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Research Design and Tools for Internet Research

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Pre-publication copy, 2016

Abstract

This chapter provides an overview of the tools and techniques available for gathering primary research data using the Internet. Both obtrusive (surveys, experiments, interviews, observation) and unobtrusive (observation, document analysis) methods are considered. Emphasis is on elucidating the range of design choices available, offering general principles of good design practice, and considering how design decisions should be made in relation to the aims and goals of a research study. Choices between offline and online implementations are considered, as well as decisions concerning the particular procedures to adopt online. The chapter raises a range of issues, including levels of sample bias and sampling techniques online, levels of control in implementing primary Internet research procedures, effects of the online communication medium, and ethical considerations. These are considered within a design framework, focusing on how to maximize the trustworthiness, reliability, and validity of Internet-based primary research studies.

INTRODUCTION

This chapter provides an overview of tools and techniques for conducting Internet-based research, within a framework which considers the design issues and choices which emerge. Focus is on *primary* Internet research procedures, referred to as *Internet-mediated research (IMR)* (Hewson et al., 2003). Internet-mediated research involves the gathering of novel, original data to be subjected to analysis in order to

provide new evidence in relation to a particular research question (Hewson et al., 2003). From around the mid-1990s when pioneers started piloting online data-collection methods, the field of IMR has grown considerably, expanding across a diverse range of academic disciplines as more and more researchers, students and professionals have started to make use of these techniques. Certain methods have now become relatively well-established, such as the web-based survey, whilst others are emerging and under development (such as data scraping and 'big data' approaches). The emergence of software tools for assisting in the design and deployment of IMR studies has facilitated developments over the last decade or so; for example there now exists a large selection of software packages for creating and disseminating web-based surveys. Such tools, as well as ongoing developments in relevant Internet technologies, have rendered many of the earlier programming guides (e.g. Göritz and Birnbaum, 2005; Hewson et al., 2003) now redundant in many IMR contexts. The current popularity of IMR methods is attested by the range of recent texts on the topic (see the 'further reading' list), as well as the range of journal articles reporting studies which have used Internet-based data collection methods (as cited throughout this chapter). Methodological reflections and evaluations, and design and implementation guides (e.g. Reips, 2010; Hewson et al., 2016), are now prevalent, across a range of IMR methods and research contexts. Also, there now exist various resources and organisations which offer dedicated information on IMR methods, often available online (and, also, in a consultancy capacity), as well as regular conferences and workshops on IMR methods. See Table 1 for a selection of these.

TABLE 1: IMR-dedicated resources, information, and meetings

Association of Internet Researchers (AoIR: aoir.org)

GESIS (www.gesis.org/en/services/study-planning/online-surveys)

General Online Research (GoR: www.gor.de)

Online Research Methods (ORM: www.restore.ac.uk/orm)

WebDataNet (http://webdatanet.cbs.dk/)

Thus, there is now a wealth of information for researchers to draw upon in informing and directing IMR research design. Present focus is on design issues and solutions which emerge specifically within an IMR context (best practice guidelines for traditional offline methods are assumed here; useful guides include Bryman, 2012; Creswell, 2014)[1]. Surveys and questionnaires, experiments, interviews and focus groups, observation (including recently emerging 'data scraping' techniques), and document analysis are considered. The discussion is organised around the 'obtrusive-unobtrusive' dimension, which has been proposed as a useful way of classifying different IMR methods (Hewson et al., 2016), and key ethics considerations are highlighted where relevant (a more detailed consideration of ethics issues in IMR is provided in Chapter X, this volume).

DESIGN ISSUES AND TOOLS FOR INTERNET-MEDIATED RESEARCH

A key principle to keep in mind is that Internet-mediated research studies, like any other study, require careful planning, design, and piloting. However, given the widespread perception of Internet-based procedures as being able to quickly and cost-effectively generate large pools of data, and their particular appeal when time and cost constraints are high, there is a danger that researchers may be tempted to implement poorly designed studies. It is crucial for trustworthiness, reliability, and validity that researchers avoid this approach, and take time to properly explore the existing available guidelines, and to pilot procedures as extensively as possible before gathering data within the main phase of a research study (Reips and Krantz, 2010). Of course, given the relative novelty of many IMR procedures, problems will emerge, and lessons will need to be learned. However, as already noted, some methods have now become fairly well-established, and lessons learned from the earlier attempts have led to the development of more effective and well-tested solutions, techniques, and procedures. The present chapter considers what has been learned to date, outlining key design choices, caveats, and principles of best practice. First, some advantages and disadvantages of IMR approaches are highlighted (particularly compared with offline methods), with a focus

on relating these to research aims and goals, so that the reader can gain an impression of how IMR approaches might facilitate and enhance their own research. Then, design issues relating to specific obtrusive and unobtrusive IMR methods are considered, including an overview of the most common tools and resources to draw upon to implement the most common types of IMR study.

Advantages and disadvantages of IMR designs

Advantages

A number of advantages of IMR have now been well-established, many early speculations about potential benefits having been confirmed, across a broad range of studies reporting these outcomes. Key advantages include: cost- and time-efficiency; ready access to a potentially vast, geographically diverse participant pool; easier access to select, specialist populations. The latter may be especially helpful for qualitative approaches, whilst large samples sizes can be especially beneficial for quantitative research designs, conferring benefits such as enhanced statistical power (Musch and Reips, 2000). Cross-cultural research may be facilitated in IMR due to the broad geographical reach. Cost and time savings may be especially beneficial in situations where resources (funding, researcher time, research assistance) are sparse (e.g. Carter-Pokras et al., 2006).

