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On the role of processing goals in evaluative judgments of environments: Effects on memory–judgment relations

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Abstract

The present paper deals with a process-oriented approach to evaluative judgments of environments. Expanding on research in social judgment we hypothesized that whether or not memory of environments is consulted to provide judgments is conditional on processing goals. That is, goals determine on which dimensions impressions of environments are formed during exploration of the environment. When a subsequent judgment on a specific dimension is required, people rely on a relevant impression when available, but otherwise consult memory of the environment to arrive at judgment. These so-called 'on-line' and 'memory-based' judgments were tested in three experiments, in which we systematically enhanced the ecological validity of the test by employing virtual environment technology. In these experiments, participants explored a railway station with the goal to form an impression about safety or not. Afterwards, all participants explicitly expressed their judgment of safety and recalled information about the environment. Overall, results showed that memory–judgment associations were rather strong when participants did not have the goal to form an impression about safety. However, when participants did have this goal, relations between memory and judgment were absent. Implications for evaluations of environments are briefly discussed.

1. Introduction

Most built environments are designed, constructed and maintained to be used. There is common agreement that buildings should serve people's needs and abilities (see also e.g. Bell, Greene, Fisher, & Baum, 1996; Gifford, 1997). A filthy railway station with improper signposting and nonworking escalators, for instance, does not appeal to us as a place where we would like to be when confronted with a travel mode decision. In other words, in order to be utilized buildings should be perceived as functional. Therefore, evaluations about different aspects of built environments comprise a prime enterprise in the design process of building for people (e.g. Preiser, Rabinowitz, & White, 1988).

The last two decades, research in environmental psychology has witnessed the importance of evaluative judgments to anticipate people's decisions to engage in the environment. One important line of research consists of inquiries into the fundamental dimensions on behavioral meaning of environments (e.g. Moore, 1979; Russell, Ward, & Pratt, 1981; Ward & Russell, 1981a; Genereux, Ward, & Russel, 1983). For example, in an adaptation of the paradigm used by Osgood, Suci, & Tannenbaum (1957), Ward and Russell (1981a) established that many judgments of molar environments are rather affective. That is, they demonstrated that evaluative judgments are primarily based on two dimensions: arousing–not arousing and pleasant–unpleasant. Other work of this kind has extended the idea of behavioral meaning to preferences for environments as a function of several needs, such as the need to make sense of and to be involved in environments (e.g. Kaplan & Kaplan, 1982; Kaplan, 1987).

Another fundamental issue that received a vast amount of attention is how judgments of specific dimensions or functional qualities, such as perceived safety in public places and experienced privacy in office environments, are related to specific properties of the physical environment. Research on judgments of perceived safety in relation to fear of crime, for instance, revealed that these judgments are closely related to cues in the environment that indicate crime or vandalism, so called 'signs of incivilities' (Perkins, Wandersman, Rich, & Taylor, 1993). Within this line of research, there has

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been some dispute about the computational models or rules (e.g. compensatory or linear additive vs noncompensatory or linear nonadditive rules) raters adopt to arrive at judgments on the basis of environmental cues, also known as the policy capturing paradigm (see for an overview, Abelson & Levi, 1985; Brehmer & Joyce, 1988). As it turned out, linear additive models, in which raters add up values of different aspects to arrive at an overall appraisal, often suffice to predict evaluative judgments fairly accurately, especially when raters have little practice with the judgment task at hand (e.g. Aarts, Verplanken, & van Knippenberg, 1997).

However, although evaluative judgment is a flourishing topic in environmental psychology, research almost exclusively focuses on the content of judgments and possible relations to aspects of the physical environment. Yet—and this is important—to investigate the content of evaluative judgments a better understanding of the process of judgment formation is crucial, as differences in the process might also affect the resulting judgment. In this respect, two different evaluation methods are common practice in research on content of evaluative judgments. In some studies, participants are asked to explore the environment of interest with the explicit goal of forming a first impression or evaluative judgment, whereas in other studies participants are asked for a specific judgment only after having explored the environment. In a study by Loewen and colleagues (Loewen, Steel, & Suedfeld, 1993) for instance, participants observed various slides of environments with the specific task of forming a judgment of the safety in the environment (*cf.* Shaw & Gifford, 1994). In using a slightly, but different method, Hackett and Foxall (1995) asked people to make judgments of several aspects of a conference center (e.g. aesthetic quality of the main hall) after they had explored the environment. Clearly, then, evaluative judgments are elicited at different moments during the judgment process. That is, evaluations may be formed either *during* or *after* the exploration of the environment.

