Tangible Musical Interfaces

Gegenständliche musikalische Interaktion

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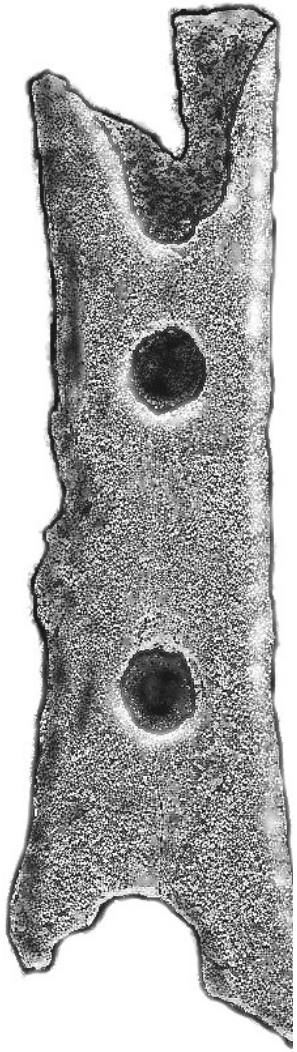
interfaceculture

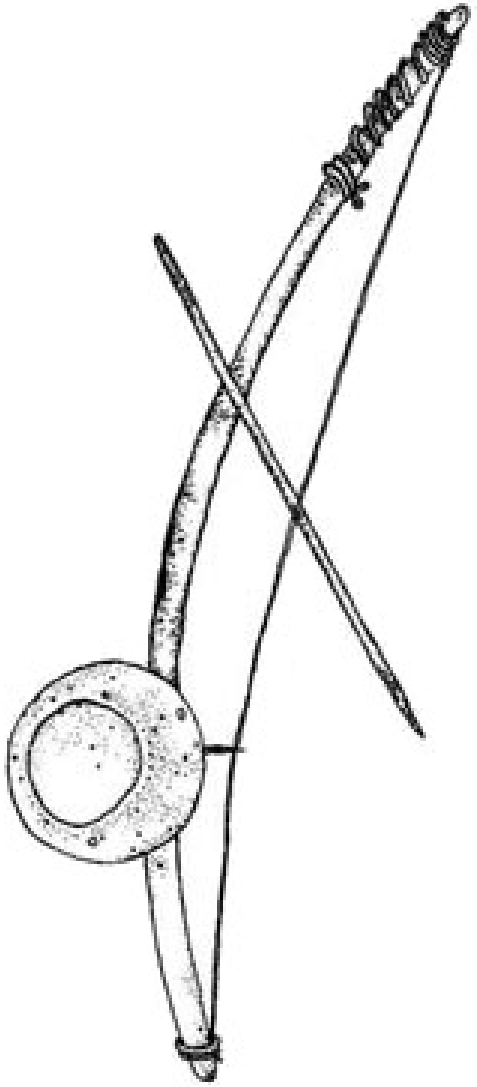
Interface Culture Lab
University of Art and Design, Linz, Austria
http://interface.ufg.ac.at/

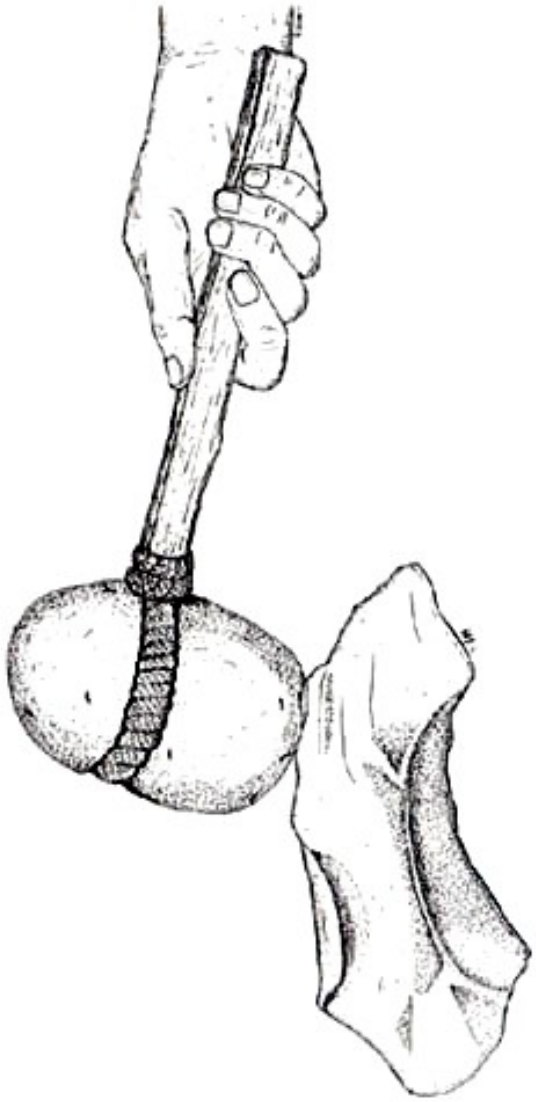
reactable
SYSTEMS

Reactable Systems, Barcelona, Spain
http://www.reactable.com/

musical instruments 35.000 years ago ...





