International Journal of Public Opinion Research Advance Access published February 24, 2012

International Journal of Public Opinion Research

doi:10.1093/ijpor/eds001

Research Note

Evaluation of an online (opt-in) panel for public participation geographic information systems surveys

Greg Brown[1,2], Delene Weber[3], Dino Zanon[4] and Kelly de Bie[4]

[1]School of Geography, Planning and Environmental Management, University of Queensland, Australia; [2]Department of Geography, Central Washington University, USA; [3]Barbara Hardy Institute, University of South Australia, Australia and [4]Parks Victoria, Melbourne, Australia

Online panels are increasingly being used in market, social, psychological, and medical research (Callegaro & DiSogra, 2008). With decline in survey response rate across all modes of delivery (Curtin, Presser, & Singer, 2005; de Leeuw & de Heer 2002; Hansen 2006), online panels may appear an attractive option for conducting public participation geographic information systems (PPGIS) surveys despite limitations compared with probability sampling methods including undercoverage of the target population, high nonresponse within the panel, and self-selection bias (see Baker et al., 2010). This research evaluates the use of an online, opt-in panel (Couper, 2000) for conducting PPGIS surveys as an alternative to random household sampling, on-site survey recruitment, or self-selected (river) sampling. We evaluate the use of the online panel against several criteria of survey data quality: participation rate, mapping effort, and usability of survey responses. We discuss the implications of the results for future PPGIS survey research.

PPGIS is a general set of methods for collecting local knowledge of places to inform land use planning processes. In PPGIS surveys, participants identify spatial locations on a map, either hardcopy or digital, using stickers, markers, or digital annotations. Typically they then respond to a set of survey questions that allow the investigator to examine correlations between these responses and the placement of their markers. PPGIS surveys are adaptable to a variety of social survey contexts where measuring perceptions of place is an important research objective. PPGIS applications have ranged from community and neighborhood planning to environmental and natural resource management (see Brown, 2005; Dunn, 2007; Sieber, 2006; and Sawicki & Peterman, 2002, for reviews of PPGIS applications and methods).

All correspondence concerning this article should be addressed to Greg Brown, Associate Professor of Environmental Planning, School of Geography, Planning and Environmental Management, University of Queensland, Brisbane, QLD 4072, Australia. E-mail: greg.brown@uq.edu.au

PPGIS survey recruitment has been most frequently implemented through random household selection and mail invitation, but researchers are increasingly looking at alternative means of participant recruitment through websites and blogs, local media advertising, or commercial email lists. Internet-based PPGIS surveys, in contrast to mail-based PPGIS methods, usually provide an option for self-selection or river sampling of a "volunteer" public because it costs no more to implement and is easy to track multiple survey participant groups to a website using access codes.

PPGIS surveys have been implemented using different modalities including self-administered mail and internet surveys, or in-person group administration. Response rates for mail-based household PPGIS surveys have ranged from 18% to 47%, whereas internet-based random household surveys averaged 13% across five studies (Pocewicz, Nielsen-Pincus, Brown, & Schnitzer, in press). The first mixed-mode PPGIS survey (mail with paper maps and internet with digital maps) was completed in 2010 with reported 17 and 7% response rates for paper-based and internet-based PPGIS respectively (Pocewicz, Schnitzer, & Nielsen-Pincus, 2010). This result is consistent with studies suggesting that in populations with access to the internet, response rates for web surveys may not match those of other survey methods (Cook, Heath, & Thompson, 2000; Couper, 2000).

Internet-based PPGIS surveys offer significant technological advantages over paper-based surveys with the most important being access to multiple map scales, customizable cartography and base map features, and elimination of the need to digitize responses thus, reducing spatial error. However, the technological benefits of digital PPGIS surveys may be offset by the inability of researchers to achieve higher response rates in a variety of research settings.

The use of online panels may be an attractive option for PPGIS surveys because recruitment and participation are combined in a single modality (participation is achieved through a click on a survey link sent in an email message) while the mapping part of the survey can utilize the mapping features of familiar internet-based applications such as Google® Maps or Earth. This research evaluated the use of an online panel for a PPGIS survey implemented for the purpose of regional conservation planning by Parks Victoria, an Australian agency responsible for national park planning and management. The results are compared with other similar PPGIS surveys.

