WEB AND PAPER QUESTIONNAIRES:

AN EXPERIMENTAL COMPARISON

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ABSTRACT

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The objective of this study is to investigate and model the acceptance of Web and paper-and-pencil questionnaires applied within a company. The study population consists of employees of United Nations agencies at any level with a corporate e-mail account and easy access to an Internet browser. This study uses a crossover design to avoid confounds such as order effects and variability between participants. Acceptance is assessed through the behavioral intention to respond (future) questionnaires, in a model where perceived ease of use, perceived enjoyment, portability value and computer anxiety are proposed as determinant variables. The results of this research do not indicate a difference in the reported behavioral intention to respond to future questionnaires between the two media. Nevertheless, response rates were higher for paper questionnaires.

ACKNOWLEDGEMENTS

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1. INTRODUCTION

The progressive adoption of computer-based surveys has received much attention from the research community over the years. After the popularity surge of telephone interviews in the last century, the Internet offers a new way for scientists and marketers to collect data. The apparent similarity between questionnaires on paper and on computers with graphical interfaces (GUIs) appeals to researchers and suggests an easy transition from the classical paper and pencil (paper) format to the Web browser.

Several hurdles remain on the way to the adoption of Web questionnaires. While paper questionnaires have a long tradition among people, computers are less familiar, intimidating to some, less portable and certainly less reliable than paper. On the other hand, electronic surveys do away with paper, postage, and data entry. Instant evaluation of results and irrelevance of geographical location are also important factors that seem to justify the pursuit of the "paperless" survey. On the Internet, the potential for large sample sizes and anonymity may be counterweighted by problems with the validity of responses.

Among all these issues, one aspect is crucial to the transition success: user acceptance. How likely is a participant to fill a paper survey versus a Web one? Many factors may motivate or discourage a given individual to respond on the Web: demographic characteristics, computer anxiety, perceptions of ease of use and enjoyment, or portability. Knowledge of these factors may be important

for the selection of a survey technique during research design. An experimental study is established to evaluate the participants' behavioral intention to respond Web or paper instruments and its relationship with a number of potential determinant factors.

2. LITERATURE REVIEW

2.1 Computer-based surveys

Computer based questionnaires are not new. Long before the Internet became accessible to the public, computerized questionnaires were used to collect data. Among the benefits of computer surveys we find a shorter turnaround time, simpler and more accurate data collection and a reduction of the survey cost.

Several issues have been raised regarding the replacement of paper by computerized instruments. For instance, the issue of equivalence between paper and computer questionnaires should be addressed case by case. Cronbach (1990), cited by Buchanan (1999) indicated: "the conventional and computer versions of a test do usually measure the same variables, but difficulty or reliability can easily change. Whether the computer version is the same test must be queried with each instrument in turn psychologically". Even if the questionnaire has been designed and validated specifically for computers, participant response to computer questionnaires may be different from paper. Schulenberg (1999) pointed out that participants who are uncomfortable with computers might have higher scores of negative affect than those at ease with computers. Meier and Lambert (1991) labelled this reactive attitude as computer aversion. A study analyzing reports of substance use on two questionnaire modes (paper vs. computer) found that adolescents had reported higher

consumption levels on the computer mode than on paper (Wright, 1998). This difference supported the notion that computerized interviewing produces better results than paper for highly threatening survey topics (Turner, 1996 cited by Wright)

Participants can exhibit a form of anxiety toward the evaluation of their responses. This apprehension sometimes drives the participant to respond in a way to "help" the researcher, trying to support a presumed study hypothesis. This behaviour can affect the internal validity of the study, introducing a bias called social desirability. Studies on the association of this bias with questionnaire media by Richman (1999) and Joinson (1998) indicate that Web administered questionnaires show less distortion than paper, even if the survey does not ensure anonymity. While an older study (Lautenschlager and Flaherty, 1990) reported higher social desirability on computer questionnaires over paper, Booth-Kewley (1992) did not find any systematic difference between these two questionnaire modes.

Another study (Mitchell, 1996) examined the effects of mode of acquisition – computer administered versus paper – on data quality and the interaction of mode (medium) and gender, in a sample of 400 students. The study examined omission rates, completeness of answers, response distortion and scales reliability. The results did not reveal any significant impact of mode of administration (computer vs. paper) on data quality or gender interaction.

Palmer (2003) reported an increase in workplace Web surveys to measure employee motivation, program effectiveness, and staff promotion. Problems with response rate, social desirability, sampling and range compression were found to be exacerbated on Web surveys.

None of these studies contemplated the potential differences on the participant's willingness to respond to a survey in each medium. Behavioral intention to use is an important measure of user acceptance for computer programs, and a study of the impact of questionnaire medium on this variable could provide useful insight for survey design and administration.

Internet surveys have been the target of intensive research, mostly due to the appeal of addressing a potentially huge number of participants with a low unit cost (Mehta and Sivadas, 1995). However, open Internet surveys suffer from well-known problems of external validity: coverage error, sampling error (Couper 2000, Bradley 1999 and Dillman 2001); and internal validity: non-response error and repeated responses (Sheehan, 1999).

