We Seek Them Here, We Seek Them There

How technical innovation in mixed mode survey software is responding to the challenge of finding elusive respondents

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Abstract

Increasingly, market and social researchers are turning to mixed mode surveys as a means to overcome a variety of research issues and constraints, not least the increased difficulty in achieving successful contact with respondents.

At a technical level, the central challenge of true mixed mode research is to combine both administered and self-completion interviewing across a range of devices and methods, each with its own inherent limitations, in ways that will minimise operational complexity and also the variability or 'modal effect' that is experienced between the different modes. Many commercially developed survey packages claim to offer support for mixed mode research, but in some cases are doing so with little consideration for the needs and requirements of mixed mode research.

This paper sets out the principal operational and technical issues that multimodal data collection software needs to address, examines specialist survey research software providers are responding to these challenges, and identifies innovation in this area. It concludes with recommendations on a minimum set of facilities or features that any mixed mode interviewing system should contain.

Keywords

Multi-mode surveys; mixed mode surveys; survey instruments; modal influence; survey software

1.   Introduction

Survey instruments exist to take measurements. Not unlike the more physical instruments used by chemists or engineers, there is a need to calibrate survey instruments to ensure they yield consistent and accurate results. While it may be possible to test the instruments, destined for the chemist's laboratory or the engineer's workshop, in a controlled setting and confirm accuracy in absolute and predictable terms, the market and social researcher's instruments can only be tested in relative terms. The verification of survey instruments has been achieved through experience. But as researchers reach for mixed mode surveys to boost flagging response, the effect of combining modes into one survey on the results is relatively little researched and little understood (Cobanoglu et al 2001).

For many decades, the choice of modes for survey administration was restricted to face-to-face or telephone. Technological advancement today, allows researchers to choose from an ever-widening palette of survey modes, as figure 1 illustrates, many of which have evolved from each other

incrementally, as technology has improved. In this way, is possible to trace back almost all computer-assisted methods back to CATI, in the early 1980. It was not until 1996 that email and Web browser-based Internet surveys started to appear on the scene, but these have encouraged an explosion in the development of new modes.
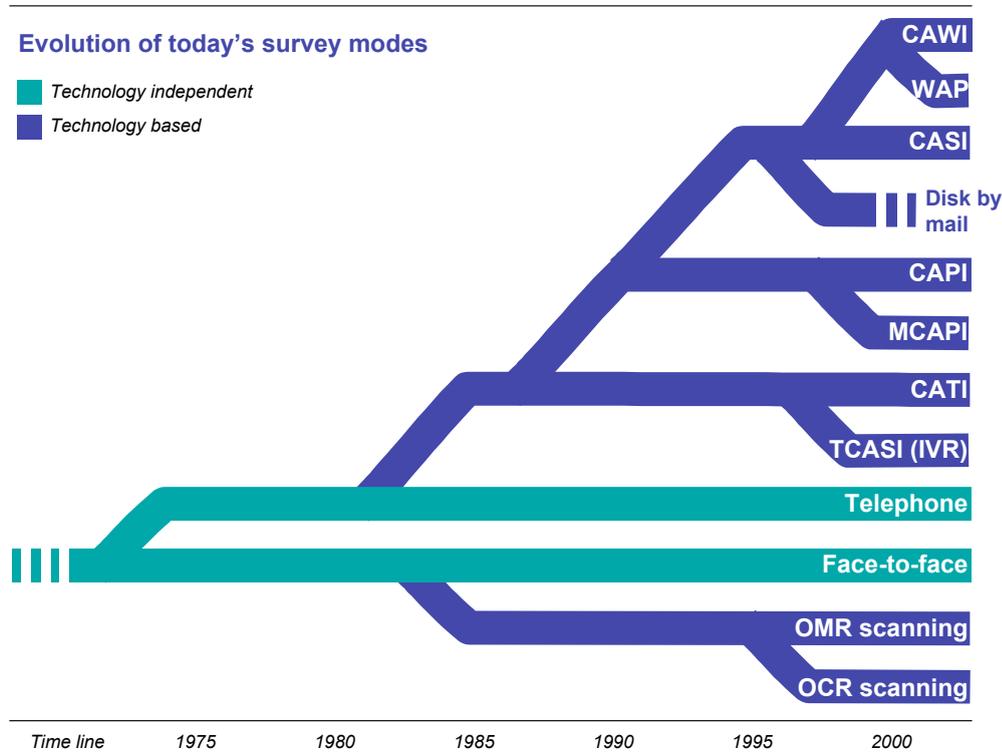
Figure 1. The evolution of today's survey modes

