

# Tap to Count - Numerical Input for Interactive Tabletops

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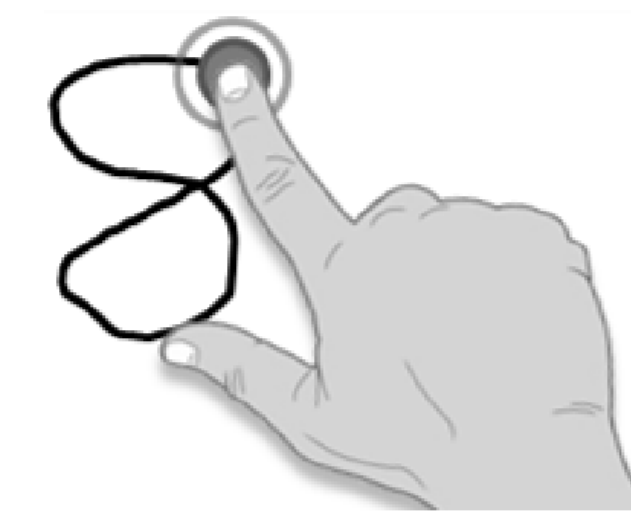
## Summary

We designed a technique ("Tap2Count") to enter numbers on Interactive multi-touch tabletops using the 10 fingers of both hands. We recognize the number of fingers simultaneously touching the screen and interpret it as digits from 0 to 9 to express any number in the decimal system.

Tap2Count works independent of the location and orientation of users at the tabletop. It does not occlude contents on the screen and it does not induce high physical strain, rendering it an interesting alternative for numerical input on interactive tabletops and surfaces.

## Related Approaches

Other techniques for numerical input on interactive tabletops exist, but have drawbacks regarding location- and orientation dependency, physical strain, friction, and screen occlusions.



**Handwriting Recognition** techniques can be used intuitively and work independent of the location and orientation of the user. On the downside, friction and a high physical demand can render this approach uncomfortable to use.



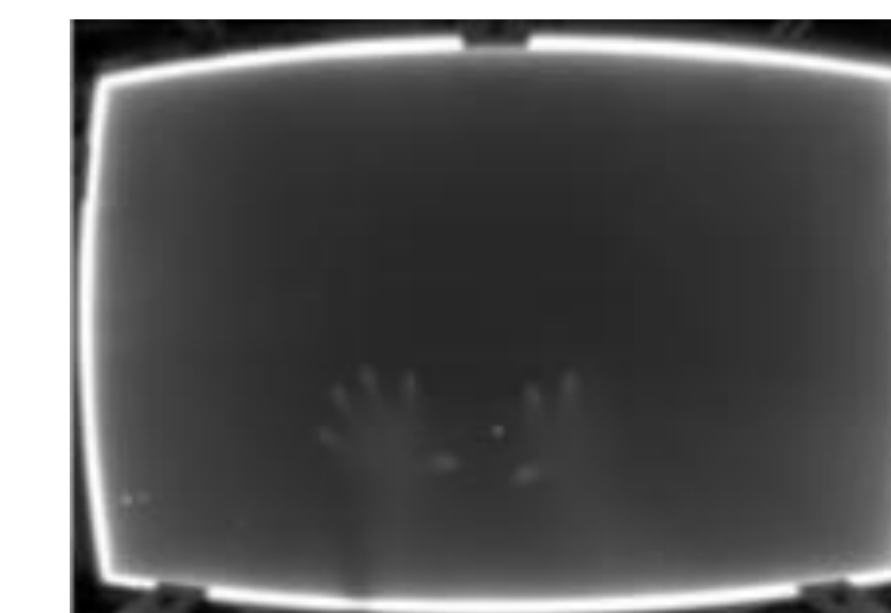
**Virtual Numpads** can also be considered intuitive, but they need to be positioned and orientated properly to use them. Also, they need to be replicated for each user, and they occlude portions of the screen due to the required visual output.

## Technical Realization

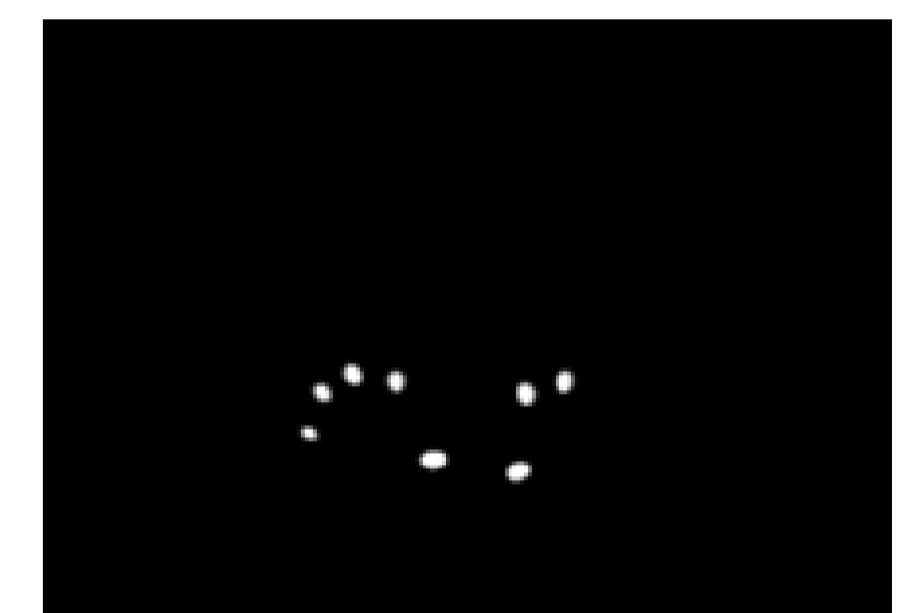
We implemented Tap2Count using a multi-touch tabletop running a camera-based Diffused Surface Illumination (DSI) setup. We use standard finger tracking software to recognize touches on the surface and count the maximum number of fingers touching the screen simultaneously. As soon as all fingers have been lifted from the surface, we map that number to a digit. One to nine contacts are mapped to 1-9, while ten fingers are mapped to 0.



User enters '8' using Tap2Count



Original Camera Image



Processed Camera Image

## Pilot Study

We evaluated Tap2Count in a Wizard-of-Oz study (n=12, avg. 29 years). Participants were asked to enter sequences of 10 pseudo-randomized digits (0-9) using Tap2Count.



Feedback from participants suggests that **the technique itself is easy to understand**. Only one participant needed re-briefing after initially explaining the technique. One participant thought that Tap2Count would be **faster to learn** than 10-finger keyboard typing. Another participant found Tap2Count **physically less demanding** than typing on an ordinary keyboard.



On the downside, most participants reported that **mental demand was quite high** when entering numbers with Tap2Count, probably due to the fact that **usage of both hands simultaneously was unfamiliar** to them. We observed **great variations in initial performance** between participants, particularly when using both hands to express numbers > 5. Nevertheless, we observed that **participants improved considerably** after some test runs.

