Simulation - How Does it Shape the Message?

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Abstract

Environmental psychologists specializing in architectural psychology offer *user needs' assessments* and *post occupancy evaluations* to facilitate communication between users and experts. To compare the efficiency of building descriptions, building walkthroughs, regular plans, simulation, and direct, long-time exposition, evaluation has to be evaluated. Architectural simulation techniques - CAD, video montage, endoscopy, full-scale or smaller models, stereoscopy, holography etc. - are common visualizations in planning. A subjective theory of planners says "experts are able to distinguish between *pure design* in their heads and visualized design details and contexts like color, texture, material, brightness, eye level or perspective." If this is right, simulation details should be compensated mentally by trained people, but act as distractors to the lay mind. Computer visualizations and virtual realities grow more important, but studies on the effects of simulation techniques upon experts and users are rare. As a contribution to the field of architectural simulation, an expert - user comparison of CAD versus endoscopy/model simulations of a Vienna city project was realized in 1995. The experiment showed that -counter-intuitive to expert opinions- framing and distraction were prominent both for experts and lay people (=general framing hypothesis). A position effect (assessment interaction of CAD and endoscopy) was present with experts and non-experts, too. With empirical evidence for "the medium is the message", a more cautious attitude has to be adopted towards simulation products as powerful framing (i.e. perception- and opinion-shaping) devices.

Architectural Simulation

The term *Simulation Aided Architectural Design* (SAAD) refers to the implementation of spatial simulation techniques in the course of architectural design work. The production of design-accompanying *intermediate products* utilizing the technology as a design-assisting testing device may be regarded as a prominent application field for SAAD. Prototyping and modeling are necessary work stages as far as design activity is concerned making for a means of verification of the reproduction and the operational execution of a building. SAAD is to be taken as a design strategy: design problems are to be realized at an earlier point than with conventional working methods. SAAD is not to entirely do away with previous working methods but rather acts as an addition also promoting the integration of traditional representation techniques. Thus spatial simulation is of significance for architecture without being a mere end-in-itself. A critical final statement has to be made anyhow. Simulation is to create a representation of reality in line with specified conditions. The possibility of manipulative use of simulation tools, however, is obvious: making believe may mean nothing but hushing up things.

Environmental psychology looking at the built environment utilizes *user needs'assessments* and *post occupancy evaluations* to measure the direct impact of architecture on users by building walkthroughs or long-time exposition [1]. Actual physical exposition is not the only possible way of interacting with a building. Plans and simulation methods offer pre-occupancy cognition, emotion and (imaginary) action about physically non-existent structures [2]. In case of an architectural competition, the decision whether to realize the project or not takes place in this *meta-physical* phase. The worlds of pre- and post-occupancy building evaluation overlap - simulating something is possible because something from the outside world can be handled symbolically by means of its mental representation. A simulated chair is correctly identified as a chair because we all have experienced real chairs. Simulation uses things stored in memory. Architectural simulation is an interaction of newly designed things and spaces with already known, existing examples.

The Selection of Simulation Techniques

The point is to what extent the product of simulation as such may mutate to be the message. How is the message presented? Or: is the wrapping itself regarded as the message? We may be running the risk that the substance is not being conveyed at all and the wrapping as it were is not even opened. Therefore, the intrinsic effects of the simulation techniques implemented are to be dealt with. Following the study “Fields of Application of Simulation Techniques“ [3] performed in 1993 a suited selection was made for the present study. It did not come as a surprise at that time that computer-assisted and the endoscopic simulation techniques, resp., were implemented more heavily than e.g. holography and stereoscopy. Furthermore, the evidently great availability of low- and high-end CAD with its major significance in comparison to endoscopy also adds to this effect, simply to be explained:

- computer-aided simulation (CAD-CAAD-CAI-...)
  The virtual-digital model is vested with the ability to “impress” i.e. the reality is in force even without physical matter. The fact that a CAD-model can be at various locations at the same time proves particularly useful.

- endoscopic spatial simulation
  Concerning endoscopic viewing physical models with very differing degrees of detailing seem suited. Apart from insignificant adjustments of models the quick and uncomplicated implementation possibilities without "strings attached" are to be stressed. Thus endoscopy proves meaningful already at an early stage of design.