Other potential benefits of online approaches relate to the nature of the online interactional medium – in particular, that interactions can emerge which are fairly elaborate in the richness of communication exchange, but where perceived (and actual) anonymity levels, and levels of perceived privacy, can be high. This feature is not easily achieved in offline contexts. This could benefit both quantitative and qualitative designs in a variety of ways, such as reducing social desirability effects, and promoting greater candour and higher levels of self-disclosure (Joinson and Payne, 2007), reducing biases resulting from the perception of biosocial attributes (Hewson et al., 1996), and balancing out power relationships between participants in online conversational contexts (Madge and O'Connor, 2002). Research on sensitive topics may particularly benefit from reduced social desirability and enhanced candour effects (e.g. Hessler et al., 2003), though it should also be noted that there is evidence that these effects may pertain only to visually anonymous contexts (Joinson, 2001).

Finally, IMR methods expand and enhance the scope for carrying out unobtrusive observational research, compared with offline methods, due to the readily accessible traces of online activity and interaction that users leave behind (e.g. Tonkin, Pfeiffer and Tourte, 2012). This confers benefits including easier access to topic-specific, naturalistic communication data, such as that retrieved from searchable online discussion group archives, and enhanced access to other forms of behavioral trace data, such as webpage navigations, Google searches, and social media friendship links.

Disadvantages

Several potential disadvantages in IMR have raised concerns amongst social and behavioral researchers, particularly in terms of how these may impact upon the reliability and validity (or 'trustworthiness') of IMR data. Key concerns have included the biased nature of the Internet User Population (IUP), and the implications of this for the generalizability of data derived from IMR studies (Schmidt, 1997); reduced levels of researcher control in IMR contexts, compared with offline methods, and implications for the reliability and validity of IMR studies (Hewson et al., 2003); possible negative effects emerging from the nature of the online communication medium, such as the introduction of ambiguities, misunderstandings, and superficiality into conversational exchanges (Davis et al., 2004). The latter issue is perhaps most relevant for qualitative research designs, such as in-depth interviews, whilst issues of sample bias and reduced control are likely to be more problematic for quantitative approaches. However, issues of reduced levels of researcher control may also be relevant to qualitative methods, such as online focus group interviews, which could suffer unexpected effects due to software and hardware failures, potentially causing problems for the running of a study. Despite the aforementioned concerns, a range of studies, across different disciplines and research areas, have now demonstrated that IMR procedures can generate valid, reliable data, comparable to that which can be achieved in offline research settings (as discussed below). This has led some researchers to argue that issues relating to sample representativeness, and levels of control, are not overly prohibitive for IMR (Hewson et al., 2016). Reports from qualitative researchers of having obtained high quality data, for example in online interview contexts (see later examples), suggest that neither is the nature of the online communication medium overly prohibitive for IMR.

Finally, demands on the levels of technical expertise required of researchers (or IT support teams), and equipment required, in order to implement IMR studies has been noted as a possible disadvantage (Hewson et al., 2003). However, recent developments have alleviated this concern to some extent, since there now exists a range of tools to assist in implementing IMR studies, such as online survey software packages.

Design issues in obtrusive Internet-mediated research

The main methods associated with obtrusive approaches in IMR are surveys (including questionnaires and psychometric test instruments), experiments, interviews and focus groups. In this section, tools and design considerations are outlined for these key methods. Researchers have also undertaken participant observation approaches online, particularly in the context of ethnographic research, which can be considered examples of obtrusive IMR; some examples are mentioned in the later section on observational IMR methods, alongside unobtrusive observational approaches.

Tools, procedures and design considerations in implementing online surveys, experiments, interviews and focus groups

Surveys

Surveys and questionnaires have been the most commonly implemented IMR methods to date. Their recent ubiquity has been facilitated by the emergence of a range of software solutions for implementation (see Table 2). These solutions allow researchers to construct *web-based surveys* (which involve placing an HTML web *form* on the world wide web) without requiring high levels of technical computing expertise. Consequently, web-based surveys have been used across a broad range of social and behavioural research disciplines, including psychology, sociology, marketing research, political science, geography, and economics. There now exist numerous guides, resources and tools to help researchers design and implement web-based surveys (see 'Further reading', and the resources offered in Tables 1 and 2).

TABLE 2: Software tools for IMR surveys and experiments

SurveyMonkey (www.surveymonkey.com)

Qualtrics (www.qualtrics.com)

Limesurvey (limesurvey.com)

WEBEXP (www.webexp.info)

WEXTOR (http://wextor.org/wextor/en)

Web-based surveys have a number of advantages over both traditional pen and paper methods, and alternative online survey methods, such as sending questions in the body of an e-mail message (which nevertheless may be useful in some contexts, e.g. see Bigelsen and Schupak, 2011). Firstly, they allow a far greater range of functions to be employed, which can serve to enhance reliability. These include features such as response completeness and format checking, answer piping, skip logic, and randomization. They can also enhance reliability by allowing tighter control over presentation parameters, compared with simple text-based e-mail approaches (the latter may lead to questions arriving misaligned, or in an undesired presentation format). This is an important consideration in designing an IMR survey or questionnaire, given that it has long been recognized by survey researchers that a range of presentation parameters, as well as different response formats, can affect participants' responses and lead to potential biases (and, in web-based survey approaches, it has been demonstrated that even minor variations in presentation format can influence participants' responses, e.g. Couper et al., 2004). Data security is also enhanced, compared with e-mail methods, which is an important ethical consideration in most research contexts. Responding to a web-based survey is also relatively straightforward for the participant, as long as they have a web browser and an active Internet connection. E-mail approaches can both require more effort, and allow participants to edit the content in undesirable ways (such as delete or edit questions), and this may cause unanticipated problems (see Hewson, 2003b).