Almost all of the earlier interviewing modes survive to this day: with the possible exception of disk-by-mail interviewing, which the Web has largely rendered redundant. WAP and SMS could share the same fate unless it finds its niche as a specialised tool (Noyce et al 2003).

Just as few interviewing modes seem to die, research software packages are also remarkable for their longevity. In many cases, as additional interviewing modes have emerged, software manufacturers have been keen to implement these. This year's Research Software Review (Macer 2003) identified 42 different survey software solutions, classified according to six modes. Of these, 34 offered support for two or more modes, and 11 offered support for all six (see Table 1).

Table 1. Modes supported in survey data collection packages Source Macer (2003)

Total number of modes			Cumulative number of modes		
Modes	Products		Modes	Products	
2	5	12%	2+	34	81%
3	5	12%	3+	29	69%
4	4	10%	4+	24	57%
5	9	21%	5+	20	48%
6	11	26%	6+	11	26%

100% = total of 42 listed software products

Increasingly, manufacturers are claiming that their interviewing solutions are multi-modal and, either explicitly or implicitly, that this support extends to mixed mode research. After examining the issues raised by several research practitioners, this paper will consider the extent to which manufacturer's are understanding the needs of the mixed mode researcher and providing solutions that meet those needs.

2.   The researcher's need for multi-modal surveys

In the past five or six years, in the United States, Web surveys have risen to become an almost undisputed replacement for paper-based mail surveys, switching one form of self-completion for another. The benefits and variations are relatively well understood, sufficient to satisfy researchers that the results are comparable and therefore useful (e.g. Owen 2001, Comely 2001).

Now, technology is finding a more important role than being simply a means to save time or reduce cost. Research is becoming more difficult and technology, particularly the sophisticated use of multiple survey modes, is looking like one of the few ways to increase both sufficient coverage to achieve effective sample incidence[1] and acceptable response[2].

Response rates are falling throughout the developed world. Poynter (2001) estimates that changes in society, including greater mobility and an increased awareness of privacy, now mean that response rates of below 20% are common, which is compounded by sampling methods that, at best, only reach 20% of the population, threatening all assumptions about coverage and response.

One proponent of mixed mode surveys is Don Dillman, who has published extensively on the subject since he proposed his Total Design Method in 1978 (Dillman 1978). At a Gallup symposium in the United States, he remarked:

> "Survey organizations, whether they are in universities like mine, in private-sector organizations or in government organizations, are going to have to change dramatically in some ways in order to do effective surveys as we bring these new technologies online and still use our other technologies where they work."

Don Dillman, in Quirk's Review (Crabtree 2000).

It is a sentiment echoed by Craig and Douglas (2001), who now consider it imperative, in the context of any international research, that researchers should engage with a range of survey technologies in order to carry out research across international boundaries, particularly where these countries are at different stages of development or where there are disparities in economic and social conditions.

