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The Influence of Auxiliary, Symbolic, Numeric, and Verbal Languages On Navigational Compliance in Self-Administered Questionnaires

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1. INTRODUCTION

In Chapter ___, Beatty and Hermann examine the cognitive processes that may lead to peoples' decisions not to respond to items in a questionnaire. In this chapter, we examine the effects of an additional complexity that is a part of self-administered questionnaires, the fact that respondents are expected to skip certain items, but not others. Research has found that item non-response, the failure to answer questions that should be answered, is greater in questionnaires that include skip instructions than in questionnaires which do not include them (Turner et al., 1990; Featherston and Moy, 1990; Messmer and Seymour, 1982). However, very little explanation for this is offered, except to say that questions with skip instructions cause greater confusion.

Our purpose in this chapter is to propose a theory of navigational compliance that builds on our previously published theory of self-administered questionnaire design and to present an empirical test of that theory as it applies to skip-pattern compliance. Previously, we discussed the important role visual perception plays in respondents' ability to navigate through the graphic language of a self-administered questionnaire (Jenkins and Dillman, 1995 and 1997). In this chapter, we expand upon that by decomposing the graphic language of a self-administered questionnaire into its constituent languages, providing a nomenclature for this decomposition, followed by systematically manipulating the decomposed information. This is done as a beginning step towards gaining an understanding of respondents' perceptions and comprehension of information in general on a self-administered questionnaire and of skip instructions in specific. We end with results from an experimental test of how these languages influence skip-pattern compliance interpreted in light of a proposed model of the question-answer process made applicable to self-administered questionnaires.

2. PAST RESEARCH

A relatively small body of research has dealt with item non-response, that is the refusal of a respondent to answer particular questions (or items) on the survey schedule. As with the unit non-response literature, much of the research on item non-response has been directed at studying compartmentalized factors leading to item non-response. So, for instance, Donald (1960) examined motivational factors for item non-response and found that the higher a respondent's involvement in terms of active participation, knowledge and understanding of the study sponsor's organization, and loyalty to it, the lower the incidence of item non-response. Bauer and Meissner (1963) looked at the effect of questionnaire length on item non-response and found

that item non-response varied as a result of length, with a two-page questionnaire demonstrating significantly higher item non-response than a one-page questionnaire. Ford (1968) examined questionnaire appearance and found that an improved appearance did not affect item non-response rates. An improved appearance was defined as a printed, folded questionnaire as compared to a questionnaire composed of copies stapled together. Featherston and Moy (1990) also looked at questionnaire design factors; however, they report that higher item non-response rates were a function of:

- X skip instructions, with the presence of skip instructions leading to higher item non-response;
- X the number of columns, with two-column formats leading to higher item non-response as compared to one-column formats;
- X item placement within a column, with items at the bottom of the page more susceptible to item non-response than those at the top;
- X and question type, with factual questions leading to higher non-response than attitudinal questions.

A consistent finding in the research on item non-response is that questionnaires, or questions, with skip instructions lead to greater item non-response than those without. For example, Messmer and Seymour (1982) found that branching instructions significantly increased the rate of item non-response immediately following a branching instruction. Featherston and Moy (1990) compared questions embedded in skip patterns with those not embedded using a bank of 900 questionnaire items from five surveys. They found that the use of branching had a strong negative effect on item response rates and that combining factual questions with skip instructions created the type of item most likely to have low response rates. Featherston and Moy posit that item non-response will be minimized as respondent burden is minimized. Therefore, it is ironic to learn that skip instructions lead to greater rather than less item non-response, since skip instructions are intentionally employed by survey designers to minimize respondent burden.

Featherston and Moy (1990, p.5) suggest that skip instructions actually cause greater rather than less mental burden, to the point where respondents become tempted to skip items rather than as they put it, "battle the logic of the item format." However, the second part of this explanation (that respondents become tempted to skip items) doesn't necessarily follow from the first (that skip instructions cause greater rather than less mental burden). Their explanation suggests that respondents get so confused that they give up and purposely skip items. While this may be true, a competing explanation could be that the greater mental burden caused by having to process skip instructions sometimes leads to respondents accidentally executing the skip instructions when they should not. It isn't surprising that this should happen to a larger degree in the case of questionnaires or questions with skip instructions compared to those without because respondents aren't given the same opportunity to erroneously execute skip instructions in the latter case.

Other authors have noted the problem of skip pattern compliance as well; however, in these cases rather than limiting the comparison to skip versus no skip instructions, they expand the discussion to include alternative skip instruction designs. Both the incentive for and the conclusion of this research seem to be that the design of the skip instruction matters. For

instance, Turner et al. (1992) reported that the faulty execution of skip instructions in self-administered questionnaires occurred to varying degrees depending on a skip instruction's format. They concluded that respondents had a greater tendency to see information to the right of an answer category if it was somehow made salient. Jenkins and Dillman (1995) confirmed and extended Turner et al.'s findings by presenting the probable eye-movements of respondents from think-aloud interviews. We suggested that respondents overlooked printed verbal skip instructions when the instructions were to the right of an answer category because they were off to the right of where respondents' eyes were naturally traveling. Raglin (1997) measured the impact of alternative skip patterns on the collection of employment data from a test census. The differences between the skip instructions Raglin evaluated, however, were largely due to manipulating the order and content of the questions containing skip instructions as opposed to comparing the same verbal content with changes in visual presentation.

Although some of the above research seems to suggest that using skip instructions leads to greater non-response, it is still premature to conclude that the solution is to do away with skip instructions altogether and to allow respondents to answer every question (meaning that respondents would mark 'not applicable' categories). It is possible that what is gained in lower item non-response rates in questionnaires with no skip instructions might be offset by greater unit non-response rates. That's because although respondents will not need to process skip instructions, they will need to process many more questions, and this may translate into an even larger amount of respondent burden. To our knowledge, no studies have been done which compare these trade-offs in respondent burden. However, we suspect that the inclinations of some survey designers are right—that is, if properly designed, the inclusion of skip instructions will minimize respondent burden overall.

3. SKIP INSTRUCTION ERRORS DEFINED

Respondents can make one of two mutually exclusive kinds of errors when responding to a question with a skip instruction:

> *Errors of Commission*: The failure to skip when instructed to skip, and thus, the respondent erroneously advances (typically to the next question on the page), and answers it, although it does not apply to him or her.
>
> *Errors of Omission*: The failure to advance to the next listed question on the page and answer it when directed not to skip.

Although an error of omission clearly produces item non-response, it is conceivable that errors of commission produce item non-response too. This might happen if respondents stop answering questions that do not make sense to them because they have not followed the skip instructions correctly. In addition, errors of commission raise the question of which answer is correct--the answer to the question containing the skip instruction or the answer to the question that was supposed to be skipped. For example, if a person indicates that they did not work during the previous week, but then they proceed to indicate that they worked "40" hours per week in the follow-up question they were supposed to skip, it is unclear which answer is correct; one of them is obviously wrong.

4. PROCESSES UNDERLYING SKIP INSTRUCTION ERRORS

4.1 The Questionnaire's Role

Tourangeau (1984) has proposed an often-cited model of the question-answer process. He describes the question answering process in interviews as consisting of four steps: (1) comprehending the question, (2) recalling relevant information, (3) making a judgement, and (4) selecting a response. However, this model is not completely adequate for analyzing the question-answer process in self-administered surveys. In this case, the respondent needs to perceive the existence of the question and any skip instructions. **Perception** and **comprehension**, and perhaps even **judgment** involves not only the verbal, but also **the numeric, symbolic and auxiliary languages plus the physical structure** of a self-administered questionnaire, as discussed below.

