Computerised environmental simulation and perceptual evaluation -
On the perception of pictures of built environments presented on computer screens

Jan Janssens
Environmental Psychology Unit, School of Architecture
Lund Institute of Technology, Sweden.

Abstract
In this study, the perceptions of on a computer screen displayed street photographs, were compared with the experiences of their real-life counterparts. Using a semantic descriptive method, SMB, experimental subjects assessed eight urban environments, presented both in field and on computer screen. Assessments were made in different light and seasonal conditions. It was shown that the perception of street pictures, presented on computer screen, did correspond well with the experience of the outdoor originals in most of the used semantic descriptive dimensions. Discrepancies between the two presentations were generally small and comparable with the minor perceptual differences between the various light conditions. Deviations could also be ascribed to certain non-perceptual factors, like the subjects' backgrounds or the environments' cognitive peculiarities. The findings indicated also possible improvement of the computer presentation technique by widening the pictures' informational content.

Introduction
Since the late sixties building and town plans, drawings and scale models have been supplemented by various simulation tools for communicating and evaluating planned environments. These new visualisation methods have been used and tested on a large number of locations. Environmental simulations with different representation techniques are used and compared to each other in order to find the most fitted or suitable for the different needs. The results of these efforts are not seldom presentations that do resemble photograph-like pictures of a planned or altered built environment, displayed directly on a computer or TV screen. Only rarely the perceptions of these simulations are compared with their real full-scale counterparts in order to investigate the computer pictures' predictive value for the environmental experience. However, all comparative assessments will fail if no appropriate methods for systematic evaluations are at hand.

In Lund at our department, in the early seventies, several environmental evaluation techniques were elaborated, one of them based on Osgood's, Suci's and Tannenbaum's (1957) work on a semantic descriptive model using factor analysis. It was hoped to obtain dimensions which would be meaningful to evaluate an environment and easy to interpret, as well as measurable through a standardised approach. We started using seven-step unipolar semantic scales for a total of about 200 adjectives, assessing a wide range of man-made environments by numerous subjects of different age, sex and occupation. It could be shown that each of the adjectives related to one or more of the following eight dimensions: pleasantness, complexity, unity, enclosedness, potency, social status, affection, and originality. These eight perceptual qualities have then been used as a means of characterising architecture and the built environment. The most reliable of the rating scales used have been compiled in a test where pleasantness is measured with eight different scales and the remaining dimensions with four scales each (Küller 1972, 1975, 1979). Thanks to numerous
validation studies including comparisons of perceptual and neuropsychological responses, the knowledge about the eight dimensions has increased considerably and the scales have become part of a theory of environmental psychology (Küller 1980, 1991).

At the same time, an environmental simulating apparatus was constructed and used in a number of simulation projects. In this simulator, a camera, provided with a relatoscope, moved around in naturalistic models and was monitored from another room where filmers/subjects could see the dynamic relatoscope eye-level picture on a TV-screen. Simultaneous registrations could be made of experimental subjects' evaluations of the presentation, as well as their eye movements, as they proceeded in the models. The apparatus was used fruitfully in many professional and educational design applications. For a number of reasons this work was discontinued and the simulator is now for sale, but the equipment gave valuable experience about environmental simulation. One result of this work was that the more realistic the simulation was made, the more accurate became the evaluation of the predicted reality. Another finding showed the semantic method to be a good tool when comparing visually different alternatives for a projected environment (Janssens & Küller, 1986).

New developments initiate the use of computer-made simulations. The computer has become the main tool for planners and designers and its potential as environmental simulating device is almost unlimited. The latest progresses in image-rendering software programs facilitate the use of visually naturalistic "real-life" surface patterns, colours and light conditions. By combining digitised photos from reality with computer-made pictures, the observer may be more or less convinced to see photos of the real world. More and more of the planned environment will be conceived, communicated and evaluated by means of computer pictures. This may imply that decision making on environmental issues becomes more easy, even for ordinary laymen. House owners, for instance, can drop a photo of their house in almost any paint shop, and get a computerised simulation for a number of more or less suitable alternative colour schemes to choose from. But how well do the subjective perceptual impressions of these computer pictures, as realistic as they may seem, predict the perception of the real world presented? Although much work has been put in the perfection of computer simulations' technical and functional aspects, only very little research has been done in testing the computer pictures' informatory or perceptual validity and reliability.