Coverage error measures the mismatch between the target and the frame populations. While the target population represents the group of people under study, the frame population corresponds to the set of individuals that could actually be reached by the survey. The tenth GVU (Graphics, Visualization and Usability Center at the Georgia Institute of Technology) Internet survey tallied 5,000 Internet respondents in 1999. Within that sample, female participation varied from 18.4% (Europe) to 33.6% (overall) and the education level shows a

strong bias toward the higher end of the scale (87.8% completed college and 59.3% had at least one degree). These statistics indicate that the Internet users are far from representing the general population and that this disparity is likely to produce severe coverage errors.

Within the frame selected (e.g. Internet users), all persons should have the same chance of being selected. Sampling error involves a systematic bias in the manner in which respondents are selected for participation in the survey. Several methods are available to invite Internet users to respond to surveys, such as banners or pop-up calls, newsgroups posting or e-mail (Sheehan, 1999).

The application of Web-based questionnaires to closed audiences such as an organization, although increasingly common, has not drawn much research attention (Thompson et al., 2003).

Why would we use Web surveys in place of paper within a company? The publishing, distribution and reminders costs of a paper survey in an office environment may not be a compelling reason to use the electronic media. Still, data collection, data entry, feedback publication and feedback distribution for a large number of participants in a short time frame require more resources for paper than Web (Schmidt, 1997, Dillman, 2000 and Thompson et al., 2003) as the number of participants increases and the initial costs are absorbed. Burkey (2003) indicates that many organizations already have networks, server capacity and standard platforms in place, and the users are familiar with the technology required to complete Web surveys.

Furthermore, the Web interface has the ability of reducing errors due to question routing (go-to instructions) and reducing inconsistencies through programmed validity checks. Also important is the potential reduction in turnaround time. On the negative side, these surveys must usually be filled at the office, unless portable and/or home computers plus remote access to the corporate Intranet are available to the respondents. More importantly, they may have an adverse effect on the response rate and on biases, if respondents reject the electronic medium (Thompson et al., 2003).

These considerations lead to the main question addressed by this study. Are we ready to phase out paper questionnaires in contemporary organizations? The answer should be positive from the cost and efficiency perspectives, but are we introducing biases, lowering response levels or quality by overlooking participant attitudes and motivations vis-à-vis the computer? An adequate knowledge of the potential factors affecting the internal validity of an electronic survey, such as non-response error, selection bias, computer anxiety and computer self-efficacy is needed before adopting a clear stance toward intranet questionnaires.

2.2 Technology Acceptance Model (TAM)

A well-known model for information technology acceptance - TAM - (Davis, 1989) describes the relationship between ease of use, usefulness, intention to use and actual usage of technology. This model has been later

extended as TAM2 (Venkatesh and Davis, 2000) to include social influence aspects, such as subjective norm, voluntariness and image. The TAM2 model accommodates scenarios where the user is obliged to use a technology, which is common for many office applications: transaction and word processing (Adams, 1992); communication systems such as voice mail and e-mail. These systems became mandatory tools in everyday's work. On the other hand, survey participation is generally volitional, and TAM constructs such as perceived usefulness and usage behavior are hardly applicable to surveys. Differently from most applications or games, surveys are not "used" or adopted by the users. Survey acceptance or success is usually measured by how many participants respond to a given questionnaire, rather than by how often a participant fills surveys.

2.2.1 Behavioral Intention to Respond

The American Marketing Dictionary defines behavioral intention as:

A cognitive plan to perform a behavior or action, created through a choice/decision process that focuses on beliefs about the consequences of the action.

Behavioral Intention to Use a system is the dependent variable used to predict actual usage of a system in the TAM model and variants (Davis, 1989, Venkatesh and Davis, 2000). Repeated studies on TAM demonstrated that perceived ease of use and perceived usefulness are good predictors of behavioral

intention to use. In this study, we propose to substitute *behavioral intention to respond* to future questionnaires for the TAM original construct.

2.2.2 Perceived Ease of Use

All the same, TAM's perceived ease of use (PEOU) construct stands as a potential motivator for survey response, and behavioral intention to respond can also be used as an indicator of questionnaire acceptance for each medium.

Venkatesh (2000) investigated the role of potential PEOU determinants over time, categorizing them as anchoring or adjustment-based. The proposed constructs are further classified as control (internal or external), intrinsic motivation and emotion. The study found that the effect and significance of each determinant varies as the user experiences the system. Nevertheless, his/her initial state of beliefs toward computers was the main determinant of system-specific PEOU.

2.2.3 Computer Anxiety

Computer anxiety is the individual apprehension a user feels when required to use computers (Venkatesh 2000). This emotion could help to explain a lower acceptance score for web surveys, regardless of the level of familiarity a participant has with the computer or the browser.

2.2.4 Computer Self-Efficacy

Compeau (1995) and Venkatesh (1996, 2000) characterize *computer self-efficacy* as a measure of internal control, or "the users belief of their own ability

to use a computer to perform a task". The design of the web questionnaire used in this study is planned to be simple, requiring only the basic understanding of using a browser, a widely used tool in a contemporary office. This will be done to minimize the role of self-efficacy in the acceptance of the web survey, thereby eliminating the need for this construct in the model. No specific training or manuals will be required and instructions will always be accessible on the screen. Furthermore, the items on the self-efficacy scale are not meaningful in the context of web surveys. Had we compared different types of web questionnaires, with varying levels of sophistication and complexity, then computer self-efficacy might become more relevant.

