

Multimedia Presentation Effects for Immersion Experience

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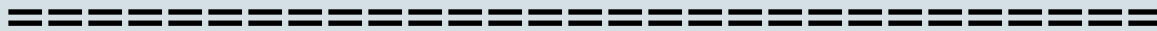
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(2001) presentation in WS-3 'Escaping Reality' at IEEE VR conference in Yokohama (Japan)

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OBJECTIVE

To investigate the contribution of different presentation media for getting people immersed into a scene.



Presentation media investigated:

- * dynamic visual channel
- * dynamic audio channel
- * dynamic tactile channel
 - vibration
 - air pressure

Test scenario:

“sitting and waiting on a station platform while on the next track (in ca 20 m distance) a train enters and passes the station from left to right”

Stimuli material [see E. Stahl (1997) PhD Thesis, ETH No. 12321]:

recorded data for 10 seconds in total

video: 1024*768 pixel, 250 ANSI lumen, PAL S-VHS

audio: DAT records SONY PCM-2500, HPS-III, HEAD acoustics

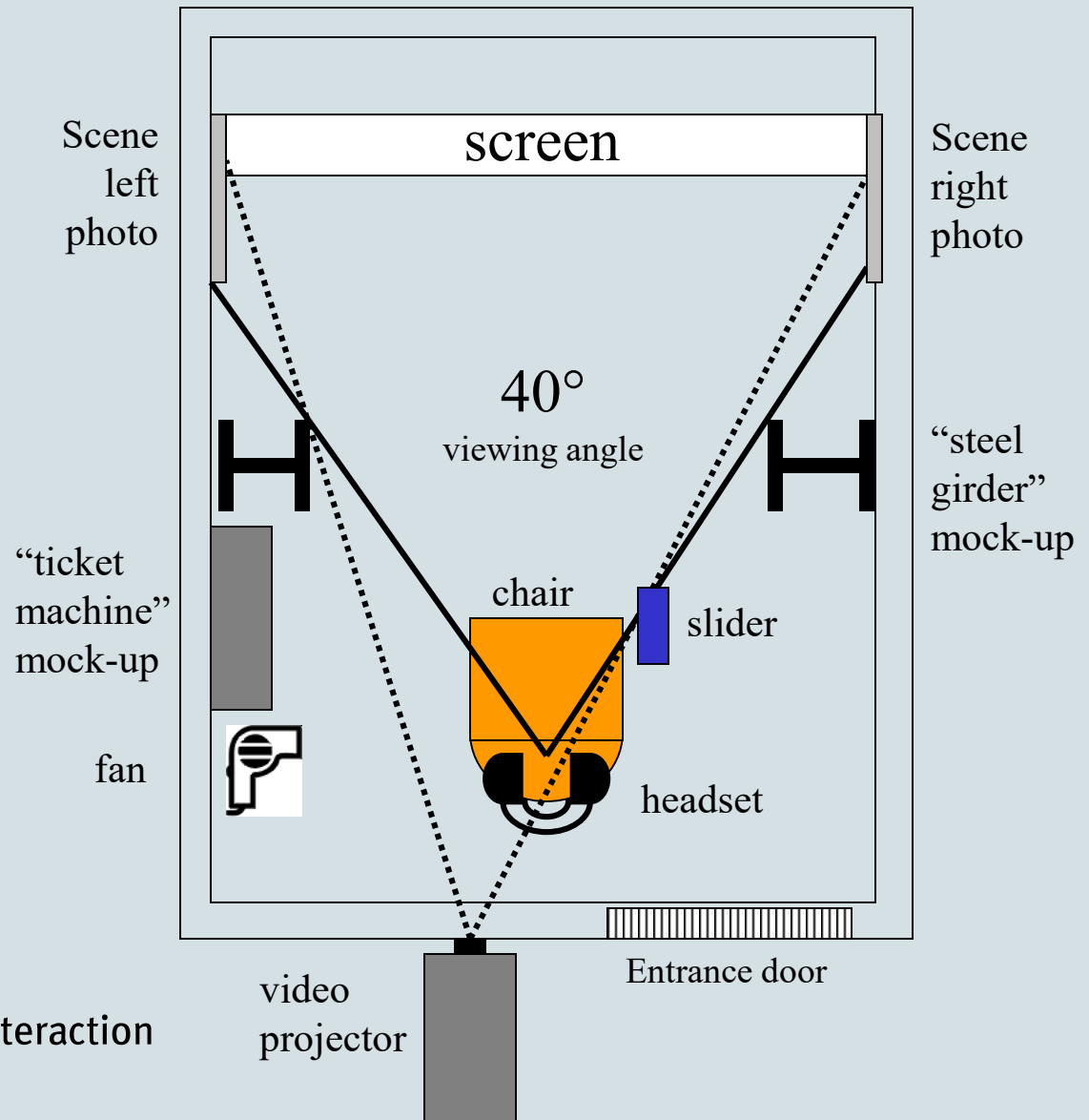
vibration: Vibrator type GWV46, Gearing & Watson Electronic Inc.
[5 - 2000 Hz, 1 m/s² acceleration]