PPGIS Survey Evaluation Criteria

To evaluate response quality in PPGIS survey research, we introduce two new metrics—*mapping effort* and *data usability*—to augment existing survey response metrics for public opinion research. Mapping effort is defined as the exertion of physical and mental power to complete the PPGIS mapping activity. It is hypothesized to be related to measurement error and thus data quality, i.e. less mapping effort is associated with lower spatial data quality. Because many PPGIS variables (e.g. recreation experiences) can apply to a wide range of landscapes, PPGIS surveys often lack a direct measure of spatial error. In the absence of specific evidence indicating that a marker was placed in error, there is a presumption of PPGIS marker placement validity.

Mapping effort in PPGIS surveys may be indicative of participant "satisficing" or suboptimal responses and lower PPGIS data quality. According to satisficing theory, respondents with lower motivation are likely to engage in a suboptimal response strategy (satisficing) rather than optimizing (Kaminska, McCutcheon, & Billiet, 2010; Krosnick 1991). The sampling groups examined in this PPGIS study—an opt-in panel and self-selected public—represent *prima facie* different types and levels of motivation. Online panelists routinely complete online surveys for extrinsic rewards. Panelist's interest and connection with the survey subject content is coincidental. In contrast, participation by a self-selected public requires some preexisting interest in the survey content to provide sufficient motivation to visit the PPGIS website and participate without any prospect of reward; the motivation is primarily intrinsic.

PPGIS *data usability* is defined as the proportion of total PPGIS markers placed that are appropriate to the purpose of the PPGIS survey and is an indirect but operational indicator of PPGIS measurement error. Usability can be defined with a range of criteria such as marker location, map scale at time of marker placement, or other survey-specific criteria. PPGIS surveys usually have a designated study area where markers are intended to be placed. Markers placed outside the study, though presumptively valid for the attribute being identified, are not usable for the stated purpose of the survey. In this survey, we operationalized data usability as markers placed within the study area prior to the implementation of map controls that limited where markers could be placed by participants.

