



Dependent Interviewing: A Framework and Application to Current Research

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ABSTRACT

Panel surveys increasingly use dependent interviewing, where substantive answers from previous interviews are fed forward and used to tailor the wording and routing of questions or to include in-interview edit checks. The main reason for adopting dependent interviewing varies across survey organisations, surveys and items. As a result, a variety of dependent interviewing designs have been developed and comparisons of their effects are anything but straightforward. This article proposes a conceptual framework of the different design options and their effects, in an attempt to further the understanding of dependent interviewing. The framework is used to evaluate the effects of different designs in the 'Improving Survey Measurement of Income and Employment' study. The article also clarifies the causes of longitudinal inconsistencies in repeated panel surveys (seam effects) and discusses the extent to which dependent interviewing can reduce these. The article ends with issues yet to be resolved.

Key words:

Pre-printing, use of historical records, computer assisted interviewing, measurement error, seam effects, longitudinal consistency, item non-response, survey costs, respondent burden.

1 Introduction

Panel surveys increasingly feed forward substantive information from previous waves of data collection, to tailor the wording or routing of questions to the respondent's situation, or to include automatic edit checks during the interview. Personalising the questionnaire through 'dependent interviewing (DI)' can reduce respondent burden, increase the efficiency of data collection and improve data quality (for reviews, see Lynn et al. forthcoming; Mathiowetz and McGonagle 2000). The main motivation for introducing dependent interviewing, however, varies across survey organisations, surveys and items, resulting in a variety of designs and applications. As a consequence it is not straightforward to evaluate the effects of different design features or compare the use of dependent interviewing in different surveys.

Based on a review of current practices, this article develops a conceptual framework of dependent interviewing, in an attempt to disentangle design features, channels through which they take effect, and implications for burden, efficiency and data quality. The aim is to aid the understanding of the effects of dependent interviewing, about which empirical evidence has been very limited until recently. Section 2 describes situations in which dependent interviewing can be beneficial and clarifies the causes of 'seam effects', a major type of error in repeated panel surveys which can be reduced with DI. Section 3 conceptualises the different design options and their effects and Section 4 evaluates different (proactive and reactive) DI designs, based on findings from the 'Improving Survey Data on Income and Employment' study. Section 5 discusses effects of DI on data quality, highlighting limitations and pointing out other factors that need to be taken into account when assessing the effect of DI across surveys and items. Section 6 concludes with issues that remain unresolved concerning the practical implementation of DI and effects on data quality, comparability and analysis.

2 Dependent Interviewing – What and Why?

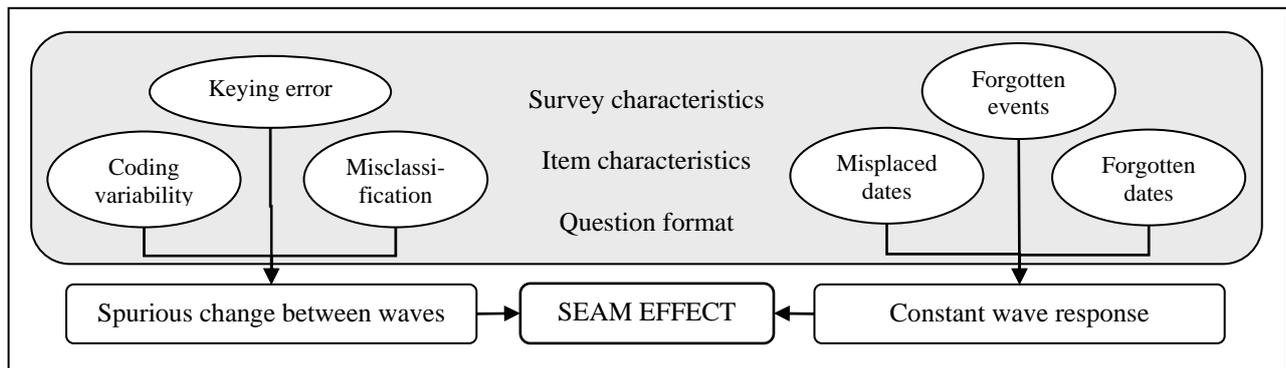
Dependent interviewing refers to a method of designing questions in repeated panel surveys, where substantive answers from previous interviews are fed forward and used to improve (1) data quality, in terms of longitudinal consistency and item non-response, and (2) survey processes, in terms of efficiency of data collection and respondent burden. This differs from traditional independent interviewing, where respondents are typically asked the same questions about their situation at different points in time, without reference to previous answers.

2.1 Data Quality

When information from repeated panel interviews is combined to create continuous histories, one typically finds large concentrations of transitions at the ‘seam’ between reference periods. Such seam effects are well documented for data on benefit income (e.g. Burkhead and Coder 1985; Czajka 1983; Moore and Kasprzyk 1984) and labour market activities (e.g. Hill 1994; Jäckle and Lynn 2004; Martini 1989; Murray et al. 1991; Ryscavage 1993). A common misconception is that the concentration at the seam is the result of misdating of changes, and that respondents have a tendency to *report* more transitions at the seam. In reality seam effects are the result of combining data from repeated panel interviews in the presence of measurement and data processing errors. These errors lead to a combination of *under-reporting* of change within a wave, and *spurious change* between waves, causing the observed concentration of transitions at the seam (see, Rips, Conrad and Fricker 2003; Young 1989).

