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The Use of Factorial Surveys in Leisure Research

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Abstract

Since the foundational work of Rossi and Nock (1982), researchers have utilized factorial surveys to evaluate judgment and decision-making in a variety of subfields within sociology, psychology, law, and medicine. Despite the value of this approach to test hypotheses through quasi-experimental design using survey formats, its well-established presence in transdisciplinary literature, and its effective use across many contexts, factorial surveys remain relatively under utilized by leisure researchers. However, factorial surveys provide a useful way to evaluate a variety of judgment and decision-making-related leisure research problems. This paper introduces associated uses, concepts and techniques, strengths and limitations of the design, and considers its application in leisure research.

KEYWORDS: Factorial Survey Approach, Survey Research, Judgment and Decision-Making

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Investigators have used factorial survey approaches (FSA) in leisure research to predict decision-making in naturalistic outdoor recreation and education environments (Galloway, 2007; Shooter, Paisley, & Sibthorp, 2009), to determine preferred resource management strategies at outdoor recreation sites (Oh & Ditton, 2006), to identify ideal leadership characteristics of youth camp leaders (Ward & Ellis, 2008), and to determine the conditions that promote loyalty to community recreation centers (Haas, Ellis, & Wells, 2009). These studies exemplify the types of projects that can benefit from utilizing a factorial survey method. The common theme among these studies is that the authors tested the influence of specific predictors on decision-making by using a research method that combines features of experimental design with traditional survey research (Dulmer, 2007; Herzog, 2003; Ludwick & Zeller, 2001). Likewise, each of these studies would have faced insurmountable challenges to conducting actual field-based experiments or else the theoretical development of the phenomenon of interest was not developed to the degree that the researchers were prepared to launch a full-scale, field-based experiment. Therefore, they relied on FSA.

Leisure researchers who wish to pursue questions that are difficult to investigate through field-based experiments for logistical, practical, financial, risk-based, and ethical reasons, among others, might consider the value of the factorial survey approach (Thurman, Lam, & Rossi, 1988). Such challenges to the ability to conduct empirical, experimental research as those listed above remain an impediment to the advancement of the field because many important problems and phenomena remain unexplored or underexplored due to the difficulties associated with study design and implementation. Therefore, this paper will provide examples of studies within the leisure research that have made use of factorial survey approaches to overcome many of the challenges listed above; will consider closely related types of factorial survey designs; and will introduce issues and recommendations related to the design and implementation of factorial surveys in leisure research.

Factorial surveys allow researchers to explore the significant correlates between the factors believed to influence decision-making, the antecedent characteristics of the respondent, and the decisions of interest (Jasso, 2006; Wallander, 2009). Factorial surveys capture real life decision-making by providing opportunities for people to express their values, beliefs, attitudes, and opinions as they evaluate and judge specific sets of circumstances (Rossi & Anderson, 1982; Taylor, 2006). Such sets of circumstances are constructed in response to theoretically derived, empirically driven questions about what is believed to influence the decision of interest.

Practically speaking, FSA utilizes survey research methodology to determine the impact of predictor variables on one or more dependent variables by having respondents read and respond to written scenarios. The scenarios, or vignettes, communicate realistic but hypothetical situations (Ludwick, O'Toole, O'Toole, & Webster, 1999; Rossi & Nock, 1982; Taylor, 2006). Each vignette contains a number of factors that most often vary within and between vignettes (Dulmer, 2007; Sniderman & Grob, 1996). Through the vignettes, which are the units of analysis, a variety of realistic situations are created to which participants respond. The responses are most commonly measured as normative judgments, beliefs, attitudes, and/or intentions (Wallander, 2009).