draught: ordinary table fan, ca 100 cubic feet per minute (cfm)

Experimental Setup

Silent chamber

(Model 403-A special of IAC; size of 9.5 m²= 2.2m * 4.3m; extra shock proof)



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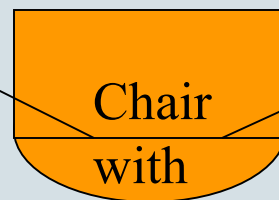
Screen
[2.1m*1.6m]



left view
of the scene

scale slider

right view
of the scene

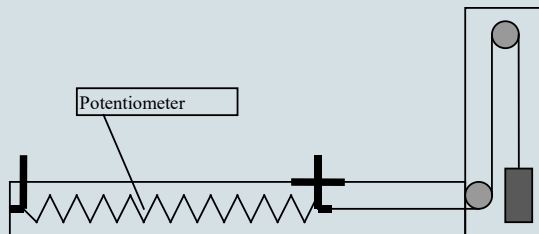


Chair
with
vibration

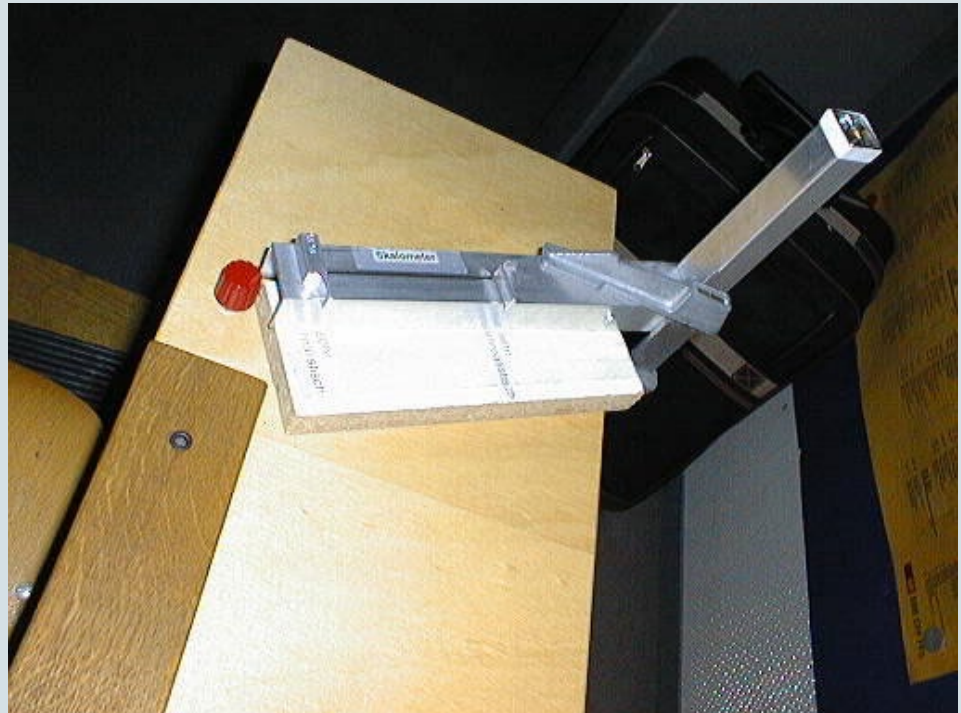
The chair
with
vibration feedback
[5 - 2000 Hz]