Deciding which of the many software packages available will be most suitable for implementing a web-based survey requires some effort, and research. Reviews of these packages exist (e.g. Carter-Pokras, et al., 2006; Hewson, 2012), but these can become quickly dated (new packages are emerging all the time, and the features of existing ones are in a state of flux). Some websites (e.g. WebSM) offer regularly updated lists of

what is currently available, along with a summary of key features, which can be useful for browsing the available options initially, before narrowing down possible choices. However, researchers should also carefully check the home pages of the relevant software packages they are interested in, for completely up-to-date information. Different packages will serve different goals and design requirements, as well as budget and technical expertise constraints. Two very popular packages for social science researchers are SurveyMonkey (discussed by Hewson et al., 2016) and Qualtrics, both of which require a subscription fee (though SurveyMonkey also offers a limited-function free version). A freely available 'open source' option is Limesurvey. Open source software benefits from continual development via input from a community of active users (in addition to being free), but generally demands greater levels of technical expertise to manage and use (for example, typically requiring software to be installed and managed on the user's own server). Flexibility and robustness are both important desirable features when selecting web-based survey software (Crawford, 2002), and rigid, inflexible systems are likely to be problematic (some packages allow HTML code to be directly edited, for example, which can be particularly useful in expanding the range of presentation format options available).

The various guides on good practice in web-based survey design are invaluable, but researchers should keep in mind that trade-offs can emerge. For example, the use of cookies (small pieces of information stored on a local computer by a web server via a web browser) has been recommended for tracking participants so as to detect multiple submissions and thus enhance validity, but this practice also has been identified as problematic in relation to privacy issues in IMR (Hewson et al., 2016). Such conflicts will sometimes emerge, and decisions need to be made taking into account the demands, requirements and features of the particular research study, including key methodological and ethical considerations. For many survey designs, one of the available software packages will likely prove suitable for implementation. However, in some cases, bespoke systems may be necessary, for example where audio or video are incorporated, or very precise display configurations are necessary (Castro and Hyslop, 2013, offer a general programming guide). Bespoke options are more likely to be required for experimental designs, however, which are now discussed.

Experiments

Experiments on the Internet, like surveys, have typically been administered via the web, and the process is very similar, in that participants access a web page where the experimental materials reside, and undertake the experimental procedure by remote interaction with a web server, via their web browser. The key difference is that experimental designs are typically more complex and thus require the use of more sophisticated technical implementations, involving advanced programming techniques. In the early days of IMR, this meant that these methods were prohibitive for researchers who were not either accomplished programmers, or had access to dedicated technical support, since unlike web-based surveys the necessary programming skills often required to implement a web experiment design are not easy to quickly acquire. For example, features such as precise timings in stimulus displays, incorporating graphics and animations, randomly assigning participants to conditions, etc., may need to be incorporated in experimental designs, and require more sophisticated programming techniques and systems to implement (see Hewson et al., 2003; Schmidt, 2002). However, more recently, as with web-based surveys, a number of packages to assist in creating and disseminating web experiments have become available (see Table 2, and Rademacher and Lippke, 2007).

As with web-based surveys, there are many reasons why web-based approaches for IMR experiments are to be preferred, mainly relating to issues of enhanced control, validity, and reliability, as highlighted above. However, alternative approaches are possible, and may in some contexts be still useful. Hewson (1994), for example, reports implementing an IMR experiment using e-mail (Hewson, 2003b provides a case-study summary), by sending different experimental text-based materials to participants via their e-mail account, after first having posted participation requests to a selection of Usenet newsgroups. However, various unanticipated problems emerged, relating primarily to lack of researcher control, and unanticipated participant behaviours. Although these did not crucially undermine the findings in this particular case, such factors could prove detrimental. Web experiments are to be preferred, where this option is feasible, in most situations. Advantages of web-based approaches compared with traditional ftf laboratory experiments include some of the general advantages of IMR methods, including cost- and time-efficiency, facilitation of cross-cultural research, and potentially reduced social desirability effects.

The issue of reduced levels of control in IMR, and the potential problems this may give rise to (compared with offline ftf approaches, in particular), is especially pertinent for experimental designs, where tight control over variables (such as display parameters, participant behaviours, and so on) is crucial to ensure the validity of an experimental study. In IMR, technical issues, such as different hardware and software configurations, and network traffic performance, can lead to unintended variations in stimulus displays. These issues, along with unanticipated and unwanted participant behaviours (e.g. multi-tasking, collaborating with others, hacking into alternative experimental conditions, etc.), could imaginably lead to an entire study being invalidated. Software packages for web-based experiments which carefully adhere to good design principles and practices for IMR can be helpful in alleviating such concerns (e.g. Reips and Krantz, 2010). It is also encouraging that a number of researchers have now demonstrated that IMR experiments can lead to high quality, valid data, comparable with that achievable offline, including designs using audio and video (e.g. Knoll, Uther and Costall, 2011), and precise reaction time measures (e.g. Corley and Scheepers, 200), both previously thought to be problematic for IMR studies. Also, experiments involving interaction between two or more users have now also been successfully carried out (e.g. Horton, Rand and Zeckhause, 2011), though these may often require bespoke programming solutions, due to their greater technological complexity. For useful discussions of issues to consider in IMR experiment design, and suggested solutions, see Reips and Krantz (2010), Reips (2010), Hewson et al., (2016). A key issue concerns how to maximize levels of control, which is crucial for the internal validity of experimental designs[2].