An important question emanating from this research is whether the two different types of evaluation methods, or processing goals, yield different results. Although highly speculative, it is conceivable that forming a first impression on the evaluative dimension of interest during exploration may result in a different final judgment compared to judgments that are merely formed afterwards, as in the former case people know where to look for and hence, encode the environment in a different way. However, when evaluations are not required earlier then after exploration, people are more likely to rely on their recollection of the environment, making them prone to biases in retrieval. Thus, questions arise as to how people process information and how memory of environmental features relates to later judgments. From the perspective of evaluation research, it would therefore be highly appreciated to obtain more knowledge about the role of processing goals in judgments, memory and the relation between both. In the present contribution, our aim was to further scrutinize the processes underlying evaluative judgments of environments. More specifically, we attempted to investigate whether the goal with which people process information about the environment, i.e. forming evaluations either during or after exploration, affects the role of memory in judgment.

There has been surprisingly little experimental work to date that focuses on effects of processing goals on memory and judgment of physical environments. Although there are some empirical data available on this matter (e.g. Peron, Baroni, Job, & Salmaso, 1985, 1990; Ward & Russell, 1981b), in none of the studies conducted, recall and evaluation were assessed together, and hence, relations between memory and judgment could not be explored. Let us take a look at two experiments in which effects of processing goals were tested on judgment or memory.

In an experiment employing a picture-sorting task, Ward and Russell (1981b) demonstrated that the salience of evaluative dimensions depends on the cognitive set (or processing goal) provided to persons. For instance, when participants were instructed to process several places in terms of activities that might be expected there, the environments were predominantly categorized and evaluated in terms of relaxation and exertion, while the absence of such instructions (participants simply explored the physical features or interior of the place) resulted in equal categorization of evaluative dimensions. These findings thus merely indicate that environments are mentally related to different dimensions, and some become more salient than others when having a certain goal in mind (see also, Leff, 1978). Peron et al. (1985) studied memory for different aspects of places under conditions of either incidental or intentional learning conditions. Their results revealed that participants who were instigated with the goal to process the environment for later recollection before exploring the environment, remembered furniture aspects (e.g. table, chair) better than structural aspects (e.g. walls, floor). Such differences were not observed when participants did not receive this goal in advance. These data show that memorization goals enhanced recall of functional elements of environments, rather than aspects of the environment itself.

By and large, then, these findings suggest that processing goals affect the dimensions on which judgments may be based, as well as the encoding and retrieval of specific details of the environments. However, these studies do not peek at, or allow conclusions to be drawn about the effects of processing goals on the moment of the formation of evaluations (during or after

exploration) or the relation between memory and subsequent judgments.

In their seminal work on the role of memory in social judgment, Hastie and Park (1986) argued that judgments may sometimes diverge from memory. That is, evaluative judgments about targets may either be based on recalled information about the targets or not. They maintained that this 'judgment from memory dissociation' results from different goals with which people process information about the target (see also Bargh & Thein, 1985). Specifically, in line with the methods used in evaluation research of built environments, Hastie and Park (1986) argued that judgments can either be formed during information encoding, or later, based on information that is retrieved from memory. These two different processes are also referred to as respectively 'on-line' and 'memory-based' judgments. As memory-based judgments are based on relevant information that is retrieved from memory, these judgments are assumed to correlate with the valence of the information that people recall. Therefore, when retrieved information is mainly negative, the final judgment will also be negative. On-line judgments, on the other hand, are formed during information encoding and stored in memory independent of relevant information. Hence, when a judgment is required at a later time, the judgment can be retrieved without consulting memory for additional information. For this reason, on-line judgments do not necessarily correlate with recalled information. Hastie and Park (1986) indeed showed that memory-based judgments of social targets (persons) did correlate with recalled information, whereas on-line judgments did not.