The study
The aim of the present study was thus to investigate the predictive power of computerised visualisations of built environments. Several questions were focused. Are there any systematic discrepancies in the perception of computer simulated environments and their real-life counterparts? Are different environmental qualities more or less problematic in these respects? Do more accidental environmental circumstances, like changes in weather or light conditions, have any importance for the overall impressions? Do differing observer groups display varying evaluative patterns?

In a recently completed research study, the importance of colour for the perception of urban spaces has been studied by means of computer-displayed stimuli. A large number of digitised naturalistic street pictures were colour manipulated and evaluated by groups of experimental subjects. These evaluations of the computer pictures were then compared with assessments by other subjects of slide presentations with the same pictorial contents and of the real life situations. In a separate part of the study, here presented, a number of assessments were gathered to test the validity and reliability of the presentation and evaluation methods used. In this part, only computer pictures of unaltered street situations
were compared with their real-life counterparts.

The stimuli
As stimuli for this study, eight urban environments were selected. They were all located within Malmö city, a south Swedish town. Over one hundred street environments were examined and photographed, of which an expert group selected the final eight, fulfilling a number of prescribed criteria. They had to contain common usual street spaces with predominantly ordinary architecture and representing both large and small scale environments, varying in age, function, complexity and building materials (Figure 1).

Figure 1. The eight urban environments. [see 09p01.tif]

In each environment, a particular looking spot was selected from which the experimental subjects had to view and evaluate the scene. From the same spots, colour slide photographs were made and digitised for computer presentation. These pictures were taken on two occasions, one during a sunny summer day and one during a dull winter day, and were presented unaltered on a computer screen. Although, in this study, they were not manipulated in their contents, they shall here be denoted as "computer pictures".

Methods, procedures and subjects
The original study consisted of three parts, using several experimental methods: a field study, a study with colour slides and a computer study. Only portions of the first and last part will be presented here.

Semantic rating scales (SMB, Küller, 1972) were used for comparing the results from the field and computer studies. They provided us with a semantic descriptive profile for the perception of each of the rated street environments by various subject groups at the different occasions (Figure 2). This standardised test consists of a paper form with 36 seven-step scales, by means of which experimental subjects have to assess their overall perception of the presented street environment. In the analyses of the answers, the ratings are compiled within eight factors, each describing a certain quality in the physical surrounding (Table 1). The resulting perceptual profiles may be complemented with written comments, and will facilitate the understanding of the experience and perception of the studied environments. Extensive practical and theoretical work has made it possible to relate SMB-profiles to specific properties in the built environment. The method as such has also shown a high reliability and stability over time.

Table 1. The eight environmental qualities, as described by the SMB-method (Küller, 1991).

<table>
<thead>
<tr>
<th>Quality</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleasantness</td>
<td>The environmental quality of being pleasant, beautiful and secure.</td>
</tr>
<tr>
<td>Complexity</td>
<td>The degree of variation or, more specifically, intensity, contrast and abundance.</td>
</tr>
<tr>
<td>Unity</td>
<td>How well all the various parts of the environment fit together into a coherent and functional whole.</td>
</tr>
<tr>
<td>Enclosedness</td>
<td>A sense of spatial enclosure and demarcation.</td>
</tr>
<tr>
<td>Potency</td>
<td>An expression of power in the environment and its various parts.</td>
</tr>
<tr>
<td>Social status</td>
<td>An evaluation of the built environment in socio-economic terms, but also in terms of maintenance.</td>
</tr>
<tr>
<td>Affection</td>
<td>The quality of recognition giving rise to a sense of familiarity, often related to the age of the environment.</td>
</tr>
<tr>
<td>Originality</td>
<td>The unusual and surprising in the environment.</td>
</tr>
</tbody>
</table>
In the field, the eight street environments were assessed with semantic rating scales by two groups of subjects, architects and laymen. They were driven by car to the locations in small groups (2-3 persons) but made their observations and evaluations individually on standardised rating forms. The presentation order of the environments was randomised and light and weather conditions were noted. This part of the study took between two and three hours, car transportation included. Four of the environments were also evaluated in the same way during the winter season, but only by laymen.

