Squaring the Circle:

How Framedness influences User Behavior around a Seamless Cylindrical Display

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Shaped Displays

Digital Advertising Column

Audience behavior

Defining qualities of shaped displays

Form Factor / Framedness / Seamlessness

Q1: Form Factor

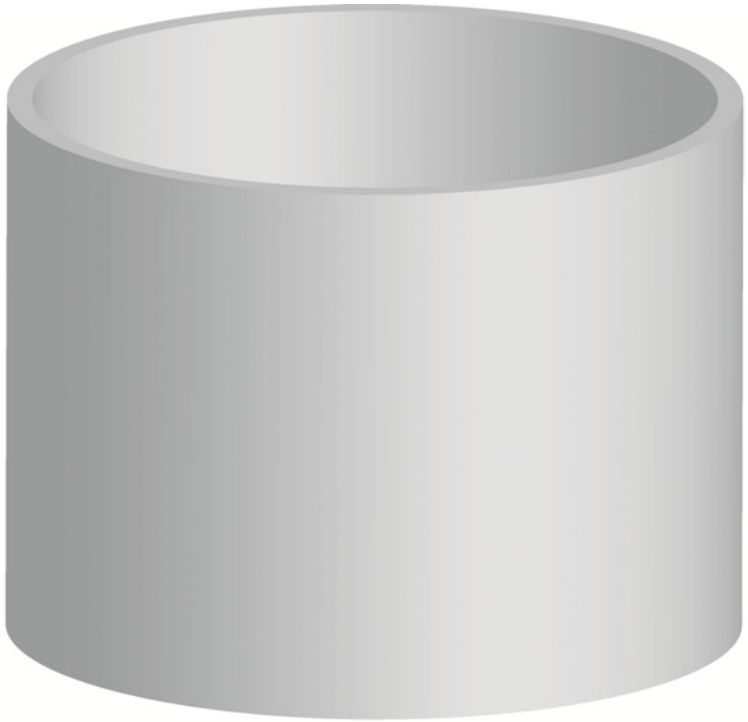
SHAPE
primitive / complex

PLANARITY
flat / non-flat