2.2.5 Computer Playfulness

The *computer playfulness* construct was defined by Venkatesh (2000) as individual openness to using new systems. This variable affects PEOU before users build experience on a new system, and it was dropped for several reasons. First, many users have already become familiar with filling up forms on the web. Second, answering a questionnaire offers little room for variation, creativity or playfulness. Also, Bozionelos indicated (cited by Venkatesh 2000) that computer playfulness is related to computer anxiety which is already included in the model. Finally, the proposed questions for the scale do not match the surveys' context.

Another study (Moon & Kim, 2000) extended the TAM to explain user behavior on the World Wide Web. They added a perceived playfulness construct to account for the intrinsic motivation a user feels when browsing the Web.

They look at the enjoyment users get from the Web as an environment, and not only from performing a specific task. Citing surveys on Web usage, they recognize that Web is used for education, shopping, entertainment, work, communication, personal information, time-wasting etc. However, in this study we examine the intrinsic motivation differences between paper and Web questionnaires; even though the Web can be fun, this does not imply that Web users will be more likely to fill questionnaires than paper adepts.

2.2.6 Perceived Enjoyment

Perceived enjoyment was defined by Davis (1992) as the extent to which the activity of using the computer is perceived as being enjoyable in its own right, apart from any performance consequences that may be anticipated. The influence of this measure of intrinsic motivation over ease of use (PEOU) undergoes adjustment over time, as the user builds experience with the system (Venkatesh, 2000).

3. RESEARCH MODEL AND HYPOTHESES

The main goal of the study is to assess and compare the behavioral intention to respond to future surveys on the Web and on paper, along with explanatory factors for this measure of acceptance. In order to achieve this objective, a model is proposed to identify and measure the relationships between constructs derived from the TAM model and some of its more recent variations.

3.1 Research Model

The research model is presented on Figure 1. We hypothesize that the behavioral intention to respond to future surveys (our measure of acceptance) is affected by the survey medium. The medium relates to perceived ease of use through three constructs, and the relationship is moderated by demographic variables. The perceived ease of use (PEOU) variable impacts the respondents' behavioral intention to respond to future surveys. This behavioral intention to respond to similar surveys (BI) identifies the questionnaire acceptance. The intervening factors are: computer anxiety, perceived enjoyment, and portability value.

Questionnaire Medium (PAP x WEB)

Gender (GEN)   Education (EDU)

Computer Anxiety (CANX)

Perceived Enjoyment (ENJ)

Portability Value (PORT)

Job Level (JOB)   Age (AGE)

Perceived Ease of Use (PEOU)

Behavioral Intention to Respond (BI) (in the future)

H_4 H_3 H_2 H_1 H_5
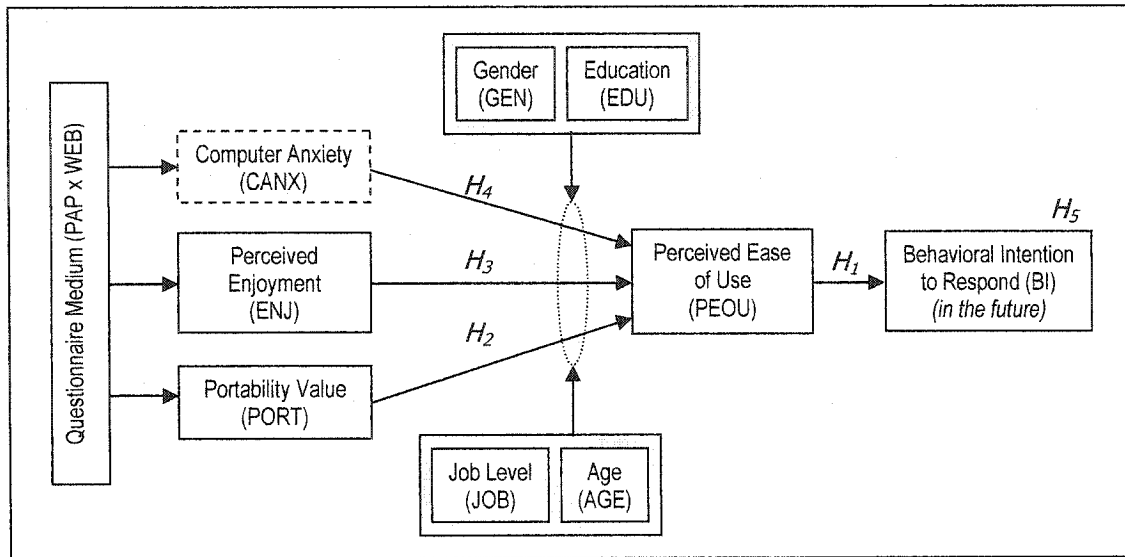
Figure 1 - Research model (arrows do not suggest causality)

This model is based on a refinement (Venkatesh 2000) of the original model of Technology Acceptance, or TAM (Davis 1989), with some specific adaptation to the study of questionnaires. Venkatesh proposed to add determinants that affect PEOU. These factors can provide more specific information to improve the design of new systems. The determinants are grouped as anchors or adjustments, to distinguish the *a priori* user knowledge from the practical information gained from system usage. Venkatesh performed longitudinal studies to measure adjustment factors, a feature beyond the scope of this cross-sectional research. For this reason, we make no attempt to classify the determinants as anchors or adjustments.