Computer-aided and endoscopic spatial simulation are the most common visualizations in planning [4]. In a society putting more and more communicative emphasis on computer artefacts and virtual realities [5], one should expect a solid body of knowledge about the effects of simulation in the minds of expert planners, politicians, administrators, and laypeople. However, empirical studies on the individual and social outcomes of simulation techniques are not numerous [6-10].

Selection and Configuration of the Referential Object

A complex urban design concept for the "Altes Flugfeld" (Old airfield) in Aspern (Vienna) acted as the starting point for experience with various perceptive and interpretative approaches. The master project by architect Rüdiger Lainer lent itself extremely well to this purpose being - at first sight - an irregular urban development area for 20.000 people hardly to be matched by any other international project. A digital, Autocad-produced Aspern model was made available. The shadow marking in the computer images indicates the project stage. Based on these digital data a 1:500 city model was produced in block-design. The respective heights of storeys were additionally specified by means of the building-up structure. As it principally was not to be an evaluation of the Aspern project, far-reaching details within the model were not shown (trees, persons, vehicles, façade features, etc.). It is to be stressed that the present manner of project representation in the field of architecture and urban design is to be regarded as representative and intentionally unspectacular (no "CAD-bluff"). Finally, an endoscopic and computer-aided picture of the main street corridor and an accompanying overall view was made.

Empirical study - Material, Method and Hypotheses

An expert - user comparison of CAD versus endoscopy/model simulations of the *Old Airfield Aspern* project was realized in 1995. The Department for Spatial Simulation at the Vienna University of Technology (VUT) provided diaslides of the planned city development at Aspern showing a) CAD and b) endoscopy photos of small scale polystyrene models. In a standard experimental design, the diaslides were presented uncommented as images of "project A" versus "project B" to student groups of architects and non-architects

Experimental design (experimenters and locations in brackets):

Group 1 (Keul/Martens, VUT) n = 30 architecture students a) endoscopy, b) CAD	Group 2 (Martens, VUT) n = 28 architecture students a) CAD, b) endoscopy
Group 3 (Keul, Salzburg Univ.) n = 19 psychology students a) endoscopy, b) CAD	Group 4 (Keul, Salzburg Univ.) n = 18 psychology students a) CAD, b) endoscopy

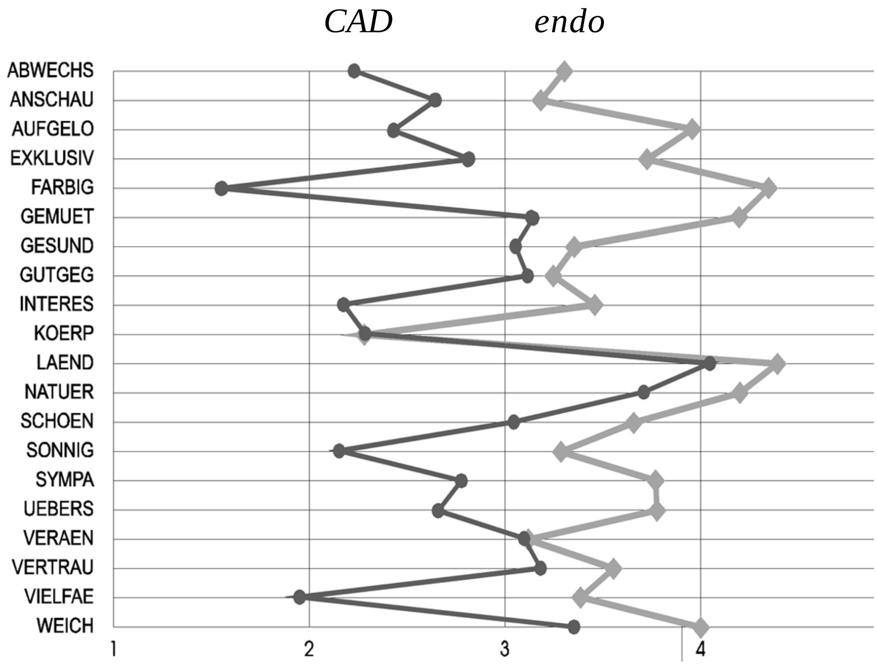

Fig. 1 CAD/endoscopy expert sample.

