User Needs at the Heart of Town: Orientation and Appraisal in an Endoscopic City Scale Model

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Introduction

In this paper we provide a "work-in-progress" report on on going investigation into the perception of building alternatives at a central urban place. The city-planning task in this case involves the development of several key parcels of real estate, with significant impact on a medium-sized German city's overall appearance and functionality. The interests of investors wishing to maximize economic utilization are competing with public interests regarding urban planning and urban design as well as development needs. Hence, there is a need for the development of different spatial layouts for the district to help identify reasonable concepts for the use of these key properties and their impact on the visual townscape as well as the functional spatial properties of the city's open space. Ultimately, clear deed restrictions and guidelines are to be identified for future investors to preserve the cityscape and to improve the quality of the existing public open space but also to enhance downtown's existing sensible economic equilibrium.

In order to develop these guidelines and clear rules for future urban design policies three alternatives have been developed – two of them designed by developers in order to maximize the floor area, while a third alternative was designed by professional urban designers aiming at the improvement of this underdeveloped part of downtown.

The experiment reported here investigates cognitive and affective consequences of the alternative urban design schemes. High-resolution photo stills are prepared from an eye-level perspective for abstracted, volumetric Virtual Reality models of the inner city.

The perspectives chosen simulate approaches to the square location from several angles and with either the original setting or new building design proposals in place. The research questions concern the impact of the new building design in terms of height, bulk, and scale on the participants' orientation in the cityscape model.

Since the building site is in a very exposed location, we suspect that changes will influence a viewer's reaction to questions like: How orientation-friendly is the square with respect to its surrounding? Does it

provide distinguishable landmarks and how does density of buildings vs. open views contribute to orientation? In addition to these spatial cognition facets, we collect aesthetic and affective judgments. Spatial abilities of participants are controlled for with standardised psychometric tests, as are gender and age influences.

The results of the study are directly applicable to the needs of city planning: They provide parameters for the planning framework of the future development of this key location in the city and may help guide planning decisions in a real-life project e.g. a typical competition mode where a jury needs an objective background for their decisions.

Experiment

An online survey was prepared to test three proposals for buildings on the central place (Berliner Platz) in the medium-sized German city of Bottrop. We opted for experimenting with internet data collection as a tool that can potentially attract a diverse group of test participants in a short time frame. Such an efficient and economical data collection tool seems especially promising for application in real-life professional consulting projects, where timely data collection is highly desirable.

Participants:
Participants for the study were acquired by online advertising. 52 (out of a total of 88) respondents answered the full questionnaire (29 men, 23 women; mean age 34 years). The clear majority of respondents had no professional experience in architecture or planning (90,4 %), making this a layperson sample. Only 3 participants claimed to be familiar with the town of Bottrop. Participants were randomly assigned to two experimental groups, receiving the questionnaire either containing or not containing aerial views of the setting. While due to unequal dropout rates, more participants actually fully completed the version with aerial views, we have no indication for a systematic distortion caused by or causing this fact.

Materials

A total of 4 building variants were tested. A short description shows the difference between the different variants.

Variant_0: This is the existing situation, with a huge open space containing a market place and the central bus station occupying the northern part. The open space is situated just next to the densely built-up downtown area. It is surrounded by unattractive functions.

Variant 1:
Two new buildings characterize this variant: One building is being situated between the open space and the central bus station separating the two parts of the open space, the other one is quite large and bulky and being planned on the eastern part of the area.

Variant 2:
One bulky building takes the place of the central bus station but includes all its functions. The eastern part of the area stays as it is.

Variant 3:
Similarly to variant 1, two buildings characterize this variant. The difference to variant 1 is the fact that in variant 3 the planned building between the central bus station and the market is smaller-scale and context-oriented. It also has a large gateway, which allows views through the building towards one of the identity buildings.