4.1.1 Language: Verbal, Numeric, and Symbolic

The fact that we use verbal language as the primary form of communication in questionnaires has long been recognized and studied (e.g., Belson, 1981; Converse and Presser, 1986). Communicating through the visual channel in self-administered questionnaires differs from communicating through the aural channel in interviewer-administered questionnaires (Jenkins and Dillman, 1997; Schwarz et al., 1991). Drawing upon Twyman's schema for language (1979), self-administered questionnaires would be classified as graphic language, while interviewer-administered questionnaires would be classified as spoken language. One of the major differences between these two channels of communication is that graphic language includes pictorial and schematic language in addition to the verbal. Twyman uses the term schematic to denote anything not covered by verbal and pictorial. Generally, a self-administered questionnaire would include numeric (e.g., question numbers and numeric scales) and symbolic language (e.g., arrows), both of which play a role in skip instructions.

Research conducted by Schwarz et al. (1998) confirms the proposition that respondents draw meaning from more than just the verbal language of a self-administered questionnaire. They found that respondents interpreted the verbal label 'rarely' as indicating a lower frequency when presented with the numeric value 0 rather than the numeric value 1. The researchers conclude that the tacit assumptions that underlie the conduct of conversation in daily life, as put forward by Grice (1975) and later applied to the survey situation by Schwarz (1995), applies to the self-administered survey situation. That is, respondents make use of every contribution to make sense of the 'survey' conversation, which in this case includes interpreting the numeric language in combination with the verbal. This is an example of the Gestalt Grouping Law known as the Law of Proximity. This law states that people tend to group information in close proximity together and to draw inferences from the grouping (see, e.g., Wallschalaeger and Busic-Snyder, 1992), in this case both the numeric as well as the verbal information.

In the case of the skip instructions, the verbal and numeric languages may unwittingly provide respondents with conflicting messages. The numeric language, that is the sequentially numbered questions, could conceivably imply to respondents that they should answer the questions sequentially, whereas the verbal skip instructions clearly direct respondents not to answer the

questions sequentially. This suggests that respondents may acquire an expectation from the numeric language of the questionnaire itself, or perhaps the numeric language serves to reinforce even further an already-present expectation to answer every question. This seems a potentially difficult problem to correct because any system used to guide respondents through the questions will be chosen because it in fact sequentially orders the questions, whether it be alpha or numeric.

4.1.2 Auxiliary Language

A second difference between self-administered and interviewer-administered questionnaires is that the three fundamental elements of visual perception apply--that is, brightness and color, shape, and location (Glass and Holyoak, 1986). Generally, paralanguage is used to refer to vocal features that accompany speech and contribute to communication, but are generally not considered to be part of the language system, e.g., loudness and tempo and facial expressions and gestures. Visual elements can be thought of similarly; that is, they accompany text and contribute to communication, but are not language per se. Since paralanguage is generally reserved for vocal features or facial expressions, we will use the term auxiliary language to refer to the visual elements.

It is important to recognize that the languages of a self-administered questionnaire--the verbal, numeric and symbolic--never stand-alone. By definition they can only be transmitted through the visual channel via the auxiliary language. This means that the same verbal language, for instance the words "skip to," can take on an enormous amount of variation when put into print. We can change the size of the words, the font, the color, the background color, and the location.

Although verbal language has long been researched, we are just beginning to explore the effects of auxiliary language on questionnaire design. Others fields have established its importance, although the results are conflicting. For instance, Kelly and Hoel (1991) reviewed studies in which large display ads attract consumers' attention better than the smaller alphabetical listings (e.g., Feldman and Halterman, 1963; Berdie and Hauff, 1986). However, they also cited studies which demonstrated the opposite (e.g., Jackson and Parasuramar, 1986). Another example of the impact auxiliary language can have comes from the educational field. In this example, Hinds and Dodds (1968) found that both elementary pupils and illiterate adults scored higher on achievement tests when colored words were used to teach them.

An example of the manipulation of the auxiliary language in the survey field comes from a study reported by Gaskell et al. (1994). They concluded that the orientation of the response scales might have affected responses to questions about the frequency of vaguely defined target events. They examined a horizontal orientation of the answer categories versus a vertical, which in effect is a manipulation of the visual element *location*. Gaskell et al. speculate that the horizontal layout made the question more distinctive. An equally plausible explanation, however, may be that respondents draw different meanings from answer categories that are *located* vertically as opposed to horizontally. Perhaps a horizontal presentation gives respondents the correct impression that the response options lie along a continuum, whereas a vertical presentation suggests they are independent of one another.

Another example, which demonstrates that the auxiliary language can have effects, comes from an evaluation of the decennial census dress rehearsal questionnaires. The data demonstrate that a long, white write-in box, which separated the 'relative' answer categories from the 'non-relative' answer categories on the long form but not on the short form, diminished the number of people selecting the non-relative answer categories that followed the write-in space. However, simply banking the answer categories, which was done in the both race and relationship items, had no effect (Davis, 1999).

These studies, and others like them, lend credence to the proposition that manipulating the visual elements of skip instructions may change respondents' perception, and therefore their understanding, of the purely verbal language. However, as evidenced by the studies' mixed results, how to best manipulate the auxiliary language is still uncertain.

4.1.3 Physical Structure

Finally, a third difference between a self and interviewer-administered questionnaire is that the self-administered questionnaire is more than just language, it is a physical entity that requires physical manipulation from the respondent. In the case of a paper questionnaire, respondents must be able to orient the questionnaire properly in space and turn its pages. Dillon (1994) assumes that such skills are acquired early in a reader?s life and that the standard physical format of most documents means these skills are transferable between all document types. However, Dillon's assertion assumes that all readers are equally competent (that is, having acquired reading skills early in life, readers equally excel at orienting documents, and turning pages) and that all documents are created equal (that is, they have standard physical formats). However, recent cognitive research with questionnaires has shown that these tasks burden less able readers more than they do able readers because they require additional work over and above the already taxing work of reading the questions and response options (Dillman et al., 1996). Therefore, it follows that the addition of even one more task—that of executing skip instructions in combination with reading the questions and response options and turning pages—may only serve to further overload the less able reader.

Another problem with Dillon's assertion is that readers may not only differ in their ability to perform tasks, but also their willingness to do so. Krosnick (1991) discusses two types of survey respondents: (1) optimizers and satisficers. Optimizers attempt to be fully diligent when they respond to questions, whereas satisficers look for ways to avoid expending effort while maintaining the appearance of answering responsibly. Although Krosnick discusses optimizers and satisficers in terms of attitudinal questions, it seems these profiles may equally apply to skip instructions. One can envision satisficers as being perfectly capable of multitasking (that is reading the questions and response categories, turning the pages, and executing the skip instructions), but as not being willing to expend the extra effort it might take to do so correctly.

A third problem with Dillon's assertion is that documents are not designed with the kind of standardization he suggests. Different purposes and kinds of data capture have had an impact upon the physical design of self-administered questionnaires. For instance, the Constitution mandates that data be collected on every person living in the United States every ten years and reported to Congress by the end of the calendar year in which it is collected. To meet this tight deadline, the Census Bureau has employed the latest technology, which for Census 2000

amounts to electronic imaging. To maximize efficiency and minimize data being lost or separated from one another, it is highly desirable to have all the data collected from a household on a single sheet of paper. Therefore, rather than being designed as a multi-sheet booklet, which would equate to the kind of standard format Dillon refers to above and with which respondents are more likely to be familiar, the census questionnaire has been designed as a one-sheet questionnaire with a bifold. In contrast to this, the American Community Survey, which asks for essentially the same data as the census, is not as large a survey as the census, nor does it operate under the same tight deadline. Therefore, it can be keyed rather than electronically captured. Since humans are capable of keying from multi-sheet booklets, the American Community Survey can be designed as a more familiar booklet. Cognitive research has revealed that folded questionnaires tend to give respondents difficulty (DeMaio and Redline, 1999). Therefore, it follows that respondents may cope even less well with skip instructions when they are placed in a folded questionnaire than a booklet.