In another experiment on social judgment, Lichtenstein and Srull (1987) presented their participants with behavioral descriptions of a person. Some of the behaviors were positive, some were negative, and some were neutral. Part of the participants read the descriptions with the goal to form an impression of the person in terms of liking (which automatically triggers the process of forming an evaluative judgment), whereas others received the goal to form an impression of the grammatical complexity of the presented sentences (which was irrelevant to the judgmental dimension of interest). After presentation, all participants indicated their evaluative judgment of the person and recalled as many of the presented descriptions as possible. Cleverly, because the valence of the descriptions in terms of liking was tested in pilot study, an index could be constructed that accurately reflected the valence of memory about the person. Utilizing this index, Lichtenstein and Srull (1987) were able to precisely calculate the correlation between the judgment and the recalled information. Their obtained pattern of memory–judgment correlations replicated the findings of Hastie and Park (1986). Similar results were later attained by McConnell, Leibold, and Sherman (1994) and McConnell, Sherman, and Hamilton (1997).

To recap, the available data suggest that evaluative judgments of targets are based on relevant recollected information about that target (that is, a memory-based judgment) when people have the goal to provide the judgments *after* exploring the target. However, judgments of targets are not related to memory of that target when people form an impression of the judgmental dimension of interest *during* exploration of the target. In that case, judgments are formed on-line. Importantly (and restrictively), in these studies the judgments under investigation always pertained to social targets. Moreover, the stimuli to be evaluated commonly consist of written behavioral descriptions, which does not provide a strong case for how we evaluate and respond to persons in daily life [see also Macrae and Bodenhausen (2000) for a discussion on the external validity of these procedures]. Therefore, it remains to be seen whether the effects of the two types of processing goals on the cognitive processes underlying judgment (on-line and memory-based judgments) are more general and do also account for judgments of the physical environment, irrespective of the type of methodological paradigm used.

2. The present research

In the present paper, we report three experiments in which we investigated how processing goals affect the role of memory in evaluative judgments. As a first demonstration of the role of processing goals, in Experiment 1 we employed an experimental procedure that is largely similar to a procedure used by Lichtenstein and Srull (1987). In an adaptation of the Lichtenstein and Srull paradigm, we asked participants to provide a judgment of the perceived safety in a railway station after they were presented with descriptions of the environment. However, participants read these descriptions either with the goal to form the relevant impression of safety or to form an impression of the grammatical complexity of the sentences (because the latter goal does not call for an impression of the evaluative dimension of interest, this condition is referred to as the irrelevant impression condition). In Experiments 2 and 3, we systematically increased the ecological validity of the issue under investigation. Adopting contemporary technology to build virtual environments (e.g. Marans & Stokols, 1993), these experiments employed computer simulation programs in which participants either passively observed the railway station in an animated movie (Experiment 2) or actively and freely explored the environment by means of an interactive control setup (Experiment 3). After processing the information, participants provided

their evaluations and were asked to recall as much information about the environment as possible. This way, we were able to compute the correlation between memory and judgments in both processing goal conditions. According to the reasoning presented above, we predicted that the correlation between memory and judgment is stronger when participants are instructed to form an irrelevant impression, than when participants are requested to form a relevant impression of safety in the railway station.

Experiment 1 served one further exploratory purpose. In addition to the memory–judgment correlation, in this experiment we also measured response latencies of judgment. The rationale behind this measurement is as follows: when judgments are formed memory based, the retrieval and integration of this information into a judgment requires more cognitive effort than the mere retrieval of judgments that were formed on-line (*cf.* Fazio, Sanbonmatsu, Powell, & Kardes, 1986). This difference in the judgment formation process should be reflected by shorter response latencies in the relevant impression condition than in the irrelevant impression condition. Therefore, response latencies of the judgment task were used to obtain additional evidence for the occurrence of on-line vs memory-based judgments.

3. Experiment 1

3.1. Method

3.1.1. Participants and design

Eighty undergraduate students of the Eindhoven University of Technology participated in the experiment. They were randomly assigned to a 2 (processing goal: relevant impression vs irrelevant impression) × 2 (order: recall first vs judgment first) between-participants design and received 10 Dutch guilders (approximately $5) for their participation.

3.1.2. Procedure

The experiment was run on computers and participants worked in separate cubicles. Participants first received the instructions that contained the manipulation of the processing goal and subsequently read 20 one-sentence descriptions of a railway station. The descriptions were presented in random order. Next, they completed a 4-min filler task to eliminate short-term memory effects (see also Hamilton, Dugan, & Trolier 1985; McConnell et al., 1994). Finally, participants were asked to recall as much information as possible about the environment and to report how safe they would feel in the station. A rater blind to experimental conditions and hypotheses rated the recollected descriptions on accuracy of recall. To control for order effects, the order of the last two tasks was counterbalanced.