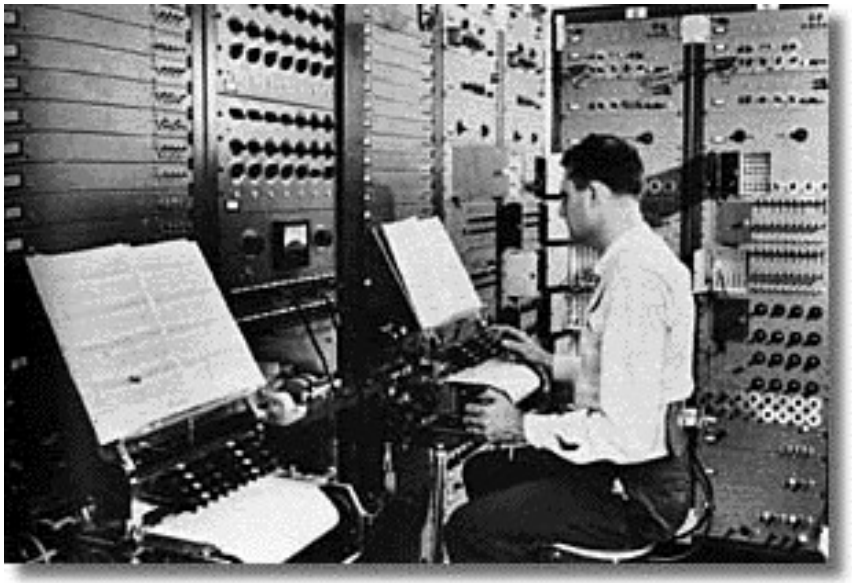


… until the 19th century

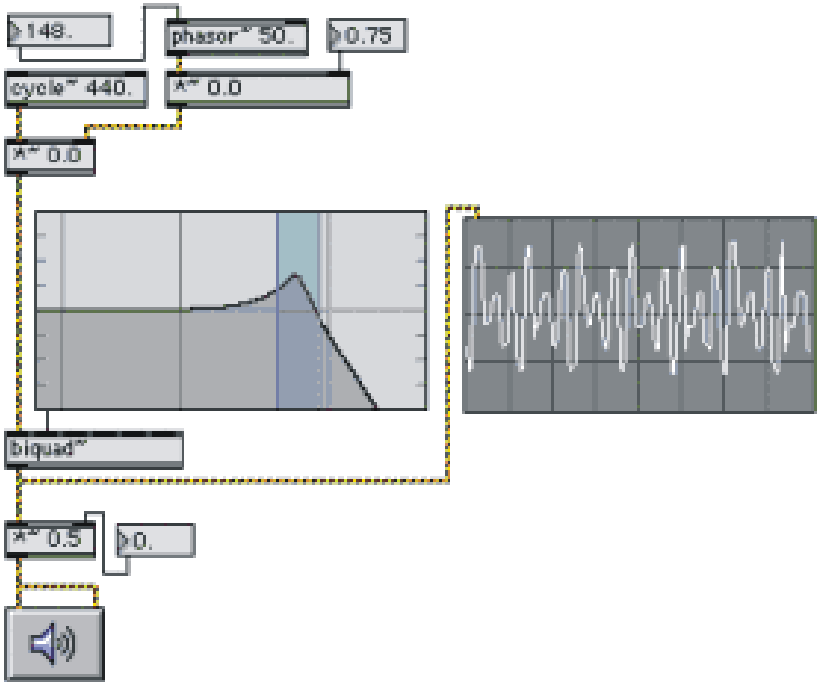
the end of the acoustic possibilities ...

The pioneers of electronic music

from analog sound synthesis



to digital sound synthesis

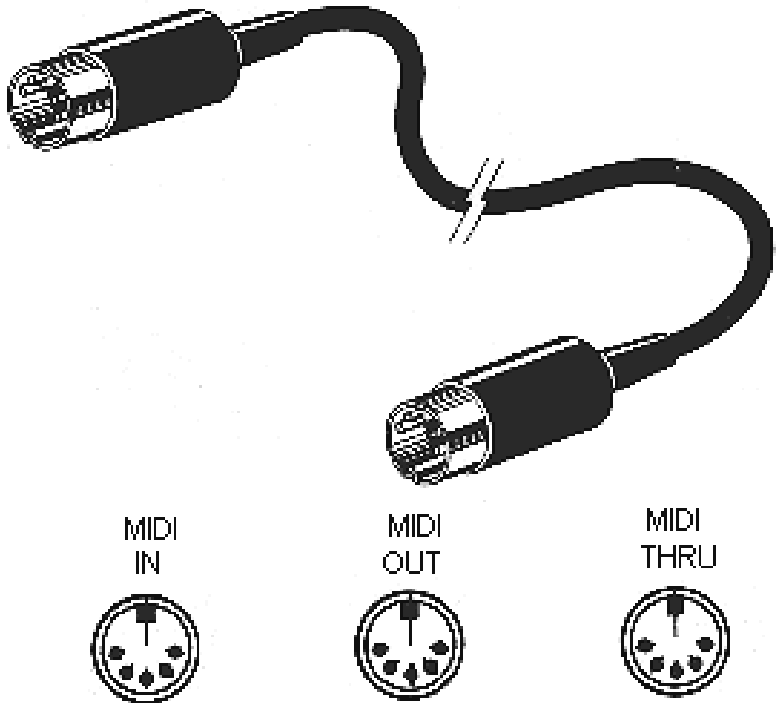


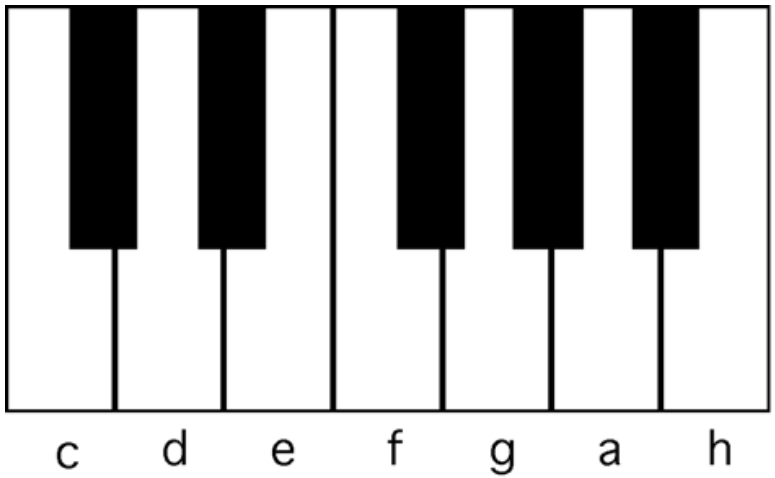
an office tool as musical instrument?

but how can we control all these parameters?

various types of musical controllers

decoupling control & sound generation





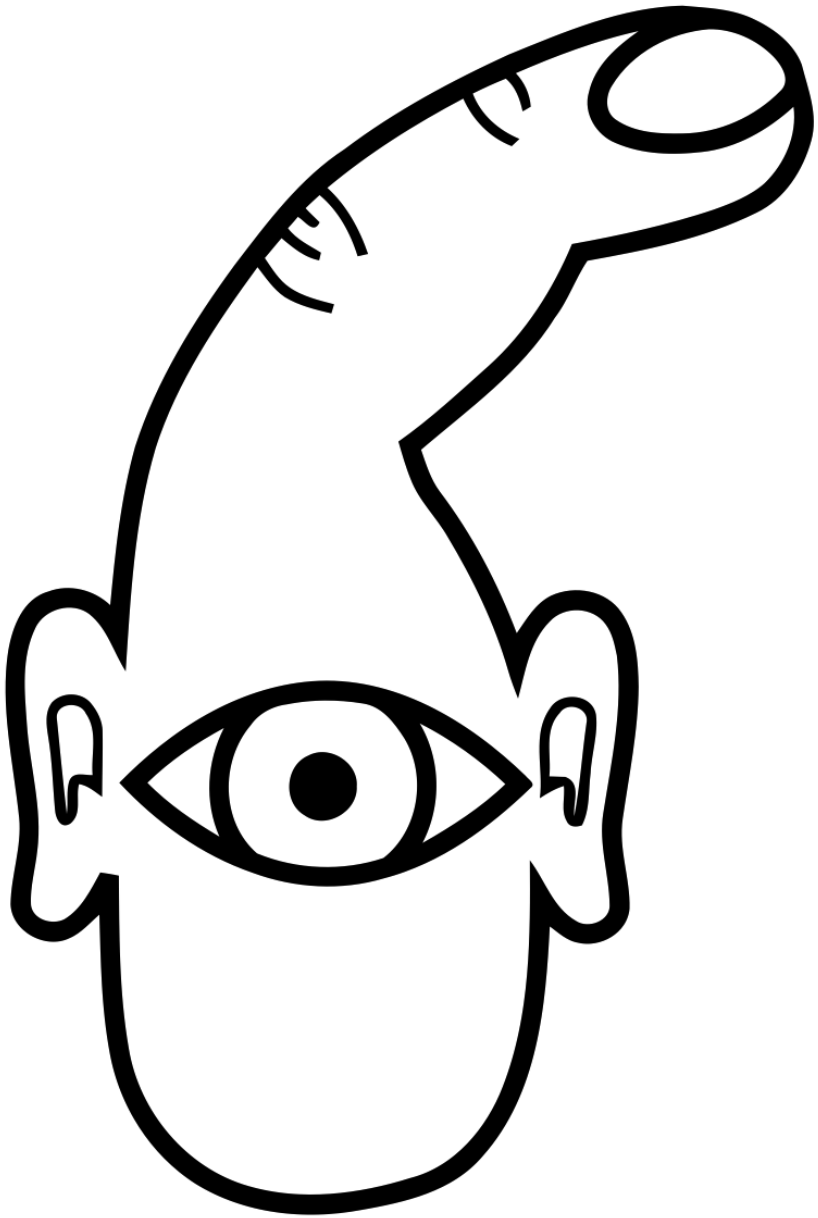
++ remote control?