4. 2 The Respondent's Role

4.2.1 Expectations

When the flow of questions is controlled exogenously, as is the case in interviewer-administered or electronic questionnaires, respondents need not be aware that they are skipping over items on the questionnaire. This fact may remain hidden from them without any adverse effects. When, however, respondents are in control of the flow of questions themselves, as they are in paper questionnaires, the situation changes. In this case, to answer a paper questionnaire efficiently and accurately, respondents must perceive, then correctly execute skip instructions. Or conversely, respondents must recognize that they are not supposed to skip and correctly advance to the next question.

However, perception is a complicated process that relies not only on respondents' seeing an external stimulus (known as bottom-up processing), but it depends as well on their expectations (or knowledge) about that stimulus (Jenkins and Dillman,1997). This is termed top-down processing in the perception literature, but other literatures use different terms for what appears to be a similar concept--that essentially human beings call upon prior knowledge to process and act upon new information. Other terms for this concept are schema, mental models, expertise, or culture, depending on the body of literature to which one is referring (e.g., Pressley and Afflerbach, 1995; Wickens, 1992; Matlin, 1998) .

With regard to skip instructions on questionnaires, cognitive research on questionnaires containing skip instructions has suggested that respondents often think they are supposed to answer every question on a questionnaire (Dillman et al., 1999). Even when respondents begin to answer the questionnaire with the proper realization that they are not supposed to answer every question, if there are long series of questions in which respondents are not required to skip, they can easily fall into the habit of expecting to answer every question. These expectations are likely to color or affect what respondents perceive--that is, this may cause respondents NOT to actively search for or notice existing skip instructions.

4.2.2 *Focused Attention*

Another reason respondents may overlook skip instructions is because the questions and response categories absorb their attention at the expense of the mechanical aspects of the questionnaire, like skip instructions. This might occur with either the educated or less educated when they become interested or absorbed in the content of the questions and response categories. However, it might also occur with the less educated because they may have less ability to handle both the demands of difficult questions and the mechanical aspects of skipping through the questionnaire simultaneously. Moving sequentially from question to question requires less cognitive effort on the part of respondents.

The solution to this problem and the previous one regarding respondent expectations may reside with breaking respondents normal processes of sequentially answering each question. This may be accomplished by introducing verbal and/or visual variations into the design that will attract respondents' attention. However, it should also be noted that if not properly manipulated, these variations could have the deleterious effect of causing respondents to skip over questions when they shouldn't, leading to increased item non-response, or of inducing respondents to answer questions they shouldn't. Thus isolating the appropriate balance between possible visual variations is a challenge of particular theoretical and practical interest.

4.2.3 Motivation

Besides expecting to answer every question, some respondents may either want to answer every question or they may want to answer questions that they find salient or appealing, despite the questionnaire's instructions. For instance, respondents who are retired may wish to answer questions concerning their previous profession, to the extent that they purposely ignore a skip instruction telling them to do otherwise. This would seem to be a more difficult problem to correct than the one above because in this instance respondents perceive the instruction, but choose not to abide by it. Still, the solution may lay with the design of the skip instruction because the same information may come across differently depending upon its design. For example, Dillman et al. (1996) conducted cognitive interviews with three decennial census mailing packages in which it was concluded that three identically worded mandatory messages elicited different reactions depending upon their graphical designs. Despite perceiving all of the mandatory messages, respondents took the message much more seriously when it was printed in bold, black capital letters on a white background and outlined by a bold black square. They took the same message less seriously (that is, they said they were less likely to abide by it) when it was printed in white letters in a small blue circle or in a long narrow black strip. This finding seemed to be confirmed by the results of an experimental test in which the mailing package with the bold, black mandatory message received a significantly higher response rate than either of the others (Leslie, 1997).

5. MANIPULATING THE AUXILIARY, SYMBOLIC, AND VERBAL LANGUAGES TO GAIN COMPLIANCE WITH SKIP PATTERNS

There are numerous ways in which the various languages of a self-administered questionnaire can be manipulated to possibly improve the design of the standard skip instruction. The auxiliary language provides the foundation with which to begin because the verbal and symbolic languages can only be transmitted through the visual channel via the auxiliary language. Thus,

any discussion of the manipulation of the symbolic or verbal languages, by definition, includes a discussion of the auxiliary language—that is, of brightness and color, shape, and location.

Despite having a goal (for example, to attract respondents' eyes to the skip instruction in its present location), it is unclear as of yet precisely how to best accomplish this goal. The purpose of this section is to begin the process of specifying the languages involved in each manipulation, the goal behind each manipulation, and the theoretical arguments both for and against each manipulation. Presently, this kind of thinking is missing in the design of self-administered questionnaires. Designers often manipulate these various languages without any real understanding of what they are doing and how it might affect respondents' perception and comprehension of the information. It should become clear that the possible combinations of the manipulations quickly compound, making the job of choosing between the myriad possibilities a real challenge in need of further study.

5. 1 Manipulating the Auxiliary Language of the Skip Instruction

Traditionally, designers of self-administered questionnaires *locate* answer boxes to the left and printed verbal skip instructions to the right of the response options, as shown here:

1. Which of the following best describes you?
   - 9 I tend to think before I act
   - 9 I tend to act before I think - Skip to 3

Note that the printed verbal instruction is nearly the same *size, shape, color and brightness* as the rest of the text. In between the response category and the instruction is a dash, which too is of the same color and brightness as the rest of the information. Advancing to the next question (that is, NOT skipping) is signaled by the absence of any information to the right of the non-skip response category.

Cognitive interviews have suggested that respondents frequently fail to see the verbal skip instruction in this location (e.g., Gower, 1989; Jenkins and Ciochetto, 1993; Bogen, 1996). Based upon probable eye-movement analysis from respondents? reading behaviors in cognitive interviews, Jenkins and Dillman (1995) suggest that respondents overlook the skip instructions because they are located to the right of where respondents? eyes are naturally traveling. This conclusion is supported by the fact that a person's vision is sharp only within two degrees, which is equivalent to about 8 - 10 characters of 12-point type on a questionnaire (Kahneman, 1973). This is known as the foveal view. Thus, when a respondent is in the process of marking a check box, the skip instruction is in most cases either clearly outside of the respondent's foveal view or bordering on it. Therefore, the skip instruction may need, because of its poor location, to attract respondents' eyes to it; that is, to bring it within the foveal view.

5.1.1 Increase the Contrast Ratio of the Verbal Skip Instruction in Its Traditional Location

Visually, all of the above information, and this entire book for that matter, exist in a particular figure-ground format. The contrast ratio between a figure and its ground and between figures is critical to influencing the perception of information (Wallschlaeger and Busic-Snyder, 1992). Up

to this point, the figure-ground we have been working in has been black print (i.e., black figures) on a white background. Black print against a white ground is highly visible because of the high level of contrast between the figure (black print) and ground (white paper). In comparison, black print on black paper (or white on white) would be invisible because of its lack of contrast.

Visual search tasks have demonstrated that a target item can be located more rapidly if it is made visually dissimilar from the non-target items (Foster, 1979). Therefore, one way to attract respondents' eyes to the skip instruction might be to make it look different from its surroundings by increasing the contrast ratio between it and the information surrounding it. However, there are numerous ways in which this may be accomplished.

