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**WEB VERSUS PAPER QUESTIONNAIRES: A DESIGN AND FUNCTIONALITY
COMPARISON**

Invited paper submitted by the Office for National Statistics, United Kingdom*

ABSTRACT

Every year the number of people who access the web, either at home or at work, increases. This increase in popularity has led to more survey organizations using the web as a means of collecting survey data, either as the sole means or in mix-modal data collection. As a result there are more and more survey questionnaires available on the web. But what are the questionnaire design implications of this new method of data collection on surveys that are already well established on paper? Many papers have addressed the quantitative aspects of paper versus web questionnaires e.g. response rate, data quality etc. (Kwak and Radler, 2002; Cobanoglu et al., 2001; Couper, 2000; Couper et al., 1999; Schaefer and Dillman, 1998). However, there is very little literature that specifically addresses design issues between the two modes. One particular area of concern is the length of the questionnaire; longer questionnaires can have an increased download time. Any delay in downloading the questionnaire will lead to an increase in completion time, which will have a detrimental effect on actual and/or perceived respondent burden. In contrast, the use of routing and the general functionality options available for web questionnaires can reduce the complexity of the questionnaire, which can lead to a reduction in respondent burden. The aims of this paper are to compare and contrast the design and functionality of web and paper questionnaires from the survey organization and respondent perspectives. In the paper, examples are given from recent business survey research and Census development work.

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WEB DEVELOPMENTS AT THE UK OFFICE FOR NATIONAL STATISTICS

1. The UK Office for National Statistics is currently carrying out research on standards and guidance for the design and functionality of web questionnaires. The aim is to use these standards and guidance for designing and implementing web questionnaires as an alternative mode for business surveys, social surveys and the population Census. Currently, business surveys primarily collect data using paper questionnaires with telephone data entry (TDE) in some surveys collecting nine or less data items; social surveys primarily use computer assisted personal (CAPI) or telephone (CATI) interviewing; and the Census traditionally has used paper questionnaires. It is anticipated that the introduction of web questionnaires will increase response rates for social surveys and the Census. In addition, the collection of data via the web may improve the accuracy and relevance of the data through online edits and validation. Furthermore, use of the web will reduce data capture expenditure (for example, costs in handling, scanning, storing and managing paper questionnaires), and improve timeliness, especially for the Census, as data received through a web capture system would be passed more quickly into the data capture process than paper questionnaires (Jones et al. 2004a).

2. Whilst undertaking the web questionnaire standards and guidance research, issues surrounding the response process and respondent burden are also being taken into consideration. This is because these issues can play an important part in deciding on questionnaire design and functionality.

THE RESPONSE PROCESS

3. When designing questionnaires it is important to bear in mind how the respondent will receive the questionnaire and the steps that they have to undertake to enable them to respond. Models of the response process have been developed for household and general population surveys (Tourangeau 1984 and Eisenhower et al. 1991). The steps in the model are:

- encoding in memory;
- comprehension;
- retrieval;
- judgement;
- communication.

4. For business surveys, this model was extended to reflect the additional steps in the business survey response process (Edwards et al., 1991; Sudman, et al., 2000; Willimack et al. 2002). The Willimack and Nichols (2002) model identifies 8 steps in the response process:

