Smooth to the touch

Chromium's challenges in input on mobile

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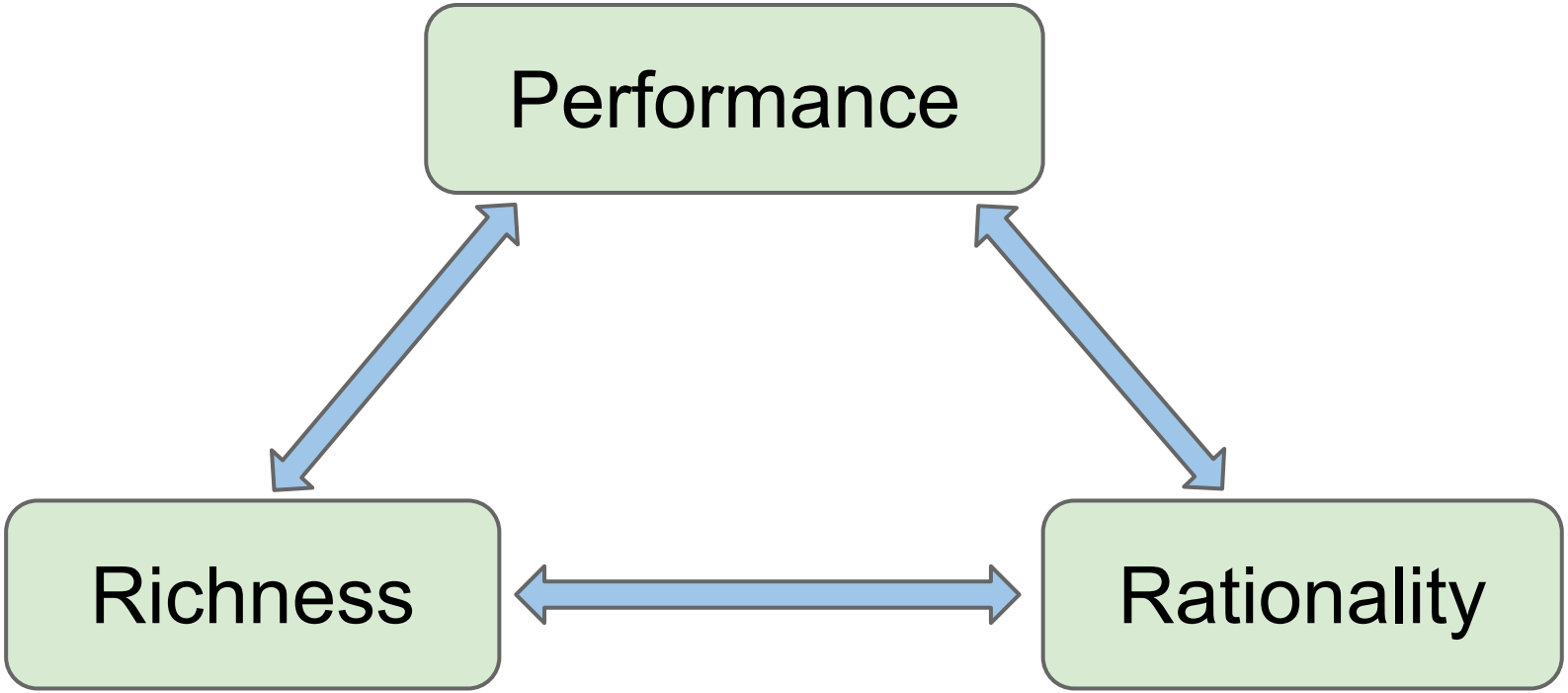
rbyers@chromium.org

Competing with native



4 Big challenges

1. Scroll customization
2. Threaded input handling
3. Consistency and interoperability
4. Consistent low latency

Scroll customization

Scroll customization: Examples

Pull to refresh

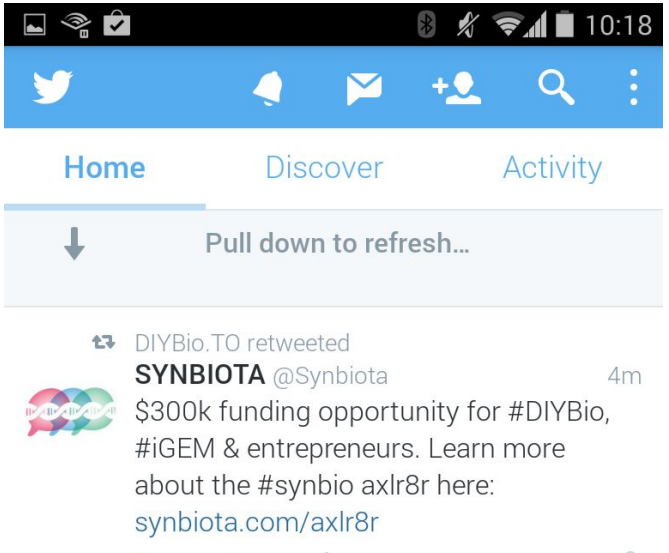
Image carousells

Hidey bars

Reimplement scrolling (badly)

- or -

Special purpose browser magic



Scroll customization: What we're doing

Now send touch events during scroll

Building sample polymer components (p2r)

Best-effort sync scrolling

Fractional scroll offsets

Fractional input event co-ordinates

Driver event timestamps

Scroll customization: Open issues

Best effort sync scroll good enough?