Not all elements from TAM are directly applicable to the study of questionnaires. Respondents do not generally see any direct usefulness of questionnaires, particularly when the questions involve deception. This

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irrelevance can be clearly seen from an item of the usefulness scale: "I find the (system) survey to be useful in my job".

The study methodology and design impose further constraints in the number of items of the questionnaires: participants will have one week to respond to each questionnaire in sequence, and the response rate may be negatively affected by the questionnaires' length. In order to minimize the response loss, we limit the number of constructs to be measured, while preserving the validity of the model.

The value of *portability*, the importance a participant gives to the ability to carry and respond the survey at different locations is included in the study to assess its impact on the acceptance of Web surveys. Today, a networked computer does not have the mobility of paper, and if the participant prefers to respond the questionnaire out of the office, the acceptance could be affected.

Demographic variables, such as gender, age, job and education levels can also explain user acceptance. Venkatesh & Morris (2000) found an influence of gender on the relationship between PEOU and usage of new technology. Adamson and Shine (2003) also obtained significant linkage of job level and age with participant satisfaction at the introduction of new systems.

Table 1 - Study Variables

	Variable	Type	Measurement	Scale
	First Questionnaire	Independent	Nominal/dichotomic	0-paper 1-Web
*	Response rate	Dependent	Ratio level	0 to 100 %
*	Participation status	Dependent	Nominal/dichotomic	{0-First 1-Both}
+	Behavioral Intention to Respond	Dependent	Interval level	{1,2,3,4,5,6,7}
+	Perceived Ease of Use	Intervening	Interval level	{1,2,3,4,5,6,7}
+	Perceived Enjoyment	Intervening	Interval level	{1,2,3,4,5,6,7}
+	Computer anxiety	Intervening	Interval level	{1,2,3,4,5,6,7}
+	Portability Value	Intervening	Interval level	{1,2,3,4,5,6,7}
+	Age	Moderating	Ordinal	{integer}
+	Gender	Moderating	Nominal/dichotomic	0-Male 1-Female
+	Education	Moderating	Ordinal	{primary, secondary, undergraduate, graduate}
+	Job Level	Moderating	Interval level	{G4-,G5,G6,G7-G9, P2, P3, P4,P5+}

(+) = Self-reported   (*) = Measured

3.2 Research Hypotheses

In this study, behavioral intention (BI) to respond to future questionnaires – Web or paper – is the measure of acceptance of questionnaires on each medium. After comparing the level of acceptance of questionnaires on each medium, we investigate potential explanatory factors for acceptance. The study is focused on Intranet surveys, an area where both paper and web can be used without drastic differences in cost or sample size. The results of this investigation

can guide researchers and managers alike on the trade-offs associated with the choice of a survey medium in a contemporary organization.

The following hypotheses will be tested:

As shown in Figure 1, we propose that behavioral intention to respond to future questionnaires is positively related to perceived ease of use. This assumption borrows from the TAM (Davis 1989), a model confirmed over 10 years of research. Moreover, since the TAM model was developed for *information technology*, we argue that Web questionnaires should present a stronger link between these two constructs than paper questionnaires.

H_{1a}: *Perceived ease of use has a positive association with behavioral intention to respond Web questionnaires.*

H_{1b}: *Perceived ease of use has a positive association with behavioral intention to respond to paper questionnaires.*

H_{1c}: *Perceived ease of use shows a stronger association with behavioral intention to respond to Web questionnaires than paper questionnaires.*

Here we investigate the potential impact of the easy access to paper questionnaires in different locations. This advantage could affect the participants' intention to respond to future surveys.

H₂: *Respondents attribute higher value to portability when filling Web questionnaires than paper questionnaires.*

Venkatesh (2000) found a significant association between perceived enjoyment (ENJ) and PEOU. We examine this association on each medium, and given the degree of interactivity in the Web, we suggest that Web questionnaires should present a higher linkage than paper.

H₃ₐ: *Perceived enjoyment has a positive association with perceived ease of use of Web questionnaires.*

H₃ᵦ: *Perceived enjoyment has a positive association with perceived ease of use of paper questionnaires.*

H₃ᵪ: *Perceived enjoyment to respond Web questionnaires shows a stronger association with perceived ease of use than paper questionnaires.*

Computer anxiety was identified as another determinant of system's ease of use by Venkatesh (2000). We expect this factor to limit acceptance of Web surveys.

H₄: *Computer anxiety is negatively associated with participant perceived ease of use Web questionnaires.*

We posit that in a corporate environment, participants would favour Web questionnaires over paper, as a result of higher levels of perceived ease of use.

H₅: *Participants are more likely to respond Web questionnaires than paper.*

3.3 Constructs Operationalization

The variables selected for the study are found on many studies including Davis (1989) pioneering work on the Technology Acceptance Model and Venkatesh (2000) research on Determinants of Perceived Ease of Use. Standard scales used by these authors were adapted to measure the study constructs, taking into account the subject of the study – questionnaires. As an example, the PEOU item "*I find it easy to get the (system/questionnaire) to do what I want it to do*" lacked meaning in the study context and was removed. All constructs were measured with a seven point Likert scale ranging from *1 - strongly disagree* to *7 - strongly agree.*

In addition to these standard constructs, a single item was introduced to evaluate the importance of questionnaire *portability* - capability to carry and respond the survey at different locations - for the respondents.