Increase the Boldness of the Verbal Skip Instruction
One possibility would be to increase the boldness of the skip instruction, as shown below:

2. Which of the following best describes you?
   - 9 I tend to think before I act
   - 9 I tend to act before I think - **Skip to 4**

Increase the Size of the Verbal Skip Instruction
A second possibility would be to increase its size. Although there is a finite number of sizes from which to choose, still there are quite a few. So the question arises: what is the optimal size for attracting respondents' eyes? The response category below is 12-point Times New Roman, whereas the skip instruction is 16-point.

9 I tend to act before I think - Skip to 4

Increase both Boldness and Size
As can be seen in the example above, a by-product of increasing the skip instruction's size is that it also becomes bolder as a result of the greater amount of ink that it requires. However, it is still possible to combine the two, that is to increase both the instruction's boldness and size, with the end result that the skip instruction can be made even bolder:

9 I tend to act before I think - **Skip to 4**

Change both the Figure and Ground of the Verbal Skip Instruction
A different path to follow for attempting to bring attention to the skip instructions would be to manipulate both the figure and ground. A format developed for questionnaires in the early 1990's and employed by the U.S. Bureau of the Census uses a figure-ground format that consists of black type on a lightly colored background (i.e., 20% of full color), with all answer spaces identified as white boxes. This format is founded upon a questionnaire design principle, which states that the visual elements should be used in a *consistent* manner to define the desired navigation path for respondents to follow (Jenkins and Dillman, 1997). The purpose of highlighting the answers spaces in white is that, as mentioned earlier, research demonstrates that a target item can be located more rapidly if made visually dissimilar from the non-target items (Foster, 1979). Not only that, but the white answer spaces should appear brighter than the black

lettering or the 20 percent background color. The hypothesis is that with time, respondents begin to associate the white areas with areas requiring action from them, a place where they are supposed to provide an answer. Repeated cognitive tests of questionnaires using this format gives limited evidence that this figure/ground format provides a powerful visual guide for reducing item non-response generally, but to date no formal experiments have tested this effect. [Indirect evidence for this comes from Wendy's paper.]

One way to change the figure-ground of the verbal skip instruction, which is an extension of the above thinking, is to highlight the skip instruction by changing its background to white too.

Black print on a white background contains a higher level of contrast than black print on a 20 percent colored background (shown here in gray), which should translate into a greater level of detection. In addition, changing the background to white may serve to convey to respondents that this is a target item, similar to the white answer boxes, which requires an action from them. However, the down side to this design is that the more information that is placed in a white background, the less it will look dissimilar from its surroundings, and therefore, the less effective it may become.

A second way to change the figure-ground of the skip instruction is to use reverse print, as shown below. Because the main figure-ground composition is black type on a white background in the example below, the reverse printed skip instruction is white type on a black background, or just as its name implies, the reverse of the main figure-ground composition.

There are arguments both for and against reverse printing the skip instructions. It is plausible that the high contrast of a reverse-printed skip instruction and the fact that the skip instruction had been singled out in this way--that is, made visually dissimilar from the other information on the questionnaire—could attract respondents? attention. Also, studies do show that white figures on a black background appear larger than the same size black figures on a white ground (Wallschlaeger and Busic-Snyder, 1992), so perhaps respondents will be more likely to see a reverse printed skip instruction. However, these studies seem to have compared one figure and ground with its reverse, which is a simpler task than the one required of respondents' in the above example. Respondents must make sense of two figure-grounds in the above example. Therefore, it is also plausible that having to reverse one?s figure/ground orientation actually has the opposite effect of the one intended. That is, rather than highlighting the skip instruction, it may actually remove it from the respondent's view. This argument is derived from the fact that one cannot attend to two reverse figure-grounds simultaneously as demonstrated by Ruben's famous two-faces-versus-a-vase depiction (1958) and from the fact that perception is dependent upon top-down processing in addition to bottom-up processing (Matlin, 1998). Although we do not expect a respondent to attend to the skip instruction simultaneous with other information, we

do expect them to attend to it in close temporal time with the other information on the questionnaire. It could be that if most of what respondents read is printed in black type, with only occasional reverse-printed material, they may naturally come to expect the material they are supposed to read to be in normal print, and therefore, not see or perceive the occasional reverse-printed skip instructions. Additional evidence against reverse printing information comes from Hartley (1981). He suggests "reversed lettering (i.e., white letters on a black, or dark, background)" actually lessens the clarity of graphic materials. Wallschlaeger and Busic-Snyder (1992) confirm this. They report that typographical studies have shown that it is difficult to read white text on a black ground because the text seems brighter and may sparkle or advance toward the reader.

Change the Figure-Ground and Increase Size and Boldness

The above three manipulations could be combined as well to create another full array from which to choose. The example given below is 16-point, reverse printed Times Roman in bold type. Note that in this situation the white print is bold.

9 I tend to act before I think - **Skip to 4**

5.1.2 *Relocate the Skip Instruction*

A different way to make skip instructions more visible to respondents may be to exchange the goal of attracting respondents' eyes to a location they are not apt to view for a location they are apt to view. A way to do this would be to reverse the locations of the check boxes and response options, as shown here.

3. Which of the following best describes you?

I tend to think before I act. 9

I tend to act before I think. 9 Skip to 5

As discussed earlier, when respondents are in the process of marking a check box, the traditional skip instruction is likely to be outside the respondent's foveal view. Reversing the location of answer spaces and response options means that the skip instruction should come within their foveal view, thus encouraging greater compliance with the instructions.

5.1.3. Relocate the Verbal Skip Instruction and Increase Its Contrast

Once again the above manipulations can be combined in any number of ways. Since the white answer box is now close to the skip instruction, one logical combination would be to place the skip instruction in a white background too, as a way of emphasizing the connection between the verbal skip instruction and the check box. It is well established that people tend to group information together based on the Gestalt Grouping Laws and to draw inferences from that grouping (see, e.g., Wallschalaeger and Busic-Snyder, 1992). In the example below, the size and boldness of the verbal skip instruction were increased as well.

I tend to act before I think. 9 **Skip to 5**

5.2. Manipulate both the Auxiliary and Symbolic Languages

5.2.1 Connect the Response Option with the Verbal Skip Instruction in Its Traditional Location

The previous section discussed manipulating the auxiliary language of the verbal skip instruction to overcome the poor location of the traditional skip instruction. This section discusses ways of attracting respondents eyes' to the skip instruction in its traditional location by manipulating the symbolic in addition to the auxiliary language.

Change Dash to Arrow

Symbols, as with verbal language, acquire meaning through cultural experience or use. In the United States, an arrow '!' suggests direction. Therefore, it seems possible that replacing the dash in question 1 above with an arrow may convey to respondents that they should go in a particular direction after reading the response option, as shown here:

4. Have you graduated from high school?

9 Yes

9 No ! Skip to 6

The intention here is to make use of the Gestalt Grouping Laws by grouping or bridging information together that the respondent may not otherwise associate as belonging together--in this particular case, the check box, response option and the skip instruction. In contrast, parentheses around the skip instructions or a pair of dashes between the answer category and skip instructions may not correctly group or connect the information. In fact, parentheses may convey to readers that the information contained within them is optional rather than mandatory, and in this way act to segregate rather than integrate the information, as can be seen here:

5. Have you graduated from high school?

9 Yes

9 No (Skip to 7)

Change Dash to Arrow and Manipulate Auxiliary Language

The auxiliary language of the arrow, as well of the verbal skip instruction, can be manipulated in any of the ways discussed previously. In the example below, the arrow and verbal instruction's size has been increased from 12 to 14-point.