Dated history information is mainly collected in one of two ways in surveys: by asking respondents to report spells and transition dates (sequential spell questions) or by asking whether the respondent experienced a particular event or status during each sub-period, e.g. week, of the reference period (period status questions). In sequential spell questions, changes within a wave are given by the reported transition dates. In period status questions, changes are inferred from changes in yes/no answers. In both cases, analysts may infer a change at the seam if the status report for the last month from the first interview does not match the retrospective report for the first month from the second interview. Such mismatches may occur due to keying errors, coding variability or misclassification by the respondent. Changes at the seam will in this case tend to be spurious and not correspond to any true changes (Figure 1). On the other hand, omissions of events or errors in the dating of events lead to under-reporting of change during the recall period, and may lead to dates being misplaced at the seam. In this case, transitions observed at the seam might correspond to true changes that took place during the reference period. Dependent interviewing can reduce the occurrence of spurious changes at the seam and of constant wave responses caused by under-reporting events.

Figure 1: Determinants of seam effects



The second aspect of data quality which can be improved with DI is item non-response. This problem affects all surveys, but repeated panels offer an opportunity which one-off surveys do not: respondents who do not give a legitimate answer can be reminded of previous reports to jog their memory and questions that remained unanswered can be fed forward and repeated in the subsequent interview.

2.2 Survey Processes

Respondents to repeated panel surveys often complain about having to answer the same questions repeatedly although their circumstances have not changed (Phillips et al. 2002). This is especially problematic for surveys with short intervals between interviews and for inherently stable items. In so far as there is genuine stability, dependent interviewing can be used to identify and route around redundant questions and thereby reduce respondent burden, interview durations and possibly the number of open-ended answers requiring coding. In addition, tailoring questions to the respondent's situation improves the flow of the interview and reminding respondents of previous answers simplifies the response task, for example by replacing recall by recognition (Hoogendoorn 2004) or requiring yes/no instead of open-ended answers (Jäckle 2005). (See also Holmberg 2004, for a discussion of reasons for the use of DI by Statistics Sweden)

3 Design Options and Their Effects

Dependent interviewing questions are typically classified as either proactive or reactive (Brown, Hale and Michaud 1998). With reactive DI, information fed forward from the previous interview is used to carry out edit checks during the interview; with proactive DI, previous information is used to determine question routing or wording. This broad

classification encompasses a number of design features. The following conceptualisation of the different design options and their effects is based on a review of current practices and research, where the classification of designs was inspired by Pascale and Bates' (2004) description of DI questions in the US Survey of Income and Program Participation (SIPP). Unless stated otherwise, examples are taken from the 'Improving Survey Measurement of Income and Employment' study, described in Section 4.