Each vignette consists of three elements: the factors and dimensions, the textual framework, and the rating task (Dulmer, 2007; Sniderman & Grob, 1996). Taken in turn, each element forms a critical and integral component of the method. The factors and dimensions chosen for a particular study represent the independent variables of interest (e.g., difficulty of whitewater river) and their levels (e.g., international scale of river difficulty I-V) pertaining to the unique application within the vignettes. These factors and their dimensions are presented in paragraph form, with the text aiding in the overall ecological validity of the vignette. In this case, the term ecological validity is being used to indicate that vignettes represent highly realistic, although hypothetical, scenarios. For example, consider the following text from a vignette: "Your friends want to travel three days to paddle an incredible Grade IV river." In this example, friends, three day, incredible, and Grade IV could each represent specific levels of the independent variables: Social group, travel time, reputation of the river, and difficulty of the river, respectively. The rating task might then be: How likely would you be to participate (with responses ranging on a Likert-type scale). The rating task operationalizes the dependent variable(s) and may be represented in a single item or a multi-item measure. Multi-item measures may be preferred as single item measures are considered less reliable (Gliem & Gliem, 2003).

There are a several types of related methods that could be grouped under the title factorial survey approaches. While each of these methods has their own strengths and applications, the randomized factorial survey approach strengthens traditional survey research with the inclusion of a balanced multivariate quasi-experimental design that is administered using survey procedures (Hox, Kreft, & Hermkens, 1991; Rossi & Nock, 1982). The following sections will explain this in greater detail, but first a brief explanation of closely related factorial survey methods is provided.

Factorial Survey Designs

One of the key distinctions among types of factorial survey design is how the factors (independent variables) are selected and displayed in the surveys. Full factorial designs utilize all of the possible independent variables and their varied levels (Kirk, 1982). Since a full factorial design involves displaying all of the possible combinations of independent variables to each respondent, this option might be a good choice if the researcher is interested in displaying only a few independent variables with limited levels. This offers the researcher an opportunity to engage with a high degree of ecological validity (Karren & Barringer, 2002) and reliability (Dulmer, 2007), but is limited by the inclusion of only one or two independent variables.

Fractional factorial designs include a fraction of the independent variables by either holding selected independent variables constant within the vignettes, or by presenting subsets of the independent variables. The introduction of this technique was reported by Kirk (1982) to be an advance of the full factorial design because it allowed the researcher to expand the number and levels of independent variables by systematically sampling from the pool of potential independent variables. The pool of potential independent variables is referred to as the factorial universe in the FSA literature (Dulmer, 2007). The fractional factorial approach samples a fraction of the factors from the factorial universe, constructs one set of vignettes, and then presents that same specified set of vignettes to each respondent (Dulmer, 2007). Haas et al. (2009) and Ward and Ellis (2008) are examples of authors who have applied this method within leisure research studies. According to Ward and Ellis, this design is good for testing main effects, but faces challenges if the goal is to test interaction terms. The strengths of the fractional factorial design include ease of use and a parsimonious approach that provides orthogonality among the predictor variables, which allows for interpretation of the influence of each predictor relative to the others.

Conjoint analysis could also be considered as a type of fractional factorial survey approach because it bears similar characteristics (Dulmer, 2007). Green and Srinivasan (1978) clarified that conjoint analysis is closely related to vignette based factorial survey studies that model clinical judgments (e.g., Ludwick & Zeller, 2001; Ludwick et al., 2004) because both of these designs display multiple attributes and ask participants to respond to variations among the attributes. Conjoint analysis differs from factorial surveys in that its focus is directly associated with the study of marketing strategies and consumer preferences rather than the broad social and psychological focus of factorial surveys (Green & Srinivasan, 1990). Besides this distinction in foci, conjoint analysis has operational differences that can include the use of rank ordering and/or paired comparisons of products and attributes and less emphasis on the construction of textual narratives (vignettes) that are meant to display realistic scenarios found in factorial surveys (Aiken & Koch, 2009; Dulmer, 2007; Green & Srinivasan, 1990; Taylor, 2006). Conjoint analysis is popular with marketing researchers and has been used in recreation (Won, Hwang, & Kleiger, 2009), sport (Aiken & Koch, 2009), and tourism (Won & Sunhwen, 2009) applications as well.