Case studies that demonstrate the efficacy of the mixed mode research are now starting to emerge. Allison and O'Konis (2002) demonstrated response improvements are achievable. In a survey of financial service customers in the United States, respondents contacted by telephone were given the option to continue the interview online: a staggering 88% chose this option, and 54% of them went on to complete the survey. Oosterveld and Willems (2003) have proved it is possible to design mixed mode surveys where mode has no influence on the answers given, in an experimental design which separated modal effect from population effects. They assert that the majority of modal differences reported in previous studies can be explained in terms of population differences. Allison and O'Konis

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[1] Incidence: the proportion of the target population actually reached by the chosen sampling method

[2] Response: the proportion of sample units completing a survey from any selected frame.

also found high levels of similarity between responses elicited from the different modes. Dillman et al (2001), exploring the same issues across four modes have also concluded that, although there are observable differences, these are outweighed by the overall improvements in sample coverage and response, as well as time and cost.

Mixed mode research can be argued as being less burdensome on the respondent (Allison and O'Konis 2001 p 88), which not only provides better response for the survey in hand, but can be argued as becoming an essential consideration for the long term survival of opinion research as a viable activity.

The rationale for fielding a survey using a combination of modes is inevitably a trade-off between the benefits outlined above and the risks. In essence, the risks fall into three categories: calibration, coverage and complexity.

1. **Calibration** refers to the risk of differential measurement error due to modal effect on the respondent, where different modes yield different answers and would lead to different conclusions if each mode was treated in isolation.

2. **Coverage** relates to the large and well-aired subject of sampling, and in particular, the risk of differential non-response from the sub-samples contact through each mode.

3. **Complexity** refers to the risks of increased cost, delays and errors, arising from the duplication of effort or additional work inherent in conducting research across different modes.

Calibration and coverage issues need to be controlled through the research design, though technology has a role to play in providing appropriate support to implement these research decisions effectively. Issues of complexity can, and should be, managed through better, more effective technology.

3.   Calibration and coverage: the issues

Presentational influences

It is well known that, from one survey to another, the style of the survey affects the response rate. Ganassali and Moscarola (2002) have quantified the effect on response of using a single scrolling screen or a single question per screen on response rate. They also determined that the presence of visual elements can produce a significantly higher response than the equivalent question with no visual support. This has implications for mixed mode research designs, if visual elements are provided in one mode and are absent in another.

Interviewer influences

The moderating effect of an interviewer in CATI and CAPI can give rise to under-reporting of personal or emotive issues. Poynter and Comely (2003 pp 175-176) described massive under-reporting on a question relating to the use of mobile telephones while driving in the UK, an emotive issue with anti-social connotations: on the Web 37% said they 'rarely' used a phone when driving, while only 21% admitted it on the telephone.

Differences in responses to open-ended questions

Oosterveld and Willems (2003), in a mixed mode research design, recorded a tendency reported by others for significantly longer and more detailed responses to openended questions recorded on the Web than on the telephone. However, Allison and O'Konis (2002 p 90) reported great similarity in terms of word length between the two modes.

Differences in responses to anchored scale questions

Humphrey Taylor (2000), noted a tendency for respondents on the Web to answer scales differently. Allison and O'Konis (2002 p 91-92) observed significantly more CATI respondents tending to use the extremes ('strongly agree' and 'strongly disagree') while CAWI respondents were favoured the middle ground. Dillman et al (2001) observed the same in their study and recommend great care in the use of classic scales with anchored points (e.g. "where 1 equals strongly agree and 5 equals strongly disagree") in mixed mode surveys. Yet the effect has been observed in mixed mode paper and Web surveys too, (Bäckström and Nilsson 2002) which means the distortion cannot be explained by differences between auditory and visual stimuli alone.

Hogg (2002 p 90) describes a tendency for respondents to select "don't know" and "no response" options more frequently in Web surveys, than interviewer-led CATI. His approach is to vary the survey instrument when delivered online to omit these in all but a few carefully judged situations.

Non-response error

One of the few experimental examinations of non-response error in mixed mode surveys is by Dillman and others (2001). Their observations do not offer encouragement to those hoping mixed mode surveys would provide high-tech relief to the growth of non-response in surveys. The study deployed four modes: CATI, CAWI, paper-based self-completion by mail and IVR-based TCASI and used a sample frame where demographic details were known. The characteristics of the non-response group were consistent across all four modes: younger, less well educated and, curiously, female; though they also observed the tendency for higher response from males on the Web and females on the telephone.