3.1.3. Stimuli

The descriptions of the railway station consisted of sentences comprising six to ten words. Each sentence described a feature of the environment (e.g. 'All the shops in the station are open'; 'One of the lockers has a forced door'). The selection of the descriptions was based on the results of a pilot study in which the valence of 50 different descriptions was tested in terms of safety in relation to fear of crime. In this pilot study, 52 undergraduate students (drawn from a different population of undergraduates than in the experiments) were presented with a list of descriptions and were requested to indicate on a 9-point scale how unsafe (−4) or safe (+4) they would feel when they would encounter the described situation in a railway station in real life. Five descriptions could be categorized as clearly negative, five as clearly positive, and ten as neutral. The negative features designated 'signs of incivilities,' whereas the positive descriptions referred to the presence of people or authorities (see also Perkins et al., 1993). The mean ratings of each negative and positive description were used to construct a measure of valence of recall (see below). The ten neutral descriptions were included for embedding so that the issue of safety did not become too obvious. In addition, we deemed that the relatively high number of descriptions (20) would produce sufficient variances in the amount of information accurately recalled.

3.1.4. Manipulation of processing goals

The manipulation of the processing goal was constructed analogous to the one employed by Lichtenstein and Srull (1987; see also McConnell et al., 1994). In the *relevant impression condition*, participants were requested to form an impression of the safety in the environment during reading the descriptions. In the *irrelevant impression condition*, participants were told that the descriptions were developed for 10-year-old children, and that their task was to form an impression of the grammatical complexity of the sentences.

3.1.5. Dependent measures

Judgment. Participants were asked to indicate how safe they would feel in the environment. They could provide their answer on a 10-point scale ranging from 'very unsafe' (1) to 'very safe' (10).

Valence of recall. In accordance with Lichtenstein and Srull (1987; see also, McConnell et al., 1994), the (positive and negative) descriptions that were correctly recalled were used to construct a measure of valence of recall. For each participant, an index was computed using the means obtained in the pilot study, that

represented the valence of each feature in terms of safety. Thus, the index equals the sum of the pilot-test-based means of the correctly recalled positive and negative descriptions (e.g. in the case of one negative, and two positive descriptions accurately recalled, the index could be: $-3.09+2.86+2.96=2.73$). Hence, a positive index reflects an overall positive valence, whereas a negative index reflects a negative valence.

Response latencies. Response latencies were measured by the computer in seconds from the onset of the question to provide a judgment to the time participants entered their answer.

3.2. Results

To detect possible effects of the independent variables on judgments, valence or recall, and response latencies, the dependent variables were subjected to a 2 (processing goal: relevant impression vs irrelevant impression) $\times$ 2 (order: recall first vs judgment first) between-participants analyses of variance (ANOVA).

Judgment. Participants in the different conditions perceived the railway station equally safe. The main effects of processing goal, $F(1,76)=1.26$, N.S., and Order, $F(1,76)=0.39$, N.S., were not significant. Furthermore, the interaction effect was also nonsignificant, $F(1,76)=0.76$, N.S. ($M=6.43$, S.D. $=1.78$).

Valence of recall. Analyses of the valence of the recalled information showed that the main effect of order, $F(1,76)=0.01$, N.S., and the interaction effect, $F(1,76)=1.11$, N.S., were nonsignificant. Furthermore, a main effect of processing goal emerged, $F(1,76)=26.82$, $p<0.01$. The valence of recall was more positive in the relevant impression condition ($M=2.57$, S.D. 1.75) than in the irrelevant impression condition ($M=0.36$, S.D. $=2.05$).

Response latencies. As suggested by Fazio (1990), logarithmic transformations of response latencies were conducted to reduce the skewness of the response distribution. The transformed response latencies were subjected to the ANOVA. First, the effect of order, $F(1,76)=2.07$, N.S., and the interaction effect, $F(1,76)=0.81$, N.S., were not significant. Importantly, however, the main effect of processing goal was reliable, F $(1,76)=3.68$, $p<0.05$, (one tailed). As predicted, participants response latencies were reliably shorter in the relevant impression condition ($M=8.90$ s) than in the irrelevant impression condition ($M=9.95$ s).