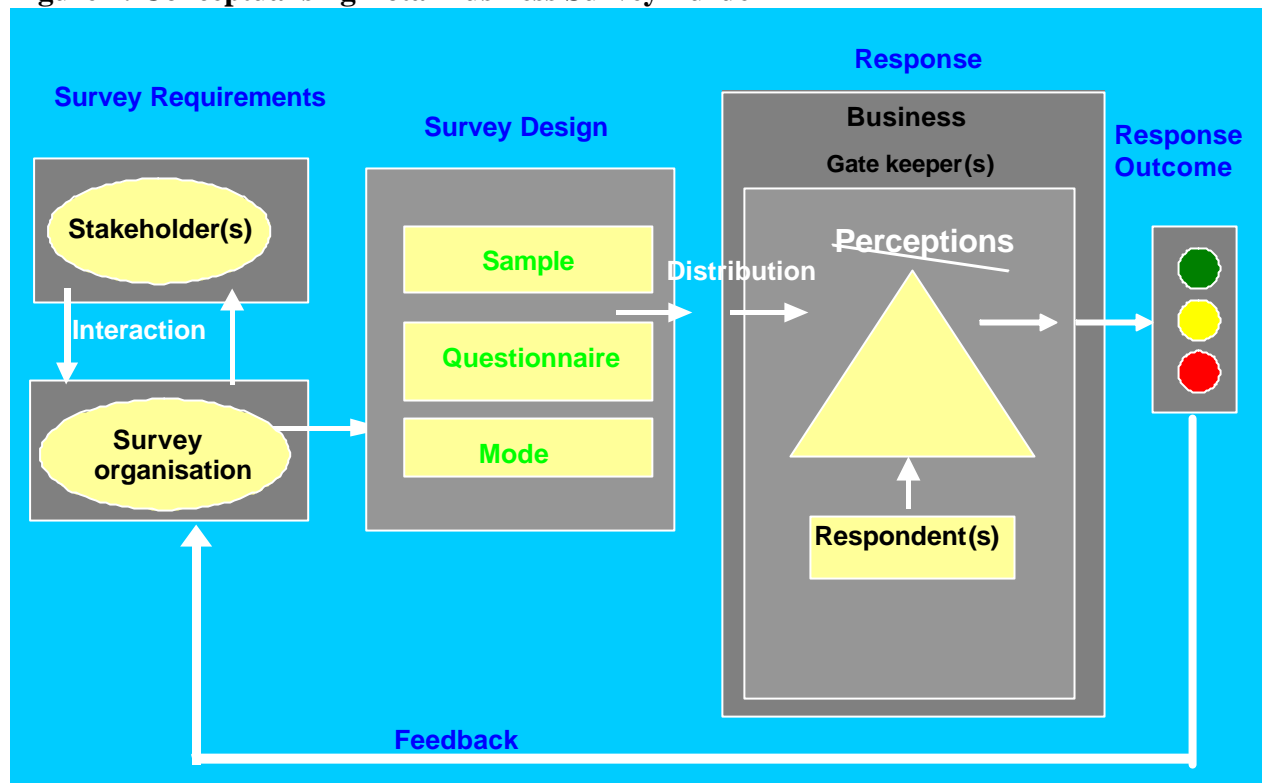
- encoding in memory/record formation;
- selection and identification of the respondent or respondents;
- assessment of priorities;
- comprehension of the data request;
- retrieval of relevant information from memory and/or existing company records;
- judgement of the adequacy of the response;
- communication of the response;
- release of the data.

5. The fact that there are additional steps in the response process for business surveys needs to be born in mind when designing business survey web questionnaires. These additional steps may require different questionnaire designs (e.g. a saveable questionnaire format) to enable all respondents in a business (e.g. gatekeepers and data releasers) to participate in the response process.

RESPONDENT BURDEN

6. Respondent burden (actual and/or perceived) should be another key consideration in designing questionnaires. Traditionally, ONS business surveys have defined and measured actual burden as the time it takes the respondent(s) to complete the questionnaire over and above their standard administrative duties. Perceived burden has traditionally not been taken into consideration. Perceived burden accounts for other factors, such as the amount of effort required by the respondent(s) and the stress induced by sensitive questions that are not necessarily related to time measurement (Bradburn, 1978). It has been suggested that overall burden is a combination of respondent burden (e.g. completion time), design burden (e.g. how often the respondent is contacted) and interaction burden (e.g. task and memory demands) and that the perception of burden can be affected by all three (Fisher & Kydonieffs, 2001). Burden can be associated with many aspects of questionnaire design including lengthy completion times, complicated help information, and over complicated survey flow, to name but a few.

7. In recent research carried out by the ONS, Statistics Norway and Statistics Sweden on 'Developing methods for assessing perceived response burden', part of the Eurostat Leadership Group (LEG) on Quality Implementation, a conceptual model of total business survey burden was developed (Jones et al., 2004b). The model (figure 1) identifies the actors and processes involved in the initiation, design and response to a business survey. The development of this model has led to an increased awareness of the survey processes a survey organization has control over and how design decisions can impact on respondent burden and data quality.