The above only presents a summary of the major influences. There are many different ways in which mode can influence not just the level of response achieved, but the actual responses given—and in ways we are still discovering. It is worth remembering that these effects are there in unimodal research too, but without the addition of the other modes, they remain latent. While we cannot look to technology to iron out the imperfections of modal influence, technology must support mixed mode in a way that does not unwittingly introduce more noise into the process.

4.   Operational complexity

The increase in operational complexity is the most obvious and immediate effect of any decision to mixed modes in a survey design. It is felt most acutely by those responsible for administering and managing the survey. The problem areas to addressed can be characterised as follows:

Different recruitment and screening strategies

Unless all initial contact is to be made by the same mode, then the recruitment and screening method will vary from one mode to another, and different strategies will need to be devised then programmed into the survey instrument for each mode. This can be time-consuming to program and is logically complex, requiring careful testing to avoid programming errors.

Brown et al (2002) identify three 'hurdles and limitations' in using online research in a business-to-business context, as opposed to telephone research: the difficulty in achieving initial contact; the loss of any sense of dialogue, which is customary in both business and personal interaction and reliability from incorrect response to questions without the intermediation of the interviewer.

Duplication of the survey instrument

Many mixed mode researchers have been faced with a complete duplication of effort, when programming the same survey instrument into incompatible CATI and Web interviewing systems. A mixed mode survey system should be able to reduce this duplication of effort by allowing a single survey instrument to be executed in different modes, and allow for adjustments and variations to be made to ensure it executes appropriately in each mode.

In reality, much current survey technology falls well short of this ideal. Even where the same system supports several modes, to run two or more modes in parallel may still require different versions of the of the script for each mode, which is a potential source of error.

Data handling issues

A relational database, with its capabilities to allow multiple, simultaneous access to data, would seem to be the ideal means to handle survey data in mixed mode surveys, by acting as a common repository for all active and complete interviews. Achieving this ideal is difficult for numerous reasons. For a start, with their legacy of sequential files based solutions, very few interviewing systems actually support relational databases. Mixing offline and online interviews is also problem, despite developments in wireless technology, and the imposition of firewalls between internal systems and external Web servers can also make it difficult to use the same database throughout.

These issues were apparent in a large multimodal survey of 60,000 households in the Netherlands carried out by a consortium of research organisations, on CATI, CAPI and CAWI (Rippen 2003). Despite using the same software, it proved impossible to link the different databases, so the researchers had to build one from scratch, which was also not without problems. Rippen described the situation as follows:

> "In practice, things turned out to be much more difficult to streamline… We had to create three different scripts for each interviewing method, and this made the database very large and unwieldy. It also required a lot more scripting hours than we imagined."

Mode switching

Bäckström and Nilsson (2002) state the importance of providing respondents with the choice of method in increasing motivation to respond even though switching an interview from one mode to another can result in considerable operational complexity. Unless all of the modes share the same database, this also introduces delay as records are moved from one system to another. Apart from the scope for error, these delays can have an effect on the response. Switching an interview from CATI to CAWI, Allison and O'Konis (2002 p 88) observed a faster response once the software was adjusted so that, an email was despatched immediately the telephone portion ended.

Operationally, it was also a critical issue on the Dutch household study. Rippen (2003) observed that, without core support in the survey software being used, their own database only provided a *results* database, whereas what was needed to ensure timely and efficient switching between modes was a *fieldwork* database, driving each of the interviewing systems.

In addition to the four main issues described above, there are several other secondary issues that those designing or implementing surveys across modes have to consider, such as enhanced operational reports to able to obtain, clear across-the-board view of sample disposition, progress towards quota targets and the ability to define call-back strategies both within one mode and across modes.