++ graphical user interfaces ...

... separate control ...

... from representation

++ a typical GUI user



from Igoe & Sullivan: Physical Computing

a musical instrument ...

... unifies control and feedback

Tangible User Interfaces

... unify control & representation within tangible physical artifacts

Embodiment

physical objects represent digital information and processes

++ reactable - tangible modular synthesizer

Goals for Tangible Instrument Design

The instrument should be perceived as such, and not just only as a controller device.

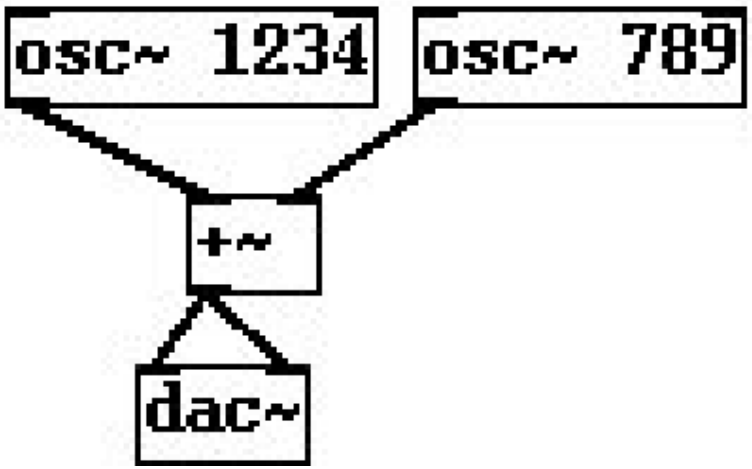
All sound synthesis and control dimensions should be available simultaneously at any time through direct manipulation of tangible instrument components.

The instrument should provide visual and haptic feedback in addition to its sonic core functionality.

The instrument should be intuitive and learnable, but also provide sufficient musical depth. No sound toy!

Support the collaboration of two or more musicians.