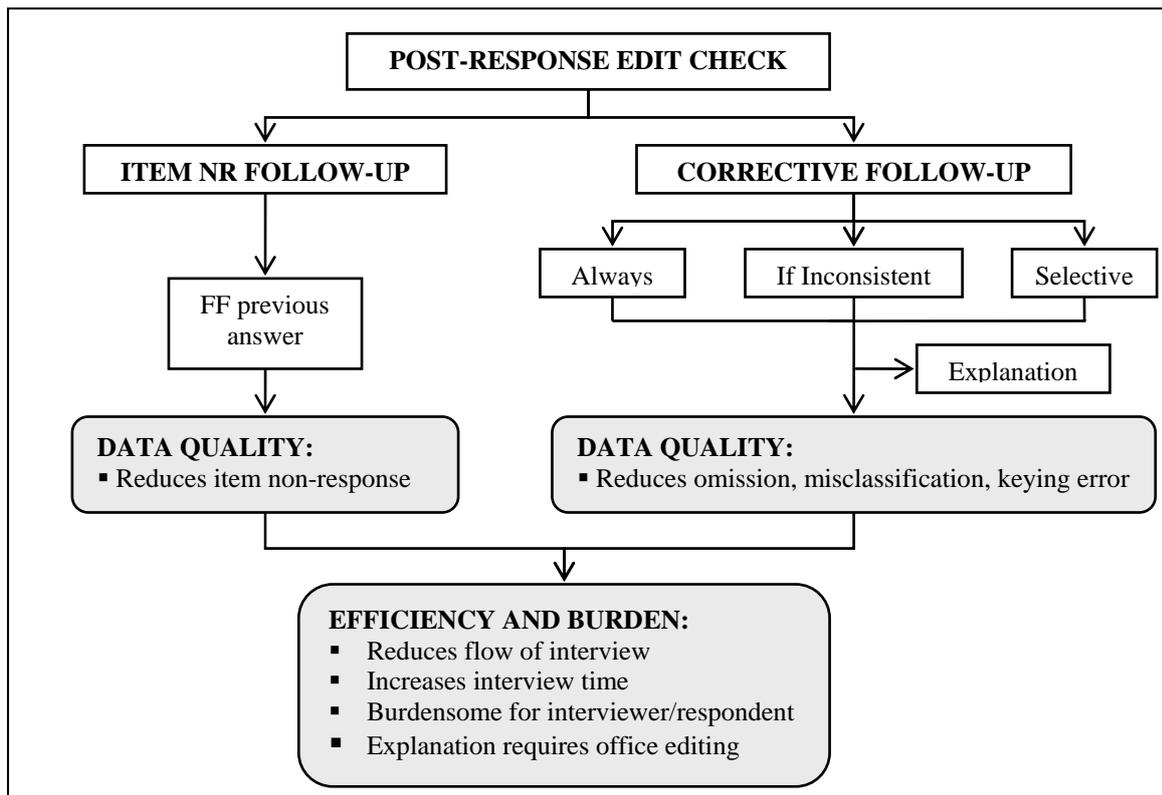
3.1 Reactive Dependent Interviewing

Edit checks based on information from previous interviews can be built in to either follow-up on item non-response or check consistency with previous reports. Edit checks are used to improve data quality, but because they imply additional and potentially difficult questions, the data improvements may come at the cost of respondent burden and efficiency of data collection. Figure 2 illustrates design options (white boxes) for edit check questions and their effects (grey boxes) on data quality, efficiency of data collection and respondent burden, where the arrows indicate conceptual associations.

Item non-response follow-up: The SIPP, for example, does not accept 'don't know' or refusal as a response to questions on income amounts from earnings, unearned income and assets. If the respondent does not volunteer an amount, he is reminded of his report in the previous interview and asked if this still sounds about right: "...last time you received <\$\$\$> in food stamps. Does that still sound about right?" (Moore et al. 2004 p. 193).

Corrective follow-up: An edit check can also be designed to check consistency with previous reports and be prompted (1) always, for example to check consistency of verbatim answers with previous reports: "Can I just check, is that the same employer that you were working for last time we interviewed you, on <INTDATE>, when we recorded your employer as <EMPLOYER>?" (2) to clarify reports that are inconsistent with previous reports: "Can I just check, according to our records you have in the past received <INCOME SOURCE>. Have you received <INCOME SOURCE> at any time since <INTDATE>?" or (3) selectively, if reports differ from previous reports beyond a defined threshold, for example if usual earnings for a standardised period differ by more than +/-10%: "So, your net/gross pay has gone <UPDOWN> since last time we interviewed you, from <AMOUNT₁> per <PERIOD₁> to <AMOUNT₂> per <PERIOD₂>, is that correct?" The respondent may also be asked to clarify reasons for the discrepancy and the explanation may be recorded either as verbatim text or as a pre-coded answer.

Figure 2: Reactive dependent interviewing: design options and effects



Notes: NR 'non-response', FF 'feed forward'. White boxes indicate design options, grey boxes effects and arrows conceptual associations.

Effects on data quality: The non-response follow-up can significantly reduce item non-response (see, Moore et al. 2004 for evidence from the SIPP), while corrective follow-ups can significantly reduce recall and keying errors leading to spurious changes, and omissions of spells leading to constant wave responses. Evidence is discussed in Section 4.

Effects on survey processes: On the other hand, reactive follow-ups are likely to have adverse effects on respondent burden and efficiency of data collection. Edit checks interrupt the flow of the interview and may be ignored by interviewers if there are too many (Dibbs et al. 1995); asking the respondent to clarify inconsistencies and possibly provide explanations may be a difficult task; and additional (difficult) questions are likely to increase the duration of the interview. Attention also needs to be given to the way in which the respondent's answers are queried (see, Mathiowetz and McGonagle 2000, p. 409) and how often they are queried, in order to prevent spoiling the rapport between interviewer and respondent. Finally, explanations of discrepancies require office editing and decisions about how to incorporate corrections of previous data.