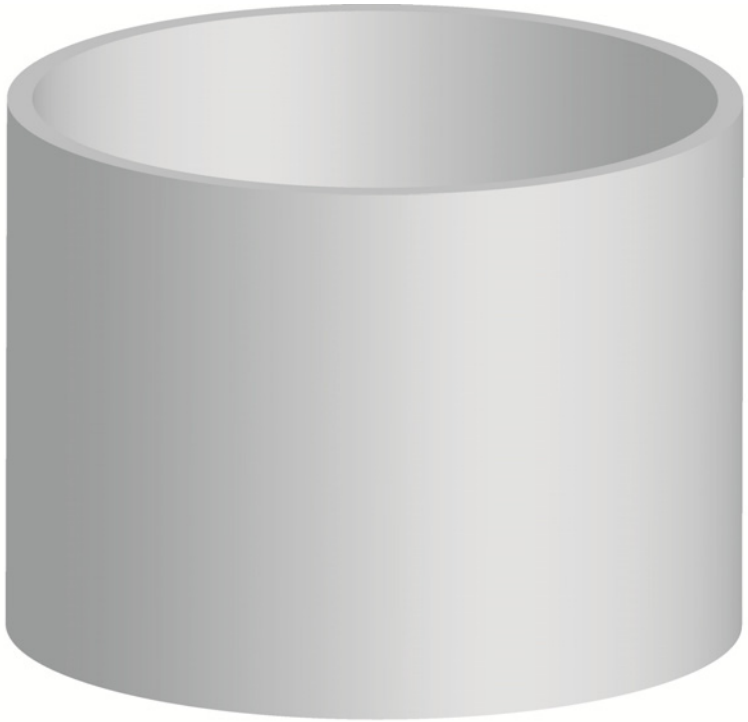
CURVATURE
concave / convex

SURFACE ROUGHNESS

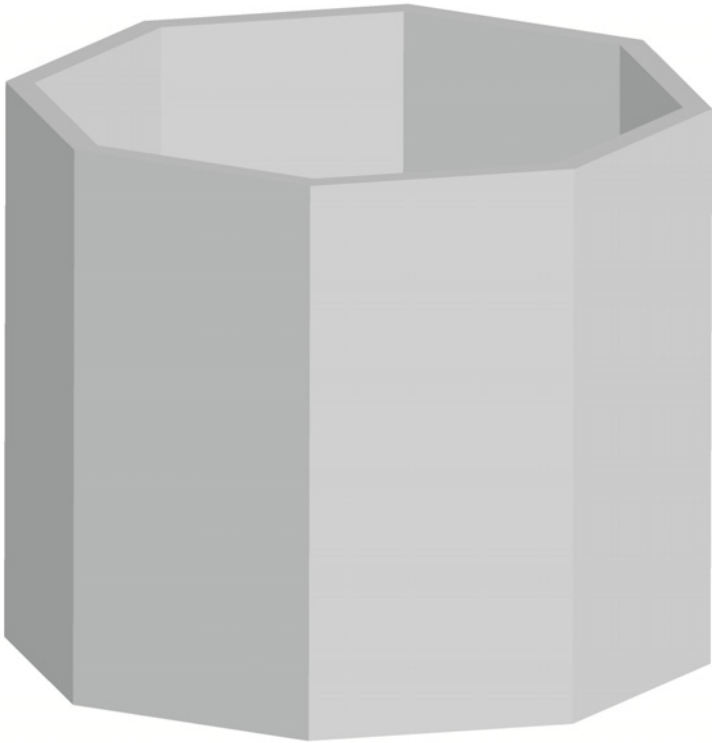
Cylinder



Circular Cylinder

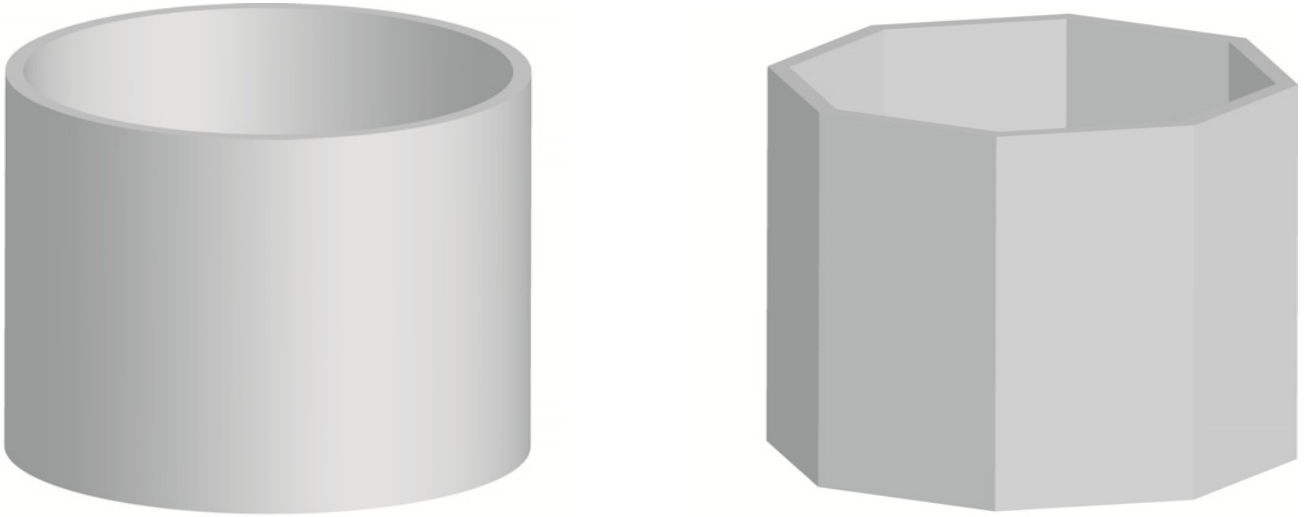


Polygon (Octagon)



*For a hexagon see Koppel et al. 2012

Surface Roughness



Q2: Framedness

FRAMED DISPLAYS
4 boundaries

SEMI-FRAMED DISPLAYS
2 boundaries

UNFRAMED DISPLAYS
1-0 boundaries

Semi-framed (curved)

Semi-framed (flat)