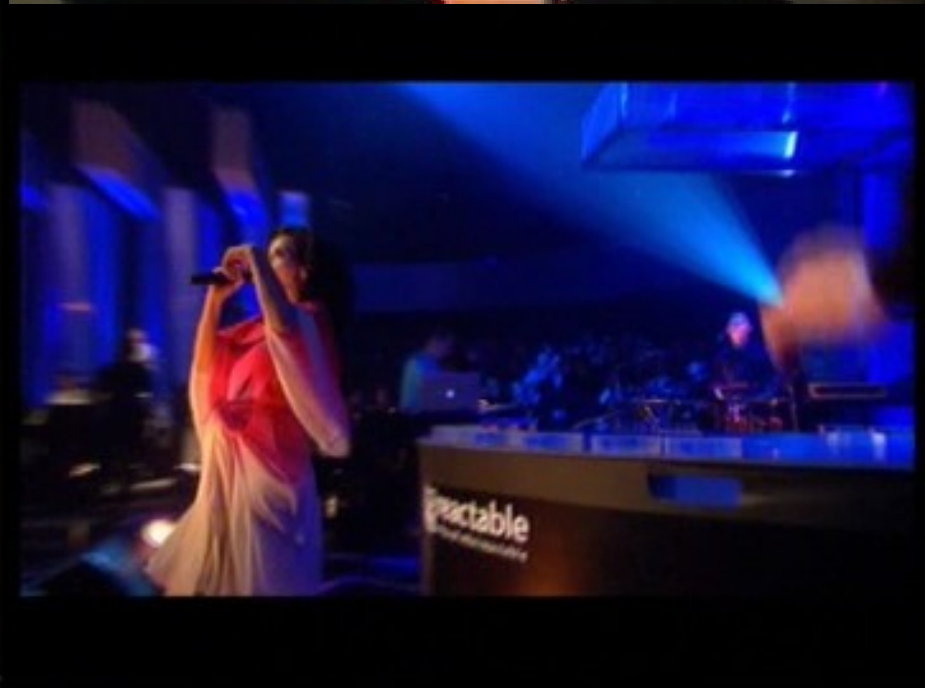
++ fundamental inspirations



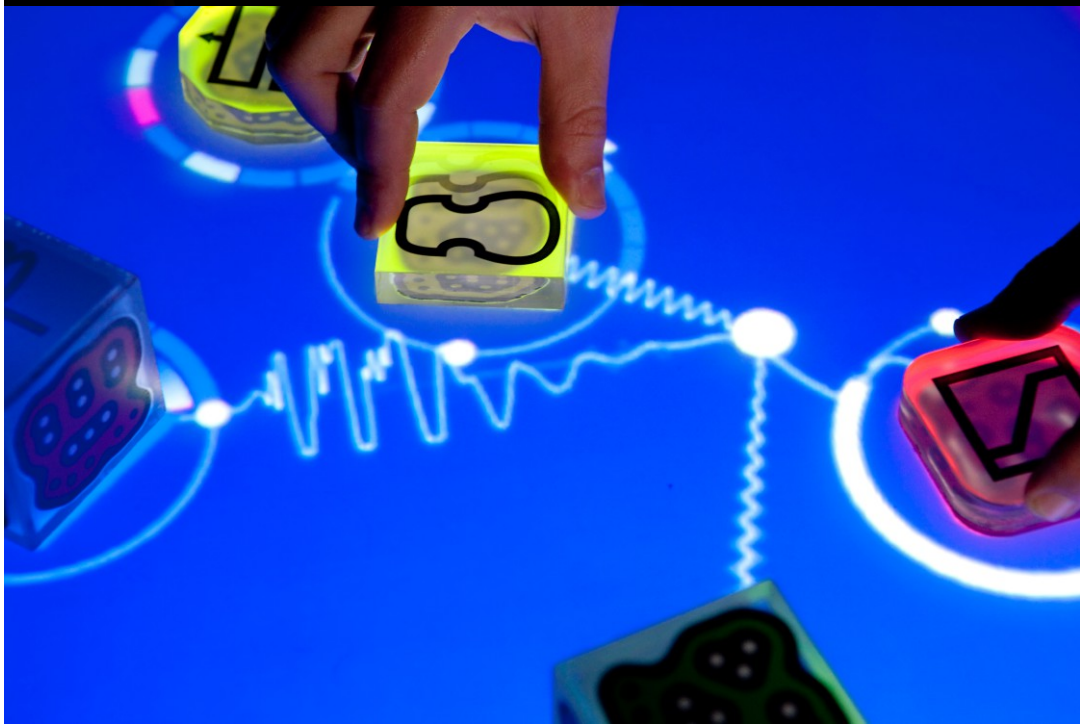
++ dynamic patching paradigm

++ shape: generic object classes

++ development history



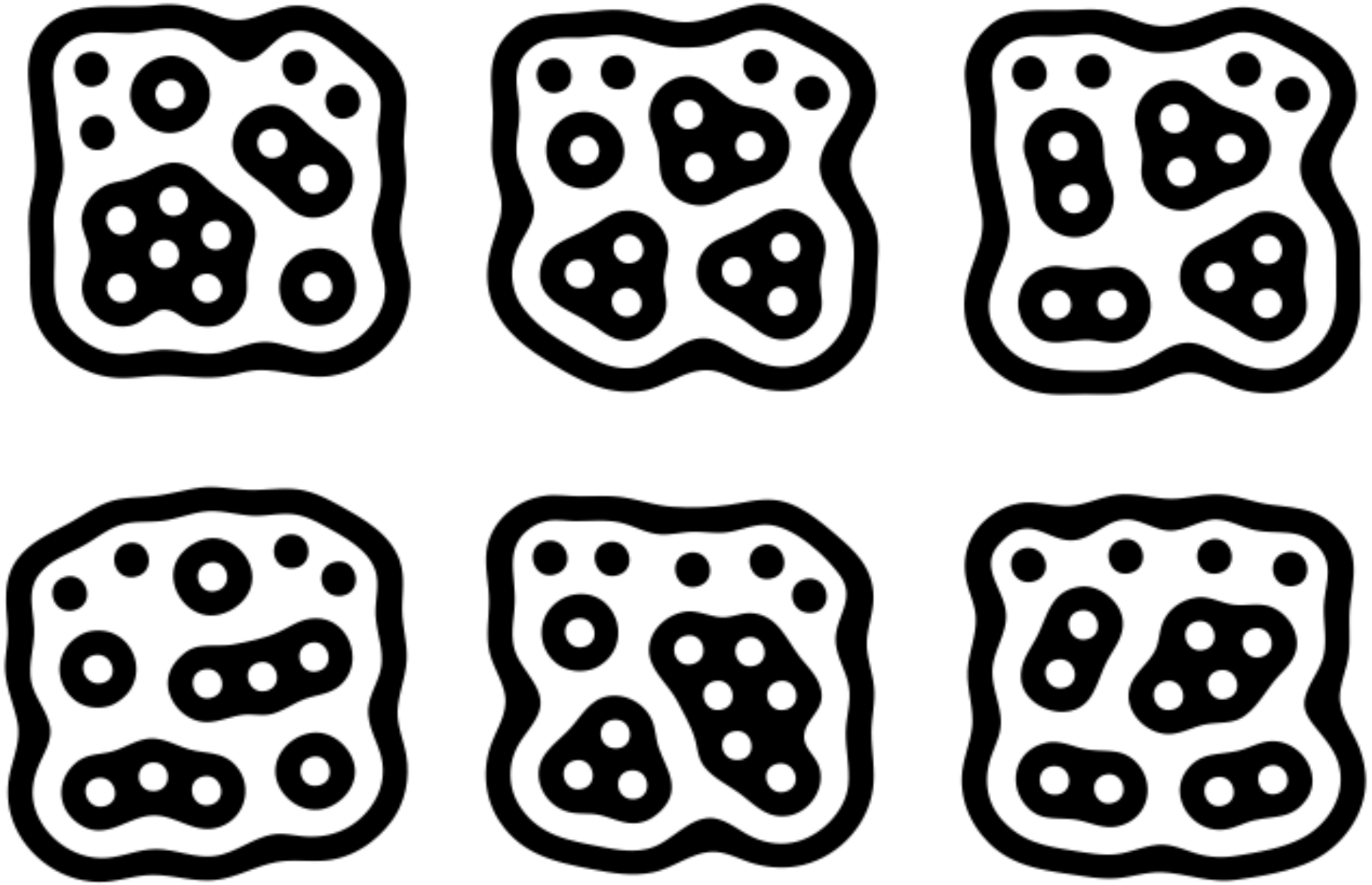
++ Reactable Experience



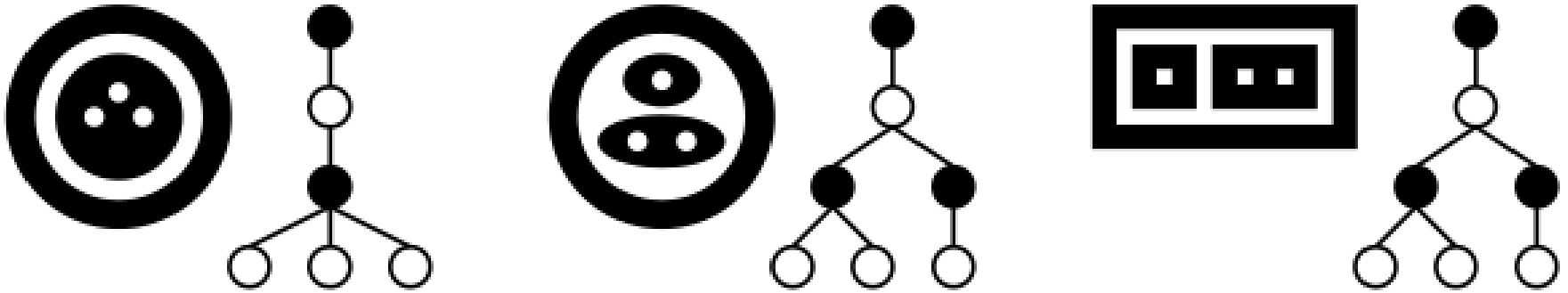
++ Reactable Live!