Finally, the *time* taken to answer the questionnaires was collected in different ways for Web and paper. The WEB version had an automatic timestamp associated with each answer, while the paper version contained one question on

how many minutes the user felt it took to answer the first part of the questionnaire.

Table 2 – Scales

Construct (items)	Scaled Variables	Questions	Reliability (Cronbach's Alpha)		
			This study	Venkatesh, 2000 (T1)	Venkatesh & Davis, 2000
Perceived Ease of Use (3)	PEOU	(Quest. 1 & 2) II.1 – II.3	0.875 paper 0.873 Web	0.92	0.86-0.98[1]
Portability (1)	PORT	(Quest. 1 & 2) II.7	-	-	-
Perceived Enjoyment (3)	PE	(Quest. 1 & 2) II.4 – II.6	0.935 paper 0.942 Web	0.90	-
Behavioral Intention to Respond (2)	BI	(Quest. 1 & 2) II.8, II.9	0.972 paper 0.916 Web	0.92	0.82-0.97
Computer Anxiety (9)	CANX	(Quest. 2) III.1 – III.9	0.898	0.91	-

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[1] PEOU scale with 4 items

Table 3 - Review of constructs in the proposed research model

Variable	Definition	Affects	Author	Operational Definition	Sample	Results
Behavioral Intention to Use (BI)	Strength of one's intention to use a system	Usage	Venkatesh & Davis, 2000	2 items, 7 points Likert scale	156 empl. of 4 organizations	BI and usage are found to be determined by PEOU
		Attitude toward system use	Davis, Fred 1989	6 items, 7 points Likert scale	120 computer users and 40 evening MBA students (paid)	Development of scale for PEOU, and testing of correlation with current and future software usage (TAM).
Perceived Ease of Use (PEOU)	Degree to which a person believes that using a particular system would be free of effort.		Venkatesh & Davis, 2000		156 empl. of 4 organizations	BI and usage are found to be determined by PEOU
		Behavioral Intention to Use	Venkatesh & Morris, 2000	4 items, 7 points Likert scale	445 individuals from 5 organizations	Gender bias: PEOU-BI relation stronger for women.
			Venkatesh, 2000		30 empl. electronics store +	Individuals' general beliefs on computers are strongest determinants of PEOU
Perceived Enjoyment (ENJ)	Extent to which using a specific system is perceived as enjoyable on its own, performance consequences aside.	PEOU	Venkatesh, 2000	3 items, 7 point Likert scale	160 empl. real estate +	ENJ affects PEOU after user experiences system
Computer Anxiety (CANX)	Individual's apprehension (fear) when faced w/ using computers.	PEOU	Venkatesh, 2000	9 items, 7 point Likert scale	52 empl. financial services firm	CANX affects PEOU.
Gender (GEN)	Male/Female	Moderator for BI	Venkatesh & Morris, 2000	N/A	445 individuals from 5 organizations	GEN moderates PEOU effect on BI

4. METHODOLOGY

4.1 Questionnaires Design

In spite of the growing popularity, electronic/Web questionnaires are not widely used in organizations yet, and the level of familiarity with this medium should vary considerably among staff. Moreover, the multitude of features, layouts and access methods applied to a Web questionnaire can provide entirely different experiences to participants, and consequently, different levels of acceptance. In the extreme case, some participants might have never completed a Web questionnaire, and their acceptance could not be measured. A direct way to minimize this undesirable source of variation could be to submit a common Web questionnaire to all participants, and measure the variables of interest.

It seems logical to extend this principle to the paper questionnaire, to avoid that different questionnaire layouts, length, and content influence the participants' perceptions regarding the paper medium. The same common questionnaire should then be applied to all participants, *on paper.*

In order to increase the study validity, all participants needed to be exposed to identical generic questions on different media (paper and WEB), and answer the same questionnaire twice. Asking each participant to fill two equivalent questionnaires, on two media, in a short sequence brings concerns about study mortality (participants' withdrawal), carryover and order effects.

Mortality was primarily addressed by breaking the questionnaires in three parts (Table 4), to minimize repetition: the first part (treatment) would contain the same test questions on both media, while the second part would measure their response to the first part in terms of ease of use, enjoyment, portability value, intention to respond to future questionnaires, and time to respond to the first part. Finally, the third part contained demographic questions on the first questionnaire and the computer anxiety scale on the second questionnaire.

Table 4 – Questionnaire organization

Part	Questionnaires	
	First (WEB/paper)	**Second (paper/WEB)**
I	Generic questions	Generic questions
II	PEOU, PE, PORT, BI, Time	PEOU, PE, PORT, BI, Time
III	Demographics	CANX

A matter of special concern was the reaction of participants to the repeated questions. The research objective could become apparent, thereby invalidating the results. Deception was applied to divert the participants' attention from the medium, and to motivate them to answer the two consecutive questionnaires. The study objective presented was the evolution of participants' well-being over a period of time. This approach would justify submitting identical questions one week apart. The switch of medium from the first questionnaire to the second was explained as an attempt to minimize the effect of recollection when answering similar questions on the second questionnaire.

The participant recollection of the first questionnaire may trigger a carryover effect that could affect the validity of the responses on the second questionnaire. The proposed crossover design does not resolve this issue, although it brings significant advantages: all participants serve as their own controls, adjusting for confounds, reducing the error variance and the sample size needed; all participants are exposed to both media; and the randomisation assumption is applicable to statistical tests. Participants are randomized into two groups and each group receives the questionnaires in a different medium sequence (paper/Web versus Web/paper). The crossover design also enables the assessment of order/medium interactions.