Exposing and tweaking fling physics?

Also implement the "magic features"?

Threaded input

Threaded input: background

Everything on UI thread must be <16ms
Compensate by adding another thread

"Performance modularity"

Hack: Touch ACK timeout

Threaded input: what we're doing

Make the main thread suck less: silk

Universal accelerated overflow scroll

Touch-action: none heuristic for timeout

Threaded input: open issues

Give the developer control (eg. scroll-delay)?

Touch-action hit testing on impl

Touch driven web animations

Expose threaded input handling as a primitive?

	touch begin	touch move	scroll event	raster	richness	perf	rational
Android native, old chrome	blocks	blocks	blocks	blocks	great	poor	great
chrome ~m30	blocks	blocks	doesn't blk	doesn't blk	ok	better	ok
chrome android m34	block w/timeout	doesn't block	doesn't block	doesn't block	poor	great	poor
chrome m36	blocks	blocks on overscroll	doesn't block	doesn't block	good	good	ok
chrome m36 desktop-on-mob	blocks w/timeout	blocks on overscroll	doesn't block	doesn't block	ok	great	poor
safari document	blocks	doesn't blk	doesn't blk	?	poor	ok	poor
safari div	blocks	blocks	blocks	?	poor	bad	poor
IE 10+	doesn't blk	doesn't blk	doesn't blk	doesn't blk	limited	excellent	ok

Interoperability

Interoperability: examples

Touch event behavior while scrolling

Click delay

Unreliable :active behavior

Direction-specific event consumption

preventDefault confusion

Interoperability: what we're doing

Eliminate touchcancel on scroll

Transparency on async touch events

Unified code: android, desktop, devtools

Standardize new input features in W3C

(eg. touch-action)

W3C TouchEvents community group

Interoperability: open issues

Apple

Pointer Events

Gestures (IP)

Consistent
Low latency

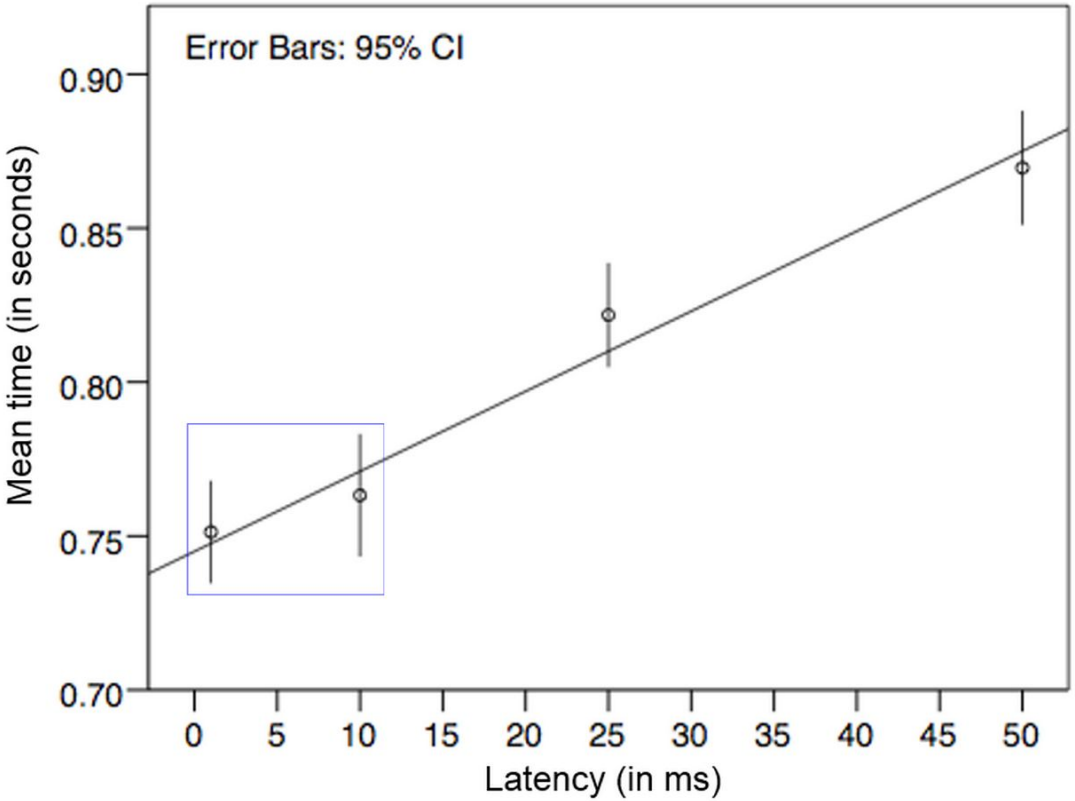
Latency: background

Goal: <10ms

Actual: ~65ms on top hardware (Nexus 5)

Consistency matters more than minimum

How fast is fast enough?