Dulmer (2007) noted that two types of factorial approaches appear in the literature and he distinguished between these two types as *quota designs* and *random designs*. Both fractional factorial surveys and conjoint analysis are quota designs in which researchers systematically draw one sample of factors from the factorial universe and then display the identical sets of factors to each respondent. This is a notable difference from random designs in which factors are selected randomly and then displayed in such a way that unique sets of vignettes are created and then judged by respondents (Dulmer, 2007). In quota designs each participant responds to the same sets of vignettes, but in random designs each participant receives unique sets of vignettes in which the factors are randomly sampled from the factorial universe. This is a central distinction between the two approaches.

The random assignment of the independent variables is commonly what authors refer to as the *factorial survey approach* (FSA), and is the most recognizable type of factorial survey design (e.g., Dulmer, 2007; Hox et al., 1991; Jasso, 2006; Taylor, 2006; Wallander, 2009). In fact, Dulmer observed that, "Most introductions into vignette analysis [factorial surveys] only advise drawing random samples" (p. 383). This approach has several noteworthy benefits. It offers increased internal validity achieved through the independence and random variance of predictor variables (factors) within sets of unique vignettes which amounts to the possibility of a more representative sample than quota designs (Dulmer, 2007; Ludwick et al., 2004). Hence, "Quota designs are seen generally as less valid than random designs" (Dulmer, 2007, p. 405). Similar to quota designs, the randomly generated factors are orthogonal, but in contrast, they can produce large enough numbers to allow for equal probability that all levels (dimensions) of each independent predictor will be included (Dulmer, 2007; Ludwick et al., 2004). An additional benefit is that randomized factorial surveys allow the researcher to test for interaction effects (Ganong & Coleman, 2006; Wallander, 2009).

Factorial survey designs have the ability to produce large numbers of observations from a limited number of participants as an additional strength. For example, Furman, Shooter, and Schumann (2010) surveyed 266 skiers, but since each of those skiers responded to six vignettes, and the vignette is the unit of analysis, there were 1596 scores on the dependent variable. Ganong and Coleman (2006) cited this as a feature that bolsters external validity. In sum, the central strength of the factorial survey approach is its ability to combine the benefits of multivariate quasi-experimental design with the relative convenience and ease of use associated with conducting survey research (Herzog, 2003; Ludwick et al., 1999).

Factorial Surveys in Multidisciplinary Research

Factorial surveys are used to study decision-making and some sociologists have described the study of decision-making as conceptualized in three types: 1) norm-based studies that investigate how decisions should be made from the perspective of a rational actor (normative judgments); 2) descriptive studies which examine how professionals make decisions in real world practice (positive beliefs); and 3) research into attitudes and/or intentions that explore decision-making with the goal of developing decision aids or other technology that assists the actor addressing the situation (Jasso, 2006; Taylor, 2006). While Taylor's work focused on the second type of decision-making studies as they related to social work, Jasso (2006) focused on the use of factorial surveys to investigate a range of normative judgments and positive beliefs within sociology studies.

Factorial surveys provide opportunities to study problems in which critical decisions must be made. Hence, researchers have used the FSA extensively to assess professional judgment and decision-making in fields such as nursing (Ludwick & Zeller, 2001) and social work (Taylor, 2006). For example, studies within the nursing literature have examined clinical judgments and decision-making by presenting nurses with situations common to their profession and then asking them how they would respond given a specific set of ecologically valid conditions (e.g. Ludwick & Zeller, 2001; Ludwick et al., 2004).

Wallander (2009) reviewed the past 25 years of factorial survey work in sociology. She concluded that FSA provides a viable method for studying human judgments of diverse situations and suggested that sociology researchers would benefit from focusing greater attention toward this technique. Ten years before Wallander's review, Sniderman and Grob (1996) regarded FSA as a revolutionary method for use in public opinion polls, which have now become a major context area represented within the factorial survey literature. Sniderman and Grob explained that FSA advanced traditional survey research by introducing a randomized experimental feature within the vignettes.

Multidisciplinary studies have established a foundation for the use of factorial surveys in leisure research by utilizing FSA to examine attitudes and intentions and to determine the potential influence of various conditions on decisions made by a range of participants (e.g., Wallander, 2009). The following section will review studies within leisure research that have depended upon this foundation and will consider the type of studies that might take advantage of this research method.

