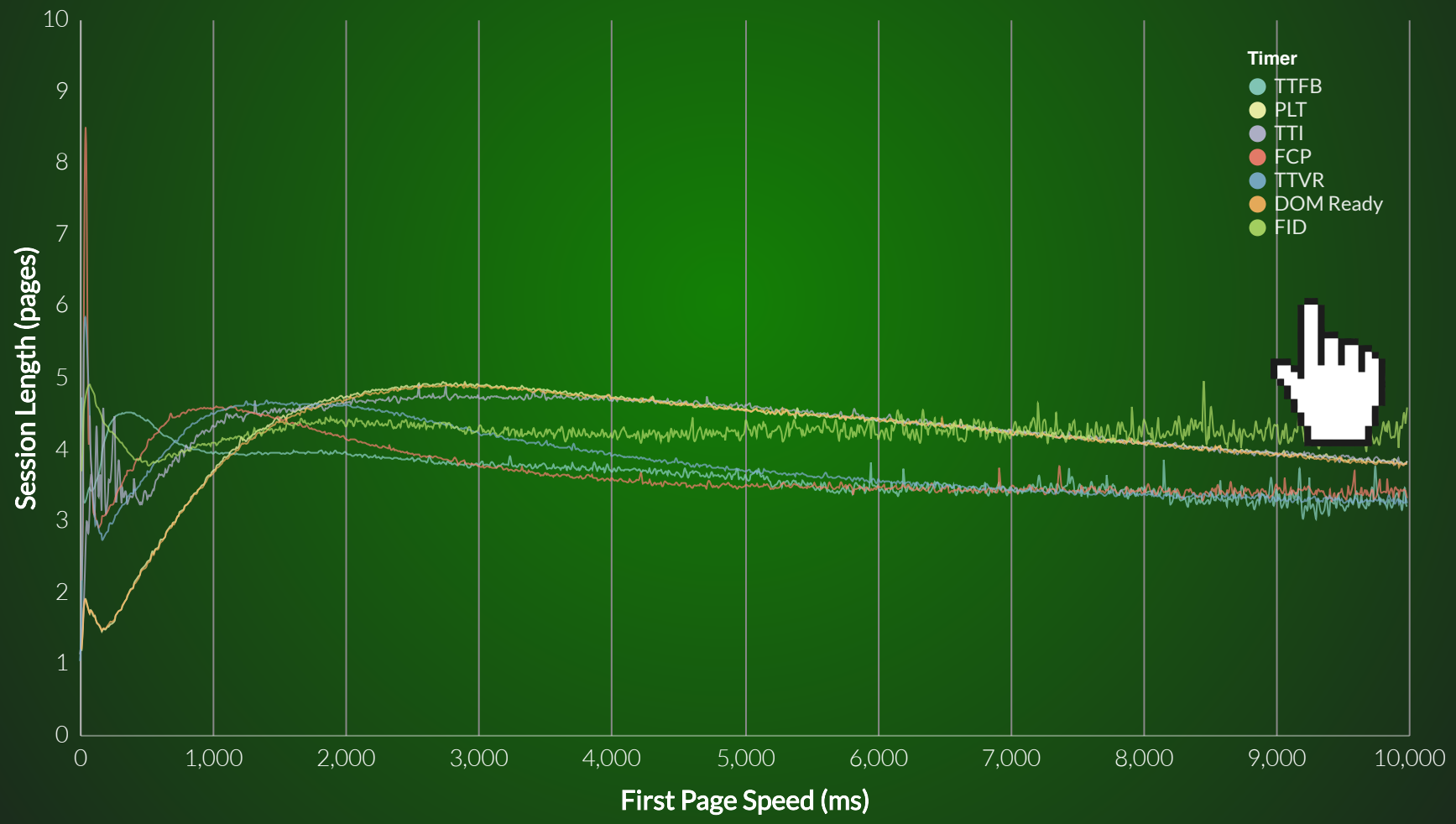


POLL 3

How do you measure engagement?