On the computer, the street pictures were assessed by laymen for the two seasonal occasions. The eight stimuli were presented to the subjects individually in a darkened office room on a standard 17"-trinitron screen with good colour rendering. Both the stimuli and the rating scales were presented on the screen and the experimental presentation and evaluation were handled by the subjects themselves by means of an interactive computer program. Also here, the presentation order of the stimuli was randomised, but the standardised rating scales were presented on the screen directly under the pictures. The subjects had thus to make their evaluations by clicking the computer mouse on answer alternatives on the screen. All responses were registered automatically and no time limits were given. This part of the study took generally between 15 and 30 minutes.

The subjects in the field study, evaluating all eight environments, consisted of two groups: one being 6 architects from the local community planning office (4 men and 2 women) and 5 teachers in architecture (4 men and 1 woman), the second group consisting of 24 volunteering laymen (12 men and 12 women), all matched within the same age range (21-70 years). The winter evaluations of four of the eight street environments were made by 40 casually passing-by laymen (20 men and 20 women), each evaluating only one of the environments. Subjects in the computer study were 48 laymen (24 men and 24 women, aged between 20 and 65), half of them evaluating the summer pictures, half of them assessing the winter pictures.

Results

Based on the semantic ratings, perceptual profiles were calculated for each environment assessed in the field study. By dividing the experimental subjects in subsamples, intergroup variations could be studied by means of variance analyses. The results show that all eight environments were perceived very differently from each other by both laymen and architects (p<.000 for all factors). Each environment showed a specific profile (Figure 2).

Figure 2. The two environments in the field study giving the largest perceptual discrepancies between architects and laymen, with their SMB-profiles. [see 09p02.tif]

Architects found several environments to be more enclosed than what laymen did (p=.03) and also somewhat higher in potency (p=.01). More irregular discrepancies between these two subject groups could be noticed for perceived complexity (p=.005), unity (p=.01) and originality (p=.002) (Figure 2). Dividing and comparing the subjects in gender and age groups did not show any statistical differences in any of the descriptive factors between men's and women's perceptions, or between older or younger people.

Half of the subjects made their assessments in bright sunny conditions, the other half on cloudy occasions. A comparison between the evaluations in these two light conditions showed no statistical differences in any descriptive factor. Assessments made during winter for four of the eight streets by passing-by subjects were also compared with the summer
evaluations. Neither here any statistical discrepancies between the two seasonal assessments could be established. Some minor variations between evaluations of summer and winter conditions could mostly been ascribed to various biases: the environments had changed somewhat over time, the experimental subject sample was more heterogeneous here and the assessing conditions were differently, making a proper statistical testing cumbersome. For these reasons, the later findings will not be commented further.

In the computer study with only laymen, similar perceptual profiles were calculated for the environmental assessments. Also here all environments showed clearly distinguishable specific patterns. Neither in this study, the gender and age of the subjects did affect the environmental assessments in any statistically significant way. Half of the subjects evaluated computer pictures of the eight environments photographed during summer, the other half assessed pictures of the same settings taken in winter season. Some minor differences between the two seasonally variegated stimuli groups could be noticed. Most of the summer environments were perceived as somewhat more pleasant, less enclosed, higher in social status and lower in affection, as compared with their winter representations. Generally these differences were rather small and not consequent for all environments. In some cases, they could almost entirely be ascribed to discrepancies within only one single environment.