Factorial Surveys in Leisure Research

Literature

The number of recent FSA studies suggests that leisure researchers are taking notice of the method. Contexts of such studies include decision-making in outdoor leadership (Galloway, 2007; Shooter et al., 2009) outdoor recreation (Furman et al., 2010; Oh & Ditton, 2006), organized camping (Ward & Ellis, 2008) and recreation centers (Haas et al., 2009). This brief review provides examples of factorial survey approaches within leisure research and reveals the potential usefulness and value of these designs across leisure settings.

Although there are some fundamental differences among the designs, each of these studies depended upon factorial surveys as a common method. For example, Galloway (2007) utilized FSA to study the medical decisions made by outdoor leaders. Outdoor leaders read a number of hypothetical conditions that described an injured participant on a wilderness course and asked them to indicate how they would respond. Each leader read and responded to 20 vignettes that included four principal independent variables, each of which varied in multiple levels. Shooter et al. (2009) tested a set of factors believed to influence participants' trust in outdoor leaders. They displayed five dichotomous leader attributes and measured to what extent participants of an outdoor program trusted the leader in a variety of scenarios. Furman and his colleagues (2010) tested forecasted avalanche conditions and a set of heuristic factors that reportedly influence decision-making in avalanche terrain by presenting a number of scenarios and asking participants to rate the likelihood that they would ski a slope under varied conditions. Ward and Ellis (2008) utilized a fractional factorial design to explore the optimal leadership characteristics of Boy Scout leaders within the context of a Boy Scout camp. Haas et al. (2009) surveyed participants in a sample of municipal recreation centers to determine what factors were most likely to promote loyalty to recreation agencies. Finally, Oh and Ditton (2006) explored the interrelationships of outdoor recreation specialization and recreation site management options. These examples reveal the range of applications for this research design.

Application

In some cases, leisure researchers may find that even though there is adequate conceptual and theoretical support to suggest the use of an experimental design, some experiments defy field-based implementation. Examples of such circumstances include matters of safety, ethics or insurmountable logistical challenges (Ganong & Coleman, 2006; Ludwick et al., 2004). Factorial survey approaches can provide researchers with a way to study previously restricted research questions using a quasi-experimental design in situations that may not allow for a full scale, field-based experiment (Ganong & Coleman, 2006; Ludwick et al., 2004). Examples of this can be found in leisure research studies reviewed above. Where it was unreasonable to conduct an actual field-based experiment enacting various organization wide treatment conditions within recreation centers, Haas et al. (2009) relied on FSA as a means to determine if a set of theoretically derived factors could predict loyalty. This example demonstrates how FSA can be used to gather information in recreation or other contexts without committing the resources required to conduct a field-based experiment. Likewise, due to issues of safety, ethics, and practicality it was not possible for Furman et al. (2010) to conduct a field-based experiment of the factors believed to be complicit in avalanche decision-making, and FSA offered a suitable alternative.

Another potential application of FSA is in the evaluation of outdoor recreation education programs. A number of organizations teach individuals how to make good decisions in outdoor settings (e.g., avalanche education providers, wilderness medicine providers, outdoor leadership educators). Factorial surveys can be used as an evaluation tool to confirm if participants have in fact gained the level of competence needed to identify, judge, and respond to factors that could impact the safety and health of participants. For example, avalanche education providers teach frameworks for evaluating avalanche hazard. These frameworks are utilized by recreational backcountry skiers to make decisions regarding snow stability and whether or not they should travel in avalanche terrain (McCammon & Hageli, 2005). An avalanche education provider can design vignettes within a factorial survey that display the context specific aspects of the decision making framework and ask course participants to read the vignettes and indicate the likelihood that they would travel in avalanche terrain. This allows administrators to evaluate participants' ability to identify key factors for decision-making, as well as whether or not they can make good decisions based on the presentation of the factors within the vignettes.