6. Have you graduated from high school?

9 Yes

9 No ! Skip to 8

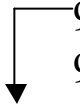
5.2.2. Connect the Non-Skip Response Option with the Next Question

As shown in question 1 above, the standard procedure for directing respondents to NOT skip, that is, to go to the next question is to NOT provide them with any directions. That is, the non-

skip situation is implied by the absence of any instructions. Perhaps, however, the skip situation would become more evident if respondents are also made more aware of when they are not supposed to skip.

Implement Arrow for Non-skip Response Option
Perhaps one way of making respondents more aware of when not to skip is to draw an arrow coming off the left-hand side of the non-skip check box that points to the next question, as demonstrated in the example below:

7. Have you graduated from high school?



9 Yes

9 No ! Skip to 9

8. Have you obtained additional schooling beyond the high school level?

Implement Arrow for Non-skip Response Option and Combine with Other Manipulations
In the example below, the right-hand arrow, skip instruction and left-hand arrow have all been made bold and increased in size from 12- to 14-point.

9. Have you graduated from high school?

9 Yes

9 No !**Skip to 11**

10. Have you obtained additional schooling beyond the high school level?

5. 3. Manipulating the Auxiliary, Symbolic, and Verbal Languages of the Skip Instruction

An obvious procedure for directing respondents to skip is to provide them with verbal instructions. However, it is less apparent exactly how these instructions should be worded and where they should be located. As described already, the standard procedure is to associate a verbal skip instruction with the response option requiring respondents to skip. On the surface, this association appears to support the principle that to be effective, information should be provided exactly where it is needed, i.e., at the place an action is to be taken (Jenkins and Dillman,1997). However, as noted earlier, there appears to be a problem with this *precise* location. Up to this point, we have manipulated the auxiliary and/or symbolic languages to overcome this problem. In this section, we discuss varying the verbal language in addition to the auxiliary and symbolic. It should be evident that the possibilities increase tremendously as we graduate to manipulating all three languages.

5.3.1 Incorporating a Supplemental Instruction In ADVANCE of the Question Requiring Respondents to Skip and Wording the Instruction Differently.
In a national mail-out test of alternative skip instructions, Raglin (1998) found that a version of the questionnaire that had a supplemental skip instruction placed at the beginning of a sequence of questions resulted in 82% of the respondents correctly following the prescribed skip-pattern. In comparison, only 44% to 47% correctly skipped when the skip instructions were associated

only with the response options. This is strong evidence in support of the use of an advance supplemental skip instruction.

Other indirect evidence in support of an advance skip instruction comes from Turner et al. (1992). Among other questionnaire design issues, the Turner et al. paper studied the extent to which respondents and interviewers correctly executed skip instructions embedded in alternative versions of the 1990 National Household Survey on Drug Abuse. It concluded that respondents were more likely to overlook a visually obscured skip instruction than a visually salient one. Raglin's findings seem to suggest that an advance skip instruction is more visually salient.

However, if the skip instruction is no longer associated with the response option, it needs to be reworded. Again, this is a good example of how people draw conclusions from the grouping of information. A skip instruction associated with a response option implies that if one chooses this response option, one is supposed to skip. However, a skip instruction placed in advance will no longer be able to rely upon an implied association, but will need to state it. Therefore, the advance skip instruction in the Raglin experiment was worded thus:

> Answer questions 11-12 for persons who did not work for pay or profit last week. Others skip to 13.
>
> **11a. LAST WEEK, was this person on layoff from a job?**
>
> 9 Yes -- Skip to 11c
>
> 9 No

Besides making the necessary information visible, Norman (1990) suggests additional strategies for reducing errors. The first strategy he discusses is the *prevention* of errors before they occur by taking information from the head and placing it into the world, in other words, preventing errors through the use of mental aids. According to Norman, the notes we write to ourselves to remind us of tasks we need to accomplish are examples of mental aids. Mental aids, however, assume we have already learned the information to begin with, and simply need to be reminded. Another technique for preventing errors, which doesn't assume we have learned the information already, is to educate or train people in their prevention (Wickens, 1992). Effectively, training works by altering people's conceptual models, schemas, or top-down processing about events.

Section 4 presents arguments for using both techniques when it comes to skip instructions. First, it makes the point that respondents' conceptual model, schema, or top-down processing of the form-filling task is often erroneous. Thus, educating respondents about the skip phenomena before they need to execute one might help to overcome this erroneous thinking. In addition, the previous section points out how respondents can come to the conclusion that they are supposed to answer every question from the questionnaire itself. Therefore, it would seem beneficial to remind respondents in advance of every subsequent question that contains a skip instruction to pay attention to the skip instructions. These reminders might also serve to motivate the less motivated respondents to pay more attention to the skip instructions and may even counter effect respondents who might consider disobeying the skip instructions. The example below incorporates both the education and reminder prevention techniques:

12. From now on, if a "Skip to" instruction follows a box you mark, skip to the number given. Otherwise, continue with the next question.

Have you graduated from high school?

9 Yes

9 No -- Skip to 14

13. Have you obtained additional schooling beyond the high school level?

9 Yes

9 No -- Skip to 15

14. Attention: Check for a skip instruction after you answer the question below.

What is your sex?

9 Male

9 Female -- Skip to 16

5.3.2. Incorporating a Supplemental Instruction AFTER the Question Requiring Respondents to Skip and Wording the Instruction Differently

Another strategy Norman (1990) suggests for reducing errors is to allow the user *to detect and correct* errors once they have occurred. Feedback can be used to allow users to detect errors. According to Norman, an example of feedback that most of us use everyday is the sound of our own voices when we speak. In terms of skip instructions, placing an additional instruction after the question requiring respondents to skip might provide effective feedback (that is, placing an instruction before the subsequent question they were supposed to skip). This instruction repeats the conditions under which respondents are supposed to answer this subsequent question, thus acting as a safeguard for those who didn't correctly act upon the verbal skip instruction in its traditional location. The example below illustrates this strategy:

15. Have you graduated from high school?

9 Yes

9 No -- Skip to 17

16. (If Yes to 15) Have you obtained additional schooling beyond high school?

6. RESULTS FROM AN EXPERIMENTAL TEST

To test the theoretical formulations outlined above, an experiment was conducted with three versions of a 50-item questionnaire. Each questionnaire contained 24 skip instructions. Shown in Figure 1a, the control form made use of the traditional format that will be employed in the

2000 Census. Shown in Figure 1b, the second form, the detection method, was structurally similar to the control with regard to the location of answer boxes and answer categories, but the brightness and size of the verbal skip instruction was manipulated. Also a left-hand arrow was included as a navigational guide. The third form, the prevention method, was structurally different from the other two. The answer categories and answer boxes were reversed, and the verbal skip instruction and its ground was manipulated. The precise manipulations of each are listed below:

Control Method

1. The use of a right-hand arrow to connect the response option with the verbal skip instruction, rather than a dash; and
2. A slight decrease in the contrast of the verbal skip instruction (the verbal skip instruction is Frutiger Normal Italic, whereas the rest of the text is Frutiger Normal, which is very slightly bolder).

Detection Method

1. An increase in the size and boldness of the verbal skip instruction to increase its visibility;
2. A large, bold left-hand arrow that connects the check boxes of respondents who are not supposed to skip to the next item; and
3. A supplemental instruction in parentheses at the beginning of the next item that states who should be answering that item (a detection technique).