In the comparison of the field and the computer assessments, for the later only the summer evaluations of the eight environments were used. Five of the eight descriptive dimensions showed strong positive correlations between the two presentation types ($r=.84 - .94$, $p<.01$). Only unity ($r=.35$), complexity ($r=.48$) and social status ($r=.66$) showed weaker correspondences. For almost all environments, the pleasantness ratings showed high correlations between field an computer evaluations. In only one case (environment 6: the oldish down town street with new infill), the field evaluations were significantly higher than the computer assessments (Figure 3, bottom). The complexity of the environment was generally assessed lower on the screen than in the field, whereas the opposite was true for the perceived environmental unity. Especially in environment 2, the suburban car sales building, the picture's unity was rated significantly higher than in the field (Figure 3, top). The perception of environmental enclosedness tended also to be somewhat greater when judging the computer pictures than when assessing the field situations. The same was true for the perception of potency and social status, although environment 6 showed a higher social status evaluation in the field than its pictorial representation. The perception of the environments' affection and originality was also somewhat higher in the field than on the computer screen, except again for environment 6, where the computer picture was assessed as higher in affection than its real-life counterpart.

Figure 3. The two environments giving the largest perceptual discrepancies between field and computer assessments, with their SMB-profiles. [see 09p03.tif]

Except for the assessments of complexity and enclosedness for some environments, none of the above discrepancies between the two methods were statistically significant. It seems that the largest discrepancies in these respects can be related to the pictorial content of the computer stimuli. The wider the visual angle for the picture is made, i.e. the more environmental information is given, the better the perceptual correspondence between reality and picture becomes. Accordingly, the correspondence for the environmental assessments between the computer and field presentations was highest for environments 1, 5, 7, 8, and lowest for environments 6, 2, 3 and 4. Although serious efforts were made to use the same visual angle when taking the photographs, looking distances were not always the same, thus
affecting the amount of surrounding visual information.

Conclusions
The study clearly demonstrated the power of computer pictures in predicting the perception of their real life counterparts. As mentioned earlier, in the original study also a slide presentation of the same environments was used. It could be shown that computer pictures mediated a generally better impression of the real environments than their slide counterparts. Consequently, presentations on a computer or TV screen may give a more persuasive or correct perception than slide shows. It was also found that more occasional effects like weather or seasonal conditions showed a somewhat stronger influence on the environmental perception than the used presentation technique. However, none of these differences showed a significantly consequent pattern. Most of the variations in the assessments should probably be ascribed to other than perceptual factors. So were most of the persons, assessing the environments in the field more familiar with these environments than the computer subjects. Their presumably higher environmental engagement has almost certainly "coloured" their perception.

It is surprising how well a purely visual cue, like a computer still picture, may mediate so many other perceptual factors, like street and traffic life, movements, sounds, smells and so on. It is also surprising how large agreement could be found between various subject groups concerning environmental perception. No disagreements were found between gender and age groups for the used descriptive parameters. Even architects and laymen agreed on most of the perceptual dimensions, not least about the main evaluative aspect, the environments' pleasantness ratings. But they evidently displayed different concepts of environmental complexity and unity. It was also demonstrated that the computerised assessment technique did not seem to affect the outcome of the environmental evaluations. More testing is needed however to validate this conclusion.

Links were found between the amount of pictorial content and the picture's predictive value for environmental perception. More visual information seems to have given better predictions. Broader overviews of surroundings would probably improve the perceptual assessments of the presented street environments. This can evidently be achieved in various ways. General overviews could be combined with selected detail pictures, sequential presentations of parts of the whole environments could be used, or even more or less dynamic approaches could be developed, handled spontaneously by the subjects or in a preset manner. There may be even more intricate ways, "less could be more". However, all these extensions must be tested and compared in order to assess their degree of improvement, validity and reliability. There is an apparent danger in supplying too much information; the human capacities are, unfortunately, limited here too. Finding these critical perceptual thresholds is an important research task.