The questionnaires were pre-tested in a graduate class at Concordia University, with 15 students. Their feedback was positive, and the deception scheme was not recognized. The pre-test also helped to make final adjustments to the study invitation process and data collection.

4.2 Web Questionnaire Design

In this study, the Web questionnaire was designed to display one question at the time to the respondent, instead of the simpler approach of presenting a single list of questions, where users scroll down the page to advance to the next question. Several aspects affected this decision.

While the single list approach allows simple navigation back and forth between questions, the chances of scrolling over unanswered questions

increases when the number of questions is large (in this study, 42 for the first and 36 for the second questionnaires). This problem could be addressed with validation checks, informing the respondent about the skipped questions when the answers are submitted. Differently from paper questionnaires, where the respondent always sees a full, fixed-size page with a specific layout, in a Web questionnaire it is difficult to ensure that the respondent can see all the required elements (with an adequate font size) to answer a question in the browser window, across different computers. The single question approach allows a better control of the screen space, providing all the details required to answer each question in a consistent way. More importantly, the one question per page approach captures each user response immediately. This feature minimizes data loss due to interruptions, computer or network failures, or accidental closing of the browser. The respondent can resume the questionnaire later on, from the last answer selected. In the single list case, all answers can be lost between the time the first question is selected and the questionnaire is completed or submitted. Also, in the single question approach each answer is stored individually, and the time and sequence of the answers can be recorded. The single question method is also more suitable to the design of conditional (*go to* type) questions, although this feature was not explored in this study. The chief disadvantage of the single question design is the programming required to provide navigation between questions and specific heading and item layout for each question.

The Web questionnaire was developed for Macromedia's Cold Fusion version 5.0, using Microsoft Access 2000 as the supporting database. JavaScript was used for input validation, and all programs and layout were aimed and tested for MS Explorer 5.0 or Netscape 4.7 and above. A few supporting programs were created to send e-mail invitations to participants on the first and second phases and to send reminders to participants.

4.3 Data Collection and Sample

The study design called for a contemporary office environment, equipped with networked computers and an Intranet site actively in use by the work force. While basic familiarity with a web browser was needed, it was important to target a technology-neutral sample, to enhance the study external validity.

The data for this study were collected in a UN international organization with approximately 700 employees. Even though the sample selection was based primarily on convenience, the size and international composition of the organization staff added value to the study. A relatively large number of participants was sought to compensate for the expected loss on response rate due to the double questionnaire required for the cross-over study design. The international, multi-cultural character of the staff could dilute the effects of the local culture; on the other hand, this might have limited the external validity of the study, given the sample distinctiveness.

In the target organization, staff is divided in two main categories: general services and professional. Each category is divided in several levels, and a higher number correlates with a higher rank. For instance, a P-5 professional corresponds to a first-level executive, such as the head of a department.

In this study, the sample (N = 726) was randomly divided in two halves, and one half ($N_1 = 363$) was assigned to receive a WEB questionnaire first, followed by a paper questionnaire. The second half ($N_2 = 363$) received corresponding questionnaires at the same time as the first half, but in the other medium (paper/WEB). In either half, a few questionnaires did not reach a respondent, either because of an incorrect e-mail address (4) or because the respondent had already left the organization (25).

The list of participants was compiled from the organization's e-mail directory to make sure that an e-mail address existed for every participant. The participant's names were kept in a database together with their e-mail and a randomly generated personal identification number (PIN). The PINs were generated by concatenating random text to a sequential number (e.g. WW379S) to avoid collision (duplicates) and to make it difficult for a participant to guess a valid PIN and respond for another person.

The Web questionnaire invitations were sent automatically by e-mail to all participants (first or second questionnaire according to the group), with the consent text in the body of the message and a consent link at the end to open the Web questionnaire. This link contained the PIN for the participant, and

therefore s/he did not have to enter any codes or passwords to respond. The first Web page contained detailed instructions about filling the questionnaire, including a description of the questions layout. At the end of the instructions, a button would bring up the first part of the questionnaire. A simple click on a response item would save the answer and open the next question. Within each part, a participant was free to move forward or back one question at a time, or directly to the first question or last question answered. On the last question of each part, a warning indicated that after answering that question, the part would be closed and the participant would not be able to navigate back. Following the warning, a list of unanswered questions (if any) was displayed with links to those questions, in case the participant would like to answer them.

The paper questionnaires were distributed through the organization's internal mail. Each paper questionnaire was marked with a pseudo-random number identifying the participant number for matching with the corresponding Web questionnaire. A few (3) participants noted this number and blocked the match by erasing the number. All paper questionnaires were sent in envelopes individually addressed for each participant. Each envelope also contained a pre-printed return envelope, addressed to the internal distribution unit who forwarded the responses to the investigator.

After the data collection, the investigator sent a debriefing message to all participants, explaining the nature and reasons for the deception (Appendix 4),

and providing feedback on the results of the test questions (well-being survey)

answered.

