Journal of Leisure Research
2007, Vol. 39, No. 4, pp. 668-685

A Comparison of Global and Actual Measures of Perceived Crowding of Urban Forest Visitors

Arne Arnberger
Institute of Landscape Development, Recreation and Conservation Planning
BOKU—University of Natural Resources and Applied Life Sciences
Vienna, Austria

Wolfgang Haider
School of Resource and Environmental Management
Simon Fraser University
Burnaby, Canada

Differences between global and actual measures of perceived crowding are investigated in an intra-individual analysis of 773 on-site visitors to an urban forest by comparing the two concepts for daily and hourly measurements. A sample of current and long-term visitor counts, measured in daily and hourly units, is added for reference points, allowing the investigation of the effects of visitor characteristics and additional situational factors on both measures. The global measure was significantly higher compared to the actual measure, even at the peak days and peak hours of the year. MANOVA analysis identified several situational and social factors such as past experience and group characteristics as influencing the differences between both measures consistently.

KEYWORDS: *Crowding, intra-individual analysis, past experience, repeat users, visitor counts.*

Introduction

Over the last three decades, research on perceived crowding has been a prominent theme of outdoor recreation research. Two types of crowding measures prevail in the literature: The actual measure of perceived crowding combines descriptive information (i.e. observed current use levels) with matching on-site evaluative information (Shelby & Heberlein, 1986; Shelby, Vaske, & Heberlein, 1989), whereas the global measure is an aggregation of crowding perceptions over one larger spatial and/or temporal unit of reporting (Hall & Shelby, 1996; Korça, 1998). Both these survey-based measures of perceived crowding often influence important management decisions such as limiting use (Cole, 2001). Therefore, researchers and managers should be aware of potential differences between the two measures and their

Address correspondence to: Arne Arnberger, Institute of Landscape Development, Recreation and Conservation Planning; BOKU—University of Natural Resources and Applied Life Sciences, Peter Jordan-Straβe 82, 1190 Vienna, AUSTRIA; Phone ++43 1 47654 7205; Fax: ++43 1 47654 7209; E-mail: arne.arnberger@boku.ac.at.

Author note: The Forest Department of the City of Vienna commissioned the Institute of Landscape Development, Recreation and Conservation Planning to collect data on public use.

causes. So far, no research has investigated the differences between the two measures systematically by comparing these with long-term counting data and analyzing the influences of situational and social factors on the differences between the two measures. Furthermore, most past research has focused on crowding in wilderness or other sparsely used areas, while work in urban settings which are characterized by high shares of repeat users is scarce (Hammitt, 2002; Lee & Graefe, 2003; Westover & Collins, 1987).

Actual Measure of Perceived Crowding

The actual measure of perceived crowding constitutes the classical approach and is typically concerned with use levels or encounter indicators (Shelby & Heberlein, 1986), because empirical studies have documented relationships between actual use levels and associated perceived crowding (Shelby et al., 1989). Several studies showed that the actual feeling of being crowded is also influenced by user characteristics such as visiting motives and frequency of visits, preferences and expectations (Baum & Paulus, 1991; Shelby, Heberlein, Vaske, & Alfano, 1983), visitor behavior and spatial needs (Gramann & Burdge, 1984; West, 1982). Generally, perceptions of crowding tended to be greater among participants who were seeking solitude or escape from social pressures along with a desire for natural surroundings, than among those emphasizing affiliation of social interaction as motives for a recreation outing (Ditton, Fedler, & Graefe, 1983).

Other studies indicated that repeat users of a conservation area reported greater perceived crowding when current use levels exceeded those of the past (Vaske, Donnelly, & Heberlein, 1980; Westover & Collins, 1987). People who are familiar with a particular site are less likely to report crowding, even if their own preferences for social contact were exceeded (Shelby et al., 1983). Situational factors such as the interviewing location have also been observed as influencing actual crowding perceptions (Cole & Stewart, 2002; Ditton et al., 1983; Tarrant, Cordell, & Kibler, 1997). Crowding has also been observed to vary by time, resource availability, accessibility and convenience, and management strategy (Shelby et al., 1989).

Global Measure of Perceived Crowding

Global measures of perceived crowding are based on the individual respondents' aggregation of numerous individual crowding situations over a larger spatial unit and/or time period to one single overall evaluation and one assumes they can recall these past experiences accurately (Stewart & Cole, 1999). The global measure draws on more experience and information compared to the actual measure. However, it forces respondents to aggregate and average over several past discrete experiences. For example, visitors may be asked about their crowding perception of an entire trip lasting several days and are forced to express it with only one crowding evaluation, although use levels might have drastically varied over the course of a trip (Dawson &

Watson, 2000; Hall & Shelby, 1996). Many of these studies used post-trip mailback questionnaires, introducing the opportunity for a significant recall bias because of reliance on long-term memory compared to perceptions assessed on-site (Borrie, Roggenbuck, & Hull, 1998; Sudman & Bradburn, 1974; Van Goor & Verhage, 1999). Some studies extracted global measures of perceived crowding from repeat users, such as local residents in suburban recreation areas (Weaver & Lawton, 2001) or in tourism resorts (Korça, 1998; Teye, Sönmez, & Sirakaya, 2002). In this case the global measure is an aggregation of several past discrete visits, coupled with specific crowding situations.