References


Osgood C., Suci G., Tannenbaum P., (1957), The measurement of meaning, Urbana, University of Illinois Press, 1957.
COMPUTERISED ENVIRONMENTAL SIMULATION AND PERCEPTUAL EVALUATION -
ON THE PERCEPTION OF PICTURES OF BUILT ENVIRONMENTS PRESENTED ON COMPUTER SCREENS

Jan Janssens
Environmental Psychology Unit, School of Architecture
Lund Institute of Technology, Sweden.

ABSTRACT In this study, the perceptions of photographs of streets, displayed on a computer screen, were compared with the experiences of their real-life counterparts. Using a semantic descriptive method, SMB, experimental subjects assessed eight urban environments, presented both in field and on computer screen. Assessments were made in different light and seasonal conditions. It was shown that the perception of street pictures, presented on computer screen, did correspond well with the experience of the outdoor originals in most of the used semantic descriptive dimensions. Discrepancies between the two presentations were generally small and comparable with the minor perceptual differences between the various light conditions. Deviations could also be ascribed to certain non-perceptual factors, like the subjects’ backgrounds or the environments’ cognitive peculiarities. The findings also indicated possible improvement of the computer presentation technique by widening the pictures’ informational content.

INTRODUCTION Since the late sixties building and town plans, drawings and scale models have been supplemented by various simulation tools for communicating and evaluating planned environments. These new visualisation methods have been used and tested on a large number of locations. Environmental simulations with different representation techniques are used and compared to each other in order to find the most fitted or suitable for the different needs. The results of these efforts are not seldom presentations that do resemble photograph-like pictures of a planned or altered built environment, displayed directly on a computer or TV screen. Only rarely the perceptions of these simulations are compared with their real full-scale counterparts in order to investigate the computer pictures’ predictive value for the environmental experience. However, all comparative assessments will fail if no appropriate methods for systematic evaluations are at hand.

In Lund at our department, in the early seventies, several environmental evaluation techniques were elaborated, one of them based on Osgood’s, Suci’s and Tannenbaum’s (1957) work on a semantic descriptive model using factor analysis. It was hoped to obtain dimensions which would be meaningful to evaluate an environment and easy to interpret, as well as measurable through a standardised approach. We started using seven-step unipolar semantic scales for a total of about 200 adjectives, assessing a wide range of man-made environments by numerous subjects of different age, sex and occupation. It could be shown that each of the adjectives related to one or more of the following eight dimensions: pleasantness, complexity, unity, enclosedness, potency, social status, affection, and originality. These eight perceptual qualities have then been used as a means of characterising architec-
ture and the built environment. The most reliable of the rating scales used have been compiled in a test where pleasantness is measured with eight different scales and the remaining dimensions with four scales each (Köller 1972, 1975, 1979). Thanks to numerous validation studies including comparisons of perceptual and neuropsychological responses, the knowledge about the eight dimensions has increased considerably and the scales have become part of a theory of environmental psychology (Köller 1980, 1992).

At the same time, an environmental simulation apparatus was constructed and used in a number of simulation projects. In this simulators, a camera, provided with a relatoscope, moved around in naturalistic models and was monitored from another room where fitters/subjects could see the dynamic relatoscope eye-level picture on a TV-screen. Simultaneous registrations could be made of experimental subjects' evaluations of the presentation, as well as their eye movements, as they proceeded in the models. The apparatus was used fruitfully in many professional and educational design applications. For a number of reasons this work was discontinued and the simulator is now for sale, the equipment gave valuable experience about environmental simulation. One result of this work was that the more realistic the simulation was made, the more accurate became the evaluation of the predicted reality. Another finding showed the semantic method to be a good tool when comparing visually different alternatives for a projected environment (Larsen & Köller, 1986). New developments initiate the use of computer-made simulations. The computer has become the main tool for planners and designers and its potential as an environmental simulation device is almost unlimited. The latest progresses in image-rendering software programs facilitate the use of visually naturalistic "real-life" surface patterns, colours and light conditions. By combining digitised photos from reality with computer-made pictures, the observer may be more or less convinced to see photos of the real world. More and more the planned environment will be conceived, communicated and evaluated by means of computer pictures.