Prevention Method

1. A supplemental advance instruction meant to EDUCATE respondents about skip instructions before the first question containing a skip instruction (one of the prevention techniques);
2. Supplemental advance instructions meant to REMIND respondents to pay attention to the skip instructions before every question that contains a skip instruction (another prevention technique);
3. Relocating the verbal skip instruction to increase its visibility;
4. An increase in the contrast between the figure and ground of the verbal skip instruction to increase its visibility; and
5. An increase in the size and boldness of the verbal skip instruction, again meant to increase its visibility.

As described in Redline et al. (1999), a total of 1266 students in classes at two campuses of Washington State University were randomly asked to complete one of the three forms. Approximately 420 students completed each form. As shown in Table 1, an analysis of the results from this experiment demonstrated that, as predicted, both of the experimental forms significantly reduced the percent of commission errors by about half from 20.3 percent on the control form to 7.4 percent on the detection form, and 9.0 percent on the prevention form. However, neither of the experimental forms significantly reduced the proportion of omission errors. Whereas the control form resulted in 1.6 percent errors, the detection and prevention forms produced 3.7 and 3.3 percent errors, respectively (Redline et al., 1999), with statistically significant differences between the control and either of the experimental forms.

It was concluded from this analysis that manipulating the auxiliary, symbolic, and verbal languages successfully resulted in increasing the likelihood that respondents would skip items when directed to do so, but did not improve the compliance with continuation instructions. It's possible that bringing attention so effectively to the skip directions may have resulted in respondents who should not have skip erroneously taking cues from these directions, a topic that needs further investigation.

As shown in Table 1, it was apparent from the analysis by Redline et al. (1999a) that substantial differences existed in the proportion of errors associated with the 24 items, with error rates ranging from 0 to 51.7 for commission errors and 1.6 to 3.7 for omission errors. Dillman et al. (1999a) theorized that certain structural characteristics of each question contributed to the complexity of following skip instructions. Each of the questions containing skip instructions was coded for eight aspects of complexity:

1. whether it was at the bottom of the page (so the visual connection of the navigational path was temporarily broken and additional tasks are introduced);

2. whether all answers skipped (so different skip patterns must be discerned for different response categories);

3. whether write-in answers were required (which demanded a different kind of response behavior than that needed for the vast majority of questions);

4. whether response categories alternated between having to skip and continuation expectations (perceived to be more difficult than if all items skip instructions were grouped together);

5. number of answer categories (more choices were expected to make processing more complex);

6. number of words in the question (more words would require more processing).

7. whether the last response category contained a skip (the respondent who chose a response category above it would have to visually pass over the skip instruction on the way to the continuation question).

8. distance between answer box and skip instruction (greater distance was expected to increase the likelihood of not seeing the skip instruction). This item applies mainly to the control and detection forms, since this distance was mostly constant on the prevention form).

Results of this analysis showed that most of these question attributes were positively and significantly correlated with the number of commission errors (alternating skips being the noteworthy exception), but were not significantly correlated with the making of omission errors (Dillman et al.,1999a). In the regression analyses, having the attribute of a "write-in" question was the only significant variable in models which explained about two-thirds of the variance for the detection and prevention forms, and about one third of the variance in a combined analysis of all forms.

Analysis of omission errors in a similar fashion produced quite different results. The most important variable for predicting error rates was the bottom of the page location. For the detection form only, bottom of the page and whether the last category skipped were both significant predictors in an analysis for which 59% of the variance was explained. Addition of interaction terms in a more detailed analysis that combined results for the structurally similar control and detection forms revealed a significant interaction between whether the last category skipped and its use on the detection form. This interaction term plus bottom-of the-page, distance between answer box and skip instruction, and last category skips resulted in 62% of the variance in skip instructions being explained.

In contrast, an analysis that combined results for the control and prevention forms showed that 'last category skips' actually led to significantly improved error rates on these forms. This was the one identified statistically significant instance in which the control and prevention forms behaved more alike than the control and detection forms.

7. DEVELOPMENT OF A MODEL APPLICABLE TO THE QUESTION-ANSWER PROCESS IN SELF-ADMINISTERED QUESTIONNAIRES

The experimental test of alternative ways for using visual design to improve skip-pattern compliance suggests that quite different manipulations of the auxiliary, symbolic, and verbal languages, as constructed into the detection and prevention schemes, were both quite successful in reducing errors of commission. Both reduced by nearly half the proportion of respondents who did not skip ahead as directed. This finding confirms the hypothesis that manipulations of these languages, at least in the manner done here, influences how people fill out self-administered questionnaires. However, the differences in omission error rates between the control and experimental forms suggest that somewhat different design factors may be involved in causing respondents to skip when they are not directed to do so.

In attempting to understand these differential effects, and to formulate questions for future research, it is useful to link the findings from these studies to the conceptual considerations that guided this research. We return here to the original Tourangeau model of the decisions that people must make in answering questions, and also bring to bear analytic results from 48 cognitive interviews with the questionnaires that were used in the classroom test (Dillman et al., 1999b and Redline and Crowley, 1999).

As noted earlier, the intent of the Tourangeau model was to isolate meaningful steps in responding to verbal language stimuli, i.e. information delivered by the interviewer. Figure 2 presents an expansion of this model applicable to the graphic language of self-administered surveys. The expanded model differs from the original in the following three ways:

1. An initial step of perceiving and attending to the question stimulus has been added. It is possible in a self-administered questionnaire for respondents to simply skip over all or part of a question stimulus, to misread the question, or to not read one or more of the response choices.

2. In addition, the definition of question stimulus has been expanded to include the auxiliary, symbolic, and numeric languages of the question in addition to the verbal. In other words, one format of a question may yield different results than another because the question stimulus is no longer precisely the same.
3. Finally, after answering a question, the respondent must go through a similar process of perceiving and comprehending the skip instruction, making a judgment about whether to obey it, which it is within their power to do, and then determining which question to go to next.

The cognitive interviews had as one of their aims to understand the extent to which compliance was dependent on these steps, and whether this answering process differed significantly for errors of commission and omission. Together with the classroom tests, the cognitive interviews suggest that mistakes occur at each of the steps specified in this expanded model (Dillman et al., 1999b and Redline and Crowley, 1999).

7.1 . Application of the Model to Errors of Commission

7.1.1 *Attention and Perception*

As expected, respondents sometimes thought they were supposed to answer every question on the questionnaire in the cognitive interviews. Consequently, their top-down processing was responsible for directing their attention to the next question on the page. As a result, they never even perceived the skip information. In our model above, this translates into their going from E to I, rather than going on to F. In a survey with no skip instructions and in which the navigational path of the questions does not in any way deviate from the expected, applying this kind of top-down processing is a beneficial timesaving device. Unfortunately, it also serves to work against a survey with skip instructions or with any unusual navigational features. The results of the classroom test suggest, however, that the alternative skip instructions were able to successfully overcome this problem and attract respondents' attention.

Another reason respondents sometimes didn't attend to the skip instructions was because their attention was absorbed by the questions and answer categories. One respondent expressed it this way: "I just wasn't paying attention to the skips. I was paying attention to the questions. I saw them [skips], but I didn't pay attention to them."

In the regression analysis of question characteristics from the classroom tests, Dillman et al. (1999a) found that open-ended questions had significantly higher commission error rates when other question characteristics were held constant. One of the respondents in the cognitive interviews offered a very likely reason for this. He said he hadn't noticed the skip instruction, probably because he was writing. In effect, his explanation suggests that his attention was focused on the question-response process too.

Perhaps one of the reasons for the success of the prevention form is that before respondents get entirely fixated on the questions and response options, it works to remind them to 'pay attention' to the skip instructions. In a sense, the objective is to induce respondents to correctly move from E to F in the response-process model. And undoubtedly, one of the reasons for the success of the detection form is that it gives respondents another chance to in effect perceive the 'skip

instruction.' That is, if respondents understand the parenthetical instruction at the beginning of the next question, they can discern whether they should be answering that question or not. This is represented in our model as respondents erroneously going from E to I, with the purpose of the parenthetical instruction to send them back up to F. This time around, F represents the parenthetical instruction rather than the actual skip instruction.