Methods

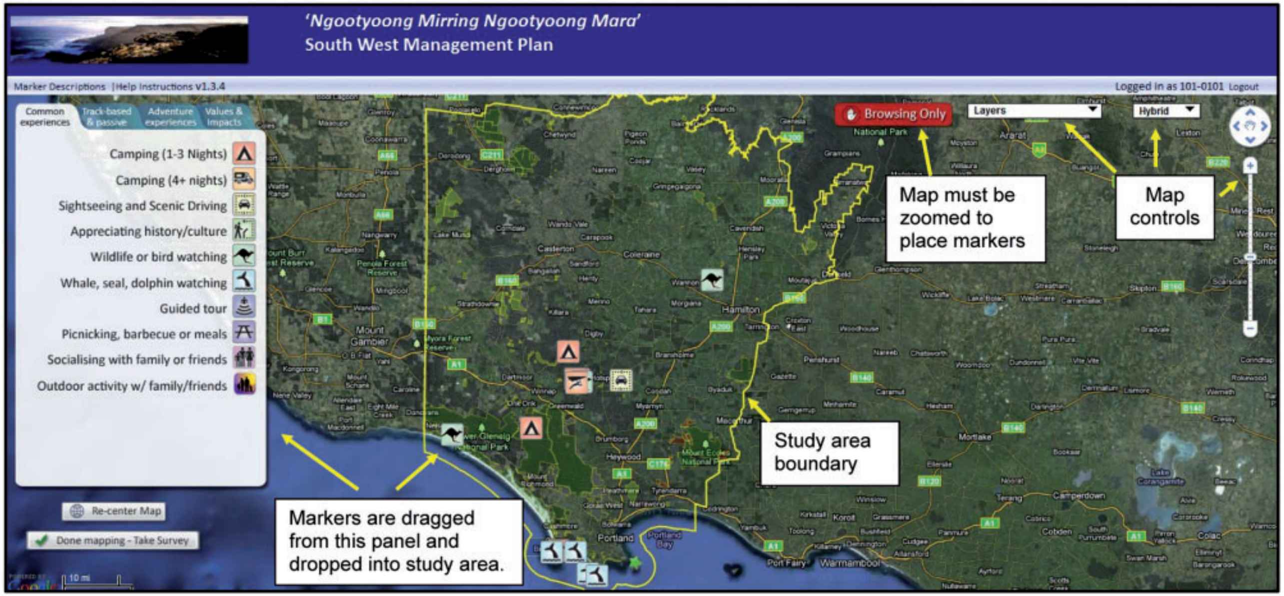
Survey Content

A PPGIS survey website was developed and implemented using a combined Google® Maps and Earth application interface (see http://www.landscapemap2.org/swparks3). The website had the following features: (1) an initial screen where a survey access code could be entered and validated, followed by (2) an informed consent screen, followed by (3) a Google Maps screen with an open window containing instructions for placing markers and completing the survey, followed by (4) a screen with standard text-based survey items to identify respondent characteristics.

The mapping application contained a panel on the left of the screen with 47 markers representing different park experiences, values, perceived impacts, and preferences for park facilities (see Figure 1). Participants were instructed to drag and drop the markers onto a map where these attributes were located. There was no limit on the number of markers that could be placed. Thus, the mapping activity with multiple markers is conceptually similar to a multiresponse survey item where a participant can check "all that apply". Standard Google Maps navigational tools were available to pan and zoom the map to different locations to place the markers. In the initial launch of the application, no minimum map scale (Google Maps zoom level) for placing markers was established under the assumption that respondents would navigate to the appropriate zoom level to gain enough map resolution to place the marker.

Figure 1

The PPGIS interface. Participants drag and drop markers from left panel onto a Google® Map image of study area. Following the placement of markers, participants click button in lower left corner to answer text-based survey questions



Sampling and Recruitment

Parks Victoria contracted with Newspoll Market Research® and Lightspeed Research Australia®, to administer survey recruitment using a national, opt-in survey panel. The Australian panel contains over 135,000 members that earn points redeemable for prizes by completing surveys online.

Potential panelists for the PPGIS survey were identified as individuals living in regional Victoria or in Melbourne, the state's largest city. In October 2010, 2,815 individuals were sampled with replacement from a list of individuals meeting self-reported geographic criteria from panel enrolment. Eligible panelists were sent an email announcing the availability of a new survey and inviting participation. Interested panelists were directed to an online survey to screen panelists using two selection criteria: (1) residence in regional Victoria or Melbourne, (2) visitation to one of the nine specific state or national parks in the study region within the last 12 months. Panelists satisfying the screening criteria were provided a link to the PPGIS survey website with an automated access code. The online panel yielded 304 complete responses that included one or more mapped attributes and completion of the survey questions following the mapping activity.

Visual inspection of the online panel map markers indicated data quality concerns such as markers placed outside the study area, some markers placed in counter-intuitive geographic locations, and a general lack of precision in marker placement. Mapping effort appeared less than reported in other PPGIS surveys. As a result, a decision was made to modify the PPGIS website to implement two spatial data quality controls. The application was modified to disallow markers placed outside the study region and a map control was implemented that would not allow marker placement until the map was zoomed to a scale that achieved minimum acceptable map resolution.

Four months from initial survey completion, the same panelists were invited to complete the same PPGIS survey again. Approximately 200 first-round respondents accepted the invitation to repeat the survey. Following a similar screening process, 63 resampled individuals completed the survey a second time. We assume the significant drop in the number eligible participants was a result of the intervening 4-month period that included the popular Easter period, in which potential participants became ineligible by virtue of not visiting a park within the 12-month screening window. In total, 23 additional completions were gained via requesting new participants from the panel.

Data Analysis

Participation rates. We calculated the participation rate for the opt-in panel as "the number of respondents who have provided a usable response divided by the total number of initial personal invitations requesting participation" (AAPOR, 2011). We also calculated the proportion of eligible panelists that were screened out and the screening participation rate, defined as the proportion of screened eligible individuals that fully or partially completed the PPGIS survey. The panel dropout rate was defined and calculated as eligible panelists that accessed the PPGIS website, but failed to place any markers or answer any survey questions.