This may imply that decisions making on environmental issues becomes more easy, even for ordinary laymen. House owners, for instance, can drop a photo of their house in almost any paint shop, and get a computerised simulation for a number of more or less suitable alternative colour schemes to choose from. But how well do the subjective perceptual impressions of these computer pictures, as realistic as they may seem, predict the perception of the real world presented? Although much work has been put in the perfection of computer simulations' technical and functional aspects, only very little research has been done in testing the computer pictures' informative or perceptual validity and reliability.

THE STUDY The aim of the present study was thus to investigate the predictive power of computerised visualisations of built environments. Several questions were focused. Are there any systematic discrepancies in the perception of computer simulated environments and their real-life counterparts? Are different environmental qualities more or less problematic in these respects? Do more accidental environmental circumstances, like changes in weather or light conditions, have any importance for the overall impressions? Do differing observer groups display varying evaluative patterns?

In a recently completed research study, the importance of colour for the perception of urban spaces has been studied by means of computer-displayed stimuli. A large number of digitised naturalistic street pictures were colour manipulated and evaluated by groups of experimental subjects. These evaluations of the computer pictures were then compared with assessments by other subjects of slide presentations with the same pictorial content and of the real life situations. In a separate part of the study, here presented, a number of assessments were gathered to test the validity and reliability of the presentation and evaluation methods used. In this part, only computer pictures of unaltered street situations were compared with their real-life counterparts.

THE STIMULI As stimuli for this study, eight urban environments were selected. They were all located within Malmö city, a south Swedish town. Over one hundred street environments were examined and photographed, of which an expert group selected the final eight, fulfilling a number of prescribed criteria. They had to contain common urban street spaces with predominantly ordinary architecture and representing both large and small scale environments, varying in age, function, complexity and building materials (1991:2).

In each environment, a particular looking spot was selected from which the experimental subjects had to view and evaluate the scene. From the same spots, colour slide photographs were made and digitised for computer presentation. These pictures were taken on two occasions, one during a sunny summer day and one during a dull winter day, and were presented unaltered on a computer screen. Although, in this study, they were not manipulated in their contents, they shall here be denoted as "computer pictures".

METHODS, PROCEDURES AND SUBJECTS The original study consisted of three parts, using several experimental methods: a field study, a study with colour slides and a computer study. Only portions of the first and last part will be presented here.

Semantic rating scales (SMR, Köller, 1972) were used for comparing the results from the field and computer studies. They provided us with a semantic descriptive profile for the perception of each of the tested street environments by various subject groups at the different occasions.

This standardised test consists of a paper form with 36 seven-step scales, by means of which experimental subjects have to assess their overall perception of the presented street environment. In the analyses of the answers, the ratings are compiled within eight factors, each describing a certain quality in the physical surrounding (1991:4). The resulting perceptual profiles may be complemented with written comments, and will facilitate the understanding of the experience and perception of the studied environments. Extensive practical and theoretical work has made it possible to relate SMR profiles to specific properties
in the built environment. The method as such has also shown a high reliability and stability over time.

| Pleasure | The environmental quality of being pleasant, beautiful and secure. |
| Complexity | The degree of variation or, more specifically, intensity, contrast and abundance. |
| Unity | How well all the various parts of the environment fit together into a coherent and functional whole. |
| Enclosedness | A sense of spatial enclosure and demarcation. |
| Potency | An expression of power in the environment and its various parts. |
| Social status | An evaluation of the built environment in socio-economic terms, but also in terms of maintenance. |
| Affection | The quality of recognition giving rise to a sense of familiarity, often related to the age of the environment. |
| Originality | The unusual and surprising in the environment. |

Table 6. The eight environmental qualities as described by the SMS-method (Kubicek, 1983).