Comparing the Two Crowding Measures

Several comparisons between the actual and the global measure have been undertaken. In these studies, the global measure typically represents the evaluation of a trip lasting several days and was derived from mail-back questionnaires. Both Shelby et al. (1989) and Vaske and Donnelly (2002) found in their comparative analysis of 35 and 13 crowding studies respectively no differences between on-site (i.e. actual measure of perceived crowding) and mail-back (i.e. global measure of perceived crowding) evaluations. However, these two studies compared aggregate means between different studies only, which is likely to disguise various individual biases.

Tarrant (1999) compared global and actual measures of crowding of recreational boaters using mail-back and on-site data to examine the recall effect on an intra-individual basis, and found that perceptions of crowding were consistently higher for the mail-back method than on-site interviews. In the same study, the amount of elapsed time between on-site contact and mail-back response did not appear to have a significant effect. Unfortunately, his research design did not include a measure of absolute density so that the perceived crowding levels could not be matched with actual use levels. Neither did this study find any evidence of a recall bias. Stewart and Cole (1999) reported the discrepancies associated with different methods of data collection in an intra-individual analysis of the duration of encounters and perceived crowding. They compared a post-trip mail-back questionnaire and an on-site diary-like method of a sample of overnight backcountry users. While the global measure used in the mail-back survey explained less than 10% of the variance of crowding, the diary-like method using daily recordings of crowding explained 84%.

Common to these few comparative studies on perceived recreational crowding are three facts: (1) with the exception of Stewart and Cole (1999) and Tarrant (1999), no other studies introduced any intra-visitor analysis of the respective measures; (2) only few studies acknowledged and fewer investigated the role of location and user specific factors; and (3) they were mostly based on subjective evaluations of visitor numbers or duration of encounters, and the analysis lacked any relationship to actual use levels derived from

long-term counting data. This last relationship may be less of an issue for studies in wilderness or remote settings; however, in heavily used areas the comparison of crowding evaluations with empirically derived visitor counts would provide additional insights. None of these above mentioned studies with an urban focus compared the global measure derived from repeat use in heavily used inner urban settings with the actual perceived crowding measure.

This paper will therefore explore the intra-individual differences of crowding measures of very regular (repeat) on-site urban forest users. First we will test the hypothesis that the global measure of perceived crowding is higher than the actual measure (Hypothesis 1), as has been observed in a previous study for one single discrete visit lasting several days (Stewart & Cole, 1999). Next we will investigate if specific variables contribute systematically to these higher evaluations of the global measure. We test the hypotheses that user characteristics (i.e. past experience and visiting motives) (Hypothesis 2) and situational factors (i.e. location of interview) (Hypothesis 3) influence differences between the two measures systematically.

Such an analysis can only be undertaken with repeat visitors and is possible in a statistically rigorous manner only if long-term use data measured in daily or hourly units are available in addition to the survey responses. Therefore, current and long-term visitor counts are added as reference points and the statistical analysis is based on daily and hourly measures, allowing a systematic investigation of the effects of visitor characteristics and additional situational factors on both measures of perceived crowding. In contrast to earlier research in wilderness areas, the global measure of perceived crowding in this study focuses on repeat use in heavily frequented settings, instead of a measure of a single trip that may last several days.

Study Area

Data were collected in the recreation area Wienerberg, which is situated in the south of Vienna, Austria. The municipal forest department manages this 120-hectare forest that is divided by a highway into two sections: one more attractive area with a lake, and a smaller, less wooded area. The recreation area contains about 14 km of mostly gravel trails and several kilometers of footpaths. Bicycling is permitted only on some main trails and dogs are allowed, but must remain on a leash. The main trail runs within the perimeter of the forest and most of the 17 access points connect directly to the main trail. Residential areas including some high rises and business areas, a hospital, and garden allotments surround the inner urban recreation area. The forest was opened to the public in the late 1980s and its recreational use has increased steadily since, primarily because of new housing developments nearby, increased popularity of the lake for swimming and more dog walkers who have few equivalent opportunities nearby.

Methods

On-site Interviews

On ten different days between April and October 2002, on-site interviews were conducted at access points along the main trail section. The interviews took place on five randomly selected workdays and five randomly selected Sundays between 8:00 AM and 6:00 (5:00) PM. On the sampling days in October, some access points were excluded from surveys. The interviewers were trained students and municipal forest personnel. They asked visitors if they were willing to participate in a 10 to 15-minute interview. Once the interview was completed, the next visitor encountered, regardless of user type, was asked to participate in the study.

In total, 952 visitors agreed to the interview (59% response rate), of which 785 (49% of the entire sample) completed all questions pertaining to crowding. Another 12 respondents provided incomplete socio-demographic information resulting in a final sample size of 773 for the analysis in this paper. One main reason for refusal was that bicyclists and joggers were less likely to stop for an interview, introducing a systematic bias between the survey sample and the long-term counting results (Arnberger, 2006). However, this bias does not affect the analysis presented below. Reasons for non-completion were trivial issues such as first-time visitors who could not provide any global crowding evaluations either for weekends or workdays, or respondents who had arrived only recently and could not yet provide any evaluations about actual crowding perceptions, and some users visited the area exclusively on weekends or workdays. This study contains only respondents who provided answers to all three crowding questions.