Finally, and similarly to web-based surveys, trade-offs can emerge in web experiment design. For example, simple, low-tech implementations may be more accessible (for both participants and researcher), but are likely to suffer reliability and validity issues, whilst high-tech solutions can allow greater levels of control and functionality, but place greater demands on both the researcher's levels of expertise (or available technical support), and the resources and equipment required (by both researcher and participant). This can lead to necessary trade-offs, which must be assessed, and decisions made, taking into account the goals and requirements of the particular research study. A recommended strategy is to use the lowest-tech solution

possible which serves the study design requirements, and where more advanced systems are required, to alert participants in advance of any less common, necessary software and hardware requirements needed to participate (Hewson et al., 2016).

Interviews and focus groups

IMR interviews and focus groups may be carried out using either *synchronous* or *asynchronous* communication technologies. The former include Instant Messaging (IM) and Chat software, and the latter include email, mailing lists, and discussion forums. Whilst most online interviewers have used text-based approaches (e.g. email, discussion forums), multimedia applications can also be supported (e.g. using Skype). Table 3 lists some useful tools and resources for supporting IMR interviews and focus groups; for a more detailed discussion of the various tools available see Hewson et al. (2016). The issues involved in deciding which approach (synchronous or asynchronous, text-based or multimedia) to adopt concern the impact that these different approaches can have on the nature of the communication process, and the data obtained, and how this may interact with the research study goals and aims.

Table 3. Useful resources and tools for IMR interviews, observation, and document analysis

Mailing list software

LISTSERV (www.lsoft.com/products/listserv.asp)

PhpList (www.phplist.com)

Discussion forum software

Google groups (www.groups.google.com)

Yuku (www.yuku.com)

Instant messaging software

Apple's iMessage, for iphone and ipad

WhatsApp for smart phones (www.whatsapp.com/)

ICQ (‘I Seek You’: www.icq.com/en)

Chat software

‘mIRC’ for Windows (www.mirc.com/)

Google Talk (www.google.com/talk)

Skype (www.skype.com/en/)

Blogs, Social Networking Sites, Virtual Reality Environments

Blogger (blogger.com)

Twitter (twitter.com)

Facebook (facebook.com)

YouTube (youtube.com)

Second Life (secondlife.com)

Possible drawbacks of IMR interview methods, compared with traditional offline approaches, include potential ambiguities and misunderstandings which may arise in communicative exchanges, due to the lack of extralinguistic cues normally available in offline interactions. This has possible implications for the quality of data derived from online interviews. Online interviewers, however, have often reported obtaining rich, detailed, reflective, high quality data (e.g. Bowker and Tuffin, 2004; McDermott and Roen, 2012). Less successful reports tend to have used synchronous approaches, which have been known to lead to playful, less elaborate, and less sincere responses (e.g. Davis et al., 2004). The latter could perhaps be due to the expectations of online chat-based interactions (e.g. as more playful, Gaiser, 1997), or the requirement that participants type in real time, allowing less time for reflection, and relying more on familiarity and proficiency with this conversational medium (with similar demands placed on the researcher). The more

relaxed timescale of asynchronous approaches can allow greater scope for reflection, and checking external sources, which could help produce more reflective, reflexive, detailed, and perhaps accurate, responses. Nevertheless, some researchers have also reported obtaining rich, high quality data using synchronous methods (e.g. Madge and O'Connor, 2002). In these cases, careful rapport-building strategies tend to have been used (e.g. initial researcher self-disclosure), which may well be an important factor in producing high quality data. Good rapport has traditionally been considered important for obtaining rich, candid qualitative interview data (Barratt, 2012). Less successful reports often do not report such strategies, and also report poor rapport with participants (e.g. Strickland et al, 2003). Adopting careful rapport-buidling techniques in IMR interview research is recommended, to overcome potential barriers associated with the lack of proximal contact with participants (Jowett, Peel and Shaw, 2011). Another possible strategy for overcoming the possible negative effects arising from a lack of extralinguistic cues in IMR interviews is to use multimedia approaches. Hanna (2012) reports conducting interviews using Skype, but notes that technical problems interfered with the smooth running of the interviews. Whilst this approach still suffers from technical issues, related to limited bandwidths, network traffic, lost connections, etc., ongoing developments in supporting technologies may well make multimedia interview approaches in IMR more viable in the future.