A third reason respondents sometimes had difficulty attending to the skip instructions was because, unfortunately, they perceived the skip instruction at a moment when they couldn't turn their attention to it. This happened when respondents read the skip instruction before they had finished responding to the question. In our model, this behavior would be represented by the following sequence: A, B, F, C, D, E, at which time they go to I without correctly going through F and G first. Poor readers who had to struggle just to read the questions and answers seemed least capable of perceiving and comprehending the skip instruction at the wrong moment in time. Maybe one of the reasons for the success of the prevention skip instruction is because information is reorganized, and therefore, respondents are less likely to prematurely perceive the skip instruction. And again, one of the reasons for the success of the detection form is that it gives respondents a second chance to take in the information.

Top-down processing is a double-edged sword. As demonstrated above, on the one hand, it operates to keep respondents from perceiving the skip instructions. However, it can also compensate for this problem by aiding respondents in determining whether a question applies to them or not based upon the content and context of the question. Therefore, in theory, respondents can actually end up navigating through a questionnaire correctly, despite not having perceived any of the skip instructions. In our model above, this would amount to comprehending in B that the question does not apply to them, recognizing that the correct response in E is 'no response' and then moving on to the next question and repeating the whole sequence of events again. Relying upon respondents, however, to always correctly comprehend whether a question applies to them seems risky. For one thing, it means greater respondent burden. Although some questions will probably require very little effort to determine if they apply, others may require a good deal of effort, and also be open to greater interpretation, in other words, error. For instance, respondents will probably be able to figure out that they shouldn't answer questions about their grandchildren if they haven't got any grandchildren. However, respondents may have greater difficulty determining if a question about income applies to them or not.

Consequently, we designed the classroom test to eliminate respondents relying upon the content and context of the questionnaire to help them navigate through the questionnaire. That is, respondents could not get clues from the questions themselves about whether they should be answering them, but had to execute the skip instructions correctly to navigate through the questionnaire correctly. As a result, we can conclude with confidence that manipulating the information increased the likelihood that respondents attended to and perceived the skip instruction on the experimental forms. This is based on the fact that the errors of commission significantly decreased for the experimental forms.

7.1.2 *Comprehend the Auxiliary, Numeric, Symbolic and Verbal Language of the Skip Instruction*

The cognitive interviews surprisingly revealed that a couple of respondents had difficulty comprehending the phrase "Skip to," and this seemed especially troublesome on the prevention form. It turns out that a couple of respondents interpreted the phrase to mean 'skip over this question and this response and skip to the specified question." This interpretation appeared to be due to the way the check box was visually connected to the skip instruction on this form. In this case respondents go through the steps correctly in our model, but unfortunately they make an error at G, and from our perspective, might decide to go to the wrong question in I.

7.1.3 *Judge Whether to Obey the Skip Instruction*

The respondents who misinterpreted the skip instruction in the preceding example made different judgments about whether to obey their interpretations, which led to different outcomes. One respondent decided we couldn't possibly mean that she should skip over this question and skip to the identified question because then she wouldn't be answering any questions, and therefore, she chose to ignore the skip instruction. In other words, she applied her better judgment to the situation, which led her to commit errors of commission rather than errors of omission.

There were also respondents in the cognitive interviews, who although they read and understood the skip instructions, chose not to obey them because according to them they wanted to read every question just to "see what is there." Perhaps another reason for the success of the prevention and detection form is that the use of the educational, reminder, and parenthetical instructions does more to discourage this kind of behavior.

7.2 Application Of the Model To Errors Of Omission

7.2.1 *Attention and Perception*

Errors of omission occur for different reasons than errors of commission. It seems that, overall, manipulating the information on the experimental forms not only increased the likelihood that respondents would attend to and perceive the skip instruction when we wanted them to, but when we didn't want them to as well. This is based on the fact that in general, errors of *omission* increased (Redline, 1999). In our processing model, this amounts to respondents erroneously attending to the skip instruction rather than the non-skip instruction in F. In the case of the control and prevention forms, the 'non-skip instruction' is quite literally nothing. That is, respondents are supposed to understand that the absence of instructions mean they should simply go to the next question. In the case of the detection form, the 'non-skip' instruction is the left-hand arrow.

The left-hand arrow should work to overcome errors of omission on the detection form. However, the classroom data seem to suggest that, overall, the left-hand arrow was ineffective, since there weren't statistically significant differences in the omission errors between it and the prevention form. The data seem to suggest that the enlarged, verbal skip instructions commanded respondents' attention at the expense of the arrow. One respondent demonstrated this in the cognitive interview when she said, "…I was supposed to go down here. I must have overlooked it. I guess I didn't see that what-you-call-it [arrow], I saw that [the skip].

Dillman et al. (1999b) found that questions located at the bottom of the page were particularly susceptible to errors of omission on the detection form. This is in keeping with our hypotheses

that not only do the various languages of the questionnaire influence respondents' ability to navigate through the form, but so does its physical structure. This seems to confirm our original hypothesis that having to switch directions at the bottom of a page to a new position presents respondents with an additional challenge, which leads to their making mistakes they might not otherwise make at the top or in the middle of a column. And the data suggests that this problem is exacerbated in a design such as that used on the detection form, and made somewhat better by the designs of the control and prevention forms. One difference between the detection form and the others which might account for this is the size of the skip instruction. It is 10-points on the control, 12-points on the prevention form, and 14-points on the detection form. Maybe under these conditions, that is being at the bottom of the page, the skip instruction is just large enough to cause respondents to habitually execute it when they aren't supposed to.

7.2.2 Comprehension

Theoretically, one can argue that respondents could misinterpret the 'educational' instruction preceding question 5 of the prevention form, as well as the 'reminder' skip instructions. Conceivably, respondents could misinterpret these instructions to mean they should skip when we don't want them to. However, the classroom data suggest that this did not occur, since, overall, the error rates were not significantly different between the detection form, which didn't have these instructions, and the prevention form, which did.

7. CONCLUSION

In a self-administered questionnaire, respondents must not only read and answer questions, but they must navigate from question to question. Past research has demonstrated that navigational errors can be a source of item non-response, especially when skip instructions are involved. To date, the only explanation offered for this has been that respondents are confused. Not understanding the underlying processes as to why respondents might be confused has led to the erroneous assumption that nothing need be done to improve the situation, which in turn has led to the recommendations that we either ignore the problem or eliminate skip instructions altogether.

In this paper, we attempt to answer the fundamental question: why do errors occur when respondents navigate through a self-administered questionnaire? We suggest that the answer to this question begins with understanding that respondents must process much more than just the verbal language of a self-administered questionnaire. They must process the auxiliary, numeric, and symbolic languages of a self-administered questionnaire, as well as its physical structure. Furthermore, they must interleave the processing of the languages applicable to the questions and responses, with those applicable to navigation, in this particular example, skip instructions or non-skip instructions. Because so much information must be processed, it is not surprising that errors occur. However, a preliminary test has led us to conclude that manipulating the auxiliary and symbolic languages, in addition to the verbal, effects how respondents perceive, interpret, and perhaps even judge this information. We conclude from this that it is possible to formulate skip instructions that guide respondents through the questionnaire more accurately. We end by elaborating upon the Tourangeau question-response model to take these considerations into account.