Mapping effort. We assessed mapping effort by examining three indicators: the total number of markers placed in the survey process, the total elapsed clock time placing the markers, and the mean elapsed time in placing a marker. These measurements are compared with other PPGIS surveys completed with random household sampling, on-site recruitment, or self-selected public sampling. We also compared navigational diligence between panelists and the self-selected public by examining the zoom level at which markers were placed in the first round prior to the implementation of a minimum zoom level control. Markers placed at high zoom levels indicate greater navigation effort in marker placement.

Usability of PPGIS survey responses. We assessed the usability of the mapped PPGIS data by calculating the percentage of total markers placed inside the study area for both the online panel and self-selected public prior to the implementation of map controls.

Participant characteristics. We compared online panelists with the self-selected public on the variables of age, level of formal education, income, general reason for visiting parks, and self-reported knowledge of parks in the region. To test for differences in characteristics, we applied chi-squares tests for proportional data and *t*-tests for continuous data ($\alpha = 0.05$).

Results

The participation rate for eligible individuals in the online panel was 12% for the first round of invitations and 4% for the second round. These overall participation rates appear low because 85 and 87% of the geographically eligible panelists were screened out for not visiting one of the region's parks in the last 12 months. For those individuals that passed the screening questions, the participation rates were 77 and 31%, respectively for the two rounds. About 41% of resampled panelists were screened out in the second round, presumptively because about 4 months had elapsed between rounds and the 12-month park visit requirement was no longer applicable. The screening participation rate was lower for resampled participants (54%) in the second round.

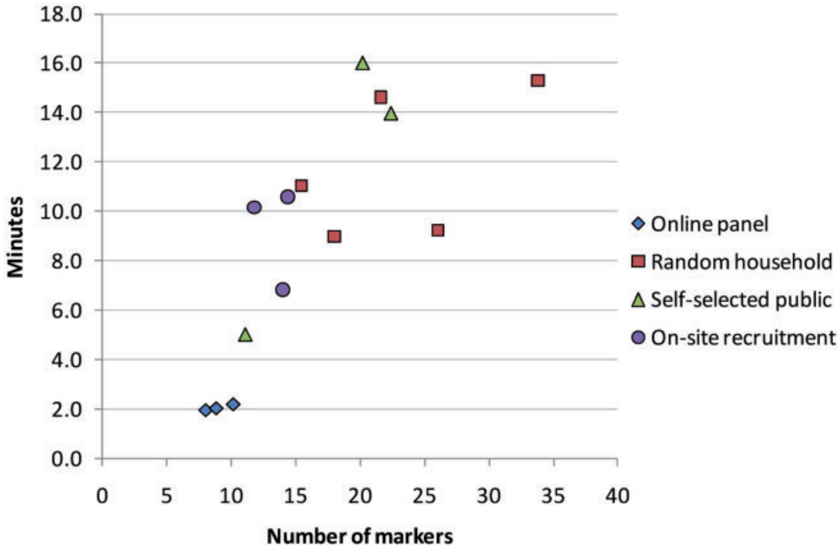
The dropout rate, defined as the proportion that passed screening, accessed the PPGIS survey website, but failed to map any attributes or answer any survey questions, was 21% for the first round of invitations, 46% for the resampled panelists, and 69% for new invitees in the second round. The higher dropout rate for the second round is likely the result of inadvertent resampling of the same panelists from the first round who accessed the survey only to realize they had already completed the survey.

The PPGIS mapping effort results are presented in Table 1 and plotted in Figure 2. The mean number of PPGIS markers placed and the time spent mapping by the online panelists were significantly less than other reported PPGIS surveys and all other sampling groups. Round one panelists placed a mean of 10 markers with an average mapping time of just over 2 min. The resampled panelists in round two put even less effort into their responses, averaging eight markers and <2 min mapping time. This online panel mapping effort was considerably less than the self-selected public sample within the same study (11 markers, 5 min) and other sampling groups in recent internet PPGIS surveys. For example, random household sample mapping

Table 1
PPGIS survey "mapping effort" of online panel compared with other PPGIS sampling and recruitment methods