Figure 1: Conceptualising Total Business Survey Burden

THE VISUAL DISPLAY OF QUESTIONNAIRES

8. One of the major differences between web and paper questionnaires is the survey organizations control of the visual display of questionnaires. Visual display design is very important as it assists respondents in navigating through the questionnaire. For paper questionnaires respondents should see the questionnaire exactly as designed by the survey organization. In contrast, the technical control of visual display for web questionnaires is determined by a number of factors in the respondent's computer environment for example, different operating systems (Windows vs Mac), different browsers (Internet Explorer vs Netscape) and different versions of the browser (Couper, 2000; Kaye & Johnson, 1999). Differences can also occur due to the settings on the respondent's computer for example, screen resolution (most common are 640 x 480, 800 x 600 or 1024 x 768 pixels) or if it is viewed as full or partial screen (Dillman, 2000). These factors can lead to changes in the relative distances between horizontal scale categories, mis-aligned text, questions not fully visible on the screen and differences in colours. The latter of these can be controlled to some extent by using 'browser safe' colours. Newer computers have the ability to display thousands, if not millions of colours; however some older computers can only display up to 256 colours. The World Wide Web Consortium (W3C) has recommended a range of colours for use in websites that are browser safe. This means that they will appear in the same colour for most operating systems and browsers.

9. Other than these technical factors, the visual display of web questionnaires adheres to many of the same standards and guidance as paper questionnaires: consistency in typography (eg font, size, use of colour, use of upper/lower case); spacing between headings, the

placement of questions and response options; question wording and structure. All of which can impact on actual and perceived response burden.

QUESTIONNAIRE LENGTH

10. Questionnaire length is a consideration for both paper and web questionnaires. A respondent friendly paper questionnaire may increase in length as it maybe less condensed; include additional information at the point that it is required; and include appropriate routing. Despite an increase in length respondent burden may still be reduced due to the respondent friendly design. For example, when the ONS redesigned the New Earnings Survey¹ (NES) paper questionnaire and new questions were also incorporated, a field test of the 'old' two sided questionnaire and a 'new' six sided questionnaire showed virtually no increase in actual respondent burden and fewer respondent complaints were received. However, from the survey organizations perspective the questionnaire production, distribution, handling, scanning, and electronic storage costs became too great. To reduce these costs the questionnaire was further redesigned to a four sided questionnaire.

11. For the survey organization, longer web questionnaires will not have the same financial resource implications as paper questionnaires. Although there are the initial set-up costs there are no printing, postage, or scanning/keying costs. Further financial savings may also be made in the use of on-line validation. Longer web questionnaires might have a greater impact on respondent burden by increasing the download time. In addition to questionnaire length, some selected design features may also increase download time, for example the selection of a paging versus a scrolling format. Reports in the literature are somewhat contradictory, with some studies reporting no differences between the two designs (Norman et al., 2001; Zukerberg et al., 1999) and others reporting longer download with paging (Fuchs, 2001; Couper et al., 2000).

12. Lengthier or slow downloading questionnaires can have financial implications to the respondent. Household respondents might be using a dial-up connection, which means they might end up paying more to complete a longer/slower to download questionnaire. The financial cost to business respondents will be in the person hours taken to complete the questionnaire; though the respondents themselves will not be paying, the business will be paying for the time away from other duties and the web connection. However, there is also a financial/time burden on business respondents with the use of paper questionnaires.

FUNCTIONALITY

13. Paper questionnaires have no inbuilt functionality as there is no inbuilt interaction with the respondents. In contrast survey organizations can design web questionnaires to include functionality such as on-line validation, automatic routing and on-line question instructions and guidance. When designing web questionnaires survey organizations should also consider the implications of increased functionality from the respondents' perspective. The reason being that increased functionality may for some elements increase respondent burden.

FUNCTIONALITY - VALIDATION

14. For both paper and web questionnaires the survey organization decides where to include validation and designs the validation checks. Validation is used to check that a respondent has consistently completed all the necessary questions in the correct format. In panel surveys, data is often validated against data returned in previous waves. What data are validated and how they are validated needs careful consideration by the survey organization.

15. For web questionnaires on-line validation checks can be implemented for some or all of the questions, can appear at different stages of questionnaire completion, and can appear more than once. Web questionnaire validation is carried out in 'real-time', that is as the respondent is completing the questionnaire. Over validation could deter the respondent from progressing through the questionnaire and can potentially increase actual and perceived respondent burden. Under validation could affect data quality and increase burden on the survey organization, stakeholders and other users.

16. There is no real-time validation for paper questionnaires. Instead validation is carried out after the respondent has completed and returned the questionnaire. In business surveys validation errors are often dealt with by recontacting the respondent for clarification. For the Census there is no recontact and imputation methods are often used. This eases the burden on the respondent but increases the burden to the survey organization.