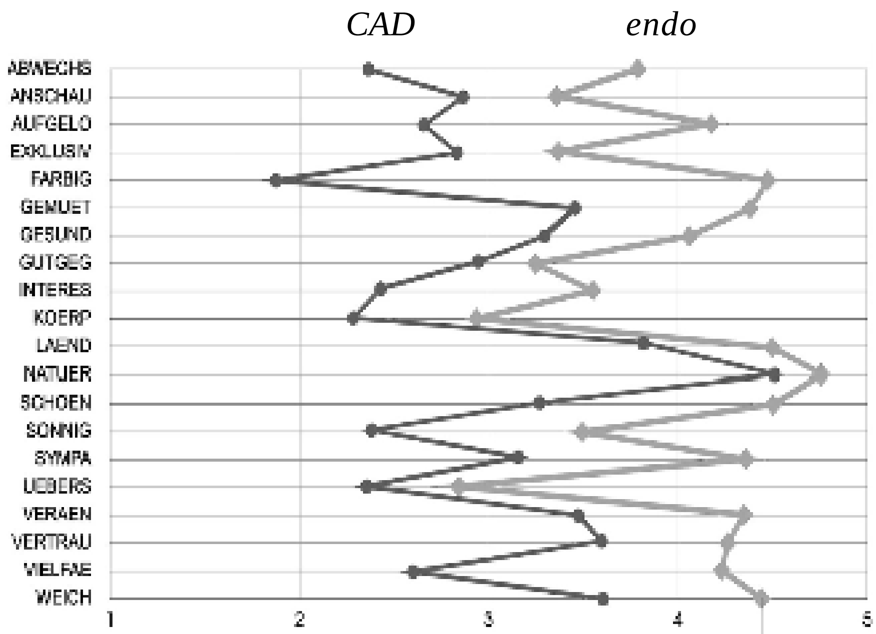

Fig. 2 CAD/endoscopy non-expert sample.

at VUT and Salzburg University (N= 95) and had to be assessed by a semantic differential [11] comprising 20 polar pairs of adjectives (e.g. ugly - beautiful). Two series - CAD and endoscopy - of four slides each were presented with a projection time of 15 seconds per slide. The students had to fill in the instruments twice on separate pages immediately after projection of the fourth slide. The experiment tested two contradictory hypotheses :

1. The selective framing hypothesis (SFH) close to the subjective theory about planners, postulating different judgment effects through selective attention of planners versus material- and context-bound perception of untrained users.
2. The general framing hypothesis (GFH) postulates typical framing and distraction effects of simulation techniques affecting experts as well as non-experts.

Results and Discussion

To present the results in a graphic, understandable way at the EAEA-Conference, only elementary statistics with a significance test was used. First, the similarities and differences of the data sets were examined. Arithmetic means were computed for every polar pair of adjectives [12]. In the graphic display (Fig. 1 and 2), the positive poles are all shwon left, and the negative poles at the right edge. A "totally average" profile would run at "3", exactly in the middle. What falls between 2 and 3 is "rather good", between 1 and 2 means "very good". Values between 3 and 4 should be read as "rather bad", between 4 and 5 as "very bad". It is obvious that both architecture student groups at Vienna found the endoscopic simulation pictures "rather bad", and that the CAD simulation pictures of the same project were rated between "rather good" and "average". Looking at the non-expert psychology student profiles (Fig. 2, Salzburg), it becomes clear that the endoscopy slides were rated "rather" to "very bad", whereas the CAD slides got "average" to "rather bad". So at first glance there are clearer differences between the endocopic and CAD simulations than between the two user groups.

T-tests for dependent samples were run for the means. They indicate whether the arithmetic differences of the means are significant or not. In Fig. 3, highly significant t-test results [$p \leq 0.01$] are printed bold face. Note that when endoscopy was presented before CAD, 10 of the 20 pairs of adjectives show highly significant differences both of experts and non-experts. When endoscopy was shown after CAD, only two adjectives produced significant differences in both groups. What does the paradox result mean?