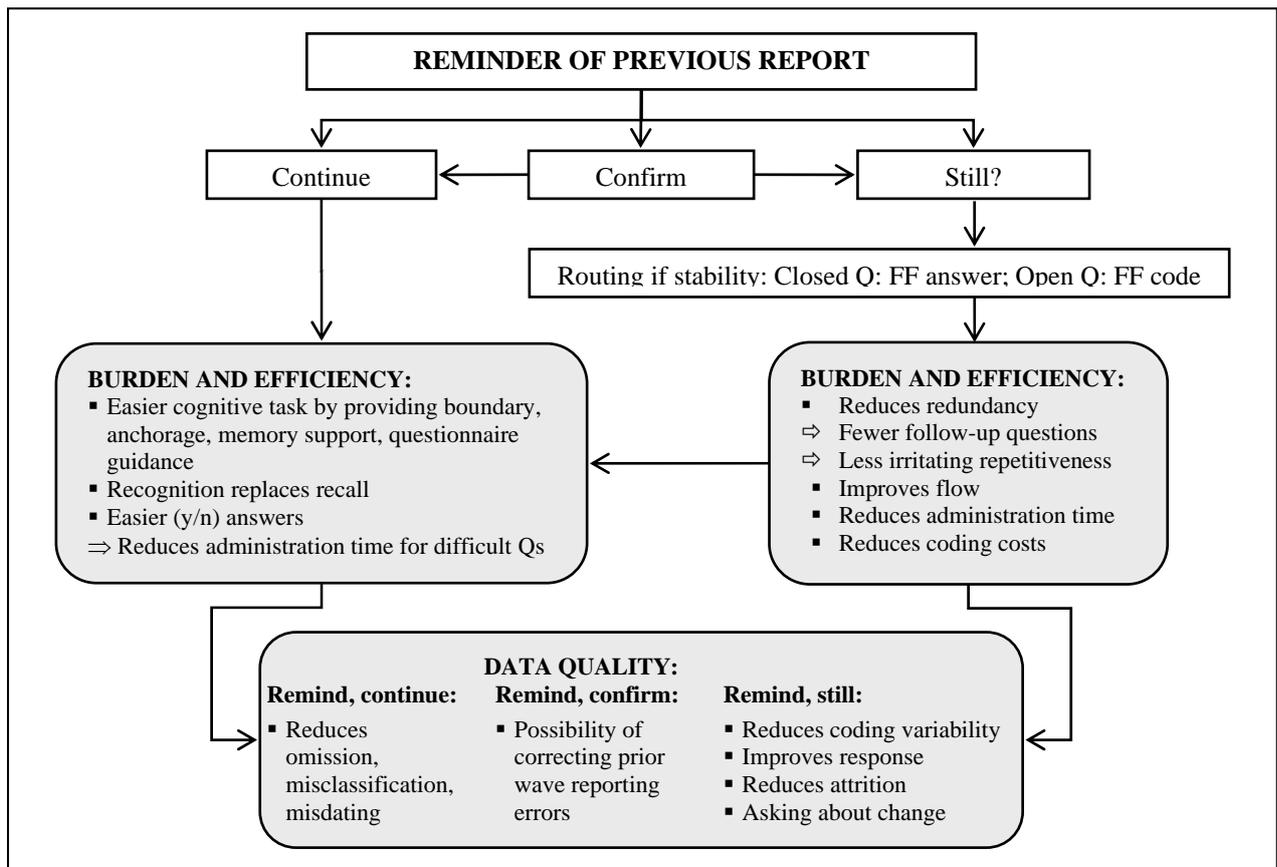
3.2 *Proactive Dependent Interviewing*

With proactive DI respondents can be reminded of previous answers or asked questions they did not answer previously. Reminders primarily simplify the response task and can also be used to reduce redundancies of questions, in either case leading to improved data quality. Figure 3 illustrates the design options (white boxes) for proactive reminders and their effects (grey boxes) on data quality, efficiency of data collection and respondent burden, where the arrows indicate conceptual associations (the use of proactive DI to feed forward previously unanswered questions is not shown).

Feeding forward item non-response: The Canadian National Longitudinal Survey of Children and Youth (NLSCY), for example, asks respondents about the number of times they have moved since the previous interview. Respondents who have not reported on moves previously (because of item non-response or because they were not previously eligible for the question) are asked about the total number of moves in their lifetime. “Thus the survey ensures the same data for all respondents, regardless of what happened in the previous interview” (Brown, Hale and Michaud 1998 p. 195). Feeding forward non-response to previous questions could be particularly useful for baseline demographic information collected only in the first interview.

Reminder of previous reports: Previous information can be used as a reminder (1) to aid the respondent’s memory and provide a boundary before asking the standard independent question (remind, continue): “According to our records, when we last interviewed you, on <INTDATE>, you were receiving <INCOME SOURCE>, either yourself or jointly. For which months since <INTMONTH> have you received <INCOME SOURCE>?” (2) to ask respondents to check and confirm previously recorded answers (remind, confirm): “When we last interviewed you, on <INTDATE>, our records show that you were <LABOUR MARKET ACTIVITY_i>. Is that correct?” or (3) explicitly to ask about changes (remind, still): “Last time we interviewed you, on <INTDATE>, you said your occupation was <OCCUP>. Are you still in that same occupation?”. ‘Remind, still’ type questions are often combined with routing if circumstances have not changed (possibly with subsequent imputation of previous data), for example routing around questions about the characteristics of a job. ‘Remind, confirm’ questions are usually either followed by the standard independent question (as are ‘remind, continue’ questions) or followed by questions about change (similar to ‘remind, still’ questions) and sometimes combined with routing.

Figure 3: Proactive dependent interviewing: design options and effects



Notes: Q 'question', FF 'feed forward'. White boxes indicate design options, grey boxes effects and arrows conceptual associations.

Effects on survey processes: Reminders primarily reduce respondent burden and as a result lead to efficiency gains and improvements in data quality. 'Remind, continue' questions simplify the response task by providing memory support, guidance on the type of information required and temporal boundaries. The cognitive task of recall is replaced by the less demanding task of recognition (Mathiowetz and McGonagle 2000). As a result, questions that are typically difficult, such as long list or retrospective questions may be easier and quicker to administer when combined with reminders. 'Remind, still' designs with routing remove redundancies and can reduce respondent frustration at seeming to have to answer the same questions at every wave (Hoogendoorn 2004). In fact, respondents expect interviewers to be able to use their responses from previous interviews and are not concerned by privacy issues (Pascale and Mayer 2004). Reducing redundancies can also improve the flow of interviews and reduce administration times. In addition, 'remind, still' questions are often phrased as yes/no questions which are easier and quicker to answer, especially for open-ended questions (Jäckle 2005). Finally, the reduction of redundancies can lead to significant

savings in coding costs. The potential for efficiency gains and burden reduction depends on the degree of stability experienced by respondents, which is determined by characteristics of the survey (such as the length of the reference period) and the inherent stability of the item (see, Jäckle 2005 for a discussion).

