Manual tracking of the double-drift illusion

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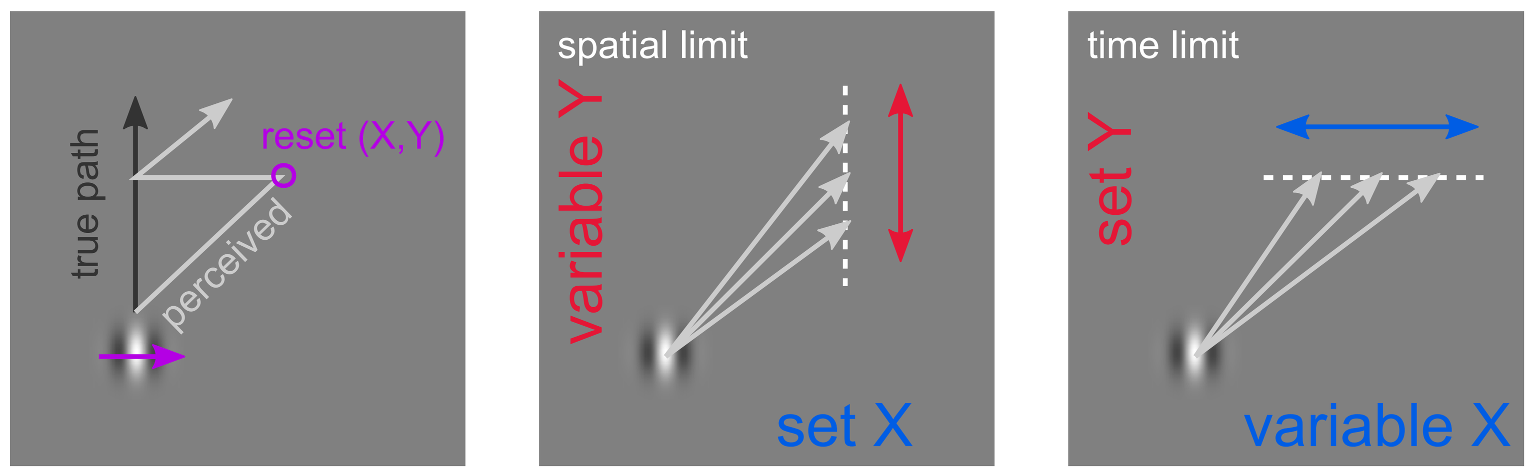
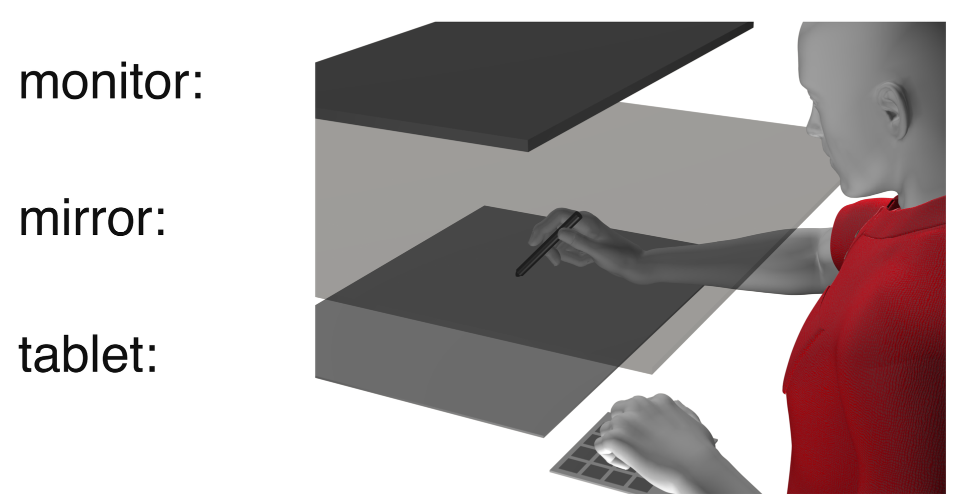
Limits on the double-drift illusion

The perceived path in the double-drift illusion periodically returns to the veridical position. What causes these resets?