A possible disadvantage of asynchronous interview approaches in IMR (compared with synchronous online approaches, and offline ftf approaches), is reduced continuity and flow of the communication (e.g. Bowker and Tuffin, 2004). Gaiser (2008) has pointed out the difficulty for the researcher in monitoring asynchronous focus group discussions, since this would require being available 24 hours a day, since participants (perhaps broadly geographically dispersed) may be logging on and contributing at any time. This may reduce the control the researcher has over the continuity and flow of topics. In cases where ongoing close monitoring of a discussion is beneficial, synchronous approaches may thus be preferred. Synchronous approaches may also benefit from the use of emoticons (e.g. :-)) and acronyms (e.g. ROTFL) which can serve as substitutes for extra-linguistic information, and which tend to be more prevalent in synchronous than asynchronous communications. This might add richness to a conversation, which could be particularly useful for some research goals, perhaps where the types of well-considered, reflective responses more likely to be generated

by asynchronous approaches are not required. It should be noted that the level of proficiency and experience of an online conversant will affect the extent to which such 'extra-linguistic' devices can be usefully employed to provide more expressive communications.

One possible advantage of both synchronous and asynchronous (text-based) IMR interviews, over offline (particularly ftf) methods, is the potential reduction of social desirability effects, due to heightened levels of anonymity and perceived privacy, possibly leading to enhanced candor and disclosure. This could especially benefit research on sensitive and personal topics. Some researchers have reported these effects (e.g. Madge and O'Connor, 2002). As well as enhancing candor, heightened anonymity may also balance out power relationships (e.g. due to a lack of perception of biosocial characteristics). Further, empowerment may emerge from the enhanced control participants have over how, when and where to participate, which may particularly benefit certain groups, such as the pregnant women on home bed rest studied by Adler and Zarchin (2002), who were able to participate from home. Thus, ease of access and participation (not having to visit a physical research site) may offer benefits over traditional offline methods, by enhancing participation opportunities. Asynchronous approaches may be especially beneficial in this way, as they generally impose lower demands on levels of typing proficiency, dexterity, and stamina.

In summary, there are clear reasons why online interviews may be preferred to offline methods. However, studies which rely crucially on the analysis of extra-linguistic cues may be less suited to an IMR approach which relies on text-based communication. Cross-cultural research may particularly benefit from an IMR approach, due to the facilitation of participation by geographically dispersed participants, asynchronous approaches offering most scope here, since presence all together at one particular time is not required. As with other IMR methods, trade-offs will emerge. For example, features which lead to higher levels of anonymity may produce more candid responses, but may also hinder relational development and establishing good rapport. It has been suggested that the features of synchronous and asynchronous online interview approaches may complement each other, and thus the two approaches may usefully be combined within the same study (Hewson, 2007). For further discussion of online interviews, and the relative merits of synchronous and asynchronous approaches, see Section X of the present volume.

Sampling procedures and issues of access in obtrusive IMR designs

IMR methods for obtrusive research typically involve sampling from the IUP, and this approach offers researchers access to a broad, diverse population of potential participants, with scope to acquire very large sample sizes more cost- and time-efficiently than is possible using offline methods (e.g. Reece et al., 2010), and to recruit select, hard-to-access populations, e.g. via specialist discussion groups, in ways not achievable offline (e.g. Bigelsen & Schupak, 2011). Researchers have also reported generating very large sample sizes from specialist populations (e.g. Hirshfield et al., 2010). However, concerns remain about the representativeness of data generated from Internet-accessed samples, due to potential biases inherent within the IUP, and the limited scope for implementing probability sampling methods online. Essentially, probability sampling from the entire IUP is not possible, due to the lack of a central register of all Internet users. This issue of *representativeness* of IMR samples is most relevant to quantitative survey-based research approaches, which often require probability samples in order to make valid generalisations from sample data to a broader population (e.g. as in much marketing and social survey research). For other IMR methods, as discussed here, representative samples are arguably less crucial; for example, experimental designs make sacrifices to external validity in the service of achieving internal validity, which allows inferences regarding cause-effect relationships (Mook, 1983). Further, in some areas (e.g. cognitive psychology), the processes being studied are often assumed to be relatively universal, and probability sampling therefore less necessary[3]. Qualitative approaches are typically less concerned with generalizing from samples to populations than generating sample data which allows rich insights into individuals' perspectives, interpretations and constructions of meaning, so are also less affected by issues relating to sample representativeness. Disciplinary differences, and differing research traditions and goals, will clearly influence the extent to which sampling from the IUP might be seen to pose particular problems, beyond those which are already present in offline approaches.

Particularly useful, in relation to the issue of the quality of data that can be generated by Internet-accessed samples, are studies which have compared different online, and offline, sampling strategies. Such studies have reported online samples to be more diverse in various ways than traditional offline convenience

samples, such as undergraduate students, commonly used in much psychological research[4] (e.g. Gosling et al., 2004). Most importantly, a number of studies, across a range of research areas and disciplines, have shown that IMR studies using Internet-recruited samples, including non-probability volunteer samples, can generate high quality, valid data, comparable to that which can be achieved offline, even in cases where broader generalizability is required (e.g. Brock et al, 2012; Stephenson and Crete, 2010). The use of probability samples in IMR has been explored (e.g. using large scale online probability panels), with reports that these can produce data of at least equivalent quality to that which can be achieved using offline probability samples (e.g. Heeren, 2008; Yeager et al, 2011), perhaps even conferring benefits over offline samples, due to reduced social desirability effects (Chang and Krosnick, 2009). Despite these encouraging findings, for some research areas and goals, ongoing problems in obtaining broadly representative probability samples online remains problematic (see Chapter X, this volume). Still, shifting patterns of Internet access, usage, and structures may change the scope for obtaining probability samples from the IUP, in the future. It is also worth noting that existing offline sampling methods may themselves be impacted by socio-technological developments (e.g. RDD methods may be impacted by the shift from use of landline telephones to mobile telephones). Some strategies which can be used to obtain samples in IMR are now considered.