Effects on data quality: By simplifying the response task reminders can improve data quality significantly, reducing omissions, misdating of changes and misclassifications, and thereby reducing both spurious change and spurious stability. In addition, ‘remind, confirm’ questions can be used to verify previous records and ‘remind, still’ questions can be used to explicitly ask about change instead of inferring change from differences in reports. Coupled with routing and subsequent imputation of previous data, ‘remind, still’ questions can further reduce coding variation and are likely to improve response and reduce attrition by removing detrimental impact on respondent motivation.

4 Empirical Evidence

The ‘Improving Survey Measurement of Income and Employment (ISMIE)’ study presents a unique opportunity to compare the effects of alternative DI designs. This experimental study was funded by the Research Methods Programme of the UK Economic and Social Research Council. The study compared independent interviewing, reactive DI and proactive DI for sets of questions on income sources, current employment, earnings, activity histories and school-based qualifications, based on the 2002 British Household Panel Survey and covering a reference period of on average 18 months. Respondents were randomly allocated to one of the three treatment groups. For a detailed description see Jäckle et al. (2004). The DI questions were primarily designed to improve data quality, although questions on occupation and industry were also designed to reduce redundancies. Appendix 1 provides a summary of the experimental ISMIE questions.

4.1 Income Sources

The ISMIE dependent interviewing questions were designed to reduce omission among respondents who had previously reported receipt of a source. Respondents were first asked which of a list of income sources they had received since the previous interview and then asked period status questions about the timing of receipt. With *reactive DI* this led to a ‘follow-up, inconsistent’ design, similar to that used in the Canadian Survey of Labour and Income Dynamics (SLID) for questions on unemployment insurance, social assistance and workers’ compensation (see, Dibbs et al. 1995). For *proactive DI*, a ‘remind, continue’ design

was used, similar to questions used in the SIPP until the redesign in 2004 (see Burkhead and Coder 1985). Compared to administrative benefit records, both DI designs reduced under-reporting but did not eliminate it, confirming the findings reported for the SLID by Dibbs et al. (1995). There was evidence that cessation of receipt during the reference period was associated with an increased risk of under-reporting and DI was particularly successful in these cases. There was no evidence that reminding respondents of previous income sources led to any increase in over-reporting (Lynn et al. 2004; forthcoming). Although DI reduced under-reporting, the administration time for the corresponding section of the questionnaire did not increase significantly (Jäckle 2005).

Comparison of DI designs: Proactive and reactive DI were similarly effective at reducing under-reporting when compared to administrative records. Reported receipt with reactive DI, when answers to the follow-up questions were not considered, was similar to that with independent questions, suggesting that the experience of reactive follow-ups earlier in the interview did not alter response to later independent questions. Reactive DI might therefore be an attractive design to introduce in ongoing panel studies, since longitudinal consistency is maintained if analysts can identify answers given in response to the edit check (Lynn et al. forthcoming). On the other hand, initial evidence suggests that proactive DI might be better at reducing seam effects (see Section 5).

4.2 Current Earnings

The ISMIE DI questions were designed to catch keying errors in earnings amounts and periods which would lead to spurious change. With *reactive DI*, a ‘follow-up, selective’ design was chosen, prompted by a change in earnings by more than +/-10%. Respondents who did not confirm the change were asked to explain the reason for the discrepancy and to correct the amount or period. Similar designs are used in the SLID and the SIPP (see, Hale and Michaud 1995; Moore and Griffiths 2003). With *proactive DI*, a ‘remind, still’ design was used. To test whether proactive DI would capture changes, respondents were also asked the independent earnings questions. Although 59% of respondents were asked the reactive edit check question, all but one confirmed the change. In comparison, Hale and Michaud (1995) reported that only 8.3% of SLID respondents reported earnings which differed by more than +/-10% and under a third confirmed an error. This suggests that there may not be an optimal band width to query changes in earnings across surveys, but that the bands should be determined from the actual distributions of change observed in the data. Proactive DI did not lead to aggregate under-reporting of change, although at the individual level some

answers to the ‘remind, still’ question were inconsistent with the answers to the independent questions (Jäckle 2005). Unfortunately, it is impossible to distinguish whether the reminder led to false reports of stability, or whether the independent amounts contained errors leading to false rates of change.

Comparison of DI designs: Proactive DI is not recommended because of the potential under-reporting of change over time, although this was not evident in the ISMIE survey. Ideally one would want to know how well proactive DI captures change after a number of successive interviews, since an initial amount of earnings may be fed forward several times, if the respondent repeatedly answers the ‘remind, still’ question saying he has not experienced a change. Reactive DI designs appear most appropriate, with bands chosen to target potential errors and minimise the additional burden for respondents.

