Supplemental Error Analysis

Some trials were rejected prior to extracting the reach trajectory from the recorded data. Here we elaborate on the exact number of trials that were rejected for each of the reasons listed in the main text. Those reasons were: (1) The reach was too short in either duration (<100ms, 3 total trials) or distance (<150mm in depth, 6 total trials), (2) the obstacle was misplaced by the experimenter (18 total trials), (3) or a collision with an object was detected (object moved by more than 5cm, 13 total trials).

The most interesting of these rejected trials are the collisions. Of the 13 collisions detected, 10 occurred on trials where a target jumped (these 10 collisions were spread across 8 subjects, meaning that 10 subjects had no collisions on jump trials). The three that occurred on the non-jump trials were likely the result of the table being shifted (thus causing the obstacle to topple) or the experimenter moving the obstacle prior to the completion of data recording (thus the object would appear to move during the trial).

Interestingly, all 10 of the collision trials occurred when the target jumped to the right and the obstacle was in the Near-Right position. This confirms that in this configuration the chance for collision was highest, thereby lending credence to our interpretation of the velocity slowing observed on these trials. It is possible (though highly unlikely given that less than 50% of our subjects (8/18) had collisions on less than 25% (2/8) of trials in this configuration) that by excluding these trials we may have biased our results and exaggerated the avoidance effect. To rule out this possibility, we show in supplemental figure 1 the trajectory traces (thin black lines) from each of the 10 collision trials overlaid on the relevant average trajectories from figure 3B in the main text. It is clear from this figure that on only one collision trial was the trajectory significantly closer to the object than on the trials when it was successfully avoided. The remaining nine collision trials are all pushed away from the obstacle position, relative to the baseline trials (green) and the majority of them (7/9) are actually further from baseline than the plotted average. Overall, this indicates that even if had we included these 10 trials, the average would – if anything – be shifted even further from baseline. It also indicates that it may not have been the hand but the forearm that was colliding with the obstacles (in fact from anecdotal observation it was almost always the forearm that struck the obstacle). Finally, we would also argue that on trials when the obstacle was successfully avoided in this configuration, the margin for error was quite small – again strengthening our claim that for corrections to the right with an object in the near right location special care is required (as reflected in our velocity analysis and discussed in the main text).
Supplemental Figure 1. Collision trajectories (thin black traces) from Jump-right, obstacle Near-Right trials overlaid on average trajectory traces taken from figure 3b. Only one collision trial seems to follow a path significantly different than the non-collision trials from the same configuration (thick black trace with average standard error).

A second set of trials was removed after reach extraction for having an incorrect endpoint (61 total trials, see supplemental table 1). Again, it could be the case that by removing only these trials, we were removing some set of data that biased our results to show a larger avoidance effect (there does appear to be some bias toward removing trials that jumped left with obstacles on the left, see supplemental table 1). To argue against this possibility we show a scatter plot of the endpoints of trials rejected due to this criterion (see supplemental figure 2). On only one trial did a participant incorrectly point to a jumped target location when in fact the target did not jump (green dot). By comparison, the vast majority (42/61) of these trials were rejected because participants failed to correct to the jumped target location, instead competing a movement toward to the initial target position (red and blue dots within...
the green circle). Of the remaining trials (18/61), 3 incorrectly ended to the right when the target jumped left (blue dots in the red circle) while 15/61 appear to be the result of partially corrected movements, mostly ending beyond the initial target and between the two jump locations. Of trials that were rejected for an incorrect endpoint, 39/61 were on trials when the target jumped left (blue dots) and 21/61 were on trials when the target jumped right (red dots). This pattern confirms that participants had a slightly harder time correcting to leftward jumps. More importantly, this analysis of endpoint errors shows that these rejected trials were due to problems in correction and had no specific relevance to the reported avoidance effect.

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Acceleration</th>
<th>Jump-Left</th>
<th>Jump-Right</th>
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Supplemental Table 1. Total number of rejected trials broken across reason for rejection (Endpoint, row 1, see supplemental figure 2; Acceleration, row 2, see supplemental figure 3), Jump-direction and Obstacle Position. More trials were rejected that Jumped-Left, corresponding to the greater difficulty correcting in this direction. There appears to be some bias for rejecting trials that jumped left, specifically when obstacles were on the left – justifying further analysis of behaviour on these error trials to confirm we did not selectively bias our data to show an avoidance effect. Note one trial rejected due to endpoint came from a No-Jump trial and is not represented in this table (but see green dot in supplemental figure 2).
Supplemental Figure 2. Analysis of endpoints of trials removed for having an incorrect endpoint. Green dot = no-jump trial, Blue-dots = jump-left trial, Red-dots = jump-right trial. Large green, blue and red circles indicate the approximate size and location of the cluster regions defined as correct for each of the initial, jump-left and jump-right trials respectively (note actual cluster location determined for each individual - see main text). The majority of rejected trials were ones that terminated at the initial target when a correction was required.

A final set of trials was removed after reach extraction for having re-accelerations suggesting a non-continuous correction toward a jumped target (56 total trials, see supplemental table 1). Of these, the majority (42/56) were on correct-left trials compared to only 14/56 on correct-right trials. This again confirms that correcting to the right occurred more automatically in the current study. Again, it is possible that the subset of trials that were removed could have biased our data (this again appears as if it may be true since more trials that jumped left with obstacles on the left were removed, see supplemental table 1). To clarify this issue we plot the average trajectories on the rejected trials in cases...
where an obstacle needed to be avoided. The most important thing to note about these trajectories is that they all come much closer to (indeed in most cases cross) the initial target position. This confirms that these trials represent cases where participants likely completed the reach to the initial target before making a second movement toward the jumped location. As such, we had good reason to reject these trials as not being representative of true online corrections. It is also clear, however, that even during these double movements the position of the obstacle still influenced the latter half of the movement. This is specifically true on the left where the obstacles induced a clear pattern of avoidance. On the right, the pattern of avoidance is slight, but these trajectories represent the average of only 6 trials (magenta) and a single trial (black) so it is difficult to draw conclusions from this specific pattern.

Supplemental Figure 3. Trajectories of trials removed for having significant re-accelerations during online corrections. Left panel – Jump-left trials with objects on the left. Right panel – Jump-right trials with objects on the right. Green lines = no-object trials, Red line = Object Near-Left, Blue line = Object Far-Left, Magenta = Object Far-Right, Black = Object Near Right. Note all trajectories come close to crossing the initial target position, suggesting two separate movements. Despite this, obstacle avoidance effects persist, especially for Jump-Left trials (left-panel).
Given the observed behaviour on rejected trials, we are therefore confident that the effects we report in the main manuscript are a genuine reflection of the avoidance of real objects during online corrections.