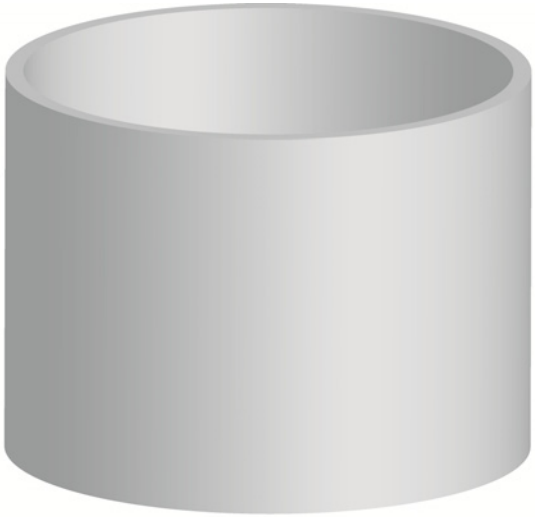
Q3: Seamlessness

NO EDGES

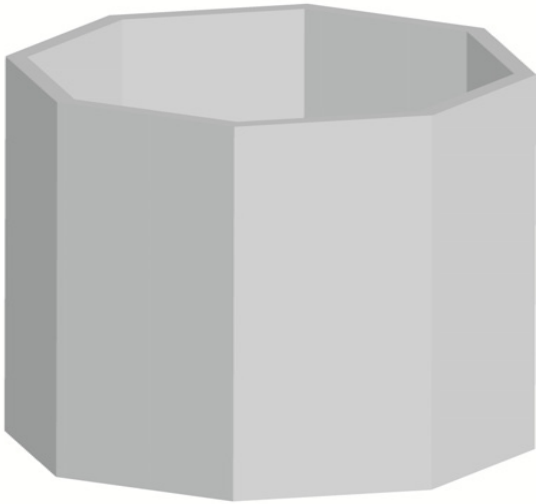
NO BEZELS

NO FRAMES

Q3: Seamlessness



seamless



not seamless

The same?
Or producing different user behavior?

User positions and constellations

Column Display

Interaction / Hardware /
Challenges

Interaction Principle

Communicating the interactivity by means of an unaware or implicit initial interaction

Frontal approachers

Unaware initial interaction using a space-saving user representation

Tangential passers-by

Unaware initial interaction using particles appearing slightly ahead

Design Challenges

SEAMLESS INTERACTION
within a circular space

SEAMLESS CONTENT
not affecting positions

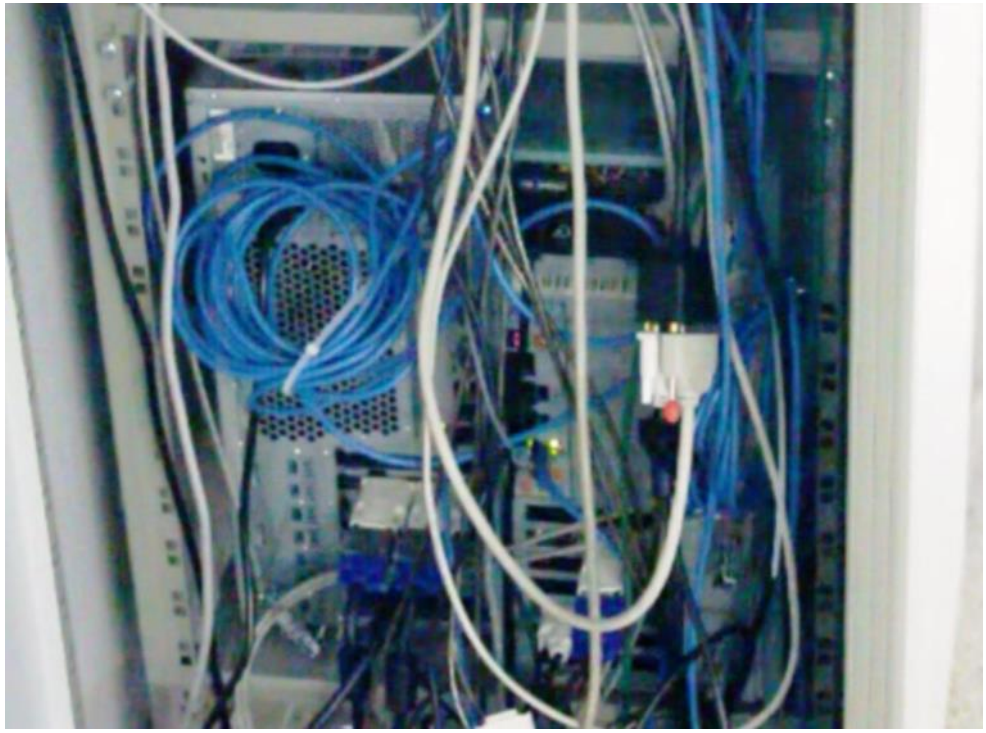
UNBIASED INTERACTION STYLE
no specific poses