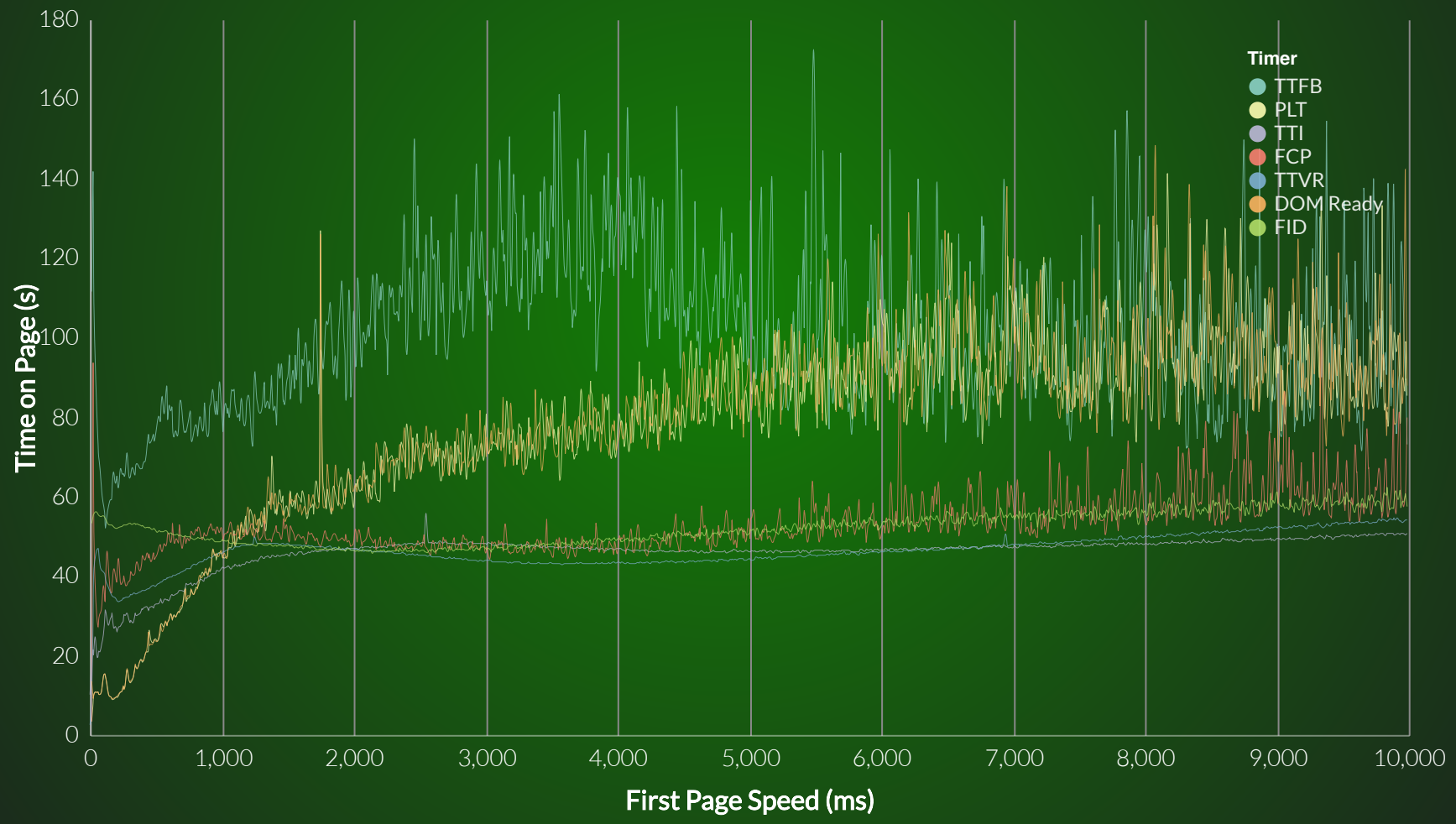
- Session Length
- Bounce Rate
- Exit Rate
- Time on page