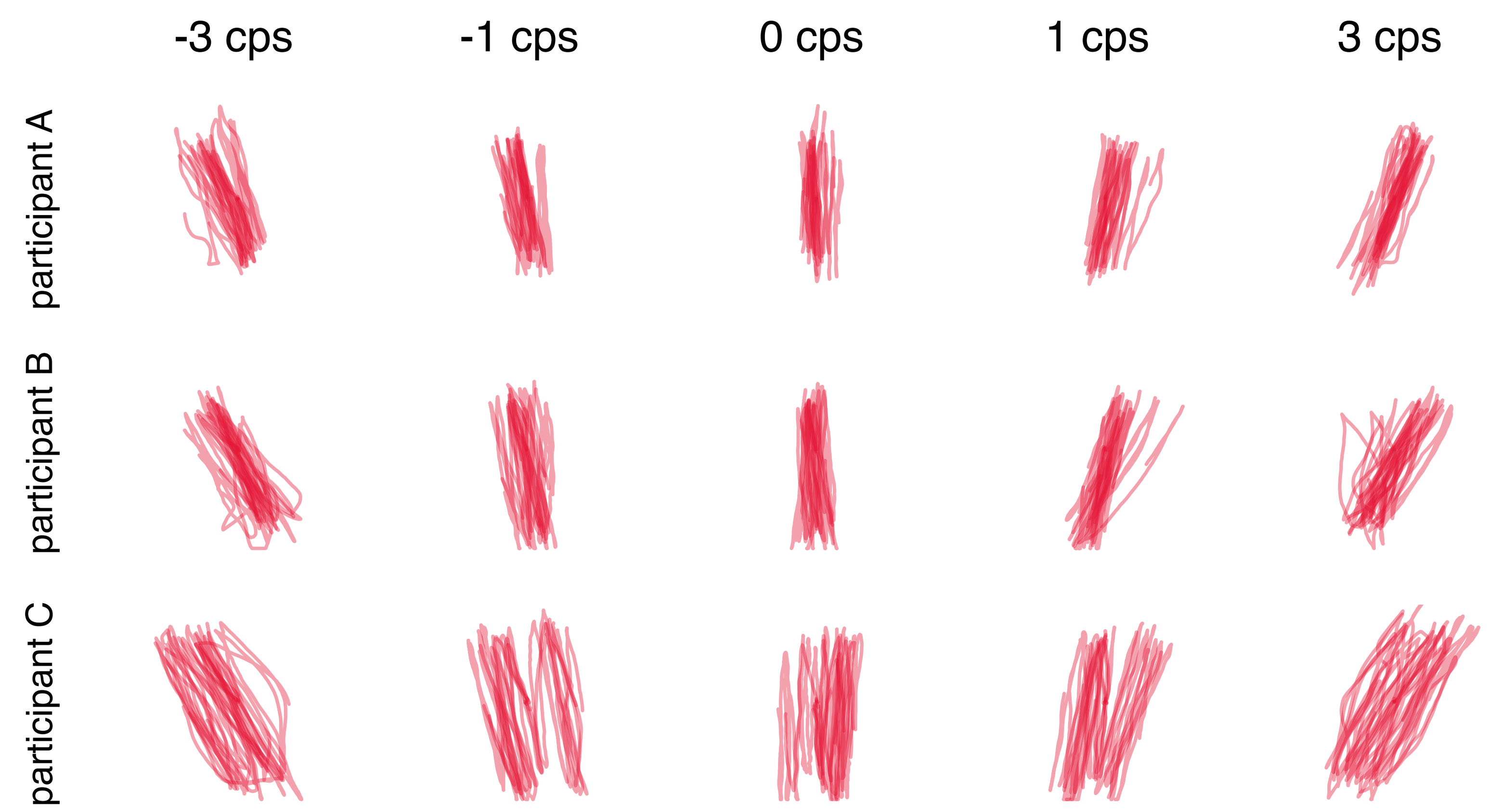
Given the true path (from the origin, along the Y axis) and varying strengths of the illusion, a spatial limit would predict that resets occur once the perceived location reaches a set horizontal distance from the start position, regardless of the speed. A temporal limit would predict a fixed vertical offset from the initial position.