Recall-judgment correlation. In order to investigate the relation between the valence of recall and judgment, Pearson correlations were calculated for both conditions of processing goal. The pattern of correlations supported our predictions. First, the correlation was significant in the irrelevant impression condition ($r=0.36$, $p<0.05$). However, there was no relation between recall and judgment in the relevant impression condition, $r=-0.13$, N.S.

3.3. Discussion

In sum, the memory–judgment correlations suggest that judgments in the relevant impression condition were formed on-line, whereas judgments in the irrelevant impression condition were formed memory based. These findings were further corroborated by analyses of response latencies, showing that participants were faster in arriving at evaluative judgments in the relevant impression condition, compared to the irrelevant impression condition.

Importantly, although the results of Experiment 1 suggest that processing goals do indeed affect the process by which judgments of environments are formed, the question remains whether the same results emerge when the environment is presented in a more realistic way. Reading descriptions about a physical environment (in the present case, a railway station) on a computer screen does not install much of a setting in which we experience our environment in daily life. In other words, the findings of the first experiment do not have high ecological validity, a concern widely acknowledged in environmental psychology (e.g. Hull & Stewart, 1992; Canter, 2000). Whether the hypothesized effects of processing goals on memory and evaluative judgments of physical (molar) environments also occur in a more realistic setting awaits further empirical scrutiny.

Therefore, to be more conclusive about the genuineness and robustness of the effects, we enhanced the ecological validity in two steps. Specifically, we constructed a computer model of an existing Dutch railway station, enabling us to control and carefully manipulate the presented environment without compromising much on the ecological validity of the experiment, as was the case in Experiment 1 [see Marans and Stokols (1993) and Loomis and Blascovich (1999) for an overview of the potential applications of computer simulations in psychology]. In Experiment 2, we presented participants with a computer-generated movie that showed the environment, as it would be seen during a walk through the station, thereby controlling the sequence in which relevant information was encountered. However, in Experiment 3 we completely abandoned the control of information presentation, as in this experiment, participants could freely explore the railway station interactively, that is, features of the environment could be encountered in any order and a different number of times. Thus, in Experiment 3 participants could investigate the environment in a manner that allows a highly exploratory way of acting, which is so characteristic for experiences of real environments.

4. Experiment 2

4.1. Method

4.1.1. Participants and design

Fifty undergraduate students of the Eindhoven University of Technology participated in the experiment. They were randomly assigned to a 2 (processing goal: relevant impression vs irrelevant impression) × 2 (order: recall first vs judgment first) between-participants design and received 10 Dutch guilders (approximately $5) for their participation.

4.1.2. Procedure

All participants were seated in separate rooms at a table with a computer and were presented with the instructions on paper, containing the manipulation of processing goal. Subsequently, the movie of the simulated railway station was presented on the computer monitor. After the presentation of the environment, subjects were requested to complete a 4-min filler task. Next, they were asked to recall information about the environment and to indicate how safe they would feel in the environment. Like in Experiment 1, order of recall and evaluation was counterbalanced.

Because we simulated an existing Dutch railway station, familiarity with this station may contaminate the predicted effects. Therefore, to be able to control for these effects participants were asked to indicate whether they were familiar with the station that was presented and if so, to name the city in which it is situated.

4.1.3. Stimuli and apparatus

The computer model of the railway station was constructed according to the plans of an existing Dutch railway station, using several software packages, such as AutoCAD and 3DstudioVIZ among others. Based on this model, a 5-min movie was rendered that simulated a walk through the station. In this environment, items were placed that had been rated in a pilot study (see Experiment 1). Five positive and five negative items were selected based on this pilot study and added to the environment. Among others, participants encountered a wall with graffiti (negative), and a sign that indicated ticket control at the platform (positive). Fig. 1 shows a frame of the movie used in the experiment.

4.1.4. Manipulation of processing goals

The treatment of processing goals resembled the manipulations of Experiment 1. In the relevant impression condition, participants were told that they were about to watch a simulation of a railway station and were asked to form an impression of the social safety in the environment. In the irrelevant impression condition however, subjects were instructed to form an impression of the visual quality of the simulation.

4.1.5. Dependent measures

The measurement of judgment of safety and the valence of the recalled information were similar to those in Experiment 1. Since participants used paper and pencil to express their judgments, we were not able to measure response latencies by the computer in this experiment (see also Experiment 3).