Factorial Survey Design and Analysis

The validity of the factorial survey approach is dependent upon construction of the vignettes themselves (Rossi & Nock, 1982). A central task of constructing the vignettes within the factorial surveys is deciding which predictor variables (factors) to include in the vignettes. Formal theories, models, previous research, and practical problems of action research may each contribute to choosing which factors are most important for each unique study (Jasso, 2006). For example, Haas et al. (2009) selected their predictor variables in response to recommendations grounded in social exchange theory as they were presented by Searle (1991).

If there are only a limited number of factors of interest, the researcher may consider constructing the vignettes in such a way that all of the possible combinations of factors are displayed in the vignettes (full factorial design). For example, if there are three factors of interest, each with two levels (dimensions), then the design of $2 \times 2 \times 2$ would require 8 total vignettes in order to display every possible combination of the theoretically derived predictive factors (Dulmer, 2007; Wallander, 2009). Clearly this approach has the potential for a high degree of predictive validity (Green & Srinivasan, 1978), but rarely are there so few factors of interest.

If the design involves a larger number of factors, and therefore a larger factorial universe, then such an approach becomes unrealistic because adding just one factor to the example above doubles the number of vignettes (16) needed to represent the factorial vignette universe (2x2x2x2). Since the later example of having numerous factors of interest is most often the case, a decision must be made by the researcher regarding how she will sample from the factorial vignette universe. At this point, the researcher has two choices; she can present a designated fraction of the factors (fractional factorial design) or she can draw a series of random samples from the factorial universe (random factorial design). The latter option strengthens the design through the process of randomization associated with traditional experiments by randomly manipulating the factors that are presented in the vignettes (Dulmer, 2007; Ganong & Coleman, 2006; Ludwick et al., 2004; Sniderman & Grob, 1996). Hence, this paper focuses primarily on the potential of the randomized factorial survey approach as a preferred solution to the question of sampling from the factorial universe.

With the sampling method clarified, the total number of factors selected for inclusion in the vignettes should now be considered carefully as this can effect the reliability and validity of the survey. Respondents will read and rate multiple vignettes and each factor adds length and complexity to the vignettes. Dulmer (2007) noted that reliability and validity can be compromised if there are too many predictor variables included in the vignettes. The likelihood of respondent fatigue, which can lower reliability and validity, can be increased if the vignettes are too long and cumbersome. In Wallander's (2009) review of the factorial survey literature, the number of factors in 92 studies ranged between two and 25 with a median of six. This is consistent with Taylor's (2006) conclusion that most FSA studies included a range of five to ten predictor variables. Ludwick et al. (2004) suggested that up to 15 independent variables are possible. However, one noted weakness of the Galloway (2007) study was the inclusion of too many factors (N= 21).

Researchers should recognize that participants are essentially being asked to read the vignettes, recognize the important information therein, and remember that information when determining and indicating responses. This task of both recalling and processing information from the vignettes is subject to the limitations of short-term and working memory (Dehn, 2008; Taylor, 2006). Due to the level of complexity involved, the recommendations from previous studies (e.g., Galloway, 2007; Wallander, 2009), and the known limitations of short-term and working memory, the authors of this paper suggest no more than seven, plus or minus two, factors per vignette. This recommendation is consistent with the commonly held understanding that the short-term memory can store approximately 7 items at one time (Krause, Bochner, Duchesne, & McMaugh, 2010) and is consistent with the current approach taken by most researchers (Taylor, 2006; Wallander, 2009).

Length of the overall survey might also be worthy of consideration when determining the number of vignettes. Ludwick and Zeller (2001) claimed that up to 30 vignettes could be administered in one survey. However, unless the vignettes are overly simplistic and have only few independent variables, researchers might consider the fatigue and attentional capacity of the respondents. If too many vignettes are included, validity may be compromised (Karren & Barringer, 2002). There is no known formula for calculating an acceptable number of vignettes and researchers are encouraged to balance desired sample size with sound theoretical reasoning.