In the field, the eight street environments were assessed with semantic rating scales by two groups of subjects, architects and laymen. They were driven by car to the locations in small groups (2-3 persons) but made their observations and evaluations individually on standardised rating forms. The presentation order of the environments was randomised and light and weather conditions were noted. This part of the study took between two and three hours, car transportation included. Four of the environments were also evaluated in the same way during the winter season, but only by laymen.

On the computer, the street pictures were assessed by laymen for the two seasonal occasions. The eight stimuli were presented to the subjects individually in a darkened office room on a standard 17"-trinitron screen with good colour rendering. Both the stimuli and the rating scales were presented on the screen and the experimental presentation and evaluation were handled by the subjects themselves by means of an Interactive computer program. Also here, the presentation order of the stimuli was randomised, but the standardised rating scales were presented on the screen directly under the pictures. The subjects had thus to make their evaluations by clicking the computer mouse on answer alternatives on the screen. All responses were registered automatically and no time limits were given. This part of the study took generally between 15 and 30 minutes.

The subjects in the field study, evaluating all eight environments, consisted of two groups: one being 6 architects from the local community planning office (4 men and 2 women) and 5 teachers in architecture (4 men and 1 woman), the second group consisting of 24 volunteering laymen (12 men and 12 women), all matched within the same age range (21-70 years). The winter evaluations of four of the eight street environments were made by 40 casually passing-by laymen (20 men and 20 women), each evaluating only one of the environments. Subjects in the computer study were 48 laymen (24 men and 24 women, aged between 20 and 65), half of them evaluating the summer pictures, half of them assessing the winter pictures.

RESULTS Based on the semantic ratings, perceptual profiles were calculated for each environment assessed in the field study. By dividing the experimental subjects in subgroups, intergroup variations could be studied by means of variance analyses. The results show that all eight environments were perceived very differently from each other by both laymen and architects [p<.001 for all factors]. Each environment showed a specific profile (Figure 9 to 10).

Architects found several environments to be more enclosed than what laymen did (p<.05) and also somewhat higher in potency (p<.01). More irregular discrepancies between these two subject groups could be noticed for perceived complexity (p<.005), unity (p<.01) and originality (p<.002) (Figure 9 to 10). Dividing and comparing the subjects in gender and age groups did not show any statistical differences in any of the descriptive factors between men's and women's perceptions, or between older or younger people.

Half of the subjects made their assessments in bright sunny conditions, the other half on cloudy occasions. A comparison between the evaluations in these two light conditions showed no statistical differences in any descriptive factor. Assessments made during winter for four of the eight streets by passing-by subjects were also compared with the summer evaluations. Neither here any statistical discrepancies between the two seasonal assessments could be established. Some minor variations between evaluations of summer and winter conditions could mostly be ascribed to various biases; the environments had changed.
somewhat over time, the experimental subject sample was more heterogeneous here and the assessing conditions were different, making a proper statistical testing cumbersome. For these reasons, the later findings will not be commented further.

In the computer study with only laymen, similar perceptual profiles were calculated for the environmental assessments. Also here all environments showed clearly distinguishable specific patterns. Neither in this study, the gender and age of the subjects did affect the environmental assessments in any statistically significant way. Half of the subjects evaluated computer pictures of the eight environments photographed during summer, the other half assessed pictures of the same settings taken in winter season. Some minor differences between the two seasonally variegated stimuli groups could be noticed. Most of the summer environments were perceived as somewhat more pleasant, less enclosed, higher in social status and lower in affection, as compared with their winter representations. Generally these differences were rather small and not consequent for all environments. In some cases, they could almost entirely be ascribed to discrepancies within only one single environment.