COMPUTING POWER
8 Kinects

Multi-Kinect load

name	core count	core clock	1	2	3	4
Core 2 Duo (Allendale , Conroe, Melom)	2	up to 2.8 GHz				
Core 2 Quad	4	up to 2.8 GHz				
Core 2 Quad	4	from 3.0 GHz				
Core 2 Duo (Wolfdale)	2	up to 2.8 GHz				
Core 2 Duo (Wolfdale)	2	from 3.0 GHz				
Core i7 (Bloomfield)	4	up to 3.0 GHz				
Xeon	2	up to 2.6 GHz				
Xeon	4	from 2.8 GHz				
Core i7 (Nahelem)	4(8)	2.5 - 3.3 GHz				
Core i5 (Nahelem)	4	2.5 - 2.8 Ghz				
Core i5 (Westmere)	2(4)	3.2 - 3.6 GHz				
Core i3 (Westmere)	2	2.9 - 3.3 GHz				
Core i5 (Sandy-Bridge)	4	2.5 - 3.3 GHz				
Core i7 (Sandy-Bridge)	4(8)	2.8 - 3.6 GHz				
Core i3 (Sandy-Bridge)	2(4)	2.5 – 3.3 GHz				
Core i3 (Ivy-Bridge)	2(4)	2.8 - 3.4 GHz				
Core i5 (Ivy-Bridge)	4	2.7 – 3.4 GHz				