4.3 Current Employment

Dependent interviewing was implemented for a set of questions about the respondent’s job and employer, with the objective of reducing spurious changes compared to the previous wave report. With *reactive DI*, ‘follow-up, always’ questions were used for the open-ended occupation and industry questions, and ‘follow-up, inconsistent’ questions for the remainder items. With *proactive DI*, ‘remind, still’ questions with routing were used, similar to designs in the SLID, SIPP and the US Current Population Survey (CPS), although these surveys make more use of routing around questions on employment characteristics if the respondent is in the same occupation and working for the same employer (see, Hiltz and Cléroux 2004; Kostanich and Dippo 2002; Moore and Griffiths 2003). For respondents in the same job since the previous interview, levels of change in employment characteristics were implausibly high with independent interviewing. Proactive DI resulted in lower levels of observed change for occupation, industry, managerial duties and size of workforce; reactive DI did not significantly reduce rates of change (Sala and Lynn 2004). This suggests that proactive DI led to reductions in measurement error and confirms reports from the CPS (see, Polivka and Rothgeb 1993 p. 19), about which Hill concluded that “most of the observed ‘change’ [in industry and occupation codes] with independent data collection methods is a result of variability in the response/coding process” (Hill 1994, p. 366). Proactive DI also achieved substantial savings in coding costs: routing around open-ended industry and occupation questions reduced the number of items to be coded by 2/3 (Jäckle 2005). Similar gains were reported by Kostanich and Dippo (2002, p. 9-1) for the CPS.

Comparison of DI designs: Reactive DI does not appear effective at reducing measurement error for questions on current employment. In addition, proactive designs offer large scope for efficiency gains, especially for open-ended occupation and industry questions, if combined with routing and feeding forward of previous codes. There are however open issues as to which employment characteristics can be assumed unchanged if the respondent is still in the same occupation and working for the same employer.

4.4 Labour Market Activity Histories

The ISMIE DI questions were designed to reduce spurious transitions at the seam in reports of labour market activities since the previous interview. With *reactive DI*, a ‘follow-up, inconsistent’ design was used to query retrospective reports that were inconsistent with current activity reports from the previous interview. With *proactive DI*, a ‘remind, confirm’ design was used, reminding respondents of the previous wave current activity as an entry into the history. With reactive DI inconsistencies arose in 14% of cases. Half the respondents said the earlier report was correct: the respondents had forgotten about spells and confirmed them when they were presented to them. The remainder respondents either said both reports were correct (for example, retired and in part-time employment) or that they no longer remembered (Jäckle and Lynn 2004). When reminded of their previous current activity, nearly 99% of respondents confirmed this (Hale and Michaud 1995, reported similar confirmation rates for the SLID). Proactive DI led to a significant reduction of seam transitions, especially for job to job changes, confirming findings from the Canadian Labour Market Activity Survey (LMAS) (Murray et al. 1991). Proactive DI did not appear to lead to under-reporting of change, since transition rates at the seam still tended to be higher than in non-seam months. Eliminating the redundancy in reporting the previous wave current activity reduced the number of questions answered in this section by 55% and coding time for open-ended industry and occupation descriptions by 81% (Jäckle 2005).

Comparison of DI designs: Reactive DI is not appropriate to collect activity histories with sequential spell questions: if the respondent corrects a report in reaction to an ‘inconsistent, follow-up’, the entire sequence of spells may in fact be erroneous and would probably have to be asked again. Proactive DI is effective both at reducing redundancies of reports across waves and at reducing seam effects. Errors are not eliminated, however, because proactive DI remains sensitive to errors in reporting of transition dates.

4.5 School-Based Qualifications

The DI questions were designed to improve the reliability of highest qualification measures, derived from annual questions about education and training during the reference period. With *reactive DI*, respondents were asked ‘follow-up, always’ questions for any new qualifications reported. With *proactive DI*, respondents were asked ‘remind, confirm’ questions about their qualifications recorded previously. A similar design is used in the National Longitudinal Survey of Youth 1979, which starts by asking respondents to confirm or correct the highest educational attainment recorded in the previous interview, before asking about changes since (Hering and McClain 2003, p. 98). Sample sizes were extremely small for the reactive follow-up, since only few respondents reported obtaining new qualifications during the reference period (N=6). Only in one of these cases were the records incorrect. With proactive DI, 6% (N=22) of the treatment group corrected their record (not taking account of qualifications gained since the previous interview). But only in four cases did this affect the derived highest qualification measures. Respondents who had not been interviewed in all waves since the start of the panel were more likely to have incorrect records, although wave non-response did not explain all cases of erroneous records.

Comparison of DI designs: The ‘remind, always’ design can be useful to verify information which is updated annually. If wave non-response is related to changes, for example if students in their final year are too busy to take part in the survey but join the survey again later, then their qualification will not be picked up since the following survey will only ask about changes in the current reference period. The reminder may also be used for occasional verification purposes, or only asked after a wave non-response, rather than as a regular design. The reactive design appears less suitable, since it will only detect errors for respondents who have obtained and reported a new qualification.

5 Effects of Dependent Interviewing on Data Quality across Surveys

The evidence suggests that DI improves cross-wave continuity: both reactive and proactive DI reduce misclassification and under-reporting of events, in addition reactive DI reduces keying error and proactive DI with routing reduces coding variability. Returning to Figure 1, DI reduces spurious changes at the seam and constant wave responses caused by under-reporting of events or statuses, especially for respondents who experienced a change during the reference period.