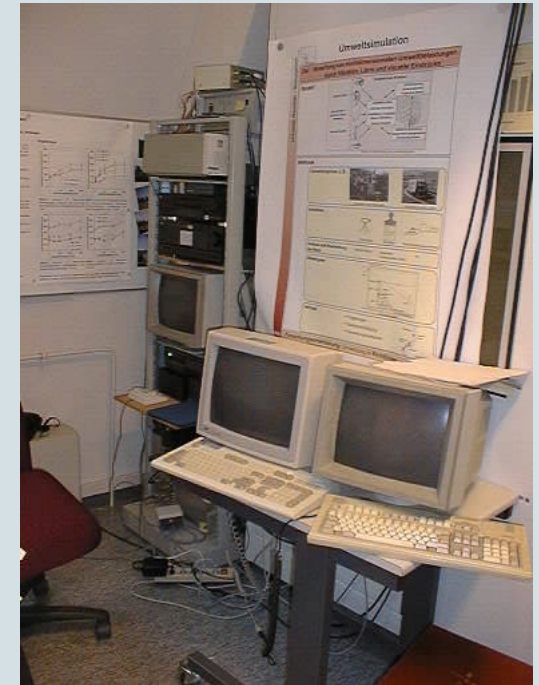
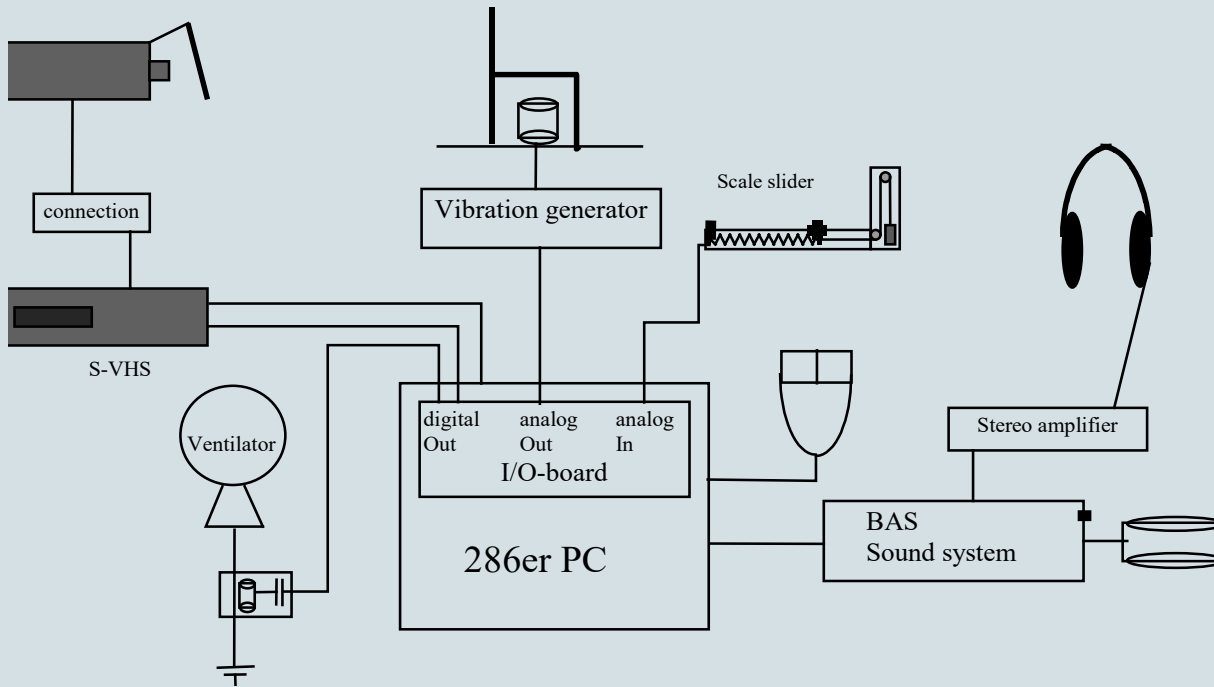
Measurement of immersion via the scale slider