Crowding issues were asked in three separate questions which used precisely the same wording and the same evaluative scale, but referred to different time periods: Perceived global crowding was assessed by asking visitors "How crowded do you perceive the recreation area. . . :" (1) on workdays; and (2) on weekends. Perceived actual crowding was assessed by asking visitors "How crowded do you perceive the recreation area now?". A 7-point scale was used for all questions, with the following descriptors: 1 = Severely undercrowded, 2 = Undercrowded, 3 = Slightly undercrowded, 4 = Appropriate use levels, 5 = Slightly crowded, 6 = Crowded, 7 = Overcrowded.

This bi-polar scale differs from the standard uni-directional perceived crowding scale (Shelby et al., 1989), which ranges from not at all crowded to extremely crowded. A bi-polar measure was, for example, used by Vaske et al. (1980), which appeared to be more appropriate for urban settings, as perceived underuse is an additional possible phenomenon due to safety concerns (Luymes & Tamminga, 1995) or social under-stimulation (Arnberger & Haider, 2005; Kaplan & Kaplan, 1982). Unfortunately, this application of the bi-polar scale limits any direct comparisons with the traditional 7 and 9-point scales used by crowding studies in remote areas (Shelby et al., 1989). However, this should be of little concern for the main objectives of this study

of analyzing and comparing the two crowding measures and the observed visitor numbers within the same study area.

For the purpose of exploring whether user characteristics or situational factors explain any differences between the two crowding measures, multivariate analyses of variance (MANOVA; General Linear Model in SPSS, 12) was used with two dependent variables and several covariates. The dependent variables were the individual respondent's scale evaluations of the global measures of perceived crowding for weekends or workdays and actual measures of perceived crowding for Sundays or workdays respectively, and measured in one-hour time periods. Socio-demographic (age, gender, group size, origin), and visit-related variables (children and dog in the group, motives for the visit such as nature, recreation, sport, dog walking, general satisfaction with the area, activity engaged in, and expectations regarding visitor numbers), descriptors of the traditional use of the forest (frequency of visit, typical length of stay), hourly use levels in the forest, and site-specific factors as well as weather conditions, measured in terms of temperature, precipitation and wind speed, all entered as independent variables. The Pillai statistic at a significance level of $p \leq .05$ was applied to test for main effects between the dependent variables, although the Wilks-lambda test produced the same results.

Observations

In addition to these on-site interviews, year-long (01/18/2002-01/17/2003) counts by video monitoring were available for three main access points and intersections of the main trail. From this huge data set relevant daily and hourly observations could be tabulated for the days and even the hours matching the surveys described above (Arnberger, 2006). The settings of the video system were sufficiently crude to ensure the anonymity of the subjects. The combination of long-term permanent video monitoring and temporally selective counting by human observers on sample days suggested approximately 1.24 million visits annually. On Sundays and holidays, 5,000 visits per day were counted on average, on Saturdays 3,400, and on workdays about 3,000 visits per day. Use levels between workdays varied only slightly.

Results

Users' Profile

The profile of respondents showed a fairly even mix of males (53%) and females. The age of respondents varied widely with the group of 31 to 45 year-olds representing the largest single group (28%), closely followed by the group of 46 to 60 year-olds with 27%. The majority of respondents were walkers (62%) and dog walkers (26%), whereas only 7% were joggers and 4% bicyclists. Thirteen percent of all groups interviewed contained at least one child. The mean group size was rather small ($M = 1.5$). About 60% of

respondents lived within a 15-minute walk from the forest, and another 18% reached the forest within 30 minutes. During the summer, more than one quarter of the respondents (28%) visited the recreation area daily, a further 57% visited at least once a week. The closer visitors lived to the recreation area, the more frequent they visited it: Correlation between the frequency of visit and distance from home to recreation area resulted in a coefficient of $r_S(773) = .354$ ($p < .001$). Most visitors (59%) stayed between one and two hours in the forest, while another 23% enjoyed it for one hour or less per visit. These characteristics emphasize the importance of the forest for routine urban recreation activities. In general, the visitors were quite satisfied with the recreation area, as documented by a mean of 1.6 on a scale ranging from 1 (very satisfied) to 5 (unsatisfied).

Differences Between Global and Actual Measures

Based on the evaluation of the global measure of perceived crowding on the 7-point scale, about 17% of the interviewees perceived the forest as overcrowded (= 7 on the scale) on weekends, and a further 47% regarded it as crowded (= 6) or slightly crowded (= 5). The urban forest was perceived as undercrowded (= 1 to 3) by only 4%. Only 2% of respondents judged workdays as overcrowded, and about 13% reported some perception of crowding (= 5 or 6). In contrast, workdays were perceived as undercrowded (= 1 to 3) by a full 27%. Over the entire study period, the global crowding measure for workdays was significantly lower than the measure for weekends, $t(773) = 25.834$, $p < .001$. Intra-personal comparisons revealed that the more respondents felt crowded on weekends, the higher were also their global crowding ratings for the workdays, $r_p(773) = .276$, $p < .001$.