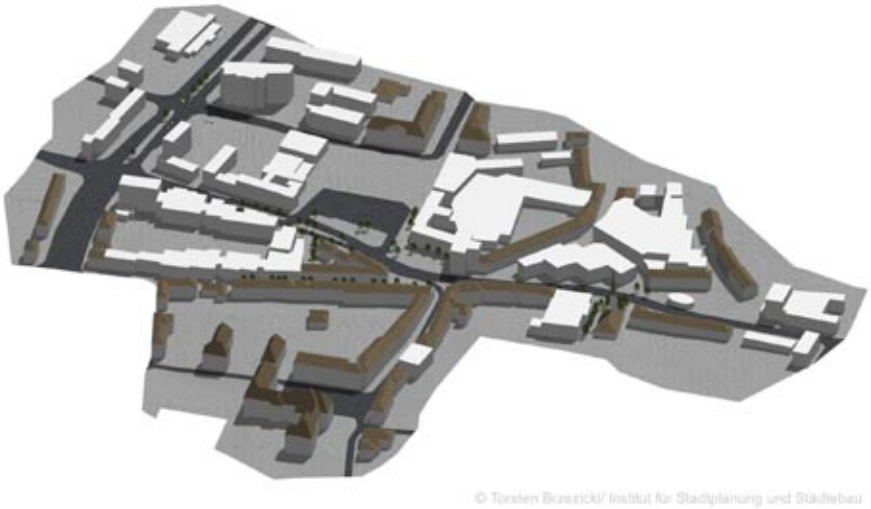


Figure 1: *Overview of the existing situation: The Berliner Platz in the City of Bottrop*

Figure 2: *Eyelevel view of the existing situation from the north*

Figure 3: *Eyelevel view of the existing situation from the south towards the bus-terminal*

Figure 4: *Overview of the variant 1: A new block between the bus-terminal and the open space*

Figure 5: *Eyelevel view of the variant 1 from the north*

Figure 6: *Eyelevel view of the variant 1 from the south across the Berliner Platz towards the new building, which separates the bus-terminal from the open space*

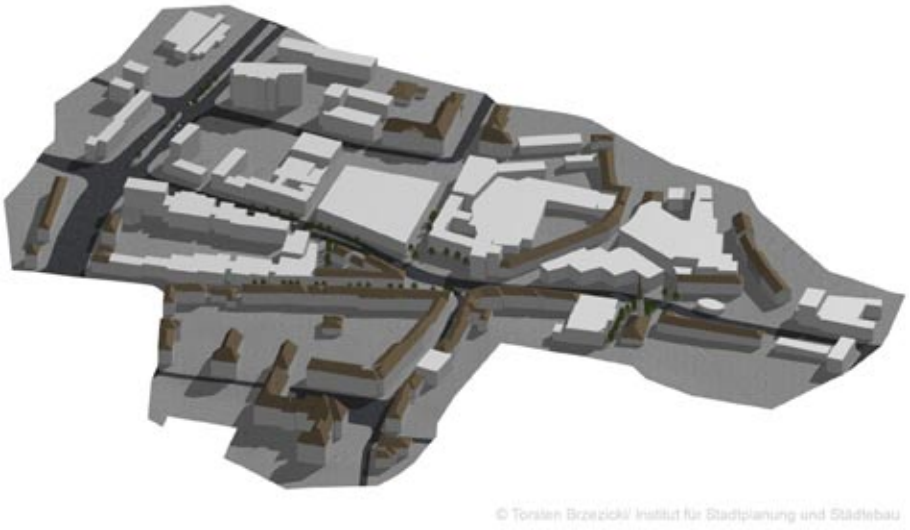


Figure 7: *Overview of variant 2: A huge bulky building mass on the site of the bus-terminal*

Figure 9: *Eyelevel view of the variant 2 from the south*

Figure 8: *Eyelevel view of the variant 2 from the north: a new massive building which includes the bus-terminal and blocks the view and access to the open space of the Berliner Platz*

Figure 10: *Overview of variant 3: A new integrated building allowing view corridors between the open space of the Berliner Platz and the bus-terminal*

Figure 11: *Eyelevel view of the variant 3 from the north, with distance from the eastern building and view corridors to the open space through the new building between the bus-terminal and the open space*

Figure 12: *Eyelevel view of the variant 3 from the south, with more transparency of the new building including wide stairs between the two levels of the bus-terminal and the open space*

The main focus was on preparation and presentation of simple eye-level perspectives, which focus on the most prominent features of the variants: Urban space, distance between bulk and height of the buildings, directions, view corridors and perspectives. Instead of perfectly rendered computer drawings the intention was to produce quick-and-easy pictures. For each building variant, two eye-level Virtual Reality photo stills were prepared of the most prominent portion of the building setting, namely one shot each from the north and south of the open market square area. These same two perspectives were chosen for all 4 building variants, the southward perspective always presented above the northward one. The aerial views (presented only to one group of participants) were also based on the VR model and faced south from an elevated position like a bird's eye view.