FUNCTIONALITY - ROUTING

17. Incorporating routing into questionnaires can identify item non-response and/or unnecessary response and remove unnecessary question completion. The survey organization decides if and when to include routing. In ONS routing is generally used in social survey CAPI and CATI questionnaires; it is also used in the Census paper questionnaire; but it has not been used in business survey paper questionnaires².

18. Where routing is included in paper questionnaires it is the responsibility of the respondent to follow it. Successful routing by the respondent depends on clear routing instructions; even then questionnaires are sometimes incorrectly completed. Despite good design it is impossible in paper questionnaires to ensure that every respondent fully reads the questions and understands the routing. Web questionnaires can use automatic routing based on the answers already provided and remove potential respondent error. Depending on the layout of the questionnaire and the selection of the routing method, respondents might be completely unaware that they have been routed past questions. Appropriate routing is likely to reduce perceived response burden, could decrease completion times and may increase data quality through the identification of item non-response and unnecessary response. The inclusion of routing in paper questionnaires often places a financial cost on the survey organization as it increases the length of the questionnaire.

FUNCTIONALITY - ADDITIONAL QUESTIONNAIRE INFORMATION

19. To assist respondents in completing a questionnaire there is generally a need to include additional information such as whether to tick or cross response boxes; what to do if they have

made a mistake; and to provide additional clarification to questions. The amount of additional information included on or with the questionnaire is generally decided by the survey organization.

20. For paper questionnaires, too much information can be daunting for respondents and become unhelpful and burdensome. It can also increase the financial costs to the survey organization as more paper has to be printed and dispatched. To assist respondents, relevant, concise additional information should be included at the point where it is required. However, for many paper questionnaires there is often insufficient space for the level of information required. To overcome this issue additional information is either collated and presented at the beginning or end of the questionnaire or placed in a separate booklet. This could result in respondents having to continually move between the questionnaire and the respective additional information or in an attempt to reduce the response process, guessing how to respond. With a web questionnaire, detailed help information can be provided via a link alongside the relevant question, which can be accessed if needed.

FUNCTIONALITY - PERSONALISING QUESTIONNAIRES

21. Survey organizations can design web questionnaires to use data or information entered earlier in the questionnaire. For example, at the beginning of the 2001 UK Census paper questionnaire respondents were asked to enter the names of all household members. In subsequent person questions the paper questionnaire must still refer to each member as 'person 1' or 'person 2' and so. In a web questionnaire the names of the household members listed at the beginning of the questionnaire could be used to personalise subsequent person questions thereby removing the need for the impersonal use of 'person 1' and so on. This would make it easier where one person is completing the questionnaire on behalf of the entire household as there will be a reminder as to the identity of each 'person'.

22. Another question that could be improved by using this procedure is the 2001 Census 'relationship' question. This question was designed to ascertain the relationships of every member of the household to one another. The question was divided into four sections (Figure 2): section one asked the relationship of 'person 2' to 'person 1', the response options were listed vertically and the respondent was required to tick the correct box; section two asked the relationship of 'person 3' to 'person 2' and 'person 1', this question was presented with the answer options in a response matrix format, again requiring a tick response; section three and four followed the same format as section two, e.g. state the relationship of 'person 4' to 'person 3', 'person 2' and 'person 1' etc. The instructions for completion were long and the layout was confusing.

Figure 2: 2001 Census relationship question

The figure displays two pages of a census form. The left page is titled "Household Members and their Relationships within the Household" and includes instructions. It shows a form for three household members: Person 1 (John Smith), Person 2 (Mary Smith), and Person 3 (Alison Smith). The right page continues the form for Person 4 (Steven Smith) and Person 5 (James Smith). Each person's section includes a box for their name and a grid of checkboxes to indicate their relationship to each other household member.

Figure 2, illustrates the double page spread of the relationship question. Respondents were required to input the name of each household member into one of the pink boxes halfway down the page and cross the box detailing the relationship of that person to each of the others in the household.

23. A web version of the relationship question could make it much simpler and personal for respondents to complete. The relationship question could be preceded by two household member questions; the first would ask for how many people were usually resident in the household; and the second would ask for the first name and surname of each household member. These two questions would allow the relationship question to become personalised. Firstly, the correct number of household members could be presented; having already established how many people were usually resident. Secondly, the names of the household members could be presented instead of 'person 1' etc. Thirdly, with the use of the appropriate response options the question could be set out as individual questions with drop down menus for the answers (Figure 3) e.g. how is Fred related to Mary? A drop down menu could then provide a list containing all the appropriate answers.