Although we propose a model of the question-answer process in self-administered questionnaires and provide examples of how to systematically manipulate the various languages of a self-administered questionnaire to improve respondents' navigation through a questionnaire, still much remains unknown. Questions such as what are the most effective manipulations, what are the most effective thresholds per manipulation, and what are the most effective combinations of manipulations remain to be answered before we will be able to design self-administered questionnaires that effectively guide respondents through them without fail.

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Figures 1a-c. Alternative versions of the skip instruction.

Figure 1a. Control Version

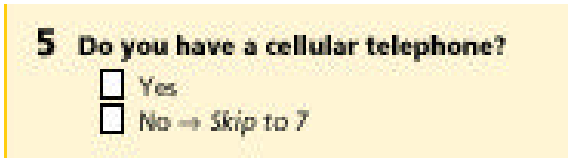


Figure 1b. Detection Version

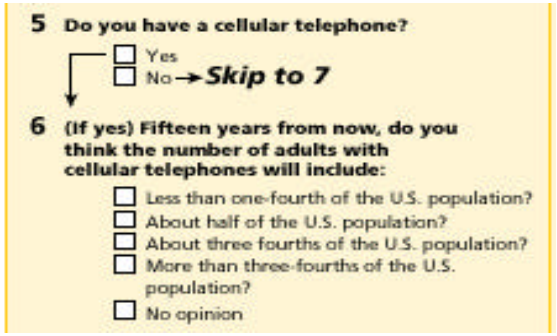


Figure 1c. Prevention Version

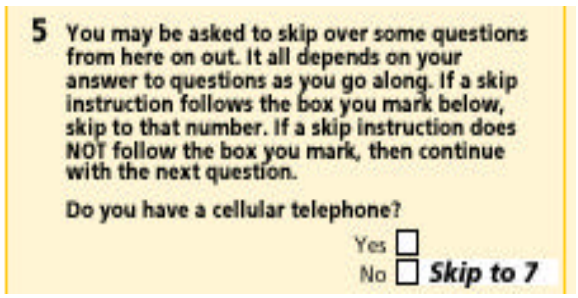
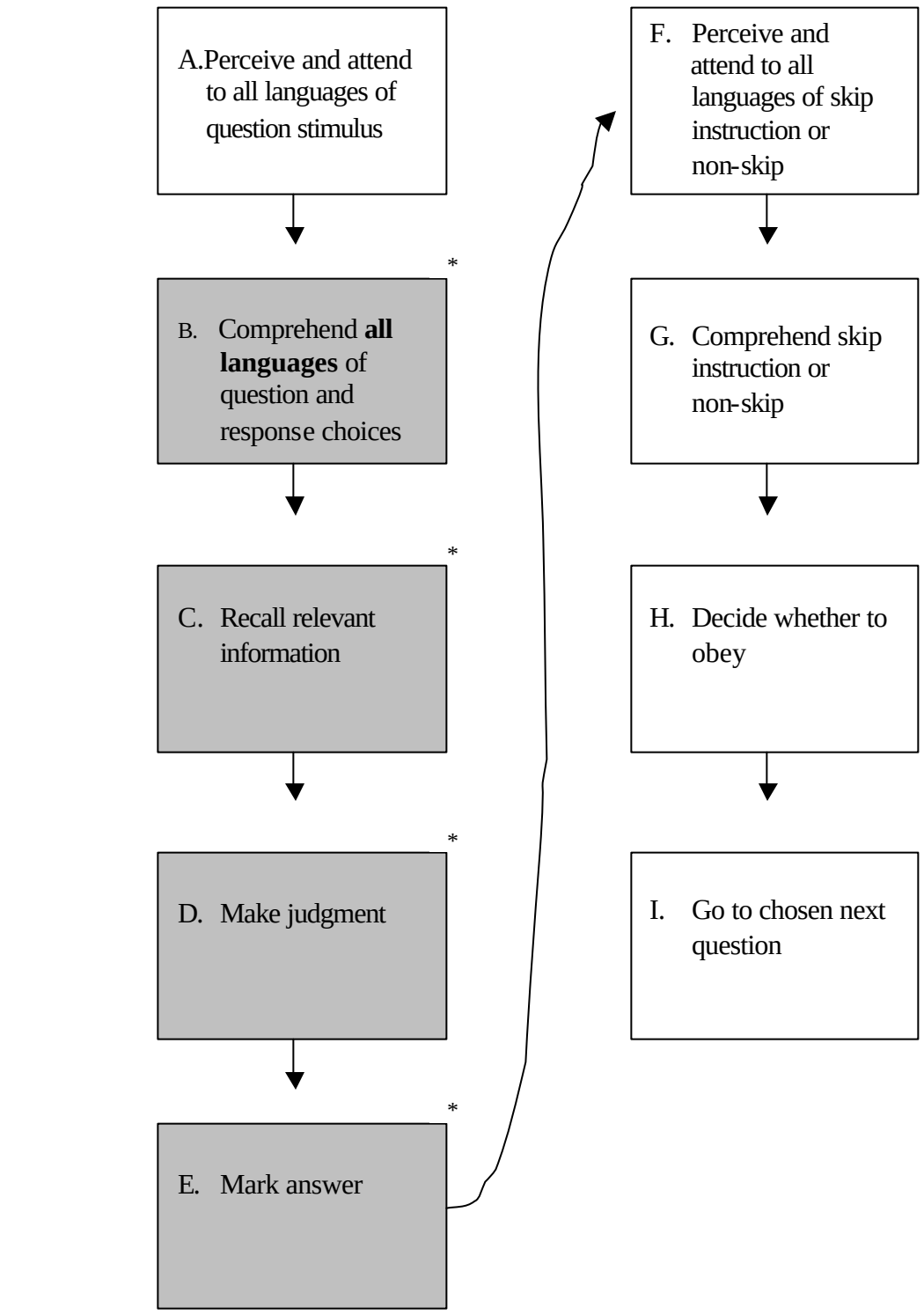


Figure 2. Revision of Tourangeau (1984) model for self-administered questionnaires with skip instructions.



*Shaded boxes represent four steps in Tourangeau model.

Table 1. Error rates and intercorrelations from a test of alternative skip instructions (Redline et al., 1999; Dillman et al., 1999).

	Control Form	Detection Form	Prevention Form
Commission Errors			
Range	**0 – 51.6**	**0 – 28.6**	**0 – 51.7**
Mean	**20.3**	**7.4**	**9.0**
Intercorrelations			
Prevention	**.82**	**.66**	**---**
Detection	**.84**	**---**	**---**
Omission Errors			
Range	**0 – 22.8**	**0 – 14.3**	**0 – 33.9**
Mean	**1.6**	**3.7**	**3.3**
Intercorrelations			
Prevention form	**.90**	**.30**	**---**
Detection form	**.37**	**---**	**---**

Table 2. Effect of question characteristics on error rates (Dillman et al., 1999).

Type of Question	Commission Errors			Omission Errors		
	Yes	No	Probability	Yes	No	Probability
Bottom-of-the-page	**15.1**	**11.0**	**.02**	**5.2**	**2.3**	**.21**
All choices skip	**16.2**	**11.3**	**.01**	**0.0**	**2.9**	**---**
Write-in answer	**34.1**	**11.7**	**.00**	**5.0**	**2.7**	**.50**
Alternating skips	**14.0**	**12.3**	**.49**	**1.2**	**3.3**	**.60**
Last choice skips	**5.4**	**13.5**	**.04**	**5.8**	**2.4**	**.16**
Distance between answer box and skip instruction	**15.3**	**9.9**	**.00**	**1.7**	**3.8**	**.39**
Number of words in question	**8.7**	**14.1**	**.01**	**2.3**	**3.2**	**.68**