For each comparison, the pictures for each version were presented one below the other. The corresponding pictures of the two variants under scrutiny were placed horizontally next to each other to allow for direct comparison.

Thus, a survey page consisted of the following layout:

Aerial Variant X	–	Aerial Variant Y
Eyelevel1 Variant X	–	Eyelevel1 Variant Y
Eyelevel2 Variant X	–	Eyelevel2 Variant Y

Questionnaire items (10)

Table 1: Questionnaire Items

Dimension	Category	Engish Items: “Which variant is more...”	German Items: “Welcher der Varianten ist/ bietet...”
Valence	*Beauty*	*Beautiful*	*Schöner*
Arousal	*Excitement* *Interestingness*	*Exciting* *Interesting*	*Anregender* *Interessanter*
Dominance	*Obtrusiveness* *Gravity*	*Unobtrusive* *Light*	*Zurückhaltend* *Leichter*
Spatiality	*Spaciousness* *Enclosure*	*Spacious* *Open*	*mehr Weite* *Offener*
Orientation	*Clarity* *Overview* *Orientation*	*Clearly laid out* *Provides better overview* *Easy for orientation*	*Übersichtlicher* *besseren Überblick* *leichtere Orientierung*

The questionnaire items were adapted from Franz (2005). Franz developed the items over a series of experimental investigations and distilled the dimensions “valence”, “arousal”, “dominance” and “spatiality” as the most clearly applicable dimensions of appraisal (albeit for the judgement on indoor settings rather than streetscapes). They represent a current refinement of the well-accepted PAD model (pleasure, arousal and dominance) by Mehrabian & Russell (1974) and thus cover the range of affective qualities people can identify in architectural settings. The original Franz scales are bipolar (semantic differential) scales (e.g. “ugly” vs. “beautiful”). Pilot studies for our setting indicated that we would require direct pair wise comparison of materials (“pair wise forced-choice comparisons” in terms of Stamps, 2000), forcing an adaptation to the monopolar scale, as in the following example:

Welche der Varianten ist schöner?

Variant A	0	0	0	0	0	0	Variant B
	-2,5	-1,5	-0,5	0,5	1,5	2,5	

Note that in this setup participants were required to integrate their impression of each variant from the two perspectives (north/south). All items were presented in German and in a fixed order; all items were formulated positively. The scale has no neutral middle point, thus participants have to choose one of the variants as preferable, with three degrees of differentiation to each side of the scale.

To provide an estimate of the spatial competence of the test participants, the Santa Barbara Sense of Direction Scale (Hegarty et al., 2002) – a set of questions about general wayfinding and orientation ability – was applied. Yet, analysis of this aspect of the study will need to be reported at a later stage of our project.

Procedure

Participants logged into the website and first received explanations about the procedure and answered demographic questions. Several experimental checks were applied: Participants were randomly assigned to whether they received the materials including an overview picture or eye-level pictures only. They were presented with the three direct comparisons (1 vs. 2, 1 vs. 3, 2 vs. 3) of the three building alternatives in random order. The comparison of the current (old) setting (Variant 0) with the ISS proposal (Variant 3) was always presented afterwards. Test subjects were not aware which variants were old or new. All comparisons were fully counterbalanced for which of the alternatives was shown on the right vs. left side of the Web page, eliminating any artificial right-left order preference effects. The spatial knowledge questionnaire was administered last to avoid interference with the comparative judgement tasks.

Analysis

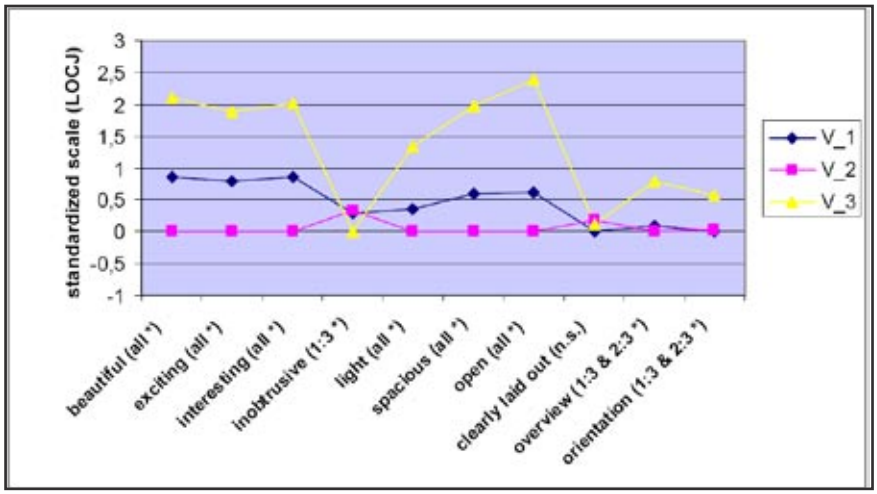
For the three variants representing new building proposals (Variant 1 to 3), all possible pair wise comparisons were available. We pursued two types of analysis, inferential and descriptive tests. For each pair-wise comparison, t-tests were computed against the null hypothesis that the mean scores do not significantly differ from the scales zero midpoint. Significant differences