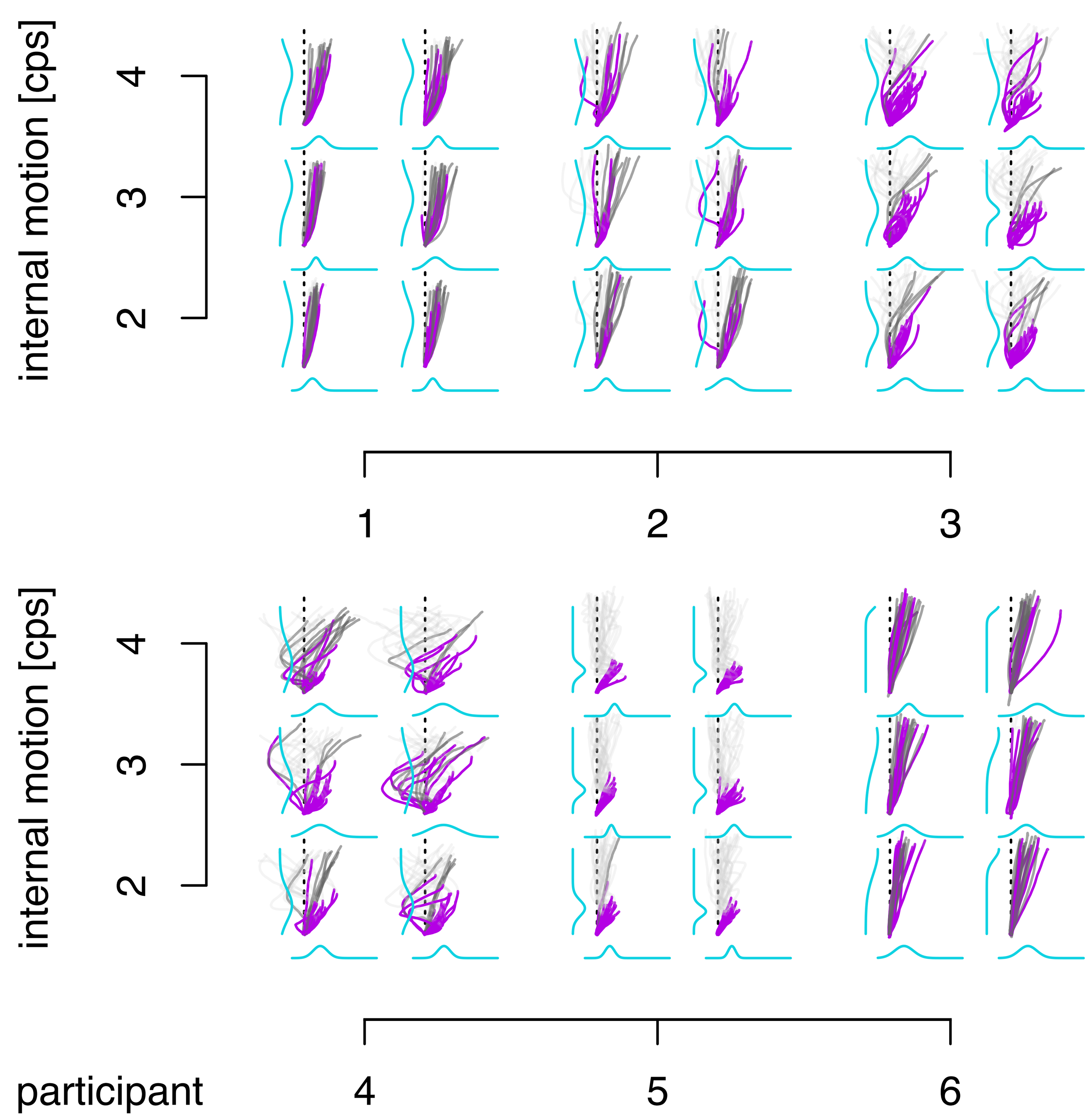
On a mirror setup participants traced the perceived path of the stimulus, without seeing their hand. First, six participants tracked an ongoing double-drift stimulus (external: 13.5 cm / 3 s, internal: 3 cps or ~5.15 cm/s). A second group (N=9) both indicated the initial perceived movement direction as a measure of illusion strength, and re-traced their percept of a single movement of 13.5 cm in 3 or 4 seconds at 2, 3 or 4 cps internal drift.