Hardware Setup



distributed system exchanging depth and skeleton data

integrating Kinects as unobtrusively as possible

Hardware Setup

distributed system exchanging depth and skeleton data

integrating Kinects as unobtrusively as possible

Study

Conditions / Design /
Data collection

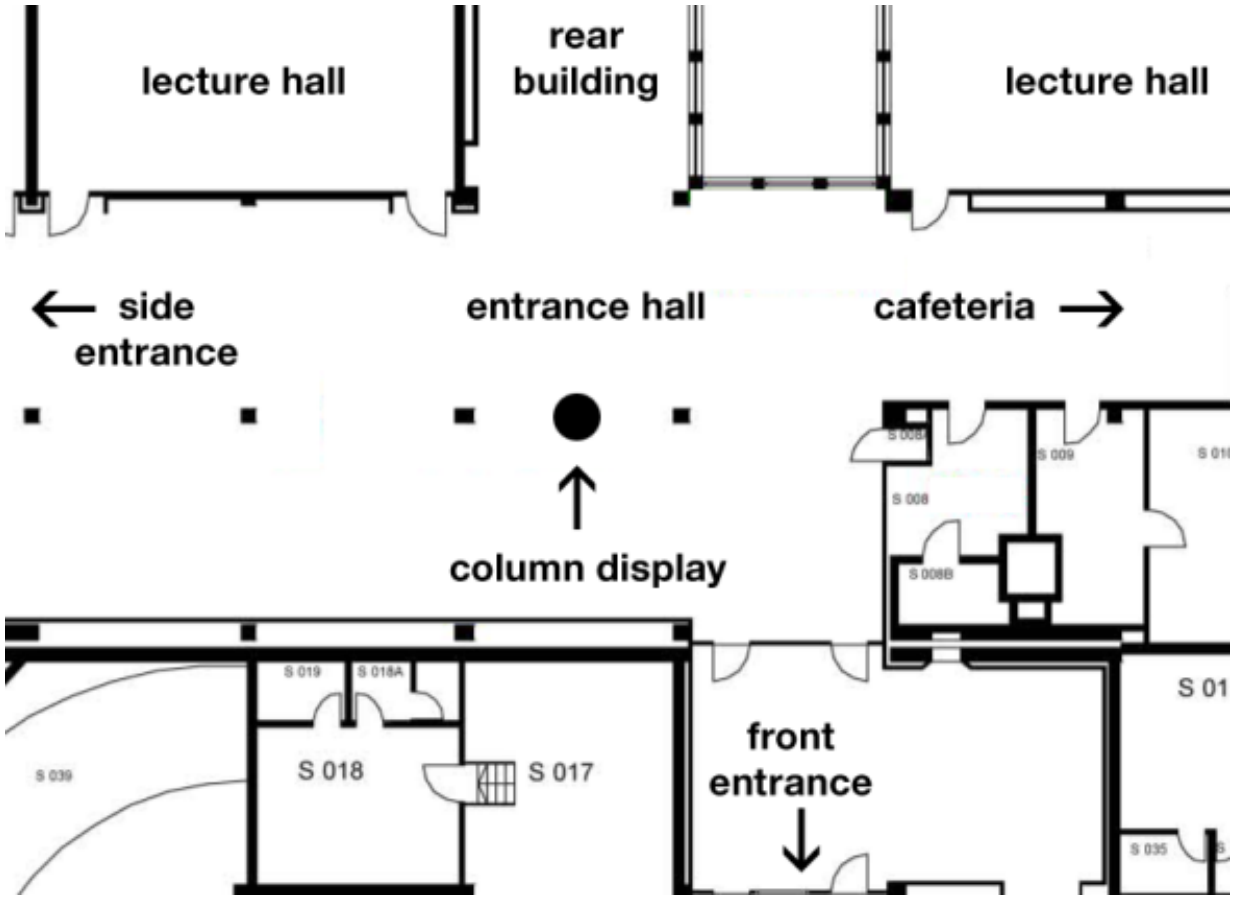
Condition 1: Unframed Column

Seamless content and interaction

Condition 2: Framed Column

Frames were just a visual overlay over the seamless content

Four-week deployment



Data Collection

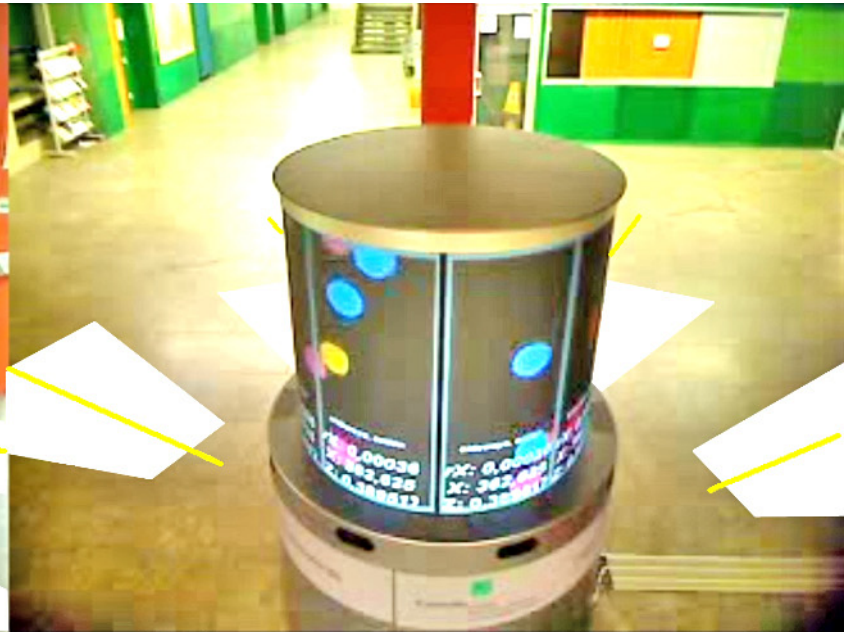
FIELD RATER
(hidden)