PPGIS survey	Participant group	Range of markers placed	Mean number of markers per participant	Mean (SD) total mapping time (min:s)	Mean time per marker (min:s)
SW Parks (Victoria) 2011	Online panel (Round 1) ($n = 333$)	1–118	10.1	2:12 (3:56)	00:12
	Online panel resample ($n = 63$)	1–50	8.0	1:57 (3.52)	00:11
	Online panel (Rounds 1 and 2) ($n = 359$)	1–57	8.8	2:02 (3:48)	00:11
	Self-selected public ($n = 41$)	1–103	11.1	5:02 (15:53)	00:15
Alpine Region (Victoria) 2009 (*Source*: Brown and Weber, 2011)	On-site visitors ($n = 253$)	1–70	14.0	6:51 (11:51)	00:27
Kangaroo Island (South Australia) 2010 (*Source*: Brown and Weber, in review)	Random sampled households ($n = 104$)	1–195	33.8	15:18 (14:43)	00:37
Southland Region (New Zealand) 2011 (*Source*: NZ Department of Conservation Report)	Random sampled households ($n = 21$)	1–111	15.4	11:03 (18:29)	00:40
	On site visitors ($n = 67$)	1–80	11.8	10:10 (12:55)	00:50
	Self-selected public($n = 182$)	1–379	20.2	16:01 (23:28)	00:50
Otago Region (New Zealand) 2011 (*Source*: Unpublished data)	Random sampled households ($n = 60$)	1–187	21.6	14:38 (19:38)	00:49
	Self-selected public ($n = 357$)	1–320	22.4	13:59 (35.75)	01:03
	On site visitors ($n = 10$)	2–42	14.4	10:35 (8:56)	00:25

Figure 2
PPGIS survey mapping effort across multiple studies and sampling groups



effort in three recent PPGIS surveys ranged from a mean of 15 markers (11:03) to a high of 34 markers (15:18). Beverly, Uto, Wilkes, & Bothwell (2008) reported a mean of 26 markers (9:15) and Pocewicz et al. (2010) reported 18 markers (9:00) with random household samples in Canada and the US, respectively. Mapping effort from participants recruited on-site for PPGIS surveys was also significantly greater than online panelists, and ranged from a mean of 12 to 14 markers and mean mapping time from 6:51 to 10:35.

Finally, we examined the usability of the PPGIS mapped responses using a simple measure of the percent of attributes placed within the study area as directed in the survey instructions. In the first round of panel invitations before map controls were implemented to restrict marker placement, 36% of the markers were placed outside the study area by online panelists. In contrast, the number of markers placed outside the study area by the self-selected public sample was 13%.

An additional PPGIS map control was implemented in the second round of panel invitations that required navigation to a minimum map scale (Google Maps zoom level) before a marker could be placed. This minimum zoom control had the consequence of reducing the number of map markers placed. The same panelists placed significantly fewer markers in the second round, with the average number of markers dropping from 14 to 8 ($t = 2.12$, $p \leq .05$). About 48% of panelists placed fewer markers in the second round, whereas about 40% placed more markers.

There were no statistically significant differences in age between the panelists and self-selected public (t-test, $p > .05$), and no statistically significant associations between level of formal education, general reason for visiting parks, or self-reported knowledge of parks in the region (chi-square tests, $p > .05$). The online panel reported somewhat lower income levels than the volunteer public (47.9% of panelists reported income of $\leq$60 K compared with 26% of self-selected public). The only difference between panelists and self-selected public potentially related to mapping effort was the number of times the participant had visited national parks in the region in the previous year. Panelists averaged five visits compared with a mean of eight for self-selected participants. However, there was no significant correlation ($p > .05$) between the number of times visited in the past year and the total number of markers placed.

Discussion

PPGIS surveys are a relatively new specialization with the first Internet-based survey being completed in 2006 (Beverly et al., 2008). The emergence of this new type of survey that places higher cognitive demands on participants comes at a time when general survey response rates are in decline. With the upper end of Internet-based household PPGIS surveys' response rates are ~20%, and recent studies reporting even lower response rates (Brown, Montag, & Lyon, 2011; Pocewicz et al., in press), it is inevitable that survey sponsors would trial alternatives such as online panels to increase PPGIS participation. As a recent AAPOR task force concluded, "increasing nonresponse in traditional methods, rising costs and shrinking budgets, dramatic increases in internet penetration, the opportunities in questionnaire design on the Web, and the lower cost and shorter cycle times of online surveys—continue to increase pressure on all segments of the survey industry to adopt online research methods" (Baker et al., 2010).