Source: Daniel Wigdor et. al. How fast is Fast enough?: a study of the effects of latency in direct-touch pointing tasks. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems

Latency: what we're doing

Latency tooling

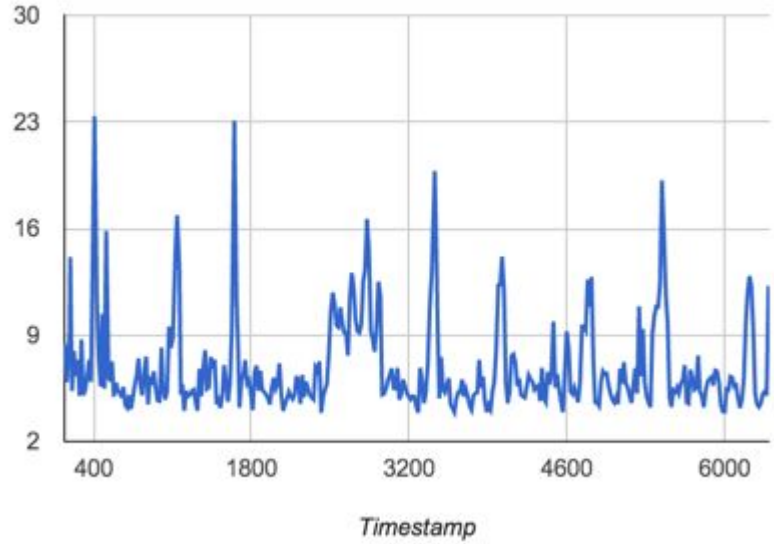
Deadline scheduler

Latency discrepancy metric, user studies

Vsync aligned buffered input

Ruthlessly find and fix jank

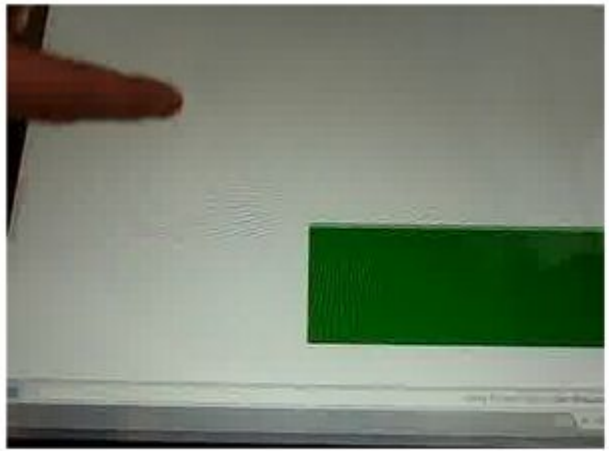
scheduler.tough_scheduling_cases | Select bots | mean_touch_scroll_latency



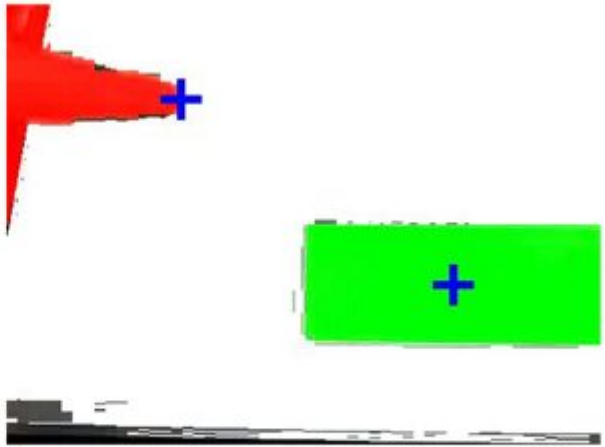
Selected Slice:

Title	"InputLatency:GestureScrollUpdate"
Category	"benchmark"
Start	1565.067 ms
Duration	26.774 ms
Args	
step	"GestureScrollUpdate"
data	{INPUT_EVENT_LATENCY_BEGIN_RWH_COMPONENT: {comp_id: 1541893259266, count: 1, time: 18581566036}, INPUT_EVENT_LATENCY_ORIGINAL_COMPONENT: {comp_id: 0, count: 1, time: 18581565631}, INPUT_EVENT_LATENCY_RENDERING_SCHEDULED_COMPONENT: {comp_id: 0, count: 1, time: 18581566289}, INPUT_EVENT_LATENCY_SCROLL_UPDATE_ORIGINAL_COMPONENT: {comp_id: 1541893259266, count: 1, time: 18581565631}, INPUT_EVENT_LATENCY_SCROLL_UPDATE_RWH_COMPONENT: {comp_id: 1541893259266, count: 1, time: 18581566042}, INPUT_EVENT_LATENCY_TERMINATED_FRAME_SWAP_COMPONENT: {comp_id: 0, count: 1,

Camera measurement



The raw frame from the camera.



The processed frame including finger position and div position.

Latency: open issues

Noisy benchmarks

Prediction

Motion vectors: rendering for the future

We want your input!

input-dev@chromium.org