Performance metrics correlate with engagement
(session length)



~1Bn mPulse pageview beacons - early March 2019

Performance metrics correlate with engagement
(time on page)



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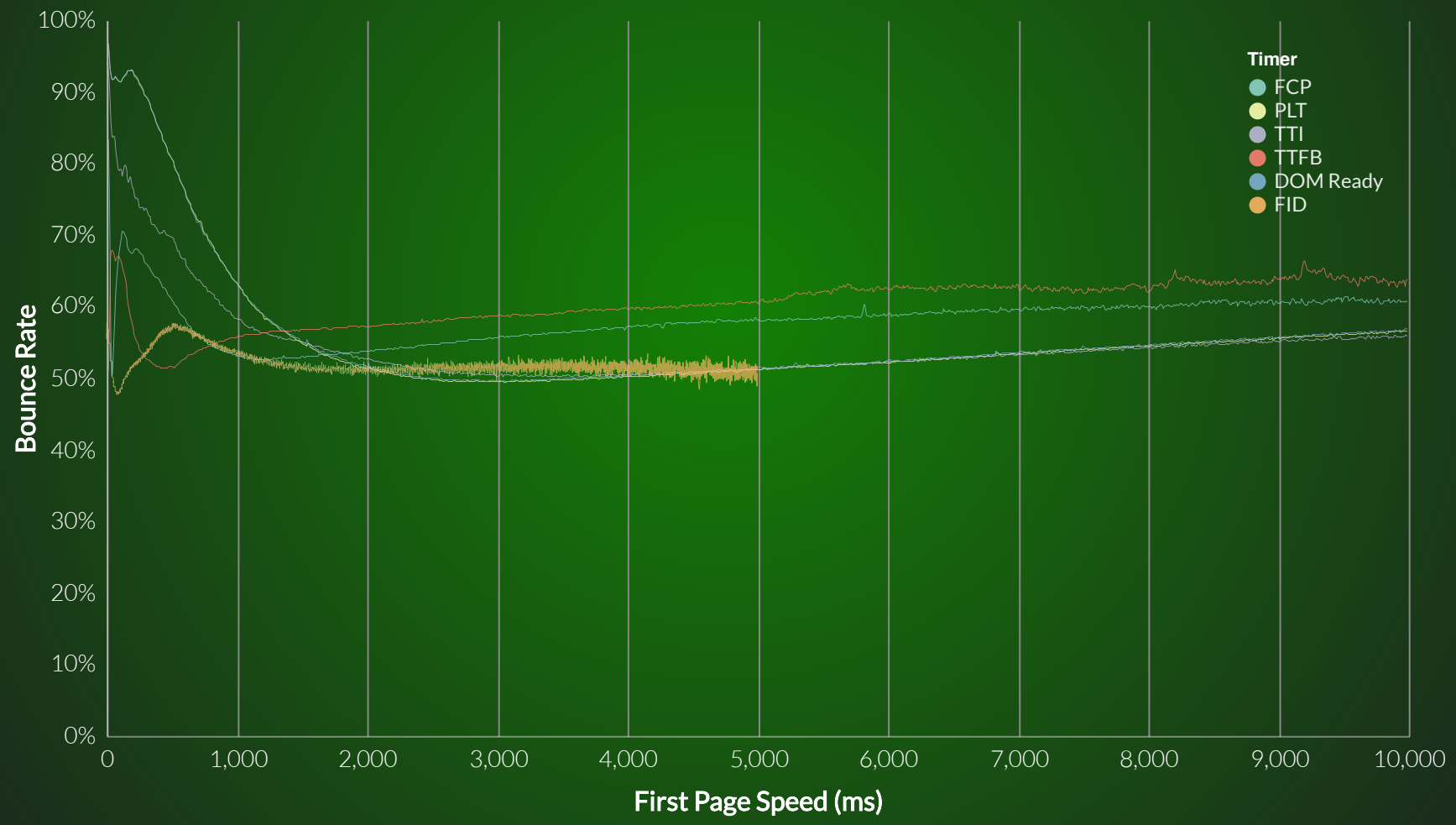
Performance metrics correlate with engagement
(bounce rate)