Although online mapping technology offers clear advantages over mail-based PPGIS surveys, lower response rates and mapping effort, sampling approaches, and PPGIS designs that increase participation rates and mapping effort will be essential to advance PPGIS survey methods.

PPGIS responses from online panelists indicate less mapping effort resulting in lower quality PPGIS data than obtained with random household sampling, on-site site sampling, or self-selected public sampling. We attribute this outcome to panelist satisficing due to lower motivation levels. The cognitive demands of the PPGIS mapping activity may amplify the satisficing effect. A repeat of the PPGIS survey with the same panelists to improve mapping results had the opposite effect; there was less mapping effort with a higher refusal rate and fewer overall markers placed suggesting lower motivation. A potentially confounding variable—level of familiarity with the study region—was also examined. Other PPGIS surveys have reported that familiarity with the study area positively influences mapping effort (Brown & Reed, 2009) but there was no significant difference in self-reported familiarity between online panelists and the self-selected sample. Further, there was no observed relationship between the number of park visits and total number of markers placed.

Because nonprobability samples are generally less accurate than probability samples, there should be compelling evidence that online panels offer advantages over household-based probability samples. While caution is warranted for overreaching conclusions based on a single trial of an online panel, our results are not encouraging. The survey cycle is shorter using an online panel but PPGIS surveys are generally not time critical as the survey data normally feeds into an extended planning process. The potential cost advantage of using an online panel was not clearly evident in this study. Based on the participation rates, the cost per completion using the online panel was approximately $42. The recruitment costs using a random household sampling design would compare favorably with this result while providing the possibility for population estimation. The cost of using an online panel does, however, compare favorably with the cost of on-site recruitment for PPGIS surveys involving geographically dispersed sampling locations unless the recruitment effort could be implemented using park volunteers.

The use of online PPGIS surveys is likely to increase and self-selected sampling will continue to be a sampling option. But government and NGO-sponsored PPGIS research must be credible if it is to influence policy, and toward that end, the production of high quality spatial data is of paramount importance. Although this study used a large, reputable panel, there are significant differences in the composition and practices of individual panels that can affect survey results. Additional panel trials for PPGIS survey research would be beneficial; especially those that can meaningfully address motivational factors, perhaps through increased incentives or more targeted screening questions that better identify cognitive or emotional connection of potential panelists to the PPGIS subject content. Although an emotive connection to the PPGIS study area is not essential for PPGIS survey participation, it is a distinguishing feature of the PPGIS survey research that can be leveraged in recruitment methods.

Participant satisficing in PPGIS surveys is an area of future research that would benefit from experimental design. Satisficing behavior is more likely when there are not clearly communicated and understood expectations of participant mapping behavior. The majority of PPGIS surveys currently provide wide latitude for participant mapping given the highly variable spatial attributes being solicited. There are a number of possible experiments in both PPGIS survey design and instruction to decrease satisficing behavior: displaying a finite rather than unlimited number of PPGIS markers; instructing participants to map a specific (and potentially variable) number of markers; automated prompts to encourage additional mapping effort; positive reinforcement for markers placed; disallowing markers to be placed outside the study boundaries or at an inappropriate scale; and real-time dashboards displaying the number of markers placed compared with other participants in the survey.

One of the challenges for PPGIS survey research, however, is that optimal response behavior is likely to be unknown for a given application. Encouraging additional mapping beyond participant capacity could result in spurious and random mapping of attributes and may pose a greater threat to research validity than satisficing. Controlling and guiding participant mapping effort is a delicate dance in which researchers are just beginning to learn the steps. Given that PPGIS survey research will increase with the proliferation of internet mapping applications, a significant investment in PPGIS survey methods appears warranted.

References

American Association for Public Opinion Research (AAPOR). (2011). *Standard definitions: final dispositions of case codes and outcome rates for surveys* (7th edn) AAPOR. Retrieved from: http://www.aapor.org/AM/Template.cfm?Section=Standard_Definitions2&Template=/CM/ContentDisplay.cfm&ContentID=3156.