Tracking reflects the illusion

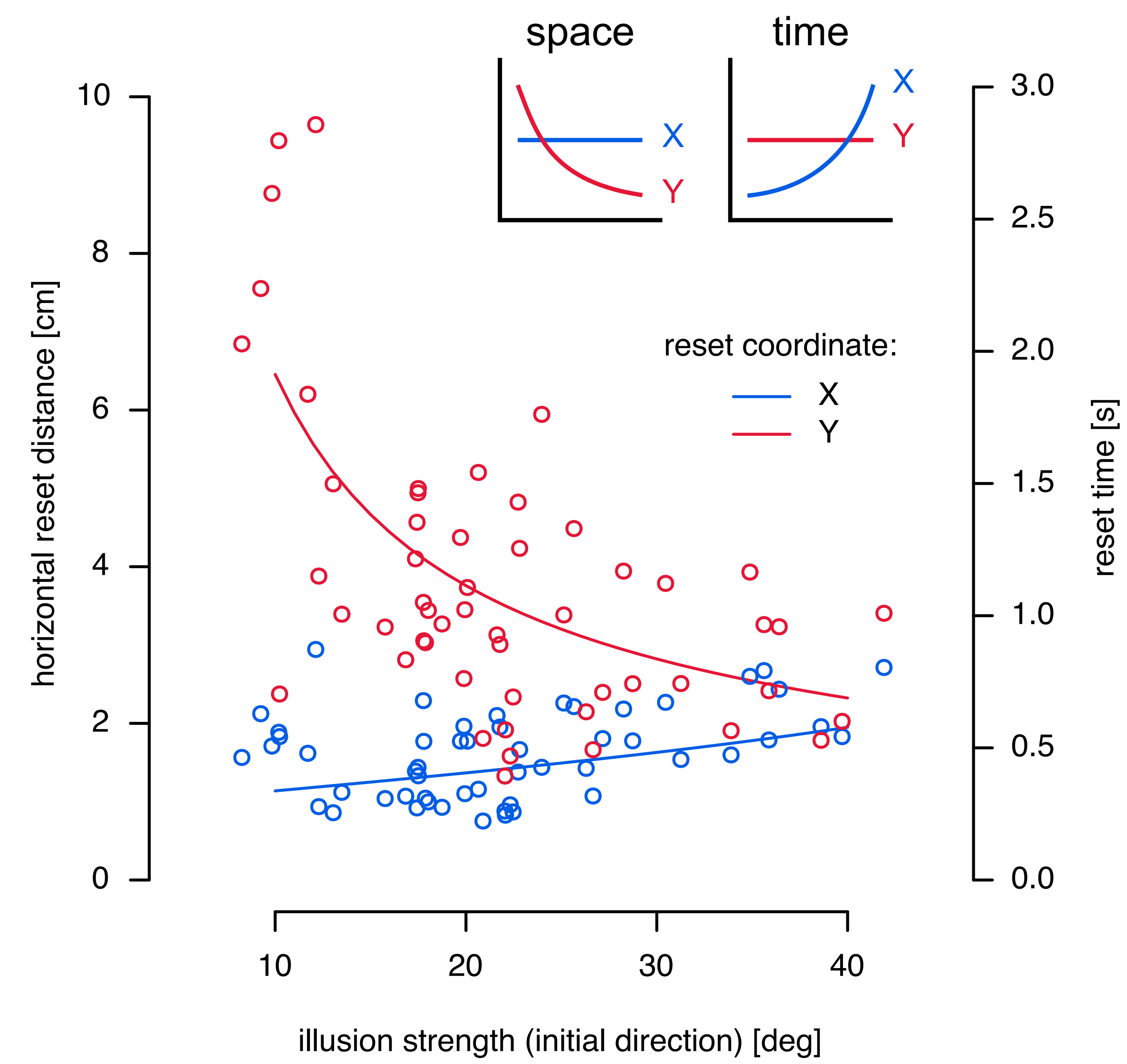
In a continuous tracking task, the direction of tracking responded to the strength of the illusion (c.f. Nakayama & Holcombe, 2018).



In the second experiment we get reset coordinates by localizing the first location where the derivative changes sign, shown here as the end of the purple trace:



The double-drift illusion resets at virtually a constant horizontal distance from the true position



The brain represents both the true position for eye movements and the illusory, perceived location for pointing (Lisi & Cavanagh, 2017). Resets could be triggered when the distance between these two positions exceeds a threshold.

Weighted average model

With the slope of the initial trace (at 2 cm distance from the start), we can fit a model:

$$X = a * Lx + (1-a) * Ly / slope$$
$$Y = a * Lx * slope + (1-a) * Ly$$

Lx: 1.12 cm — spatial limit (on X)
Ly: 2.07 s — temporal limit (on Y)
a: 82.5% — weight: 83% space, 17% time

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