++ Reactable Mobile

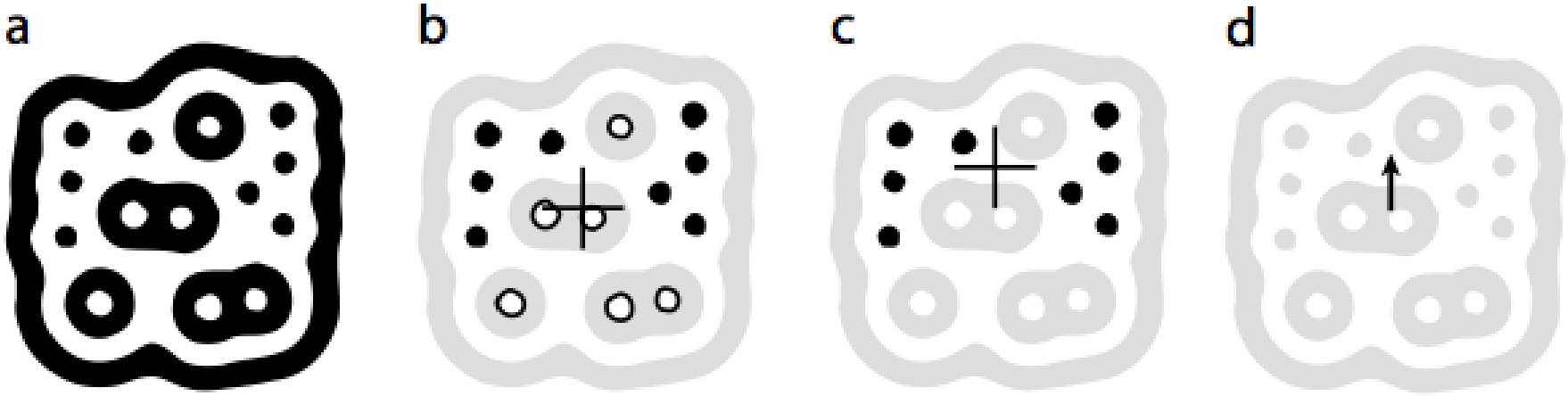
++ amoeba symbols



++ region adjacency graph

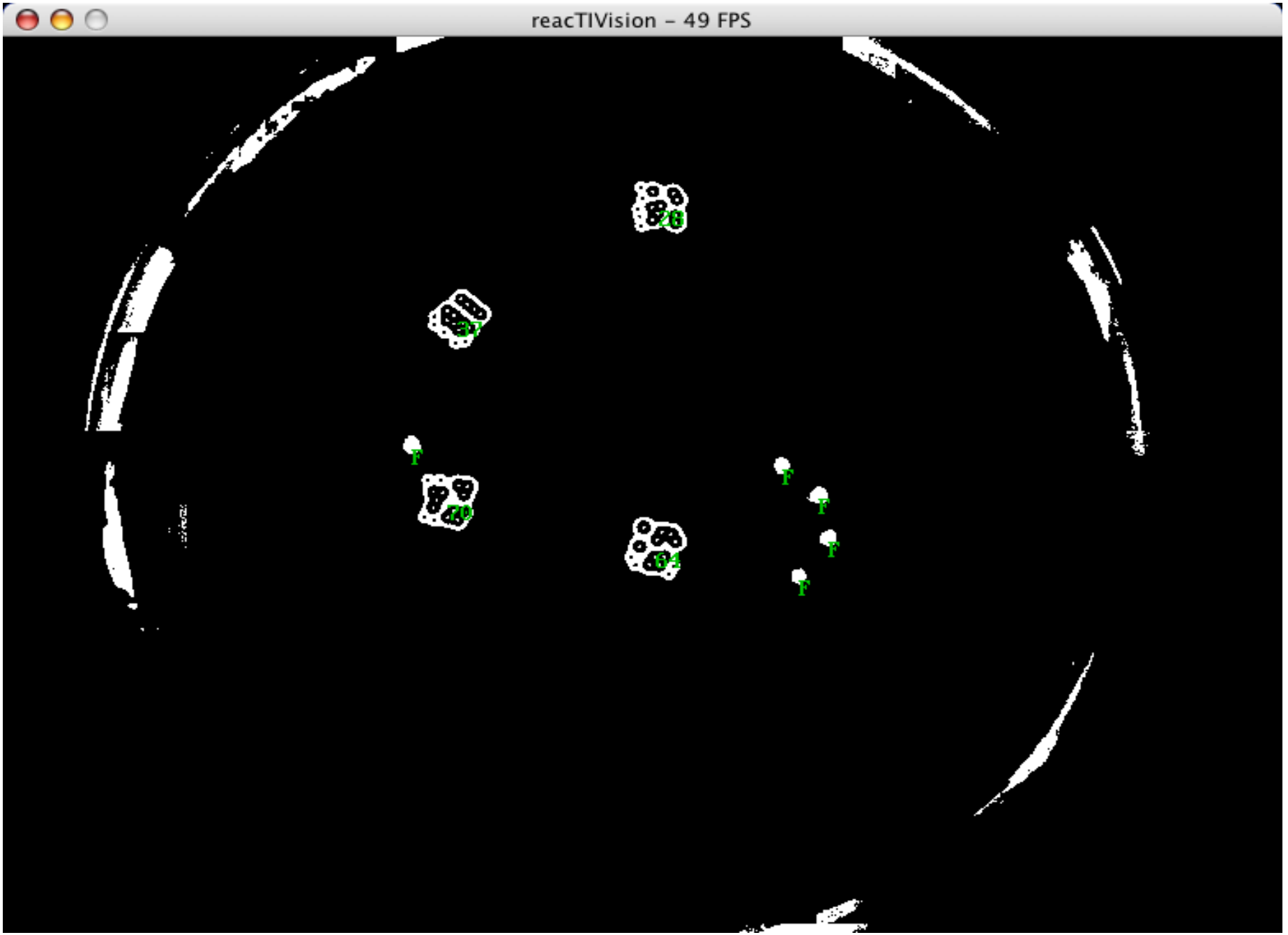


Some simple topologies and their corresponding region adjacency graphs.