Figure 3: Possible web relationship question

The screenshot shows a web interface for the 'count me in Census2001' survey. On the left is a vertical navigation menu with buttons for 'Home', 'Household Members', 'Relationships', 'Fred Jones', 'Mary Jones', and 'Jonny Jones'. The 'Relationships' section is active, displaying three questions. The first question asks 'How is Fred Jones related to Mary Jones?' with a dropdown menu showing 'Partner' selected. The second question asks 'How is Fred Jones related to Jonny Jones?' with a dropdown menu showing 'Grandparent' selected. The third question asks 'How is Mary Jones related to Jonny Jones?' with a dropdown menu open, showing a list of relationship options including 'Husband or wife', 'Partner', 'Son or daughter', 'Brother or sister', 'Mother or father', 'Step-mother or step-father', 'Grandchild', 'Grandparent', 'Other related', and 'Unrelated'. At the bottom right of the main content area are 'Back' and 'Next' buttons.

Figure 3, taken from the ONS web data collection testing plan, illustrates what the relationship question could look like on a web questionnaire. The names of the household members have been used in the question wording and the correct number of household members has been included (based on the answer to a previous question). The names have also been used to personalise the menu button links to the personal information pages on the left.

24. Personalization techniques can also be applied in web questionnaires through the use of automated calculations. For many business surveys this would reduce the need for respondents to calculate totals of requested breakdowns themselves. These techniques are within the control of the survey organization and could significantly contribute to reducing the level of actual and perceived respondent burden.

25. For panel surveys, both paper and web questionnaires could use dependent data collection methods to make the questionnaire appear more personal. Dependent data collection is when data collected in previous waves are fed back to the respondents for them to confirm or change. For business surveys the benefits of dependent data collection are still being considered. From a respondent burden perspective dependent data collection should reduce respondent burden. However, from a survey organizations' perspective there are also data quality concerns. Respondents may confirm past data as correct when in fact there has been a change, simply because it is easier to do so.

QUESTIONNAIRE COMPLETION

26. A respondent who receives a paper questionnaire can browse through it, set aside time for completion and fill parts of it out when they are ready. Although this can be seen as an advantage it can also be a disadvantage as respondents may not complete the questions in the order intended by the survey organization.

27. Prior to completing a paper questionnaire respondents can make informed decisions about the potential burden, by looking at the questionnaire length and making a judgement about the complexity of the task. In contrast respondents completing a paging web questionnaire will be unable to see the questions in advance and therefore will not be able to assess the complexity of the task. Furthermore, once they have decided to start filling it in they will have to wait for the initial download and potential download delays between pages. If this process takes too long they could become frustrated and break off.

THE RESPONDENTS' PERSPECTIVE

28. In 2004, a collaborative research project between ONS and the University of Surrey, investigated respondents' opinions on general design and functionality of business survey web questionnaires. Two business surveys were chosen for the research. The first survey, the Monthly Inquiry into Distribution and Services Sector (MIDSS), as its name suggests, is a monthly survey gathering turnover figures for that period. The other survey, E-Commerce, is an annual survey asking businesses about their use of, and attitude to, the Internet and e-commerce.

29. The businesses sampled and recruited to participate in the interviews were selected from the ONS interdepartmental business register (IDBR) based on geographical location (southern England and Wales) and business size. This created a mix of small, medium and large businesses that were already participating in the selected surveys. In total, 30 businesses participated in the research. Sixteen of these were MIDSS respondents and 14 were E-Commerce respondents.

30. The interviews were conducted in two phases over a six-month period. The first phase involved respondents of the short-term, MIDSS, survey, whilst the second phase of interviews involved respondents of the annual E-Commerce survey. The interviews were carried out at the business location. Respondents were initially presented with the paper questionnaire, which acted both as an 'icebreaker' (by taking the focus off themselves) and jogged their memory about the content of the survey and their previous experience of responding to it. Following this, the web questionnaire was viewed on a laptop that was brought along to the interview. The web questionnaires were essentially the paper version in HTML format. The MIDSS questionnaire, which consists of one double-sided A4 sheet, was created as a scrolling page with validation occurring upon clicking the submit button. The validation checked that all compulsory fields were completed and also checked that total number of employee entered matched the total entered by the respondent. The E-Commerce questionnaire, which is around 10 paper pages, was created as a paging design with appropriate questions grouped together on a single page. In this illustration more use was made of the various design features that the web offers. For example, automatic routing was built-in, together with page-by-page validation. Respondents were invited to complete to the web questionnaire and comment upon their experience. The information imputed into the illustration was not recorded, thereby reducing security issues.