Actual perceived crowding was also analyzed separately for each day of interviewing. Close to 5% of interviewees intercepted on Sundays perceived the actual conditions as overcrowded, and another 25% felt that the Sunday use levels were higher than appropriate (= 5 or 6). Undercrowded perceptions (= 1 to 3) were perceived by 22%. On workdays in contrast, only 1% of respondents perceived the actual conditions as overcrowded (= 7), and a further 7% had the impression of more than appropriate use levels (= 5 or 6), while appropriate use levels were reported by 45%.

A dependent sample *t*-test was used to formally test the relationship between the two crowding measures (Hypothesis 1). The top portion of Table 1 contains the respective overall means, reported separately for Sundays and workdays because they are two independent samples and investigated separately. For both types of days, the global measure is significantly higher than the actual measure, and the discrepancy is almost twice as big for Sundays as compared to workdays. For both Sunday and workday visitors, the actual and global measures were correlated (Sunday visitors: $r_p(379) = .399$, $p < .001$; workday visitors: $r_p(394) = .322$, $p < .001$). Workday users' global measure of weekends with a mean of 5.22 was significantly higher than the weekend global measure of Sunday visitors with a mean of 4.90, $t = 4.016$,

TABLE 1
Mean Global and Actual Measures of Crowding by Day of Observation
(1 = Severely Undercrowded, 7 = Severely Crowded)

Sampling day			Perceived Crowding			
			Global	Actual	*t*-value	*N*
Sundays	Mean		4.90	4.17	***11.807	379
Workdays	Mean		3.89	3.49	***7.875	394
Sundays	Visits	Rank[a]				
April 28, 2002	10,059	1	4.97	4.18	***8.622	151
June 23, 2002	5,578	44	4.99	4.22	***4.961	68
September 29, 2002	7,355	8	4.90	4.01	***6.040	88
October 20, 2002	6,479	20	4.75	4.33	**3.460	55
October 27, 2002	5,656	38	4.53	4.29	0.746	17

t-Test ***$p < .001$; **$p < .01$, *$p < .05$
[a]Rank of 365 days

$p < .001$. For the global measure of workdays no significant difference was found between Sunday and workday visitors.

Differences between Global and Actual Measures at Peak Days and Hours

Use levels in this urban forest vary dramatically over the year, and also in the course of a day (Arnberger, 2006). Therefore, the question arises whether use levels and actual crowding experienced on these ten randomly selected sampling days is representative for the use levels on all other days of the year long observation. While one cannot answer this question regarding on-site crowding perceptions for each day or hour of the year, based on long-term count data (Tables 1 and 2) one can nevertheless pose the hypothesis that during the top peak periods the actual measure should surpass the global measure, because the latter is an aggregate measure that inevitably should be lower than the peak values of the actual measure. Therefore, the following analysis focuses on peak daily and peak hourly use levels. Hourly use levels were chosen because daily totals of visitor numbers are still highly variable, given the dominance of short-term visits.

The remainder of Table 1 contains the means of the global and actual measures for each of the Sundays sampled, as well as the respective total daily number of visitors, the rank of the respective day with regards to daily visits among all days of the year as elicited by long-term counting data, and the results of the *t*-test between the two measures. The peak day of the year, a Sunday in April (4/28/2002), happened to be one of the randomly selected survey days and accounted for more than 10,000 visits. On this most heavily visited day of the year, the actual measure was evaluated with a mean

of 4.2, while the global measure received a significantly higher mean of 5.0. For four out of five of survey Sundays the same significant relationship was observed. The lack of a significance difference for the fifth Sunday may be caused by its small sample size.

Similar patterns of differences between the two crowding measures emerged when specific hours are used as unit of analysis (Table 2). For that comparison, the eight peak interviewing hours with more than 1,000 visits, all of which belonged to the peak 1.1 percentile of all 4,576 hours recorded, were used. These eight single busiest hours had a mean evaluation of the global measure of 5.0, which was significantly higher than the corresponding actual measure with a mean of 4.5. The second highest peak hour of the year was one hour in the late afternoon of the peak sampling day with 1,668 visits. Even this heaviest attended hour was evaluated with an average actual measure of 4.4 compared to the mean of 5.1 of the global measure, $t(22) = 3.464$, $p < .01$. Consequently, even for the peak day and peak hours of the year the global measure was significantly higher compared to the actual measure, further confirming Hypothesis 1.

Factors Influencing Discrepancies between the Measures

A final step of analysis explored which variables contributed to this discrepancy between global and actual evaluations, and to what extent each of these variables influenced either of the two measures. It was hypothesized that user characteristics and situational factors might explain a portion of these systematic differences (Hypotheses 2 and 3). Two MANOVAs were calculated; one for Sunday respondents and one for workday respondents (Table 3). In the multivariate analysis, ten significant main effects for the Sunday

TABLE 2
Mean Global and Actual Measures of Crowding by Peak Sampling Hours (1 = Severely Undercrowded, 7 = Severely Crowded)

					Perceived Crowding	
Date	h	Visits	Rank[a]	*N*	Global	Actual
Total/mean				86	***4.97	***4.52
April 28, 2002	4pm-5pm	1,668	2	22	5.09	4.36
September 29, 2002	3pm-4pm	1,347	14	4	4.75	4.25
October 20, 2002	2pm-3pm	1,270	17	9	4.78	4.67
September 29, 2002	2pm-3pm	1,193	27	8	5.25	4.50
April 28, 2002	2pm-3pm	1,181	29	17	4.88	4.35
October 20, 2002	3pm-4pm	1,116	37	6	5.67	5.50
September 29, 2002	4pm-5pm	1,116	37	9	5.11	4.89
October 20, 2002	1pm-2pm	1,039	51	11	4.36	4.27