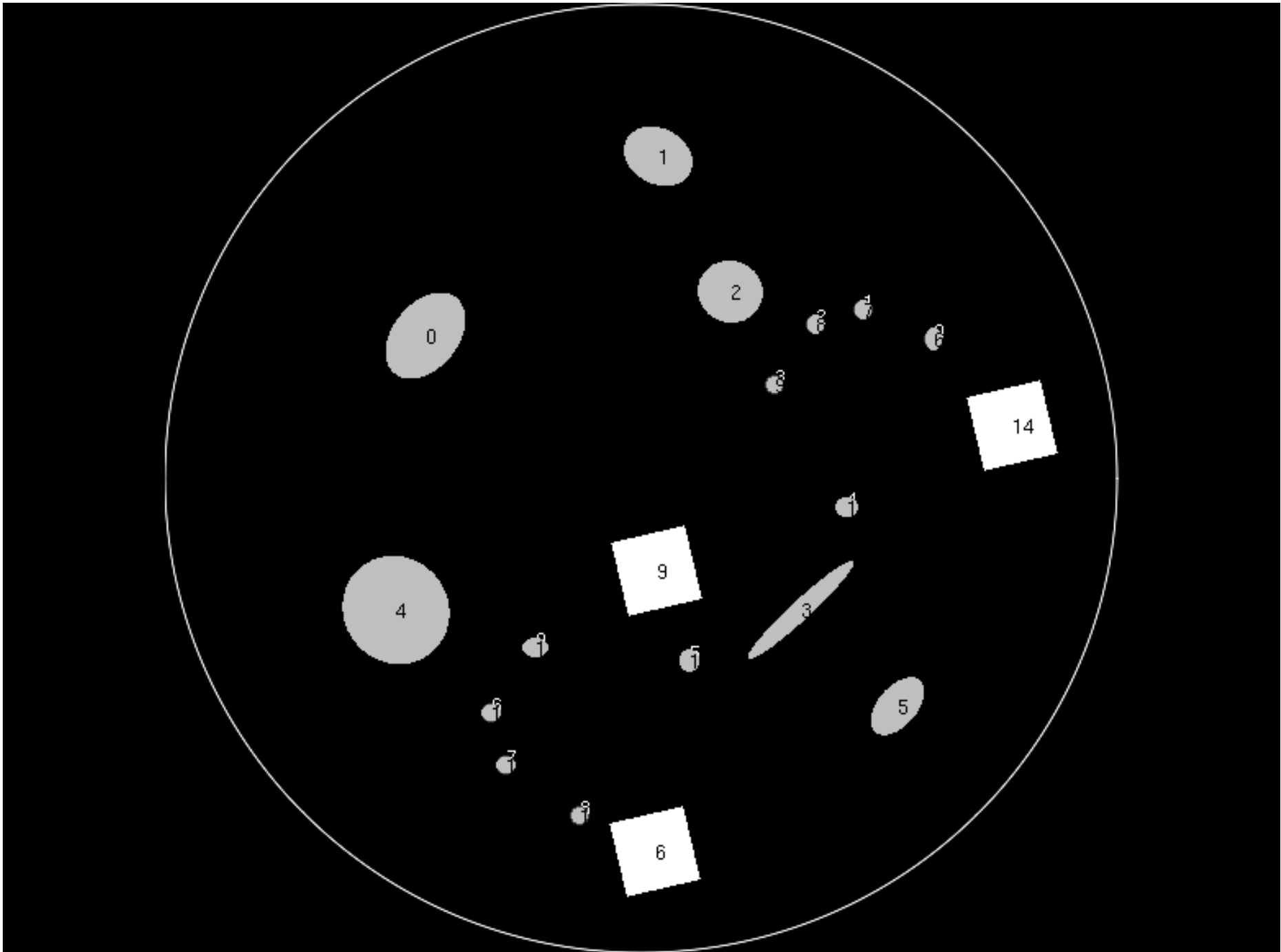
(a) a reacTIVision fiducial (b) black and white leafs and their average centroid
(c) black leafs and their average centroid, and
(d) the vector used to compute the orientation of the fiducial.

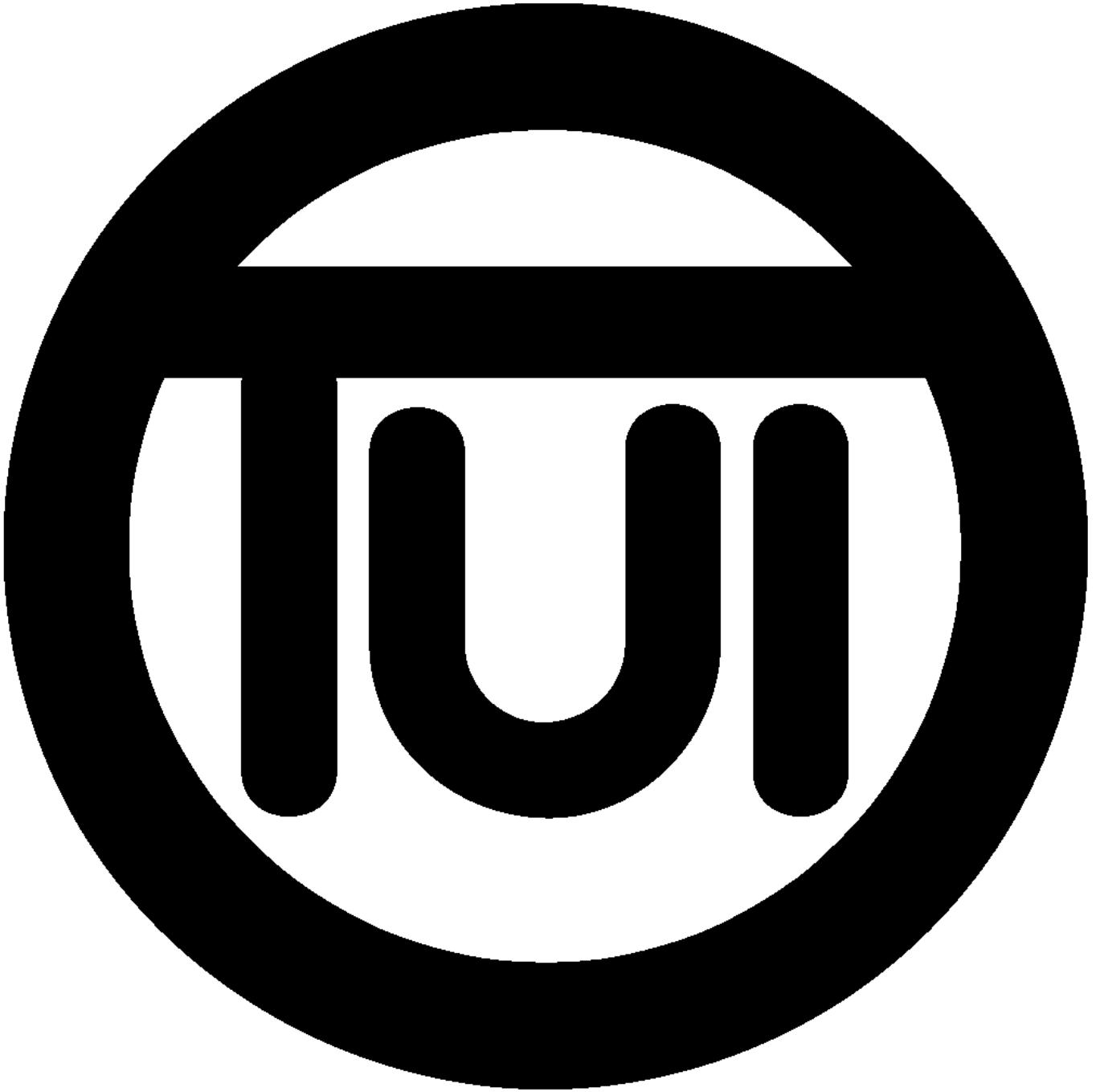
++ marker & finger tracking



++ marker, finger & object tracking

++ object, cursor & blob abstraction





++ TUIO components

+ original TUIO 1.0

Objects: **/tuio/2Dobj**

describes arbitrary physical objects, which are usually tracked with the help of visual symbols (fiducial markers), RFID tags or similar methods

tokens are not defined by their physical appearance but by their ID
encodes position and rotation angle.