In the comparison of the field and the computer assessments, for the later only the summer evaluations of the eight environments were used. Five of the eight descriptive dimensions showed strong positive correlations between the two presentation types (r = .84, .94, .96). Only unity (r = .38), complexity (r = .28) and social status (r = .66) showed weaker correspondences. For almost all environments, the pleasantness ratings showed high correlations between field and computer evaluations. In only one case (environment 6: the oldish down town street with new infill), the field evaluations were significantly higher than the computer assessments (r = .38 and .60). The complexity of the environment was generally assessed lower on the screen than in the field, whereas the opposite was true for the perceived environmental unity. Especially in environment 2, the suburban car sales building, the picture's unity was rated significantly higher than in the field (r = .43 and .50). The perception of environmental enclosedness tended also to be somewhat greater when judging the computer pictures than when assessing the field situations. The same was true for the perception of potency and social status, although environment 6 showed a higher social status evaluation in the field than its pictorial representation. The perception of the environments' affection and originality was also somewhat higher in the field than on the computer screen, except again for environment 6, where the computer picture was assessed as higher in affection than its real-life counterpart.

Except for the assessments of complexity and enclosedness for some environments, none of the above discrepancies between the two methods were statistically significant. It seems that the largest discrepancies in these respects can be related to the pictorial content of the computer stimuli. The wider the visual angle for the picture is made, i.e. the more environmental information is given, the better the perceptual correspondence between reality and picture becomes. Accordingly, the correspondence for the environmental assessments between the computer and field presentations was highest for environments 1, 5, 7, 8, and lowest for environments 2, 3, and 4. Although serious efforts were made to use the same visual angle when taking the photographs, looking distances were not always the same, thus affecting the amount of surrounding visual information.

CONCLUSIONS. The study clearly demonstrated the power of computer pictures in predicting the perception of their real life counterparts. As mentioned earlier, in the original study also a slide presentation of the same environments was used. It could be shown that computer pictures mediated a generally better impression of the real environments than their slide counterparts. Consequently, presentations on a computer or TV screen may give a more persuasive or correct perception than slide shows. It was also found that more occasional effects like weather or seasonal conditions showed a somewhat stronger influence on the environmental perception than the used presentation technique. However, none of these differences showed a significantly consequent pattern. Most of the variations in the assessments should probably be ascribed to other than perceptual factors. So were most of the persons, assessing the environments in the field more familiar with these environments than the computer subjects. Their presumably higher environmental engagement has almost certainly "coloured" their perception.

It is surprising how well a purely visual cue, like a computer still picture, may mediate so many other perceptual factors, like street and traffic life, movements, sounds, smells and so on. It is also surprising how large agreement could be found between various subject groups concerning environmental perception. No disagreements were found between gender and age groups for the used descriptive parameters. Even architects and laymen agreed on most of the perceptual dimensions, not least about the main evaluative aspect, the environments' pleasantness ratings. But they evidently displayed different concepts of environmental complexity and unity. It was also demonstrated that the computerised assessment technique did not seem to affect the outcome of the environmental evaluations. More testing is needed.
however to validate this conclusion.
Links were found between the amount of pictorial content and the picture's predictive value for environmental perception. More visual information seems to have given better predictions. Broader overviews of surroundings would probably improve the perceptual assessments of the presented street environments. This can evidently be achieved in various ways. General overviews could be combined with selected detail pictures, sequential presentations of parts of the whole environments could be used, or even more or less dynamic approaches could be developed, handled spontaneously by the subjects or in a pre-set manner. There may be even more intricate ways, "less could be more". However, all these extensions must be tested and compared in order to assess their degree of improvement, validity and reliability. There is an apparent danger in supplying too much information; the human capacities are, unfortunately, limited here too. Finding these critical perceptual thresholds is an important research task.

REFERENCES


• Osgood C., Suci G., Tannenbaum P. (1957), The measurement of meaning, Urbana, University of Illinois Press, 1957.