4.2. Results and discussion

Similar to Experiment 1, the dependent variables were subjected to a 2 (processing goal: relevant impression vs irrelevant impression) × 2 (order: recall first vs judgment first) between-participants ANOVA.

Judgment. The analyses of variance on judgment showed that the effects of processing goal, $F(1,46) = 2.42$, N.S., and order, $F(1,46) = 0.12$, N.S., were not significant, neither was the interaction effect $F(1,46) = 0.22$, N.S. ($M = 5.96$, S.D. $= 1.84$).

Valence of recall. Similar as to the judgment measure, the effects on valence of recall of processing goal, $F(1,46) = 1.31$, N.S., and order, $F(1,46) = 0.59$, N.S., were not significant, neither was the interaction, $F(1,46) = 0.91$, N.S. ($M = -1.79$, S.D. $= 1.84$).

Familiarity with the railway station. The recognition measure of the railway station revealed that 44% (22 out of 50) of the participants were familiar with the railway station. A chi-square test however, revealed that these participants were evenly distributed across conditions of processing goal, χ^2 (1) $= 1.31$, N.S. Recognizing the railway station, however, had a significant effect on the judgment about the safety in the environment, $F(1,48) = 6.75$, $p < 0.05$. Participants that were familiar with the railway station rated the environment as safer ($M = 6.68$, S.D. $= 1.43$) than participants that were not familiar with the station ($M = 5.39$, S.D. $= 1.95$). The effect of familiarity on the valence of the recalled information was not significant $F(1,48) = 0.39$, N.S.

Recall-judgment correlation. Like in Experiment 1, Pearson correlations were calculated for both conditions of processing goal to investigate the relation between the valence of recall and judgment. However, because familiarity with the railway station affected judgments of safety, a partial correlation was calculated, partialling out the effect of familiarity on judgments. The relation between valence of recall and judgment again followed the predicted pattern: a significant correlation was established in the irrelevant impression condition ($r = 0.50$, $p < 0.05$), but not in the relevant impression condition, $r = 0.00$, N.S.

Shortly, the present findings replicated the results of Experiment 1. That is, memory and judgment were substantially related when participants had the goal to form irrelevant impressions, whereas the relation between memory and judgment was virtually absent when participants formed relevant impressions. These

Fig. 1. A screenshot of the environment.

results thus show that on-line and memory-based judgments of environments do also occur when the environment is presented in a more realistic (though still highly controlled) way. The aim of Experiment 3 was to test effects of processing goals on memory and evaluative judgments of environments by giving up the final control of information presentation we had previously, and to allow participants to freely explore the environments in an interactive computer simulation setup.

5. Experiment 3

5.1. Method

5.1.1. Participants and design

Forty-two undergraduate students of the Eindhoven University of Technology participated in the experiment. They were randomly assigned to a 2 (processing goal: relevant impression vs irrelevant impression) × 2 (order: recall first vs judgment first) between-participants design and received 10 Dutch guilders (approximately $5) for their participation.

5.1.2. Procedure and apparatus

Participants were seated in separate rooms at a table with a computer. The instructions for the experiment were presented on paper. First, participants conducted a practice trial in which they could familiarize themselves with the technique of maneuvering through a virtual environment using a mouse. For this purpose, an abstract environment was created consisting of cubes, cylinders and cones. After they felt comfortable about using the equipment, they received the processing goal instructions used in Experiment 2. Subsequently, participants were invited to freely explore the virtual railway station for 5 min. The computer model used in the experiment was the same as in Experiment 2. The simulation was presented on a 21-in screen and generated by a Silicon Graphics workstation. After this free exploration of the environment, the experiment proceeded in exactly the same way as Experiment 2. That is, participants successively completed a filler task, a recall task and a judgment task, and the order of the last two tasks was counterbalanced. Finally, participants were requested to indicate whether they were familiar with the railway station.

5.2. Results and discussion

The dependent variables were subjected to a 2 (processing goal: relevant impression vs irrelevant impression) × 2 (order: recall first vs judgment first) between-participants ANOVA.

Judgment. Again we found no effects on judgments: the effects of processing goal, $F(1,38) = 1.76$, N.S., and order, $F(1,38) = 1.66$, N.S., were not significant, neither was the interaction effect, $F(1,38) = 0.57$, N.S. ($M = 7.02$, S.D. = 1.57).