VIDEO-REC.
220 hours

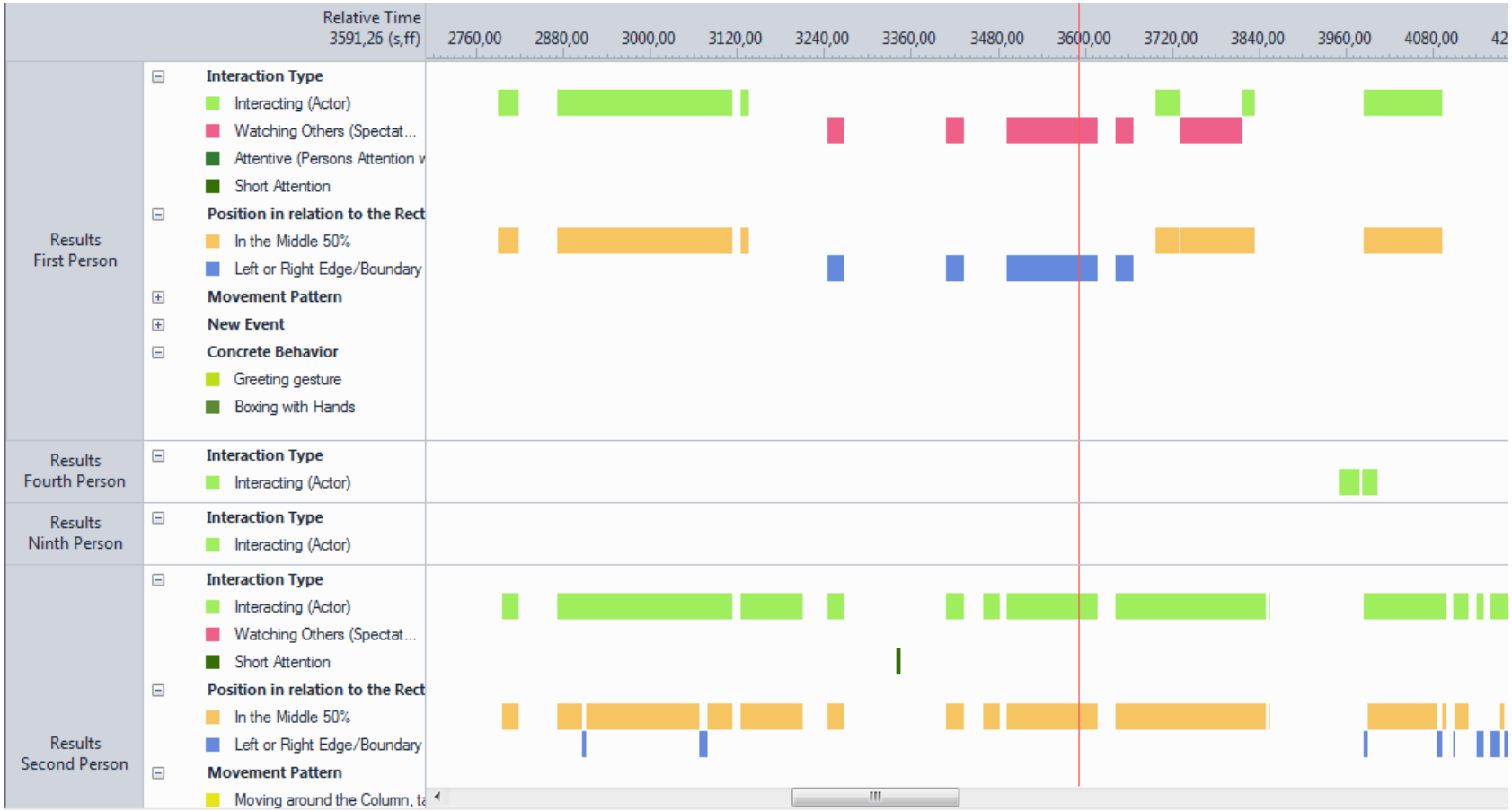
LOGGING
data assessed
by Kinects

INTERVIEWS
semi-structured
after the study

Scoring Positions



Nesting Behaviors



Results

General / Conditions /
Post-hoc analysis

General Observations

762 interactions and 205 people watching others within 33 hour sample

40.9 seconds average interaction interval length

General Observations

Initial interaction: already reacting from a distance if approaching frontally – later when deviating

General Observations

Pairs and groups interacted untiringly, but singles devoted as well

General Observations

All kind of human behavior between cooperation, competition, self-activity

Conditions

Observations: unframed condition

Users assumed diverse positions, dispersed around the column to assume an active role

Observations: framed condition

Significant association between frame and whether users assumed a central position

Observations: framed condition

Nested behaviors: Users reposition themselves when starting to interact

Observations: pairs and groups

Unframed condition: comfortable distances between users

Observations: pairs and groups

Framed condition:
Conflicts when interacting in front of the same frame or cooperating between neighboring frames

Interviews


symbolic image

Out of 79 interviewees

- most assumed purpose was entertainment
- most could reproduce detailed functionality
- only 1 recalled the presence of the frames

Interpretation

Columns / Framedness /
Seamlessness

Framedness significantly influences user positioning

around more complex display shapes

The basic shape should not be considered in isolation

when designing for
new display shapes

Blindness for the Frames

?

Advantages or otherwise

CLOSE-BY INTERACTION
avoid frames

MAXIMIZING USERS
avoid frames

POSITIONING USERS
use frames

REGULATING DISTANCE
use or avoid frames

Seamless displays: more options

Virtual frames already performed well to draw users to a position

Outlook: visual moderation

Actively shaping the audience by dynamically employing virtual frames?

Discussion





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