are indicated in figure R1 and R2 with asterisks ("*"). While the pair-wise comparisons provide sensitive measures for differences between the individual pairs, they do not provide a natural way to integrate all variants on a single scale for relative comparisons. We used a technique called "Law of Comparative Judgement" (after Thurstone, 1927; see Bortz & Döring, 2002) to produce a scale integrating the ratings for the variants 1 to 3. Its properties are similar to z-scores, with the lowest ranked variant projected to zero and the differences being interpretable as interval scale.
The comparison of the existing buildings setting (variant 0) and the new variant 3 is provided separately in figure R2. Negative scores indicate that variant 0 is more pronounced than its counterpart on the respective questionnaire dimension, while positive scores indicate that variant 3 surpasses the old building on that dimension. For space concerns, we must limit our presentation of results for this work-in-progress report; more tails

on descriptive and significance tests are available on request

Results

Figure R1. Integrated Comparison of the three proposed new building variants; scaled to Law of Comparative Judgement.

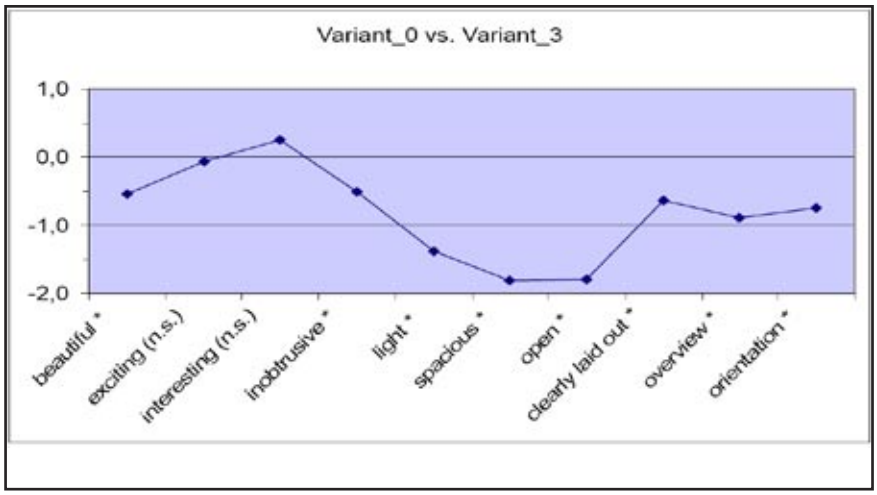


The LOCJ scaled comparisons in figure R1 provide a clear picture of the overall pattern of preferences with respect to the three new building proposals. For 6 of the 10 evaluative dimensions, Variant 3 is clearly preferred over both alternatives 1 and 2. Also, variant 2 is regarded more positively than Variant 1, but this difference is quite less pronounced than the superiority of variant 3. Note, that the pattern of differences in this scaled graph finds a clear correspondence in the pattern of statistical significance of differences, indicating the statistical validity of the findings.

The clear preference pattern was established for the subscale of valence (beauty), arousal, spatiality and for the enclosure subscale. Obtrusiveness – the second subscale of dominance – as well as the orientation scales did not show such a clear pattern. For obtrusiveness we see a reversed pattern with the otherwise preferred variant 3 as the least preferable option. The pattern of results for the orientation scales generally again shows a preference for variant 3, but only for 2 of 3 subscales and to a much lesser degree than for the other dimensions. Also, we received several comments from test participants, indicating that they found the orientation related questions difficult to answer. This is reflected in the relatively smaller size of the differences, as well.