Cursors: **/tuio/2Dcur**

describes surface pointers such as finger touches or dedicated devices

multiple pointers are only distinguished by their position

+ extended TUIO 1.1

Blobs: **/tuio/2Dblb**

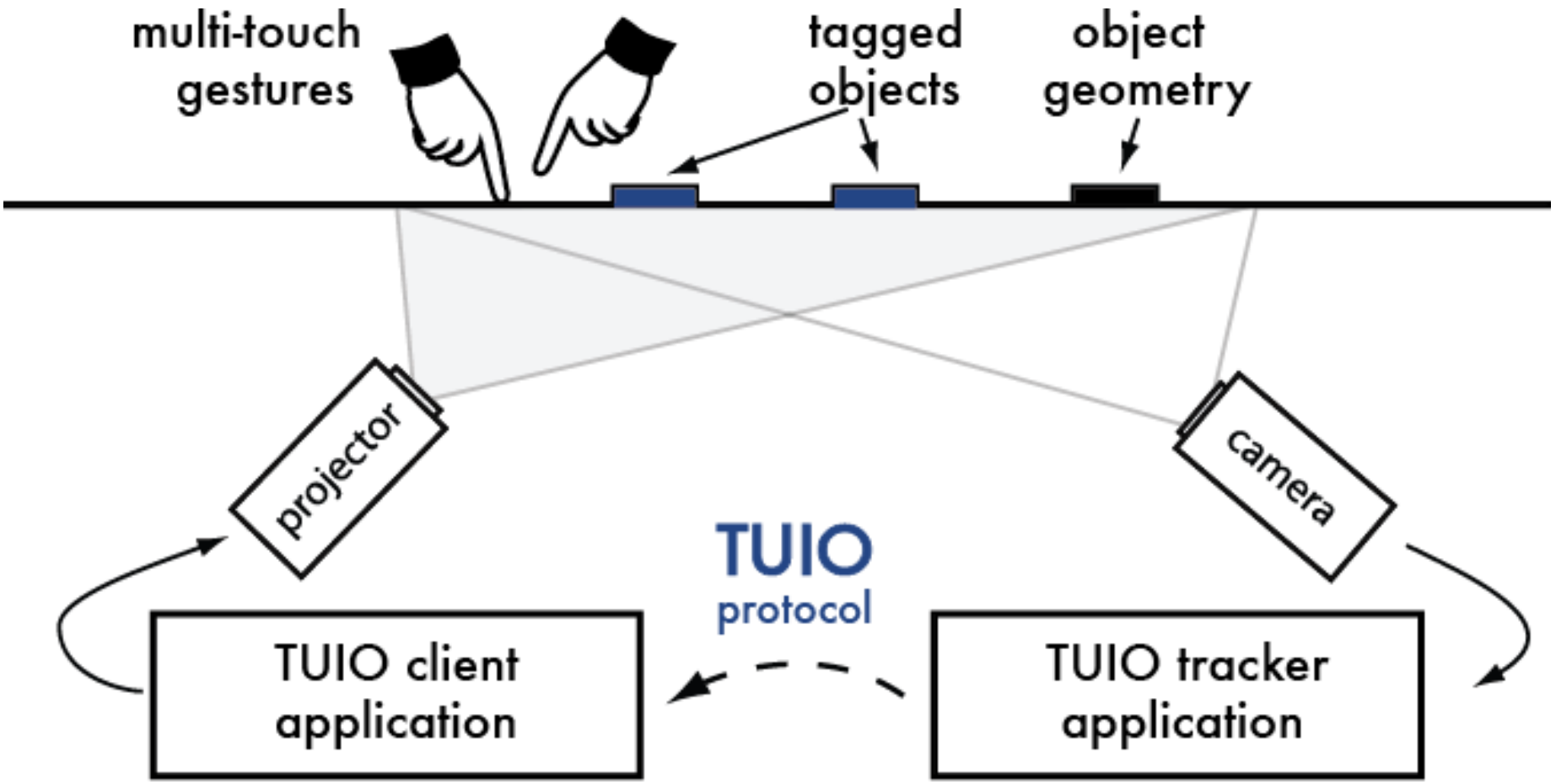
describes the bounds of untagged physical objects

encodes position, and oriented bounding box (angle, width, height)