A common sampling approach for obtrusive IMR methods is to obtain 'true volunteer' samples, by placing adverts in public spaces for potential participants to view and respond if they wish (Hewson et al, 2016). Adverts may be placed on any of the online study clearing houses available (e.g. Online Psychology Research UK: www.onlinepsychresearch.co.uk), or posted in newsgroups, online discussion forums and social media spaces (ethical protocols permitting, see Chapter X, this volume). This approach can lead to very large sample sizes, cost- and time-efficiently. In contexts where obtaining broadly representative samples is not crucial this method may be useful, and has been shown to be able to lead to high quality data (see aforementioned examples). When posting to online public spaces, certain procedures are to be recommended. Firstly, in accord with the rules of ‘netiquette’, permission from discussion-group moderators should always be sought prior to posting participation requests (Hewson, 2007). Selection of which

discussion groups to post requests to will depend on the research question, and goals; for example, some researchers have reported successfully targeting particular discussion groups in order to obtain samples with certain characteristics (e.g. Bigelsen and Schupak, 2011). Posting to newsgroups with a large volume of 'traffic' may not be the best approach in order to generate large sample sizes, since participation requests may go unnoticed amongst other postings (Buckley and Vogel, 2003). There is evidence that posting follow-up requests (Coomber, 1997), and high *issue salience* (Birnbaum, 2001) can be important for generating larger sample sizes in IMR.

One problem with the method just described is that it precludes measurement of the sampling frame. This is especially so when placing an advert on a web page, but also applies when posting requests to newsgroups, where the readership is not known. Further, it is difficult to determine the number of potential participants who saw the participation request and thus had the opportunity to take part. This means that factors such as response rate and response bias, for example, cannot be measured. For research contexts where this information is important, such methods will therefore not be suitable. Contacting individuals directly by e-mail (or other similar channels, e.g. SNS private messaging) may allow the closest approximation of the sampling frame, and thus who had the opportunity to participate, but has been more controversial in terms of whether this approach should be considered an invasion of privacy which goes against the rules of netiquette, and research ethics protocols (e.g. BPS, 2013). Also, issues such as dormant e-mail addresses make measurement of the sampling frame less than fully reliable using this approach. However, such direct contact strategies do open up possibilities for obtaining probability samples in IMR, for example using list-based approaches (see Chapter X, this volume). Another option for obtaining probability samples in IMR is to use online probability panels, mentioned above. Access to such panels can be expensive, however, and the issue of 'time in sample' bias also must be considered. For contexts where samples approximating those achievable using offline probability methods (e.g. RDD) are required, and research budget allows, these panels may be useful.

Finally, another option in IMR is to sample offline and ask participants to access and complete a study online. However, this approach may undermine many of the benefits of IMR, such as easy, quick, cheap

access to a geographically diverse, and very large, population of potential participants. Also, the approach still relies on participants having Internet access (which cannot be assumed), and this may impose similar restrictions on who can take part to when using Internet-based sampling procedures. Sampling offline for an IMR study may thus not confer many (if any) additional benefits to sampling online. In summary, there is no doubt that IMR researchers today have access to a massive, expansive, diverse population of potential participants (Hewson et al., 2016). Different sampling approaches have been outlined here, along with consideration of when they might be most useful for the various obtrusive IMR methods discussed.

Design issues in unobtrusive Internet-mediated research

Unobtrusive approaches in IMR involve observation (which can also be carried out obtrusively, see below) and document analysis. This section considers design issues related to these approaches, and the tools and resources that can support them. The distinction between observation and document analysis techniques in IMR can become blurred, but a useful working definition classifies observational approaches as those which study online behaviors and interactions, either as traces or in real time, whilst document analysis involves accessing and analyzing static, published documents and media, placed on the Internet, often as a final authored product (Hewson et al., 2016). Blurred boundaries can emerge due to the idiosyncratic nature of the technologies and services supported by the Internet; for example, blogs may appear as relatively static, published documents (which may receive regular, or less regular, updates), as more interactive, fluid, discussion and comment spaces, or as something in between (see Herring et al., 2005, for further discussion). Some IMR studies using blogs are considered here, as examples of document analysis.

Tools, procedures and design considerations in implementing unobtrusive observation and document analysis

Observation

The scope for carrying out observational IMR is expansive, given the wealth of traces of interactions and behaviors online (facilitated by developments including 'Web 2.0', and the 'Internet of things'). Such approaches can be divided into those which make use of contentful information, such as text-based

conversational exchanges (e.g. harvested from discussion group archives), and those which gather information about the structures and processes of online interactions and behaviors (e.g. friendship networks on SNSs). Here, examples are offered which represent some of the main approaches possible in observational IMR, and some key design choices are highlighted.