5. DATA ANALYSIS AND RESULTS

Table 5 - Descriptive Statistics (questionnaire items)

		Item	N	Min	Max	Median	Mean	SD
		My education level is	218	2	4	3	3.35	0.69
		My gender is	220	1	2	2	1.60	0.49
		My job level is	218	1	8	4	4.53	2.18
		My age is	217	1	6	4	3.79	1.00
Paper	PORT	Portability value	190	1	7	4	3.63	1.35
	PEOU1	Part I was clear and understandable	190	1	7	6	5.12	1.59
	PEOU2	Part I did not require a lot of effort to	190	1	7	6	5.63	1.47
	PEOU3	Part I was easy to answer	191	1	7	6	5.42	1.61
	ENJ1	Part I was enjoyable	191	1	7	4	4.37	1.22
	ENJ2	Part I was a pleasant experience	191	1	7	4	4.27	1.20
	ENJ3	Part I was fun to answer	191	1	7	4	4.18	1.23
	BI1	Assuming I receive a similar	191	1	7	5	5.25	1.52
	BI2	Given that I receive a similar	189	1	7	5	5.30	1.51
	TIME	Time to respond (minutes)	186	2	51	5	7.53	4.96
	INT	Interruptions	185	0	10	0	0.59	1.21
Web	POR	Portability value	164	1	7	4	3.79	1.37
	PEOU1	Part I was clear and understandable	164	1	7	6	5.43	1.40
	PEOU2	Part I did not require a lot of effort to	164	1	7	6	5.85	1.22
	PEOU3	Part I was easy to answer	164	1	7	6	5.70	1.37
	ENJ1	Part I was enjoyable	163	2	7	4	4.71	1.16
	ENJ2	Part I was a pleasant experience	164	2	7	4	4.57	1.12
	ENJ3	Part I was fun to answer	164	1	7	4	4.36	1.22
	BI1	Assuming I receive a similar	163	1	7	5	5.22	1.31
	BI1	Given that I receive a similar	163	1	7	5	5.27	1.29
	TIME	Time to respond	161	0	15	4	5.07	2.75
Computer Anxiety	CANX1	Computers do not scare me at all	134	2	7	6	5.84	1.41
	CANX2	Working with a computer makes me	134	1	6	1	2.03	1.44
	CANX3	I do not feel threatened when others	134	1	7	6	5.46	1.65
	CANX4	It wouldn't bother me to take computer	134	2	7	6.5	5.99	1.29
	CANX5	Computers make me feel uncomfortable	134	1	7	1	2.15	1.58
	CANX6	I feel at ease in a computer class	134	2	7	6	5.51	1.47
	CANX7	I get a sinking feeling when I think of	134	1	7	1	1.82	1.33
	CANX8	I feel comfortable using a computer	134	1	7	7	6.09	1.36
	CANX9	Computers make me feel uneasy	134	1	7	1	1.88	1.35
		Valid N (listwise)	118					

Descriptive statistics for all questionnaire items is presented on Table 5.

The study data was analyzed through conventional statistical methods

(multivariate analysis of variance) for main effects and Partial Least Squares (PLS) regression (or path) analysis for model validation. This technique was originally developed by Herman Wold (Wold, 1985). PLS is a predictive technique applicable to causal modelling with many independent variables, overcoming problems such as multicollinearity and lack of normality.

Response rates are presented on Table 6. The rates were calculated as the number of responses divided by the number of invitations sent on each period. Paper questionnaires produced a higher response in either period, albeit at a slower pace. Even if the study did not record the temporal distribution of paper responses, paper questionnaires were sporadically returned up to four weeks after the closing date.

Table 6 – Response rates by treatment (medium) and sequence

Medium Sequence	Initial invitations	Period	
		First	Second
WEB/paper	359	89 (25%)	59 (66%)
paper/WEB	338	132 (39%)	75 (57%)

As described earlier, the time to complete questionnaires was not included in the study model, due to concerns about the validity of comparing time measured on the computer with user-reported time estimates. All the same, the data indicated a significant difference in time between the two media. Paper

questionnaires took an average 7.3 minutes to fill, while Web questionnaires took 5.12 minutes. This difference was highly significant (p=0.000 at α=99%).

5.1 Non-Response Bias

Two approaches were used to test for non-response bias. In the first, based on the *continuum of resistance model* (Kennickell 1999), we used the date/time stamp of the Web questionnaires to compare early and late respondents. *Early* respondents were those who filled the questionnaire before the reminder message was issued. Participants that answered after the reminder were considered *late*, and taken as proxies of non-respondents. MANOVA tests (SPSS GLM procedure) for mean equality were run for the BI, ENJ, PEOU and PORTAB variables; In the Web-first group, we obtained N_{early}=45, N_{late}=44, p=0.334 and in the Web-second N_{early}=54, N_{late}=21, p=0.938. No difference was found at the 5% significance level[2] to support the existence of non-response bias.