Valence of recall. Analyses of variance revealed no reliable effects on valence of recall of processing goal, $F(1,38) = 0.12$, N.S., order, $F(1,38) = 0.02$, N.S., and the interaction between the two, $F(1,38) = 0.34$, N.S., ($M = -2.30$, S.D. = 2.00).

Familiarity with the railway station. Exactly 50% (21 out of 42) of the participants were familiar with the railway station. A chi-square test revealed that those participants were evenly distributed among the conditions of processing goal, χ^2 (1) = 0.95, N.S. Although familiarity with the railway station tended to affect the evaluative judgment of the safety in the environment, the effect was not significant, $F(1,40) = 1.66$, N.S. Furthermore, the effect of familiarity on the valence of the recall was also unreliable, $F(1,40) = 0.21$, N.S.

Recall-judgment correlation. Like in Experiment 2, a partial correlation was calculated, in which the possible effect of familiarity with the railway station on the relation between valence of recall and judgment was partialled out. The relation between valence of recall and judgment again showed the predicted pattern. The correlation between valence of recall and judgment was substantial and significant in the irrelevant impression condition ($r = 0.51$, $p < 0.05$), while this was not the case in the relevant impression condition, $r = -0.06$, N.S.

6. General discussion

The present study was conducted to gain more insight in the cognitive processes underlying the formation of evaluative judgments of environments. We investigated the effect of processing goals on judgments as to perceived safety in railway stations. Based on common practice in research on evaluative judgment of environments, it was argued that judgments are either formed during or after information processing. In other words, people may either have a goal to form a relevant or irrelevant impression of the evaluative dimension of interest in the course of exploring environments. We posited that the occurrence of these two types of processing goals have differential effects on the relation between memory and judgment (see also Hastie & Park, 1986; Lichtenstein & Srull, 1987). When people explicitly express their evaluative judgment after exploration of environments they will not consult their memory of the environment, but only if they formed the relevant impression already on-line. People who do not form such a relevant impression during exploration are more likely to rely on their recollection of the environment. These ideas were supported in three experiments.

In Experiment 1, in which subjects were presented with descriptions of features of a railway station, we demonstrated that processing goals do indeed affect the role of memory in judgments. A significant correlation between valence of recall and judgment was obtained when participants had the goal to form an irrelevant impression, but not when they had the goal to form a relevant impression, suggesting that judgments were formed, respectively, memory based and on-line. These findings were corroborated by establishing that participants were slower in arriving at evaluative judgments in the irrelevant impression condition, compared to the relevant impression condition. This deceleration in judgment time supports the idea that recollected information about the environment was consulted and integrated at the time the judgment was required (i.e. after the environment was explored). That is, contrary to the judgment in the relevant impression condition, in which an evaluation was already formed on-line and thus could be readily accessed and retrieved, computational processes were put in motion to come up with a judgment. Therefore, the time to arrive at a judgment increases only when participants do not form an evaluation on-line. Together, then, these results complement the growing body of research dealing with goal effects on evaluation and memory of environments.

In the last two experiments, we tested an important additional hypothesis. In these experiments, we investigated to what extent the effects of processing goals on memory–judgment relation do also emerge when participants explore the environment in a more realistic setting by means of a computer simulation. Our results indicate that this is the case: like in the first experiment, the strength of memory–judgment correlations differed as a function of the processing goals provided to participants. In fact, the differences in correlations observed in the last two experiments were even more pronounced compared to the first experiment. These findings are important, as they show that different evaluation methods (i.e. forming evaluations either during or after exploration) affect the use of memory in evaluative judgments under conditions resembling experiences with real environments in daily life. This especially pertains to the results of Experiment 3, in which participants could interactively and freely explore the railway station, and presentation of information could no longer be controlled. These results thus suggest that the theoretical test under examination can be generalized to the real world. On the other hand, our findings demonstrate the applicability of virtual environment technology as a more ecologically valid research tool for investigating fundamental questions in psychology in general, and environmental psychology in particular (e.g. Marans & Stokols, 1993; Loomis & Blascovich, 1999).