Observation of linguistic content online is possible using some of the same tools and technologies discussed in relation to interview approaches, including mailing lists, discussion forums, and online chat software. Stored archives of online (in most cases, asynchronous) discussions are abundant, and easily accessible and searchable (see Hewson et al., 2016 for some guidance on how to do this). This can enable non-participant, non-disclosed (for one thing, contacting all contributors to disclose research intentions is likely to be impracticable), unobtrusive observation of topic-specific content, cost- and time-effectively. Such logs of naturalistic conversational exchanges are not readily available in offline settings, conferring an advantage of IMR approaches (Hewson et al., 2016). Alternatively, researchers may access and follow discussions as they unfold, in real time (in both asynchronous, and synchronous, contexts), which opens up possibilities for participant observation approaches. The same considerations raised in relation to online interview approaches, regarding the types of communications that can emerge from asynchronous, versus synchronous, discussions, are also relevant here.

As well as deciding whether to use participant, or non-participant, observation approaches, researchers need to decide whether to disclose their research intentions, or not, and these choices will interact (e.g. non-disclosure in synchronous chat room settings may be more difficult, though has been reported to be successful in some cases, e.g. Al-Sa'Di and Haman, 2005). As with offline research, issues related to ecological validity are relevant in deciding whether to disclose the research, and/or participate, when carrying out an observational study. For a discussion of 'virtual ethnography' methods in IMR, which generally use disclosed, participant approaches, in which the researcher becomes immersed in an online community, see Hine (2008). Researchers have also used non-disclosed, non-participant (e.g. Tackett-Gibson, 2008), and participant (e.g. Brotsky & Giles, 2007) approaches, but these remain highly controversial, due to issues and debates about individuals' privacy rights online (and the blurred nature of the

public-private domain distinction online, see Hewson, 2015). This issue is compounded in non-disclosed participant approaches, since these will also involve an element of deception. Factors to take into account here, in making appropriate design choices, include: likely individual privacy expectations; the sensitivity of the topic and material; potential for causing harm, either by confidentiality breaches, or disrupting existing social structures (BPS, 2013). In relation to the latter, a noteworthy example is reported by Tackett-Gibson (2008), who intended to disclose intentions to observe an online group, but was blocked from doing so (being allowed, rather, to lurk and observe unobtrusively) by moderators, who felt disclosure may harm the group. Contacting moderators is generally good practice, and can be useful in helping inform design decisions. Other researchers have felt that disclosure was appropriate in participant observation contexts, due to respecting the privacy rights of group members (e.g. Fox et al., 2005).

Observations which move beyond purely linguistic interactions are also possible in IMR, using resources such as SNSs, and Virtual Reality Environments (VREs, see Bainbridge, 2007) (see Table 3). Such approaches offer scope for obtaining richer data than is possible with linguistic observation approaches (e.g. incorporating extra-linguistic information, such as multimedia sources, and spatial navigations within a virtual environment), and, for example, allow more controlled observations to be carried out (e.g. using experimental designs). IMR researchers implementing observational research methods (unobtrusively) have made use of media sharing sites, such as YouTube (e.g. Yoo and Kim, 2012), and SNSs, such as Facebook (e.g. Moreno et al., 2011). If using synchronous, multimedia technologies, such as VREs, conducting an observational study unobtrusively may be more difficult (as with linguistic synchronous technologies). As well as using existing sites, it is possible to set up a bespoke environment created specifically for the purposes of a research study, and this strategy may be especially useful in implementing experimental designs (obtrusively, e.g. Givaty et al., 1998). The latter strategy may also be beneficial where high levels of confidentiality, and security over research data, are required, such as in highly sensitive research contexts.

Observational approaches which harvest data about the *structures* and *processes* of online interactions and behaviours (as opposed to accessing online content, as in the examples discussed above) have expanded dramatically over the last decade or so, facilitated by developments such as Web 2.0, and the wide range of

commercial and leisure services now available on the Internet (and, as 'Apps', for mobile devices such as smartphones, and tablets). Online Social Network Analysis (SNA) has emerged as an established approach, with demonstrated benefits such as enabling more accurate behavioral data to be obtained, for example which does not rely on memory reports (see Hogan, this volume). The wealth of traces of online activity which are automatically logged by a vast population of users, daily, provides enormous scope for harvesting 'big data' sets, across a range of domains, and potential research topics (for example, as in capturing all Google searches over a certain period). Such approaches have received increasing attention over recent years. For a relevant project, and discussion of big data approaches (including a list of related publications), see http://www.oii.ox.ac.uk/research/projects/?id=98. Also, see Ackland (2013), and the further discussion of sampling tools and techniques below.

In summary, observational IMR approaches can confer a number of benefits over offline methods, as outlined above (including cost- and time-savings, which can enable access to larger sample sizes than is possible offline, e.g. Givaty et al., 1998, and enhanced scope for unobtrusive observation of highly topic-specific sources, e.g. Tonkin et al., 2012). These benefits also apply to document analysis approaches in IMR, which whilst there are fewer examples available to date, have also been successfully applied in an IMR context, as now discussed.