***$t = 4.678$, $p < .001$
[a]Rank of 4,576 hours

TABLE 3
Differences between Global and Actual Measures of Crowding as a Function of Selected Situational and Individual Factors (MANOVA for Sunday and Workday Respondents)

Sample Day		Perceived Crowding	
Sundays (n = 379)		*Global*	*Actual*
Parameter	Pillai V	β	β
Intercept	***0.209	***3.704	***2.824
Hourly use levels (linear)	***0.051	−0.001	***0.002
Hourly use levels (squared)	**0.030	0.000	*0.000
Part of area[a]	**0.031	*−0.348	**−0.389
Crowding perceptions at workdays[b]	**0.142	***0.401	***0.318
Child(ren) in group[c]	***0.036	−0.026	***−0.505
Dog in group[c]	*0.020	(*)0.352	*0.426
Dog as visiting motive[c]	**0.034	−0.310	***−0.734
Frequency of visit:	*0.026		
Several times in a week		**0.541	0.231
At least once in a month		(*)0.364	0.305
Less visits		0	0
Satisfaction with area[d]	*0.017	0.102	*0.150
Length of stay:	*0.038		
≤ 1 hr.		*−0.685	*−0.580
1-2 hrs.		−0.429	(*)−0.413
2-4 hrs.		(*)−0.533	−0.153
> 4 hrs.		0	0
Global: R^2_{adj} = .149; Actual R^2_{adj} = .234			
Workdays (n = 394)		*Global*	*Actual*
Parameter	Pillai V	β	β
Intercept	***0.276	***2.836	***3.721
Hourly use levels (linear)	***0.106	***0.001	***0.002
Part of area[a]	**0.030	0.159	*−0.269
Crowding perceptions at weekends[b]	***0.057	***0.156	0.017
Child(ren) in group[c]	*0.019	−0.171	**−0.375
Dog in group[c]	*0.017	−0.088	(*)0.191
Frequency of visit:	*0.029		
Several times in a week		−0.139	**−0.484
At least once in a month		(*)−0.329	*−0.430
Less visits		0	0
Global: R^2_{adj} = .090; Actual R^2_{adj} = .123			

[a] 1 = Interviewed in the more heavily used part; 2 = Interviewed in the less heavily used part
[b] 1 = Severely undercrowded, 7 = Severely crowded
[c] 1 = No, 2 = Yes
[d] 1 = Very satisfied; 5 = Unsatisfied
F- or t-value ***$p < .001$; **$p < .01$, *$p < .05$, (*)$p < .10$

model and six significant main effects for the workday model were obtained (Pillai-values significant at the $p < .05$ level for all variables; they indicate that the variable contributes significantly to the difference between the global and actual measure). All measures significant in the workday model were also significant in the Sunday model. Non-significant parameters were excluded from the analyses, implying that there might be additional variables that could still contribute to the global or the actual measure alone, but not to the difference between the two. Therefore, the R^2 of this model should not be compared with the total variance explained by Stewart and Cole (1999). When comparing the independent variables between the global and the actual measure differences between the respective global and actual β-estimates emerged. Overall, more factors influenced the actual measure than the global.

User specific and locational factors influenced the differences between the two measures confirming Hypotheses 2 and 3. Situational factors (i.e. hourly use levels and part of area) were included as control variables, in order to remove their potential influence on perceived crowding evaluations. The higher the hourly use levels, the higher the actual measure. In addition, in the workday model hourly use levels increased the global measure. Sunday and workday visitors intercepted in the smaller section of the forest showed lower actual evaluations, but only the Sunday visitors reported a lower global measure. In both models a child in the group reduced the actual measure, whereas a dog increased the same. The means of the global measures did not differ between visitors with and without a child and walkers with and without a dog. In the workday model, higher global evaluations of weekends, and in the Sunday model, higher global evaluations of workdays contributed to higher actual measures.

The more often respondents visited the forest in summer, the lower was the actual measure in the workday model and the higher the global was in the Sunday model. Sunday visitors showed a positive correlation between the frequency of visit and the global measure of weekends, $r_s(379) = .112$, $p < .05$, while for workday visitors this relationship was not significant. For the global measure of workdays no significant differences could be found between frequent and infrequent visitors.

In the Sunday model an additional four variables were significant. The squared term of hourly use levels affected the actual measure, indicating that higher use levels lead to proportionally higher actual crowding; however, the β-values were minute. The less satisfied Sunday visitors were with the area, the higher the actual measure. In contrast to the dog walking activity per se, Sunday respondents with dog walking as a visiting motive reported a lower actual measure, while the global measure did not differ between visitors with and without the dog walking motive. Short-term visitors reported lower actual and global evaluations than visitors staying more than four hours. The following variables were not significant in either of the MANOVA models: other user types except dog walkers, gender, age, origin, group size, crowding expectations, other visiting motives, and weather conditions.