There is no evidence to support the concern voiced by Mathiowetz and McGonagle (2000) that proactive DI may lead to bias caused by respondents simply agreeing with previous information: in the ISMIE survey transition rates for labour market activities remained higher for seam than non-seam months, even with proactive DI; the reminder did not increase over-reporting of income sources; aggregate measures of change in earnings were not affected; confirmation rates for previous reports of labour market activities in the SLID and ISMIE were slightly less than 100%, which can be taken as evidence that respondents do not blindly confirm what is presented to them (Hale and Michaud 1995) and in the LMAS transitions from employment were not under-estimated at the seam compared to administrative records (Murray et al. 1991). The ISMIE findings reinforce Hale and Michaud's (1995 p. 10) conclusion that survey organisations "should be using feedback to help [...] collect data that otherwise might be forgotten rather than worry about feedback preventing reporting of change."

Several problems remain, however. First, some under-reporting remains, because DI can only have an impact on respondents for whom feed forward information is available from the previous wave. Given that the propensity to under-report is likely to be associated with some fixed characteristics of the survey respondent, those who under-report at the current wave could be expected to have an increased propensity to have under-reported also at the previous wave. Under-reporting could further be reduced if the DI questions could be extended to other sample members. Lynn et al. (2004) for example suggested extending the DI questions for income sources to include all who reported receipt at any of the previous three waves (three appearing optimal in terms of coverage of under-reporters versus additional burden for non-recipients), plus groups with a high likelihood of receipt by filtering DI questions on predictors of receipt (e.g. mothers for child benefit) to increase coverage of under-reporters.

Second, DI does not improve dating of events. In sequential spell questions, DI does not reduce non-response to date questions and it is not clear to what extent misdating of changes is reduced. As a result, the capacity of DI to reduce seam effects is limited (see, Jäckle and Lynn 2004). In period status questions respondents still tend to provide constant wave responses. In ISMIE around 86% of income sources were reported as having been received for all months in the reference period, regardless of treatment group. By reducing under-reporting, DI did reduce spurious changes, but could not eliminate the concentration of transitions at the seam: with independent interviewing 76% of all transitions observed in the

reference period occurred at the seam, compared to 64% with reactive DI and 58% with proactive DI. The comparable figure from the administrative records was 8%.

This leads to a puzzle regarding the impact of DI on errors in measures of change. While proactive DI has been shown to successfully reduce seam effects in transitions from employment (Murray et al. 1991) and to a lesser extent transitions in labour market activity status in general (Jäckle and Lynn 2004), proactive DI is not effective at reducing seam problems for income data (Burkhead and Coder 1985). Lemaitre's (1992) discussion suggested that the differences are due to differences in design of the DI questions: the LMAS used 'remind, confirm' questions where information about employment at the time of the previous interview served as the starting point for the following interview. In contrast the SIPP and ISMIE income questions used 'remind, continue' designs. Apparently inspired by this critique, the SIPP questions were revised in 2004 as 'remind, confirm' questions, such that any apparent changes at the seam were queried. This new design was, however, disappointing in that it did not eliminate seam effects: the percentage of transitions in receipt observed at the seam was reduced from 66% with the original DI design to 52% for income from welfare programmes. The expected value in the absence of seam effects would have been 17% (Moore et al. 2004, Table 10.6).

This suggests that factors that determine the nature of errors need to be examined when evaluating the effect of DI for different items or in different surveys. The nature of errors is likely to be influenced by characteristics of the *survey*, for example the length of the reference period (since recall errors increase with time), following rules (since alternations between proxy and self response will lead to response variation), or changes in interviewers or coders. The nature of errors is also determined by characteristics of the *item* of interest. Labour market activities are likely to be more salient, not least because they may form an important part of the respondent's identity, and therefore be easier to recall correctly than income sources. In addition, income sources are multi-dimensional, since respondents may have received any number during the reference period, whereas labour market activities are mutually exclusive sequences of spells (at least if the survey asks about a well-defined 'main' activity). In general, the extent to which the item is clearly defined and response categories are unambiguous and mutually exclusive can determine the effectiveness of DI. The puzzle also suggests that the *temporal structure* of a question may have an impact on seam effects, regardless of the features of the DI design. As Burkhead and Coder (1985) pointed out, period status questions do not require the respondent to explicitly think about dates of changes. This may also explain Rips, Conrad and Fricker's (2003) low expectations as to the

effectiveness of DI at reducing seam effects, since their laboratory study of the causes of seam effects was based on period status questions.

6 Open Issues

Much has been learned since Mathiowetz and McGonagle (2000, p. 416) concluded that “With respect to dependent interviewing, the empirical literature is virtually nonexistent”. Nonetheless, many questions remain unanswered and many new questions have arisen.

Practical issues of implementation: Little is still known about the effects of alternative question wording for given DI designs or about the impact of DI on the interviewer-respondent interaction.

Data quality: Although extensions to further reduce under-reporting have been proposed (see, Lynn et al. forthcoming), their effectiveness has not been tested. Improving the reporting of dates remains an unsolved problem, as does the question to what extent DI really reduces errors or merely leads to correlations in errors. There is also only anecdotal evidence about items on which DI has had detrimental impact and no clear evidence whether DI has any positive effect on attrition (see, Moore et al. 2004).