Various forms of multiple regression are the standard means of analyzing factorial survey data (Ludwick et al, 2004; Taylor, 2006). Of 106 articles reviewed by Wallander (2009), 77 used linear regression to analyze the data. The design and analysis combination allows the researcher to predict, and through the independence of randomly selected orthogonal factors, researchers can interpret the standardized beta coefficients in order to determine the contribution of each statistically significant factor relative to the others in a given model (Karren & Barringer, 2002). It is this feature of having independent, randomly sampled and manipulated predictor variables within a survey design that is a distinctive feature of FSA. This allows researchers to infer causal relationships, is what makes it unique from other survey designs, and is what determines the experimental nature of FSA (Ludwick et al., 2004; Sniderman & Grob 1996; Taylor, 2006). Taylor (2006) clarified this point by explaining that "It is possible to infer a causal explanation (i.e. that the factors actually cause the change in the decision, rather than merely being associated with it by 'accident') because the factors in the vignette are virtually independent" (p. 1196). Therefore, FSA is a good choice for researchers who want to understand the effect of specific factors on decisions (Ludwick et al., 2004).

It is noteworthy that a number of authors refer to FSA as an experimental design (Dulmer, 2007; Haas et al., 2009) and others as a quasi-experimental design (Wallander, 2009). FSA is described as a hybrid technique that combines features of experimental and survey designs (Ludwick et al., 2004). Therefore, for the purpose of the present paper, the authors have chosen to introduce FSA as a quasi-experimental approach. While the factors can be sampled and manipulated randomly, the actual respondents may be selected from a variety of sampling techniques and the experimental condition is limited by its hypothetical nature.

The emergence of multilevel modeling and related analysis has increased the potential usefulness of factorial surveys by allowing researchers to collect and analyze data at more than one level simultaneously (Hox et al., 1991). For example, in a two-level model, a researcher can collect and analyze data at both the participant level and the vignette level (e.g., Galloway, 2007; Furman et al., 2010; Shooter et al., 2009). This type of design can be used to account for the influence of demographic variables and/or other personal level variables along with the responses to the vignettes in one model. Here the researcher would test the effectiveness of a model that includes the influence of the individuals' unique characteristics or traits and their responses to the vignettes. Likewise, a three level model might also include the group within which an individual is a participant (Russell & Sibthorp, 2004). Options for software packages that compute such multilevel models are SPSS (starting at version 11) or the Hierarchical Linear Modeling (HLM) software based on the work of Raudenbush and Bryk (2002), available through Scientific Software International (SSI).

The limitations related to implementation of factorial surveys are worthy of consideration. Chief among these is that once generated, the vignettes offer a simulation or an approximation of the real life situation under study and participants respond only to the information provided therein (Karren & Barringer, 2002). There is a risk of carryover effect as respondents read one vignette, they might be influenced by the vignettes that they just read (Sniderman & Grob, 1996). Since independent variables and their varied levels are typically presented in single phrases within the vignettes, the ability to capture full operational definitions is often limited. Therefore, researchers are advised to take care insuring that the vignettes do in fact present combinations of independent variables that together establish realistic situations and operationalize construct definitions as accurately and completely as possible (Karren & Barringer, 2002). It is important to note that the vignettes establish scenarios that communicate manipulated images of the object of interest and may be interpreted differently by different respondents. While that may be true, Rossi and Anderson (1982) emphasized that each individual is responding from the underlying principles that guide their judgment in consistent ways. They maintained that respondents seem to follow reliable patterns in their responses. Finally, the randomization of the independent variables strengthens the internal validity, but the external validity can be compromised by choices regarding sampling approaches.

Conclusion

The purpose of this paper is to familiarize the reader with factorial survey approaches and how they relate to leisure research. In this article we offered perspectives on the conceptualization of this method, as well as a brief history of its use in the social and medical sciences. Furthermore, we believe that the FSA method can provide leisure researchers with a much-needed advantage in terms of answering questions through quasi-experimental design, which have heretofore been problematic due to elements of safety, ethics, and logistics that prevented researchers from conducting field-based experiments. Foremost among the advantages of the FSA method are its versatility of design, applicability to a wide range of contexts related to judgment and decision-making, potential ease of administering, randomized sampling of predictor variables, and the potential to use multilevel models to analyze the data. While certainly not without its limitations, the use of factorial surveys within leisure research may yield noteworthy advantages due to its quasi-experimental design modification of the traditional survey approach.

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