Discussion

This study revealed significant differences between the actual and global measures of perceived crowding. More precisely, the global measure is systematically higher compared to the actual measure (Hypothesis 1, Tables 1 and 2), confirming the findings in earlier studies. This study differs from earlier research with its focus on repeat visitors in an inner urban forest setting, and the inclusion of long-term actual count data on a daily and hourly basis. Theoretically, the actual measure should exceed the global measure at peak times, but even for peak days and peak hours of the year the opposite pattern was observed. One unintended detail of the study design makes this result even more striking: The global evaluation asked respondents to consider both days of the weekend combined (i.e. Saturday and Sunday), even though long-term monitoring data revealed that on Saturdays the total volume of visitors was actually more similar to workdays than to Sundays. Obviously, the combination of lower use Saturdays and higher use Sundays into one global crowding measure did not affect this evaluation behavior, although for Sundays only the discrepancy between the global and actual measures would most likely be even higher.

This systematic pattern of discrepancy between the actual and global measures of perceived crowding was then scrutinized in more detail. Daily and even hourly crowding evaluations were linked to corresponding actual count numbers and several user specific factors. Some group characteristics, past experience, and satisfaction influenced the differences between the two measures (Hypotheses 2 and 3). The fact that in both the workday and the Sunday models, the same six factors are significant underlines the importance of these influencing factors. The observation that the Sunday model contained additional four explanatory parameters should not come as a surprise given the much higher use pressure on Sundays. Some differences identified may be also caused by different visitation patterns, between workday and Sunday visitors, with the former being the more frequent users.

The MANOVA model explained only a small proportion of the variance, but one should remember that this model only retained variables which contributed significantly to the difference between the two measures and can therefore not be compared to other models explaining either the global or the actual measure in itself. In most instances the actual measure fluctuates, while the global measure remains much more stable. This phenomenon in itself is an empirical validation of the relatively more stable nature of the global measure under varying circumstances, at least with repeat users. Most of the variability in the actual measure is associated with the location dependent variables such as the actual use levels experienced and group characteristics such as the company of a child, while past experience affected predominantly the global measure. The fluctuation of actual measures of perceived crowding in different locations within an area and the influence of use levels have also been observed by many other researchers in remote and urban settings (Cole & Stewart, 2002; Ditton et al., 1983; Shelby &

Heberlein, 1986; Shelby et al., 1989; Stewart & Cole, 1999; Tarrant et al., 1997; Westover & Collins, 1987). Interesting is the fact that higher use levels lead to proportionally higher actual perceived crowding, as indicated by the significant squared effect. Arnberger and Haider (2005) found a similar preference pattern for evaluations of social trail use conditions in an image-based choice experiment in the same study area.

Group Characteristics

The discrepancy between the two measures was affected significantly by the presence of a child and the company of a dog. When respondents visit with children they are engaged in a more intensive social situation, focusing on the child, and may be less sensitive to the number of other users, resulting in a lower actual crowding perception (see also Ditton et al., 1983), while dog walkers may feel constraint to pursue their ultimate recreational goal due to high use levels, which is to release their dog from the leash (Arnberger & Haider, 2005). To dog walkers, the negative effect of crowding may arise from interference with their goal for which they would require a less visited area (Gramann & Burdge, 1984). In both cases visitors differentiated strictly between their current and the global situation, between the direct experience and the interpretive experience, indicating that actual and global measures are two separate concepts.

Peculiar is the different effect between the factor dog walking and the motivation of walking a dog in the Sunday model. The detailed count data collected for the period of the interviews offer no possible explanation because both user types experienced the same use levels. One can only assume that two different types of dog walkers frequent the area, and dog walkers without the dog walking motive, who are the more frequent users of the forest, were more crowding sensitive.

Past Experience

Past experiences in terms of the frequency of visit, crowding experiences of the other days of the week, and the typical length of stay increased the discrepancy between the two measures, affecting predominantly the global measure. Past experiences are shaped by the interpretive experiences, and their strong influence on the global measure support the assumption that both measures are different concepts. Frequent or long-term exposures to high use levels, particularly on Sundays, seems to be one explanation why the global measure is higher than the actual one even at the peak times of the year.

The high global measure of regular Sunday users could be caused by the frequent exposure to the high use levels of weekends and can also be interpreted as an indicator for visitors' concerns about their everyday environment. Although use levels have increased over the past few years, these long-standing repeat visitors, despite a negative feeling towards the crowding

situation, must still visit during times of heavier use, such as Sundays. One can assume that they cannot displace temporally or spatially because there simply are no nearby attractive alternatives or because they lack access to a private car or are constrained in working times. Their answers can be seen as a protest against the continuing development of the neighborhood, and may manifest a strategic response behavior (Van Goor & Verhage, 1999).

Frequent workday users had a lower actual measure than infrequent workday visitors, while their global measure of weekends ($M = 5.3$) was significantly higher than the global weekend measure of frequent Sunday visitors with a mean of 5.0, $t(298, 242) = 2.879$, $p < .01$. For their evaluation of the actual measure of perceived crowding frequent visitors intercepted on workdays may have also considered use levels experienced on Sundays, resulting in a significantly lower actual measure on workdays compared to infrequent users. Their response may reflect their dissatisfaction with Sundays' social conditions and at the same time express their relative satisfaction with a successful workday visit. In contrast to frequent Sunday visitors, this user group may be more flexible in allocating their times of visit to lower use times such as workdays. This assumption was supported indirectly by the fact that workday users were more likely to be displaced by crowding than Sunday visitors. While 54.0% of workdays visitors stated use displacement behavior in time and space, only 45.7% of Sunday users displaced, $\chi^2 = 5.283$, df = 1, $p = .022$.