Measurement range:
0 - 10'000



The control room



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Test design:

12 female and 12 male test subjects (N=24)
(average age: 27 years, 17-54 range)

Four independent variables:

(1) vision, (2) sound, (3) vibration, (4) draught

Each variable had two values: ON/OFF

Sixteen possible combinations: $2^4=16 - 1 \text{ \{all OFF\}} = 15$

All different 15 scenes with at least one presentation media ON are randomly presented to each test subject.

Total sample size: $24 * 15 = 360$

Statistical results

ANOVA Table for immersion

	DF	Sum of Squares	Mean Square	F-Value	P-Value	
video	1	34687317.042	34687317.042	7.632	.0060	SIG
audio	1	631251679.594	631251679.594	138.890	<.0001	SIG
video * audio	1	468162.667	468162.667	.103	.7484	
vibration	1	58174191.260	58174191.260	12.800	.0004	SIG
video * vibration	1	2591208.167	2591208.167	.570	.4507	
audio * vibration	1	1137743.760	1137743.760	.250	.6171	
video * audio * vibration	1	3456486.000	3456486.000	.761	.3837	
draught	1	14852266.667	14852266.667	3.268	.0715	(SIG)
video * draught	1	3397913.760	3397913.760	.748	.3878	
audio * draught	1	15125700.375	15125700.375	3.328	.0689	(SIG)
video * audio * draught	1	1272591.760	1272591.760	.280	.5970	
vibration * draught	1	1763668.167	1763668.167	.388	.5337	
video * vibration * draught	1	310878.844	310878.844	.068	.7938	
audio * vibration * draught	1	4370773.500	4370773.500	.962	.3274	
video * audio * vibration * draught	1	1484291.344	1484291.344	.327	.5680	
Residual	368	1672548804.000	4544969.576			

Means Table for immersion

Effect: video

	Count	Mean	Std. Dev.	Std. Err.
off	192	2482.682	2458.928	177.458
on	192	3083.786	2565.741	185.166

Means Table for immersion

Effect: audio

	Count	Mean	Std. Dev.	Std. Err.
off	192	1501.094	1733.781	125.125
on	192	4065.375	2549.507	183.995

Means Table for immersion

Effect: vibration

	Count	Mean	Std. Dev.	Std. Err.
off	192	2394.010	2363.864	170.597
on	192	3172.458	2630.311	189.826

Means Table for immersion

Effect: draught *

	Count	Mean	Std. Dev.	Std. Err.
off	192	2586.568	2315.014	167.072
on	192	2979.901	2715.495	195.974

Means Table for immersion

Effect: audio* draught

	Count	Mean	Std. Dev.	Std. Err.
off, off	96	1502.896	1675.134	170.968
off, on	96	1499.292	1799.320	183.642
on, off	96	3670.240	2365.482	241.426
on, on	96	4460.510	2675.319	273.049

“What was the most realistic scene?”

Observed Frequencies for Sex, Favorites

	Rest scenes	tunnel	Full scene	Totals
female	5	4	3	12
male	0	8	4	12
Totals	5	12	7	24

Summary Table for Sex, Favorites

Num. Missing	0
DF	2
Chi Square	6.476
Chi Square P-Value	.0392
Contingency Coef.	.461
Cramer's V	.519

Conclusions:

- the more media involved, the bigger immersion
- a mapping to a real situation is more important, than just adding different media (e.g. “tunnel”)
- women have different preferences than men
- high quality audio had the most important contribution