5. What do software manufacturers mean by mixed mode support?

In the course of my research, I approached ten of the software manufacturers offering support for multi-mode surveys for information, with three research questions:

1. What did each consider to be the issues, constraints, operational and technical challenges of mixed mode research that survey software needs to address?

2. Which specific capabilities did each developer provide to overcome the operational challenges?

3. What technical solutions were each developer implementing or planning to implement to control modal influence?

Of the ten approached, eight went on to provide information for this research. The interviews were conducted by a combination of email, telephone and face-to-face. The responses are summarised in Table 2, with the number of mentions for each item shown in parentheses.

Awareness of the challenges

There was a wide variation between the responses from the manufacturers, with consensus on few issues. Several chose not to address the first question, preferring to answer in terms of what they were doing (the scope of the second and third questions). Suppliers chose to concentrate on operational complexity issues more than calibration and coverage issues. Coverage received no specific mentions.

Complexity issues tended to focus on the business of creating a mode-sensitive survey instrument from a single-source authoring tool, along with data handling issues and the consideration that a relational database is required to manage this. Though ease of modal switching featured universally in the second research question, it was rarely singled out as an up-front issue, (it may have been what suppliers meant in the three non-specific mentions of operational efficiency). Recruitment and screening received not a single mention.

6. The developer's response to calibration issues

This was the third research question, though consistent with the rest of this paper, it will be considered before complexity issues. Only two companies appeared to be making a serious attempt to understand and control modal influence. OpinionOne has developed a new hybrid interviewing method which it calls CAVI, for computer-assisted visual interviewing (and has trademarked the term). Among several innovations designed to eliminate modal influence, is the system's ability to generate a consistent appearance for each question and each screen across different hardware for CAPI, for CASI in kiosk interviewing situations and for CAWI. In CAWI, the Web browser expands to fill the whole screen, the characteristics of the PC's display are interrogated and determined and the size of the items on screen are individually recalibrated to ensure consistency. If the survey is translated into multiple languages, the positions and sizes of each button and text box is readjusted so that the screen layouts are identical across all the languages.

Another pioneer in this respect is Sphinx, which has undertaken a series of research experiments in order to examine the influence of mode, and of different research designs, on the data obtained (Ganassali and Moscarola 2002).

However, an important aspect of calibration is the ability to measure the response by the mode used to collect the data. Pulse Train goes further than any other manufacturer in its Bellview Fusion product,

by recording the mode for each question, which takes into account the fact that an interview can switch mode at any point in their system. While the data are recorded automatically, it is unfortunate that in the current implementation of Bellview Fusion, this paradata is not available to data record, and some complex and rather unsatisfactory manoeuvres are required to release it for comparison with the case data. Askia, Nebu, MI Pro and Sphinx also all record the mode of the interview in the data and a similar facility is believed to be part of the metadata within the SPSS MR Data Model.

OpinionOne has also developed a potential substitute for the unaided question online. In CATI or CAPI, it comprises a predefined and displayed list of items that the interviewer does not read out, but uses to record the respondent's spontaneous response. It uses a combination of an open-ended question and a capability to perform automated coding in real time against a user-defined dictionary.

Table 2. The challenges of mixed mode research from the producer's perspective

I. Calibration issues	**III. Complexity issues**
calibration between the modes (2)	operational efficiency: *non-specific* (3)
convincing users that the data obtained are heterogeneous (1)	**(a) different recruitment/screening strategies** (no specific mentions)
considerations when migrating continuous studies from a single mode to mixed modes (1)	**(b) duplication of the survey instrument** producing a single-source authoring tool for all modes (2)
the need to establish a deep understanding of the inherent biases of one mode over another (1)	automatically vary the questionnaire by mode (2) definition of the modal context as well as the language for each question
reducing the burden on respondents (1)	context specific validation, according to the mode identifying what systematic changes need to take place with a mode change
creating a bank of predefined, calibrated questions	separation of survey definition and execution process (2) finding an equivalent for unaided questions online (2)
	(c) data handling common database for all active interviews and results (3) development of appropriate XML schemas to ease data transfer common storage of sample management data single data management tool for all modes
II. Coverage issues (no specific mentions)	**(d) mode switching** in general (2) converting survey instruments from one system to another
	(e) other operational considerations cross-modal quota control (1)