Past experience with the use levels of the area on the opposite type of day (i.e. the one the interview did not take place on) influences the differences between the measures of crowding, indicating that the global measure of one type of day (i.e. workday) is associated stronger with the global measure of the other type of day (i.e. weekend) than actual measure, even when controlling for use levels. This pattern of response supports the assumption that global and actual measures are somewhat different concepts for workday and for Sunday visitors respectively.

The typical length of stay influenced the difference between the global and actual measure of Sunday visitors. Visitors staying four hours or more in the area expressed higher crowding perceptions than short-term visitors. The long exposure to the high use levels of Sundays seems to affect the global measure more than the actual.

Satisfaction

Sunday visitors, who were less satisfied with the urban forest as a recreation area in general, reported a higher actual measure. The relationship between satisfaction and crowding perceptions has been a long standing issue in crowding research, suggesting that lower crowding perceptions would lead to higher satisfaction scores. However, most results have indicated no or only a rather weak correlation between these concepts (Shelby & Heberlein, 1986). The earlier studies correlated satisfaction with the current visit

vs. actual crowding perceptions, whereas in this study of a high use urban forest, the measure of satisfaction is based on the combined experience of several discrete visits. Surprisingly, this relationship was not found for workday visitors, although the degree of satisfaction did not differ between Sunday and workday visitors. As use levels on workdays are much lower, they do not seem to influence satisfaction.

Conclusions

The purpose of this paper was to investigate intra-individual differences between global and actual measures of crowding on an unprecedented level of detail (daily and hourly units of analysis) and to explore causes of these differences. This study confirms findings of earlier papers that the global measure of perceived crowding is consistently higher compared to actual evaluations, even on an intra-personal basis and in different situations. The influence of an individual aggregation process of averaging several past discrete experiences can be excluded as an explanatory variable, because even during peak use periods the actual measure was significantly lower than the global. Past experience, group characteristics and satisfaction contribute to these differences as they affect either the actual or the global or both crowding measures.

Since most respondents are very regular visitors, many of them use the area for several different purposes and their global evaluation is based on their rich past experience under various conditions. Frequent or long-term exposures to high-use levels and potential concerns about the quality of the immediate recreation environment seemed to contribute to the high global measure. Respondents may also find it easier to recall a few or several outstanding negative evaluations of crowding instead of objectively averaging their visits. All respondents included in this analysis are familiar with both Sunday and workday conditions. Dissatisfaction with weekend conditions and temporal use displacement behavior, i.e. reallocation of recreational use from Sundays to workdays, could also have an influence on the difference between the measures. However, these arguments are speculative and should be considered in some future research designs.

Based on the significant difference between the two measures, one of the main questions for managers and researchers is which of the two response scales should be used to obtain information about crowding. One preliminary conclusion based on this first study in an urban forest setting with repeat users is that the global measure appears to be remarkably stable, while the actual measure is influenced by several situational and context variables. It seems safe to conclude that for repeat users, the global measure apparently summarizes a well rounded experience, reflecting the longer term attitudes and concerns of visitors towards the forest more accurately than one single actual crowding measure. Therefore researchers and managers focusing on frequent users' and residents' attitudes towards tourism

and social carrying capacities should rely on this measure, but should also be aware that the global measure can be affected by strategic responses such as the concerns of local residents about use impacts by other visitors on 'their' everyday environment. Involvement of the locals in decision making about planning and management actions affecting the urban forests might be one strategy to reduce the global crowding perception. The actual measure provides insights about how specific social and situational factors influence perceived crowding and will serve as a useful measure for more specific management questions. The actual measure may also be more suitable for areas with a predominant share of one-time and first-time visitors.

Future research might want to investigate the cognitive processes leading to a global measure of crowding of repeat visitors in more detail by combining traditional formal approaches with qualitative and individual heuristic research methods and using repeated measures of actual crowding instead of one single evaluation. The difference in the two measures may occur also for other cognitive reasons and rationalization behavior. The actual measure for example might be lower than respondents actually feel, simply because they need to rationalize why they still visit at that very moment, effectively avoiding cognitive dissonance (Festinger, 1957), even though they might actually feel that the situation is overcrowded. The interviewing process itself might further contribute to this lowering of the actual measure as respondents might feel a need to further justify to themselves and to the interviewer why they still visit despite perceiving the area as crowded in general. Future research should also test if the findings about the relationships between the measures can be replicated in similar or other settings. Such a study should also investigate if additional influencing individual factors exist, such as the degree of experience, past use history and place attachment (Hammitt, Backlund, & Bixler, 2004), use displacement (Manning & Valliere, 2001), flexibility of work hours, and the years lived nearby the recreation setting, all of which might increase the explanatory value of the models used in this study.

References

Arnberger, A. (2006). Recreation use of urban forests: An inter-area comparison. *Urban Forestry & Urban Greening, 4,* 135-144.

Arnberger, A., & Haider, W. (2005). Social effects on crowding preferences of urban forest visitors. *Urban Forestry & Urban Greening, 3,* 125-136.