Document analysis

The wealth of potential online documentary data available on the Internet, including webpages, scientific articles, news articles, poems, diaries, bibliographies, artists' portfolios, and so on, provides plenty of scope for document analysis in IMR. In searching the Internet to locate documentary sources for primary research, some of the principles and issues raised in the next section are relevant (see also Hewson et al., 2016). Researchers have used webpages as documentary sources, for example Thoreau (2006) carried out a qualitative analysis of text and images from an online magazine (*Ouch!*, produced largely by and for disabled people), pointing out that the IMR methods allowed data to be gathered which are not easily obtainable using offline methods. Similarly, Heinz et al. (2002) carried out an analysis of gay, lesbian, bisexual and transgender websites, noting how this allowed the collapsing of geographical boundaries, in

ways not easily achievable offline, which led them to conclude that IMR methods can help facilitate cross-cultural research. Also, a number of researchers have used blogs in IMR, which could be seen as a form of document analysis (though note the earlier point regarding the status of blogs, and the various forms they can take). Blogs are now abundant, often freely available, for access from online public spaces, and also often easily searchable for specific content. This can confer advantages in being able to locate and access highly specific content for a particular research study. For example, Marcus et al. (2012) report acquiring rich, informative data from blogs of young people with mental health concerns, noting that the IMR method allowed this traditionally under-researched, under-treated population to be reached. Ethics issues will emerge, and need to be carefully considered, when accessing existing online sources, as with observational research approaches. These include considerations relating to what can reasonably be considered to be 'public' and 'private' online, as well as issues related to copyright law and ownership of online published content (BPS, 2013).

As well as locating existing documents, document analysts may also choose to solicit documents online. Hessler et al. (2003) adopted this approach, asking adolescents to keep and submit (by e-mail) personal diaries, in a study examining adolescent risk behavior. These authors report that the online method had benefits in establishing better levels of rapport and disclosure than is often the case in offline ftf (interview) methods with adolescents. However, ethics issues must be very carefully considered when carrying out online research with vulnerable (in this case young) participants, as well as when using non-secure (here, e-mail) methods in sensitive research contexts (see Hessler et al., for a discussion of the safeguards implemented to address these issues in this case). In summary, the ready access to large volumes of data, and the cost-effectiveness of obtaining this in a form ready for analysis, are key benefits of document analysis techniques in IMR. Studies carried out to date have also shown that enhanced access to hard-to-reach populations, and broader geographical reach, can also be benefits of an IMR approach.

Sampling techniques in unobtrusive IMR designs

Sampling for unobtrusive IMR methods involves locating and accessing online data sources, rather than people. Researchers carrying out unobtrusive IMR studies have sampled from a range of sources, including

newsgroup posts (Bordia, 1996), tweets (Tonkin et al., 2012), webpages (Horvath, Iantaffi, Grey, & Waiter, 2012), blogs (Herring et al., 2005). Apart from negotiating the public/private domain distinction issue, and whether informed consent from the individuals who have produced the data is required (as well as the issue of copyright and ownership, as noted above), similar considerations apply for unobtrusive IMR sampling approaches as those that emerge in thinking about obtrusive methods. If using quantitative approaches, where broadly representative data are required, techniques which generate large, representative samples of, for example, blogs, will be preferred (e.g. see Herring et al., 2005, who discuss procedures for randomly sampling from blogs; also Hinduja and Patchin, 2008, who randomly sampled MySpace profile pages). In qualitative research, no te other hand, it may often be appropriate to locate more select, specialist discussions (or multimedia source), which can be traced and analyzed, using some of the tools available for doing this (see Hewson et al., 2016). As noted above, documents can also be solicited, and in such contexts copyright restrictions and privacy concerns will not be an issue, but careful informed consent procedures will be required. For research contexts requiring 'naturalistic' data, archives of naturally occurring, non-reactive, online interactions will be more suitable. As always, the research goals and context will determine which techniques are most appropriate. For further discussion of the various techniques, and tools (e.g. web crawler programs), available for accessing existing web-based content, for use as data in unobtrusive IMR, see Ackland (2013).

Summary and conclusions

The above discussion has reviewed the use of the Internet as a tool for conducting primary research in the social and behavioral sciences, considering some key design choices and issues which emerge. Examples were presented which serve to illustrate the widespread, successful implementation of Internet-mediated research procedures across a range of disciplines, research traditions, and domains of investigation. Advantages and novel opportunities afforded by an IMR approach were highlighted, and potential drawbacks, problems, and caveats considered. Explication of the relative strengths and weaknesses of a range of IMR procedures, both compared with each other and with traditional offline approaches, indicated that trade-offs often emerge. Design decisions should always be made within the context of the aims and

goals of an individual research study, and this is especially pertinent in IMR, where many competing design choices and procedures still remain to be fully explored and developed. In summary, two key conclusions can be derived from the present discussion. Firstly, Internet-mediated research presents a promising, now well-established method which has been clearly demonstrated to have the potential to provide valid, reliable data and research findings across a broad range of disciplines and methodological approaches. Secondly, whilst significant progress has been made over the last decade or so, many issues and procedures in IMR remain to be further explored and developed, particularly relating to more recently emerging data scraping approaches. Future attempts by researchers, working across a diverse range of disciplines and fields, will no doubt contribute to the further elucidation and explication of sound design principles, which can lead to valid, reliable, trustworthy data generated by Internet-mediated research studies.

NOTES

1. Many good design principles for offline research will naturally generalize to an IMR context (e.g. how to word survey questions), but this may not always be the case. For example, as Reips (2010) has pointed out, reading screen-based materials is more demanding than flicking through printed pages (which may impact upon factors such as recommended maximum survey length). Such instances will be highlighted here, where relevant.

2. Note also, however, that the greater variability in IMR experiments, compared with laboratory-based offline settings, may serve as a test of the external validity of an effect, where an IMR experiment is able to replicate an effect previously established offline (Reips, 2002).

3. However, see Henrich, Heine and Norenzayan (2010) for a challenge to this assumption.

4. For evidence, see Arnett (2008), and Hewson et al. (2016).

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