7.   The developer's response to complexity issues

Operational complexity appears to be area where manufacturers are putting in most effort. The modes supported for mixed mode research for each of the manufacturers researched is shown in Table 3, and shows that a basic level of functionality already exists in most solutions for most of the attributes.

Table 3: Overview of operational support for mixed mode surveys by manufacturer

	Askia	Mercator	MI Pro	Nebu	Opinion One	Pulse Train	Sphinx	SPSS MR
CATI, full	■		■	■		■		❖
CATI, light	■	■	■	■	❖	■	■	❖
CAPI	■	■	■	○	■	❖	■	❖
CAWI	■	■	■	■	■	■	■	■
Paper	❖	■	■			○	■	■
IIIa. Differential screening	■		■	■	■	■	■	■
IIIb. Single source authoring tool	■	■	■	■	■	■	■	
IIIb. Mode-specific templates	■		■	■	■	■	■	■
IIIb. Mode specific texts	■		■	■	■	■	■	■
IIIc. Central database	■		■	■	■	■	■	❖
IIId. Mode switching	❖	❖	■	■	■	■		■
IIIe. Live, cross-modal quotas	❖			■		■		■

Key ■ Fully supported ❖ Partly supported ○ In development

The level of support has been determined by an assessment of the functionality offered within a single, consolidated application suite. For reasons of clarity, CATI is subdivided into *full* and *light*, according to whether the CATI system is appropriate for use in interviewing centres with 40 or more stations. Among the eight manufacturers listed, Pulse Train's Bellview Fusion and SPSS MR's Dimensions are in the process of making the transition from being legacy file-based systems to being re-engineered multi-modal database driven systems. Mercator's system remains sequential file based. The others were designed to be multi-modal and relational database-driven, from scratch or in an earlier version.

Design and modal independence

Most of these manufacturers have successfully separated the abstract design of the questions from mode-specific consideration of their appearance, by creating templates. In Askia, MI Pro, Bellview Fusion, Nebu (where they are called stylesheets) and SPSS MR Dimensions, a different template will be applied at the time the interview is executed, to adjust its appearance according to the mode. SPSS MR has usefully adopted the term "player" for a particular mode, which can take decisions on how to interpret the generalised survey script, both from reading the associated template and from its own innate knowledge of the characteristics of the current mode.

Nebu has sensibly provided one template for CATI, to ensure a consistent look and feel for telephone interviewers; the other templates refer to CAWI, and can vary by survey. In MI Pro, as you start to design your survey, you are confronted with a check-box list of the different survey modes. The system will automatically generate a version of the survey appropriate to each mode selected, determined by user-defined templates.

Central database

The central database is a characteristic of each of the software packages examined, with the exception of Snap. Askia, in particular, incorporates a lot of flexibility here. CATI and Web can either share the same database, or if the Web server is to be outside the firewall, there is an interchange utility to ex-

change data automatically between the databases. Both Pulse Train and SPSS MR allow the Web, CATI and database server each to be deployed independently of the other, overcoming firewall issues, as the Web servers and the database server can be on opposite sides of the firewall.

Incorporating data from offline modes, such as CAPI or paper, can be time-consuming and error-prone. Wizards are provided in Askia to step users through the process of loading offline CAPI data or keyed-in data into the database. While Nebu provides support for GPRS (cellular data) connections from CAPI interviewing, with real time checking of quotas, even though the rest of the interview is not dependent upon a live connection being maintained.