T-test significances (SPSS)	*architects E-C*	*non-archi E-C*	*architects C-E*	*non-archi C-E*
diverse	.000	.000	.525	.055
graphic	.016	.070	.907	.090
dispersed	.000	.000	.000	.002
exclusive	.000	.007	1.00	.023
colorful	.000	.000	.000	.000
comfortable	.000	.001	.894	.154
healthy	.048	.003	.852	.332
good area	.646	.056	.824	.312
interesting	.000	.003	.080	.289
bodily	.851	.134	.271	.203
rural	.003	.011	.212	.331
natural	.011	.056	.028	.854
beautiful	.001	.000	.110	.011
sunny	.000	.000	.025	.066
pleasant	.000	.000	.495	.077
clearly arranged	.000	.119	.084	.041
flexible	1.00	.004	.006	.749
familiar	.086	.048	.328	.481
varied	.000	.000	.302	.592
soft	.004	.011	.085	.848

Fig. 3 T-test results.

First, the experiment shows that -counter-intuitive to some expert opinions- framing and distraction were prominent both for experts and lay people (= GFH) in the "endoscopy first-condition". Second, a very strong position effect (assessment interaction of CAD and endoscopy) is present with experts and non-experts, too, overlapping the first effect. Endoscopy presented before CAD of the same project means "bad endoscopy, good CAD", but endoscopy presented after CAD minimizes evaluation differences both for experts and non-experts. The selective framing hypothesis (SFH) postulating the main differences between experts and non-experts is not supported at all by our data. Architectural simulation **does** shape the message, i.e. the plan's contents. With such strong differences, one could even quote McLuhan's "the medium is the message". A more cautious attitude towards simulation should be adopted. One should regard simulation products as powerful framing (i.e. perception- and opinion-shaping) devices. In presentations, simulation up- or downgrades architectonic ideas.

- The scope of our study was limited - no multimedia, no photorealism, no animation were used. As the experimental effect of this two media-study was considerable, strong effects of more advanced techniques on experts and non-experts should be expected. Hirche [9,14] reported that laypeople found model video simulations more useful than model diaslides.

- Smart, colorful CAD simulations are "Zeitgeist" and very popular whereas puristic, black & white endoscopy pictures or films are not that "cool".

Cultural and subcultural value systems are important for the impact of simulation technology on people and should be considered in evaluations.

- Wooley [13] gives an overview of epistemological speculations about virtual realities and cyberspace. Cryptic statements - “psychology is the physics of virtual reality“ or “reality is a cultural artefact“ - are not likely to shed light on interactions of technology, mind and society. One should follow a suggestion of Gregory MacNicol and do interdisciplinary research on new media, perception, cognition and emotion.

- Economically, architectural simulation methods are an innovative product. To develop successful and socially useful marketing strategies, target group-specific user research is necessary. Simulations good for architects could be bad ones for lay-people, and vice versa. Evaluation research tips the scales in that respect.

At the conference, the paper was discussed vividly. Jan van der Does underlined the importance of simulation quality. The realistic model, where the non-specific gets special attention, should be used for the communication designer-user, whereas the non-realistic model is enough for the professional communication designer-designer. Matthias Hirche remarked that the number of visual information could be crucial, so a crossover design with an information-rich endoscopic model and an information-poor CAD model would be necessary to decide. Wolfgang Thomas said that the information difference created a false comparison of apples with pears. Keul replied that simulation differences in the study were small compared to social reality. Glanville criticized that architecture students were probably more close to psychology students than to expert designers. Martens replied that in Austria, architecture studies takes a long time so students grow rather old and usually do practical work beside university. Granville also discussed the language problem sketching an experiment with architectural space vocabulary versus drawings. It was agreed upon that a semantic differential is a first indicator, but no in-depth instrument for a study of architectural perception. Other simulation methods and combinations of methods should be tested. Keul said that apparently, empirical simulation studies since 1973 have had no real impact on what designers and planners do with simulation methods. Therefore, the Keul-Martens project was meant as a constructive provocation.

Notes and References

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[12] In the experiment, subjects were asked to underline 10 adjective pairs "most important" to them. A cumulative analysis of the underlined items showed that for experts, dispersed, interesting, varied, sunny, clearly arranged, flexible, diverse and graphic were most important (underlined by more than half of the subjects), whereas for non-experts, beautiful, dispersed, pleasant, comfortable, colorful, natural, varied and sunny were the chosen items. The overlap experts - non-experts contains three important adjective pairs: dispersed-dense, varied-dull, sunny-dark.

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