From the urban designer's point of view, any interpretation of these findings would amount to speculation. In fact any of the alternatives 1, 2, and 3 are so different, that the relative similarity of ratings concerning obtrusiveness and the low scores for the orientation scales is made difficult. We must suspect, that such lack of orientation is attributable to our use of still pictures instead of interactive films or panoramic images.

Figure R2. Direct pair wise comparison of current building (v 0) and variant 3. Negative scores indicate preference for variant 0.



The comparison of variant 3 with the current buildings setting (variant 0) draws a quite different picture (figure R2). While variant 3 was considered preferable over variants 1 and 2, it is regarded to be clearly inferior to the current building setting. (Note that the participants were unaware of the old vs. new status of these materials!) The main difference between variant 0 and all other is of course the fact that variant 0 contains a very large open space. Consequently, the most distinct preference was established on the spaciousness dimension (open, spacious). Also, in this direct comparison, participants consider the open space to be better for orientation purposes, a very clear result that could not be found for the direct comparisons between the new building variants.

This result is quite noteworthy for the urban designer. On one hand people prefer clearly the open space of the existing situation. On the other hand people seem to regard the existing large open space as less interesting and less exciting. Variant 3 (as well as variant 1 and 2) shows new buildings instead of the large open space and new functions, which the urban designer would expect to be more “exciting” and “interesting”. Maybe the simple eye-level perspective showing the pure building mass without any differentiation are not detailed enough. E.g., they do not show a clear

evidence of ground floor shops, activities along the building and street live.
While one group of participants saw overview images together with the eyelevel photos, the other group had no access to this additional information. The results of comparing these groups are quite mixed. Eight out of the total 40 significance tests (= 4 pair-wise comparisons * 10 questions each) showed significant differences between the judgments of these two groups. But in none of the comparisons, the presence or absence of overview images changed the direction of preference. Also, the significant differences were loosely scattered between questions, providing no clear picture. It seems as if the participants paid little attention to the overview pictures, probably because they were physically farther away from the questions than the eye-level pictures and often no longer visible when the participants filled out the questions.

Conclusions

While our short investigation cannot be representative, nonetheless some of the results indicate that the applied method can be used for an empirical evaluation of different design alternatives. Architectural as well as urban design competitions generally need an objective tool for the evaluation – in addition to the subjective evaluation of the experts. The alternatives 1 and 2 are rough design studies aiming at the maximisation of usable space compared to the detailed alternative 3, which shows a more refined building design. The results of the investigation reflect these design approaches and indicate their clear differences on the established standardised measures of valence, arousal, dominance and spatiality.
Continuing this investigation, the authors plan to include citizens of the city of Bottrop as well as more professionals in a next study. This will allow us to assess the relative impact of “familiarity with the local context” vs. “professional expertise” on viewer judgments. Also it is planned to apply this approach in a real architectural competition in order to introduce the objective results of the design evaluation into the well-known decision-making process. Combining subjective and objective values and developing the evaluation process further could avoid the sometimes odd decisions in architectural and urban design competitions.

So far, the preliminary results of our investigation provide a mixed picture. For the well-established dimensions of environmental appraisal adapted from Franz (2005), our online experiment identified clear differences between the proposed building variants. The failure to find similarly clear differences for the subscales of the Orientation questions indicates that we may have not yet found the adequate presentation mode. Orientation may not be a property of a single building per se, but of its relation to the surrounding and to the functionality of a larger ensemble. Test participants thus may need more context information to make such judgments. This context could be provided by giving more task-oriented instructions (e.g. "Image you need to memorise your route through these streets") or by showing more environmental information. Also, still pictures hardly communicate the impression of moving in the environment, an essential feature of orientation and navigation in the real world.

The fact that the affective differences between buildings could be clearly established in our study indicates that the online data collection tool is adequate for data collection in city planning scenarios. Yet the lack of clear results for the orientation-related questions also points to the limitations of the current approach. We suspect that especially dynamic displays (movie clips) would provide a better basis for the participants' judgments on such tasks. For now, file size considerations have prevented us from using movies, but with the increasing availability of high-bandwidth internet connections for consumers, such limitations are rapidly reduced. Consequently, testing more data-intensive stimulus materials in online studies appears highly desirable.

When introducing moving images, the provision of overview images may have a larger impact than in the current setup. We suspect that for the viewers of eye-level movies going through the streets, an overview image would be quite helpful, acting as a type of map. Thus we believe that paying further attention to the interplay of overview images and dynamic eye-level stimuli (movies) will be an excellent opportunity to advance our studies.

Acknowledgments

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