31. In terms of web questionnaire design and functionality some common themes and opinions emerged:

- in some cases the similar look and feel to the paper questionnaire was welcomed by

respondents. However, most respondents would have liked to see the full use of the functionality made possible by the electronic mode, for example the use of dependent data collection, automated calculations and routing;

- additional information was also regarded as a benefit of web questionnaires;
- a saveable and/or printable copy of the completed questionnaire was requested for the business records;
- for longer questionnaires, requests were made for a printable version of the questionnaire so that respondents could have a first attempt at completion off line before electronically completing and submitting the data;
- validation was accepted as a necessary feature of the questionnaire design;
- respondents expressed the need to be able to save the questionnaire in draft.

32. Respondents were aware of burden associated with the task of completing these questionnaires but some believed that online completion would be quicker and less burdensome. Some concerns were raised over the security of web questionnaires and needed reassurance. Contacting respondents by email was also a concern because the person might be on holiday or have left the business altogether.

NEXT STEPS

33. The next steps are to gather respondent opinions and preferences for a range of web design and functionality features. The primary beneficiary of this research will be the 2011 Census. However the results will feed into the web questionnaire standards and guidance, providing a sound basis for any future ONS web questionnaires.

34. The design issues that will be tested for the 2011 Census will be divided into six stages. Each stage will cover the following:

Stage 1: scrolling vs paging and radio button vs drop down menus;

Stage 2: help information location and format;

Stage 3: routing;

Stage 4: validation;

Stage 5: progress indicator and full questionnaire testing (using the 2001 Census);

Stage 6: full questionnaire testing using the new/amended 2011 Census questions.

35. Stages 1-4 will use parts of the questionnaire, with limited functions to allow full and complete testing of the desired design feature. Stages 5-6 will be as fully functional as the final questionnaire sent out on Census night.

36. The cognitive interviews will take place in the respondent's home, with the questionnaire supplied on a mobile lab. The mobile lab consists of two laptops. The first will be used by the respondent to complete the questionnaire; it will have a web camera attached to allow a visual record of the respondent's facial expressions to be recorded. The second laptop will be used by the researcher to monitor what the respondent is viewing on their screen whilst simultaneously viewing their facial reactions from the web camera, using a split screen display. The output from the web camera, in addition to the keystrokes and progression through the questionnaire will be monitored using Morae usability software from TechSmith.

37. The respondent will be asked to complete the questionnaire in their own time and to speak aloud any likes or dislikes they have about the questionnaire; the conversation will be tape recorded. After the respondent has completed the questionnaire they will be asked a series of questions about the design and functionality of the questionnaire.

38. The testing for the 2011 Census web questionnaire will provide valuable information and an insight into respondent preferences. These preferences in tandem with survey organization and data quality considerations will form the standards and guidance for use with business surveys in the first instance and later perhaps social surveys.

SUMMARY

39. From a survey organization's perspective the design and functionality of web questionnaires has many benefits in comparison to paper questionnaires. Web questionnaires can include automatic routing, on-line validation, on-line help facilities, automatic question ordering, and questionnaire personalization. In contrast, paper questionnaires have the benefits of the survey organization being able to control the visual display of the questionnaire and postal dispatch may mean that the mail is opened by someone else in the household or business, rather than sitting in someone's email inbox.

40. From a respondent perspective the collaborative ONS and University of Surrey research showed that most respondents would like to see full use of the web questionnaire functionality. They could also see why on-line validation was carried out. From a survey organization perspective, it would be interesting to compare perceptions of on-line validation versus paper questionnaire follow-up validation.

41. When planning the design and functionality of paper and web questionnaires it is important that both the survey organization's perspective and the respondent's perspective are considered. A balance is important for controlling actual and perceived respondent burden, survey costs and data quality.

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¹ From 2005 the New Earnings Survey (NES) will be known as the Annual Survey of Hours and Earnings (ASHE).

² Routing has recently been incorporated into some of the redesigned business survey questionnaires.

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