Switching between modes

Modal switching is very capably handled in Askia, Bellview Fusion, Nebu and OpinionOne. Askia incorporates a special question type which allows you to select an alternative mode. According to the mode selected, the handover is then achieved automatically. In the case of a transfer CAWI, the email is generated and despatched automatically. In Bellview Fusion an interview can be 'abandoned' at any point in any mode and transferred to a different mode, either by scripting in a decision point as a question, or for interviewer administered modes, at any point on demand, by recourse to a special menu of actions.

A similar level of functionality is provided in Nebu though either its 'static switch' (a fixed decision point in the script) or 'dynamic switch' (can occur anywhere, on demand from interviewer or respondent), and a special question type called a 'dynamic swap object'. This is used to record vital next contact information, such as the respondent's email address. Another template determines the form and content of the email message which is then despatched automatically. Ingeniously, once a record has transferred to a self completion mode, the option to go backwards through the interview will not allow the respondent to go back into the CATI-collected portion.

Askia, Nebu and Pulse Train all allow for interviews to go back to CATI again. Pulse Train is extending the capability of its dialler software to allow provision of an instant 'call me back' button on Web interviews. It also allows for a conditional handover, by setting a CATI callback appointment at the same time as assigning the interview to CAWI. If the respondent fails to complete the interview on the Web, he or she will be contacted again through CATI.

The integration of print questionnaires in MI Pro makes it possible, if switching from CATI or CAWI to paper, for a scannable version of the survey instrument, that shows the responses to any questions already answered, to be printed and despatched to the respondent.

Missing features

Several of the researchers' concerns in mixed mode research were not convincingly addressed by the manufacturers and deserve attention:

> The need to cross-tabulate completed data by data collection mode, at a datum level (not merely a case level), as this is crucial in measuring modal influence.

> Support for the systematic removal of certain answers from certain modes, such as to vary "don't know" and "not stated" answers by mode.

> Greater consideration of the up-stream management of sample to improve coverage.

> Specific support to simplify the creation of parallel screening or sample eligibility identification strategies across different modes.

8.   Conclusions and recommendations

Empirically, mixed mode research does appear to solve problems of sample coverage, time and cost, while delivering heterogeneous data—subject to several predictable and avoidable exceptions. Some suppliers of research software are now producing multimodal research packages that contain a range of technical innovations to facilitate mixed mode research. The focus of these developments is on overcoming operational complexity, but the other issues raised by nixed mode research, such as calibration and coverage, are largely being ignored.

On close inspection, there are relatively few survey packages that will support a range of basic needs in undertaking mixed mode surveys. The systems that do, including those examined here, tend to favour particular modal pairings: CATI/CAWI, CAPI/CAWI and so on. No single solution has yet emerged capable of handling the four-mode experimental study conducted by Dillman et al (2001) or even Rippen's (2003) three-mode study with a single authoring tool and a single results database.

For many developers, mixed mode research is still work-in-progress, and the range of modes supported and facilities provided will change rapidly from now. Developers need to remain focused on the needs of the mixed mode researcher and appreciate these go beyond just operational support. From the research undertaken, the core functionality to meet these needs is identified as follows:

1.   A common survey authoring tool that generates a single survey instrument for all modes.
2.   Independence between design and execution, with mode-specific templates and rules.
3.   The ability to define mode-specific texts in addition to foreign language alternatives
4.   A single, consolidated database for all survey data, updated in realtime.
5.   Ability to determine the mode of initial contact from the sample subject's stated preference.
6.   Efficient switching between modes, initiated by the script or by the respondent.
7.   Ability to conceal all interviewer-recorded data when switching to self-completion modes.
8.   Support for reminders and fall-back strategies to revert to a prior mode if still incomplete.
9.   Single view management and reporting, which identifies response by mode.
10.   Quota controls implemented across all modes in real time.
11.   Question constructs for mixed mode, e.g. unprompted questions for CAWI, and the ability to have mode specific answer categories (e.g. "don't know and "not stated").
12.   Recording of mode applied, at a datum level not just a case level.

Acknowledgements

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