Data comparability: Within one wave of a survey, different respondents in fact answer different questions, depending on whether feed forward information is available for them. Comparability over time in an ongoing panel survey can be hampered, since the introduction of DI is likely to introduce major breaks. Comparability across surveys is also affected if different surveys use different designs. This is especially problematic in cross-national data collection exercises, such as the EU Survey of Income and Living Conditions, where no central guidance is given on the use of dependent methods of data collection. This suggests that the standardisation of DI approaches, at least for the surveys run by one agency, would be an important future development.

Impact on analysis: Most studies of the effect of DI have been carried out by government statistical offices, which tend to be interested in univariate statistics rather than relationships between variables. Not much evidence exists about the impact of different data collection methods on other types of analysis for which repeated panel data are used (a notable exception is Hill 1994). Jäckle and Lynn (2004), for example, suggested that although DI significantly reduces errors, it may not lead to different results depending on the focus of analysis.

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Appendix 1: ISMIE experimental questions and rationale for DI designs

Income sources:	
Reduce omission among respondents who had previously reported receipt of a source	<p>INDI: <i>Please look at this card and tell me if, since September 1st 2001, you have received any of the types of income or payments shown, either just yourself or jointly? And for which months since September 1st 2001 have you received...?</i></p> <hr/> <p>RDI (follow-up, inconsistent) - for each income source reported in previous wave but not in the ISMIE survey: <i>Can I just check, according to our records you have in the past received <SOURCE>. Have you received <SOURCE> at any time since <INTDATE>? For which months since <INTMON> have you received <SOURCE>?</i></p> <hr/> <p>PDI (remind, continue) - for each income source reported in previous interview: <i>According to our records, when we last interviewed you, on <INTDATE>, you were receiving <SOURCE>, either yourself or jointly. For which months since <INTMON> have you received <SOURCE>? Then INDI question to catch new sources.</i></p>
Current earnings:	
Catch keying errors in earnings amounts and periods which would lead to spurious change	<p>INDI: <i>The last time you were paid, what was your gross pay - that is including any overtime, bonuses, commission, tips or tax refund, but before any deductions for tax, national insurance, or pension contributions, union dues and so on?</i></p> <hr/> <p>RDI (follow-up, selective) - if net/gross pay has gone up or down by more than 10%: <i>So, your net/gross pay has gone <UPDOWN> since last time we interviewed you, from <AMT1> per <PERIOD1> to <AMT2> per <PERIOD2>, is that correct?</i></p> <hr/> <p>PDI (remind, still) <i>Last time we interviewed you, on <INTDATE>, our records show that your pay was <AMT1> per <PERIOD1> <GROSS/NET>. Is that still the case now, or has your pay changed?</i></p>
Current employment:	
Reduce spurious changes compared to previous wave report	<p>INDI: <i>What was your (main) job last week? Please tell me the exact job title and describe fully the sort of work you do. What does the firm/organisation you work for actually make or do (at the place where you work)? What is the exact name of your employer or the trading name if one is used? Are you an employee or self-employed? If employee: Do you have any managerial duties or do you supervise any other employees? If employee: How many people are employed at the place where you work?</i></p> <hr/> <p>RDI (follow-up, always) - for open-ended occupation and industry questions: <i>Can I just check, is that the same employer that you were working for last time we interviewed you, on <INTDATE>,</i></p>

when we recorded your employer as <EMPLOYER>?

RDI (follow-up, inconsistent) - for other employment characteristics:

So, since last time we interviewed you, on <INTDATE>, you've changed from being <EMPSTAT1> to <EMPSTAT2>: is that correct?

PDI (remind, still):

Last time we interviewed you, on <INTDATE>, you said your occupation was <OCCUP>. Are you still in that same occupation?

Activity history:

Reduce spurious transitions at seam in reports of activities since previous interview

INDI:

What you were doing immediately before [your current job / spell of <ACTIVITY> which started on <DATE>]?

RDI (follow-up, inconsistent) - If Wave 11 current activity different from ISMIE retrospective report of wave 11 activity:

May I just check something? According to our records, when we last interviewed you, on <INTDATE>, you were <ACTTX1>. That spell had started in <ACTMTX1>. But the information that you have just given me implies that you were <ACTTX2> at that time. It may be that I have recorded something wrongly and it is important to us that our information is accurate, so can you just clarify that for me?

If activity reports correspond but start month does not:

May I just check something? According to our records, when we last interviewed you, on <INTDATE>, your current spell of <ACTTX1> had started in <ACTMTX1>. But the information that you have just given me implies that this spell started in <ACTMTX2>. It may be that I have recorded something wrongly and it is important to us that our information is accurate, so can you just clarify that for me?

PDI (remind, confirm) – ask all:

When we last interviewed you, on <INTDATE>, our records show that you were <ACTTX1>. Is that correct?

Qualifications:

Improve reliability of highest qualification measures derived from annual questions about education and training during reference period

INDI:

Have you attended any education institution full-time since September 1st 2001? IF yes: Any qualifications obtained?

RDI (follow-up, always) - for each new qualification reported ask:

You have told me that you have gained <N1_x> <QUAL_x> since last time we interviewed you, and my records show that you previously had <N2_x> <QUAL_x>, so, you now have a total of <N1_x+N2_x> <QUAL_x>: is that correct?

PDI (remind, confirm) - ask all:

We are particularly interested in checking the accuracy of the information we hold about school-based qualifications. According to our records from previous interviews, you have <QUALTXT1>. Is that correct?