Baum, A., & Paulus, P. B. (1991). Crowding. In D. Stokols & I. Altman (Eds.), *Handbook of Environmental Psychology* (Vol. 1, 2nd ed., pp. 533-570). Malabar, FL: Krieger Publishing.

Borrie, W. T., Roggenbuck, J. W., & Hull, R. B. (1998). The problem of verbal reports in recreation research: Review, recommendations, and new directions. *Tourism Analysis, 2,* 175-183.

Cole, D. N. (2001). Visitor use density and wilderness experiences: A historical review of research. In W. A. Wayne & D. N. Cole (Eds.), *Visitor Use Density and Wilderness Experience* (pp. 11-20). Ogden, UT: USDA Forest Service.

Cole, D. N., & Stewart, W. P. (2002). Variability of user-based evaluative standards for backcountry encounters. *Leisure Sciences, 24,* 313-324.

Dawson, C. P., & Watson, A. E. (2000). Measures of wilderness trip satisfaction and user perceptions of crowding. In N. Cole, S. F. McCool,W. T. Borrie & J. O'Loughlin (Eds.), *Wilderness Sciences in a Time of Change Conference* (RMRS-P-15, Vol. 4, pp. 93-98). Ogden, UT: USDA Forest Service.

Ditton, R. B., Fedler, A. J., & Graefe, A. R. (1983). Factors contributing to perceptions of recreational crowding. *Leisure Sciences, 5,* 273-288.

Festinger, L. (1957). *A theory of cognitive dissonance.* Stanford, CA: Stanford University Press.

Gramann, J. H., & Burdge, R. (1984). Crowding perception determinants at intensively developed outdoor recreation sites. *Journal for Leisure Research, 6,* 167-186.

Hall, T., & Shelby, B. (1996): Who cares about encounters? Differences between those with and without norms. *Leisure Sciences, 18,* 7-22.

Hammitt, W. E. (2002). Urban forests and parks as privacy refuges. *Journal of Arboriculture, 28*(1), 19-26.

Hammitt, W. E., Backlund, E. A., & Bixler, R. D. (2004). Experience use history, place bonding and resource substitution of trout anglers during recreation engagements. *Journal of Leisure Research 36,* 356-378.

Kaplan, S., & Kaplan, R. (1982). *Humanscape: Environments for People.* Michigan: Ulrich's Books.

Korça, P. (1998). Resident perceptions of tourism in a resort town. *Leisure Sciences, 20,* 193-212.

Lee, H., & Graefe, A. R. (2003). Crowding at an arts festival: Extending crowding models to the frontcountry. *Tourism Management, 24,* 1-11.

Luymes, D. T., & Tamminga, K. (1995). Integrating public safety and use into planning urban greenways. *Landscape and Urban Planning, 33,* 391-400.

Manning, R. E., & Valliere, W. A. (2001). Coping in outdoor recreation: causes and consequences of crowding and conflict among community residents. *Journal of Leisure Research 33,* 410-426.

Shelby, B., & Heberlein, T. (1986). *Carrying capacity in recreation settings.* Corvallis: Oregon State University Press.

Shelby, B., Heberlein, T. A., Vaske, J. J., & Alfano, G. (1983). Expectations, preferences, and feeling crowded in recreation activities. *Leisure Sciences 6,* 1-14.

Shelby, B., Vaske, J. J., & Heberlein, T. H. (1989). Comparative analysis of crowding in multiple locations: Results from fifteen years of research. *Leisure Sciences, 11,* 269-291.

Stewart, W. P., & Cole, D. N. (1999). In search of situational effects in outdoor recreation: Different methods, different results. *Leisure Sciences, 21,* 269-286.

Sudman, S., & Bradburn, N. M. (1974). *Response effects in surveys: A review and synthesis.* Chicago: Aldine.

Tarrant, M. A. (1999). Variability of the perceived crowding scale: A research note. *Leisure Sciences, 21,* 159-164.

Tarrant, M., Cordell, H., & Kibler, T. (1997). Measuring perceived crowding for high-density river recreation: The effects of situational conditions and personal factors. *Leisure Sciences, 19,* 97-112.

Teye, V., Sönmez, S. F., & Sirakaya, E. (2002). Residents' attitudes toward tourism development. *Annals of Tourism Research, 29,* 668-688.

Van Goor, H., & Verhage, A. L. (1999). Nonresponse and recall errors in a study of absence because of illness: An analysis of their effects on distributions and relationships. *Quality & Quantity, 33,* 411-428.

Vaske, J. J., & Donnelly, M. P. (2002). Generalizing the encounter-norm-crowding relationship. *Leisure Sciences, 24,* 255-269.

Vaske, J. J., Donnelly, M. P., & Heberlein, T. A. (1980). Perceptions of crowding and resource quality by early and more recent visitors. *Leisure Sciences 3,* 367-381.

Weaver, D. B., & Lawton, L. J. (2001). Resident perceptions in the urban-rural fringe. *Annals of Tourism Research, 28,* 439-458.

West, P. C. (1982). Effects of user behavior on the perception of crowding in backcountry forest recreation. *Forest Science 28*(1), 95-105.

Westover, T. N., & Collins, J. R. (1987). Perceived crowding in recreation settings: An urban case study. *Leisure Sciences, 9,* 87-99.