~1Bn mPulse pageview beacons - early March 2019

Goals for maximum engagement

Timer	Goal Speed
First Input Delay (FID)	200ms
Time to First Byte (TTFB)	500ms
First Contentful Paint (FCP)	1,000ms
DOM Ready	2,500ms
Time To Visually Ready (TTVR)	2,500ms
Page Load Time (PLT)	3,000ms
Time To Interactive	4,000ms

Based on aggregate data - what are yours?

Measuring against your goals

What percentage of user experiences achieve the goal?

```
perfScore = beacons faster than goal / total beacon count
```

Enable latest features 🔍

Timer	Rate
TTFB	100%
Page Load Time	99%
DOM Ready	96%
Time to Visually Ready	88%
First Contentful Paint	47%
Time to Interactive	38%
First Input Delay	21%

~1Bn mPulse pageview beacons - early March 2019

< psychology >

Human Computer Interaction principles

Akscyn's Law

> *Hypertext systems should take about 1/4 second to move from one place to another. If the delay is longer, people may be distracted; if the delay is much longer, people will stop using the system*

"KMS: A Distributed Hypermedia Systems for Managing Knowledge in Organizations".
Robert Akscyn, Donald McCracken & Elise Yoder. 1988.

We've known this since 1969!

"Response Time in Man-Computer Conversational Interactions" by Robert B Miller. 1969.

So what?

So what?

- The fundamentals don't change

So what?

- The fundamentals don't change
- Simple & fast is better than complex and slow

So what?

- The fundamentals don't change
- Simple & fast is better than complex and slow
- Give users *something* every ~1 second

Conclusions ✍️

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- Measuring speed is difficult
  - Use metrics which correlate with engagement
  - Track the 75th - 95th percentile (with RUM)
  - Calculate scores against goal speeds

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  - Inline critical dependencies
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  - Use metrics which correlate with engagement
  - Track the 75th - 95th percentile (with RUM)
  - Calculate scores against goal speeds
- Deliver *something* to the user quickly
  - Server-side rendering
  - Inline critical dependencies
  - Optimise your CDN configurations
- JavaScript is (usually) the bottleneck
  - Analyse FID and TTI
  - Manage event listeners
  - Track third-party scripts

< hacking psychology >

Hacking human perception

There are no guarantees on performance

There are no guarantees on performance

but you can buy some time

Anticipate Behaviour

cheat with mouse events

Click Me!

Event	Free Time!
touchStart	-
mouseOver	-
mouseDown	-
click	-

Use to anticipate navigations, product viewer actions etc.

Anticipate Behaviour

cheat with mouse events

Click Me!

Event	Free Time!
touchStart	-
mouseOver	-
mouseDown	-
click	-

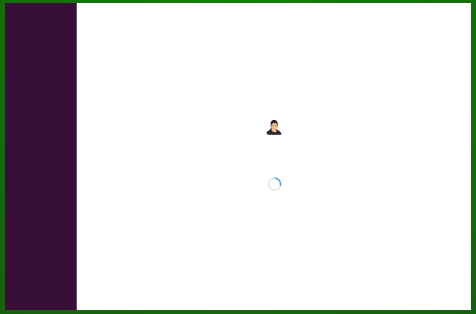
Use to anticipate navigations, product viewer actions etc.

but wait, there's more!

- mouseDown buys us 50 - 150ms
- hover transition buys another 50 - 100ms!

Keep Users Engaged

Skeleton UI



Keep Users Engaged

Skeleton UI

Keep Users Engaged

Skeleton UI

*use sparingly

Thank you 🙏

@SimonHearne

simonhearne.com/presentations/psych-speed