It should be noted that in the present studies, we were able to distinguish between on-line and memory-based judgment formation by explicit manipulation of processing goals. That is, the instruction to form a relevant or irrelevant impression, caused participants to automatically evaluate the environment on the dimension of interest. However, in daily life people often form on-line impression and evaluations spontaneously and

automatically, without any instruction (see also, Hastie & Park, 1986; Chartrand & Bargh, 1996). First, impression formation goals can be implicitly and spontaneously activated by the environment. For instance, someone who reads a newspaper article in the train about crime and vandalism in public spaces, may automatically form an on-line evaluation about safety in the railway station upon arrival. Furthermore, people can have chronic processing goals, because of the frequent or habitual nature with which these goals are activated and pursued in daily life (Bargh, 1997; Uleman, 1999; Aarts & Dijksterhuis, 2000). A person that has strong concerns about crime in society, and hence, chronically processes the environment in these terms, may form spontaneous judgments of safety in public environments when encountering these places.

This general view on automatic activation of processing goals can to some extent be compared to Leff's (1978) analysis on human experiences and potential resulting from the presence of, and interaction with physical environments. Leff maintains that cognitive sets and plans for selecting and processing information in the environment can readily be instigated by individual dispositions and environmental cues, and may determine along which evaluative dimensions impressions are formed (*cf.* Ward & Russell, 1981b). In other words, these theoretical ideas also suggest that environments can evoke processing goals implicitly and automatically. Whether these implicit goals produce similar effects as explicit goals that were the focus of the present research, however, is beyond the scope of this paper and open for future study.

So what type of processing goal should researchers on evaluative judgments of physical environments use? Providing a clear answer on this question is difficult, as it depends on what one would like to establish or to put under empirical examination. Obviously, it is important that evaluations are reliable and unbiased. A crucial question from this point of view, then, is whether the two types of processing goals yield different outcomes on evaluative judgments. First of all, in all three experiments reported here, no effect of processing goals on the final judgment was found. Therefore, based on these results we can safely conclude that processing goals do not have a direct effect on the judgment of the environment *per se*. Actually, it was not our intention to bias the final judgments. We did however successfully demonstrate the mechanism by which goals affect the process underlying the formation of judgments. Based on these findings, it may be anticipated that in some situations, the two processing goals may very well yield different results. In this light, two issues seem worthwhile to speculate on.

The first issue concerns the fact that memory-based judgments are more prone to biases in the retrieval process. After all, when no evaluation is available, relevant information about the environment needs to be retrieved in order to form a judgment. This retrieval of information from memory can be biased in several ways (see e.g. Dawes, 1988; Fiske & Taylor, 1991; Schwarz & Sudman, 1992). For instance, when after the presentation of a railway station one is first asked how well the station is maintained, related features (e.g. forced locker, graffiti) will become more salient. Consequently, given the enhanced accessibility, these features are more likely to be retrieved and used when a judgment of safety is required at a later time. Because of this dimensional or semantic priming (see Higgins, 1996), the judgment of safety may in this case be biased in a negative direction. In more general terms, memory-based judgments can be influenced by any event occurring between presentation of the environment and the formation of the judgment that biases the retrieval of information.

A second related aspect pertains to the ease of influencing on-line evaluations by modifying features in the environment. In other words, will people alter their first impression when we ask them to explore the modified environment for a second time before a final judgment is explicitly expressed? As previous research on these matters suggest (e.g. McConnell et al., 1994; Fazio & Towles-Schwen, 1999), on-line or, more precisely stated, previously formed evaluations are relatively strong, in the sense of being highly accessible and easily retrievable. Moreover, strong evaluations bias perceptions of the environment. Given the rather low motivation and capacity to process information in common life (Chaiken & Trope, 1999), on-line evaluations may not be easily changed by modifying features of the environment—unless these changes are of course extreme. Why bothering ourselves with additional information when we can produce the evaluation directly? Enhanced motivation and sufficient capacity to process information may therefore be required for on-line evaluations to be changed. However, when the judgment is not yet formed (as is the case with irrelevant impression formation goals) the additional information may be encoded during exploration and subsequently integrated when retrieving the information to form judgments.

Many evaluative judgments of environments are presumably formed on-line, that is, evaluations are spontaneously shaped upon perceiving, and exploring the environment. Such first impressions of environments are pervasive and can be very persistent. Therefore, first experiences with built environments are important, as the impression of the environment's functionality largely depends on it. Once formed on-line, these first impressions might be difficult to change. As a matter of fact, some first impressions are never reconsidered, for we act on it by not visiting the building twice.

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