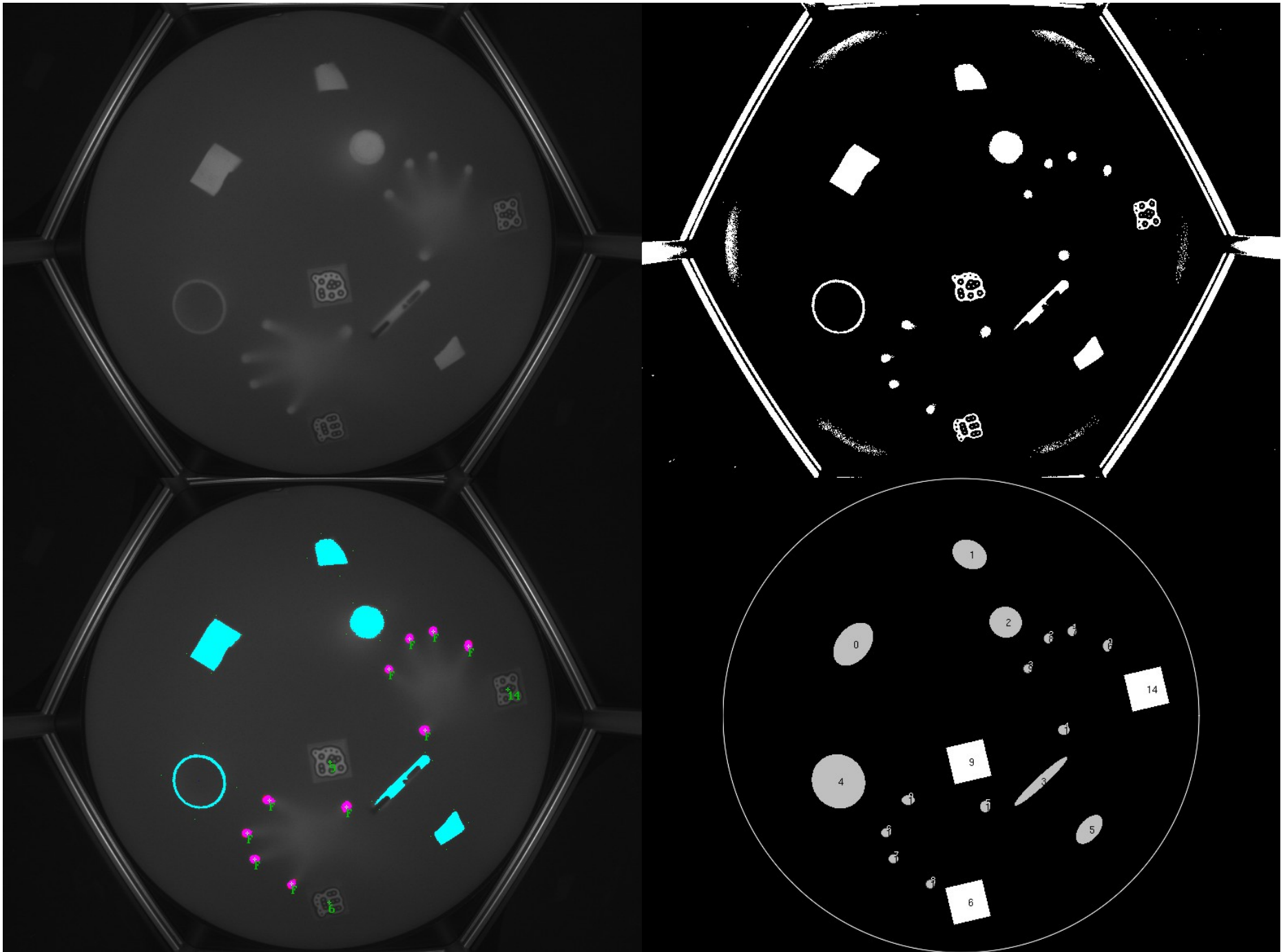
can be used to additionally describe the approximate object geometry

Source: allows the multiplexing of multiple TUIO trackers

++ TUIO framework architecture

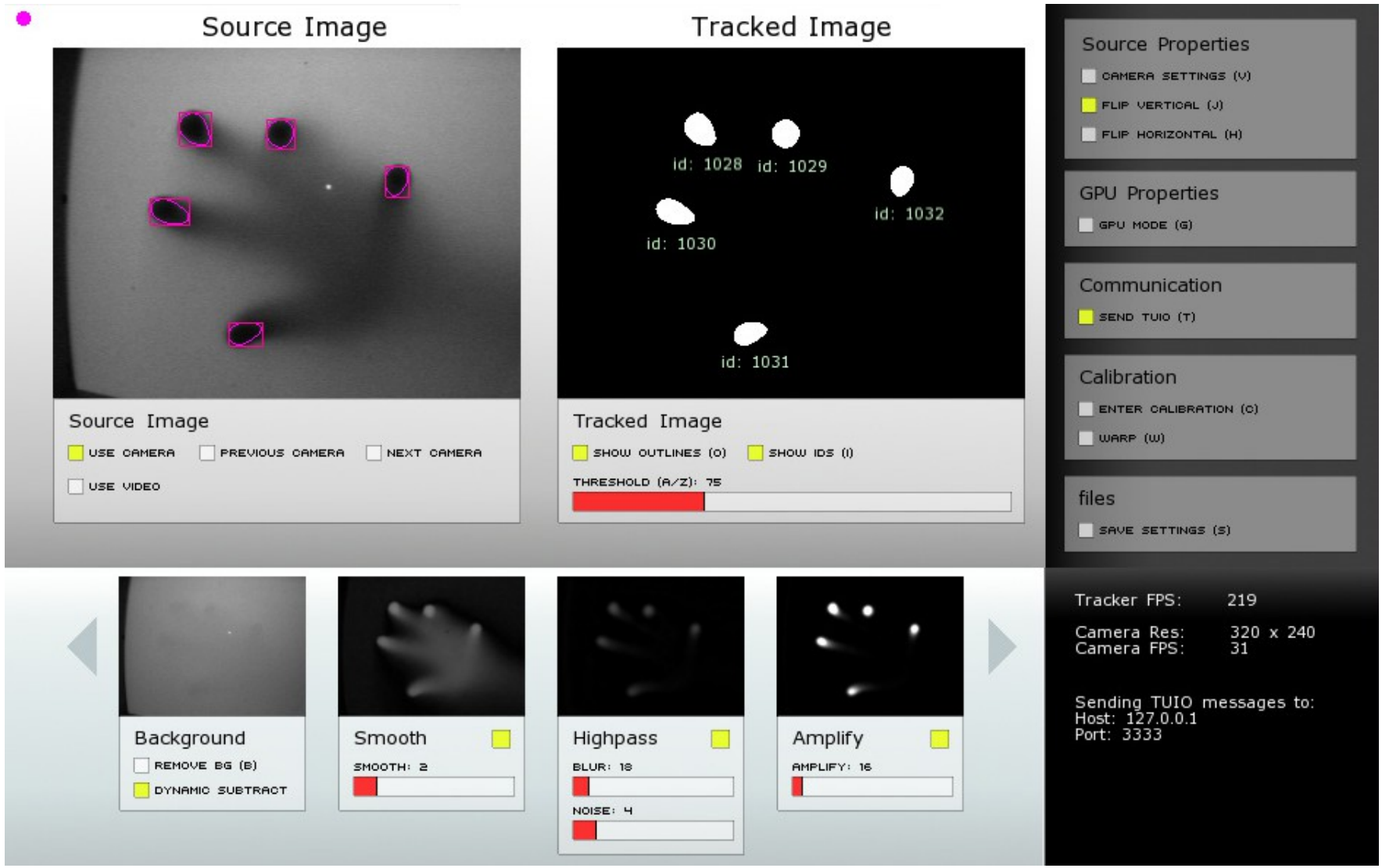


++ tangible interface component abstraction



++ FTIR – multitouch becomes popular

++ CCV – community implementation



++ TUIO 2.0 - tangible abstraction framework

+ revised component definition

Tokens (objects), **Pointers** (cursors), **Geometries** (blobs)

+ additional components

Symbols: allow the encoding of extended symbol content
Controls: for the association of additional control dimensions
Associations: allows description of physical connections & relations
Geometries: Contour, Skeleton, Area ... (incremental detail)

+ extended attributes

e.g. pointers include dedicated pointer/user ID, pressure attribute, ...
tokens allow the use of different symbol types

+ timing infrastructure

for improved gesture recognition capabilities