Baker, R., Blumberg, S., Brick, J.M., Couper, M., Courtright, M., Dennis, J.M., & Zahs, D. (2010). Research synthesis: AAPOR report on online panels. *Public Opinion Quarterly, 74*, 711–781.

Beverly, J., Uto, K., Wilkes, J., & Bothwell, P. (2008). Assessing spatial attributes of forest landscape values: An internet-based participatory mapping approach. *Canadian Journal of Forest Research, 38*, 289–303.

Brown, G. (2005). Mapping spatial attributes in survey research for natural resource management: methods and applications. *Society & Natural Resources, 18*, 1–23.

Brown, G., & Reed, P. (2009). Public participation GIS: A new method for national forest planning. *Forest Science, 55*, 166–182.

Brown, G., & Weber, D. (2011). Public participation GIS: A new method for use in national park planning. *Landscape and Urban Planning, 102*, 1–15.

Brown, G., & Weber, D. (2011). Using Public Participation GIS (PPGIS) on the Geoweb to monitor tourism development preferences. Unpublished manuscript.

Brown, G., Montag, J., & Lyon, K. (2011). Public Participation GIS: A method for identifying ecosystem services, society & natural resources, doi:10.1080/08941920.2011.621511.

Callegaro, M., & DiSogra, C. (2008). Computing response metrics for online panels. *Public Opinion Quarterly, 72*, 1008–1032.

Cook, C., Heath, F., & Thompson, R.L. (2000). A meta-analysis of response rates in web- or internet-based surveys. *Educational and Psychological Measurement, 60*, 821–826.

Couper, M.P. (2000). Web surveys: A review of issues and approaches. *Public Opinion Quarterly, 64*, 464–494.

Curtin, R., Presser, S., & Singer, E. (2005). Changes in telephone survey nonresponse over the past quarter century. *Public Opinion Quarterly, 69*, 87–98.

de Leeuw, E., & de Heer, W. (2002). Trends in household survey nonresponse: A longitudinal and international comparison. In R.M. Groves, D. A. Dillman, J.L. Eltinge & J.A. Roderick (Eds.), *Survey nonresponse* (pp. 41–54). New York: Wiley.

Dunn, C. (2007). Participatory GIS – a people's GIS? *Progress in Human Geography, 31*, 616–637.

Hansen, K. (2006). The effects of incentives, interview length, and interviewer characteristics on response rates in a CATI-study. *International Journal of Public Opinion, 19*, 112–121.

Kaminska, O., McCutcheon, A., & Billiet, J. (2010). Satisficing among reluctant respondents in a cross-national context. *Public Opinion Quarterly, 74*, 956–984.

Krosnick, J.A. (1991). Response strategies for coping with the cognitive demands of attitude measures in surveys. *Applied Cognitive Psychology, 5*, 213–236.

Pocewicz, A., Schnitzer, R., & Nielsen-Pincus, M. (2010). *The social geography of southern Wyoming: Important places, development, and natural resource management* (The Nature Conservancy, Lander, WY, pp 16). Retrieved from http://www.nature.org/wyoscience.

Pocewicz, A., Nielsen-Pincus, M., Brown, G., & Schnitzer, R. (in press) An evaluation of internet versus paper-based methods for Public Participation Geographic Information Systems (PPGIS) *Transactions in GIS*, in press.

Sawicki, D., & Peterman, D.R. (2002). Surveying the extent of PPGIS practice in the United States. In W.J. Craig, T.M. Harris & D. Weiner (Eds.), *Community participation and geographic information systems* (pp. 17–36). London: Taylor & Francis.

Sieber, R. (2006). Public Participation Geographic Information Systems: A literature review and framework. *Annals of the Association of American Geographers, 96*, 491–507.

Biographical Notes

Greg Brown is an Associate Professor of Environmental Planning, School of Geography, Planning and Environmental Management, University of Queensland and Research Associate, Geography Department, Central Washington University.

Delene Weber is a Senior Lecturer, Barbara Hardy Institute, University of South Australia.

Dino Zanon is a Team Leader Visitor Research and Development at Parks Victoria.

Kelly de Bie is a Visitor Research Project Officer at Parks Victoria.