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[2] Unless otherwise noted, all significance tests are based on α=0.05.
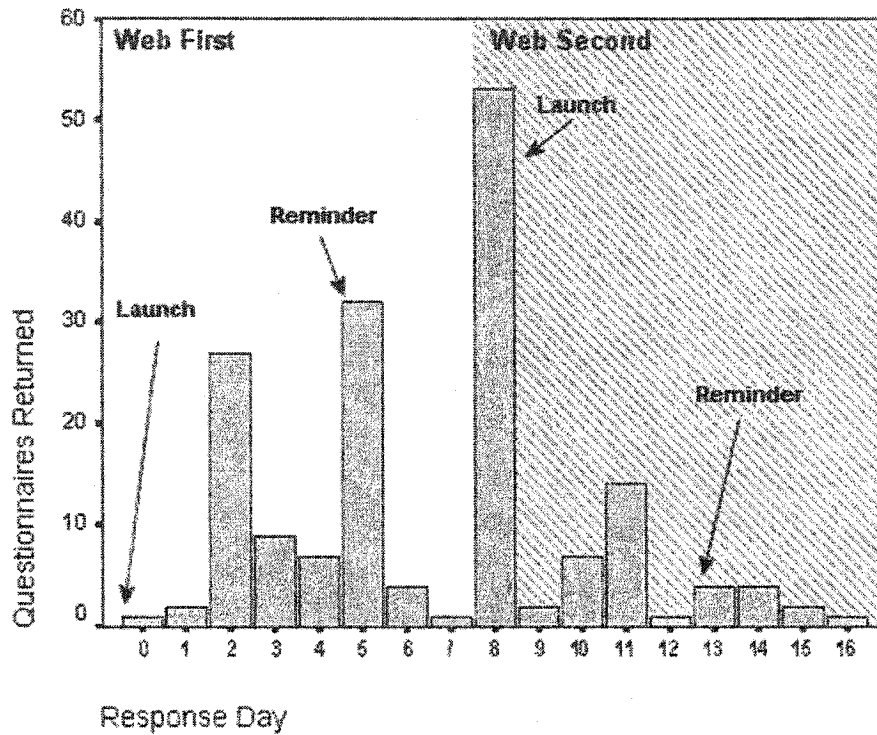
Figure 2 - Web Response Distribution

In the second approach we compared the means of responses to the first questionnaire between participants that responded only to the first questionnaire (dropouts) and those that responded to both questionnaires (full participants).

Again, MANOVA tests for mean equality were run for the BI, ENJ, PEOU and PORTAB variables. In the Web-first group we obtained $N_{dropouts}=31$, $N_{full}=58$, $p=0.014$ and in the paper-first group, $N_{dropouts}=56$, $N_{full}=75$, $p=0.271$. The difference found between Web-first dropouts and full participants originated from the Web BI variable (behavioral intention to respond to future questionnaires) at $p=0.001$. Those who responded both the Web (first) and the paper (second)

questionnaires showed an average Web BI score of 5.6, while those that dropped out after the first questionnaire provided an average Web BI score of 4.9. This result seems reasonable – the users who gave up the experiment earlier should exhibit lower levels of behavioral intention to respond. Although the overall (multivariate) difference was not significant for the paper-first group, it was also high (4.9 and 5.4, at $p=0.050$) for the paper BI variable alone.

From these results, we can conclude that the measures did not show any non-response bias on the independent variables. The main dependent variable, behavioral intention to respond, showed an expected relationship with study drop-out that should not affect the subsequent analyses.

5.2 Respondents Demographics

The organization under study made available statistics on the staff age, gender and job level at the time of the survey (Table 7). These figures were used as a baseline against which we compared the respondents of the first questionnaire on each group (Paper/Web versus Web/Paper) using a chi-squares test. While the differences identified on the Web-first group were not significant, the Paper-first respondents presented significant differences in the age distribution (p=0.021) and the job level (p=0.013). These differences are illustrated on Figure 3 through Figure 6.

Table 7 – Study sample demographic distribution (N=610)

Per Age		Per Gender		Per Job Level	
Categories	Staff	Categories	Staff	Categories[3]	Staff
Below 25	1%	Female	61%	G6 or below	45%
25 to 34	6%	Male	39%	G7 to G9	18%
35 to 44	28%			P2	3%
45 to 53	41%			P3	7%
54 to 65	24%			P4	19%
				P5 or above	9%

[3] G5 to G9 are General Services categories, P2-P5 are Professional categories. Higher numbers correspond to higher ranks.
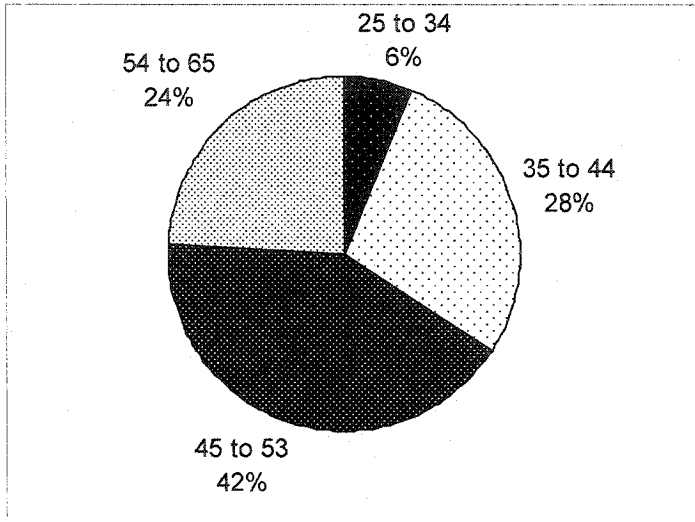
Figure 3 - Sample Age distribution

We can see that paper-first respondents showed higher participation at the age extreme groups: 25 to 34 years (from 6% to 11%) and 54 to 65 years (from 24% to 30%). This increase came at the expense of the middle age group of 45 to 54 years, where the participation dropped from 42% to 32%.
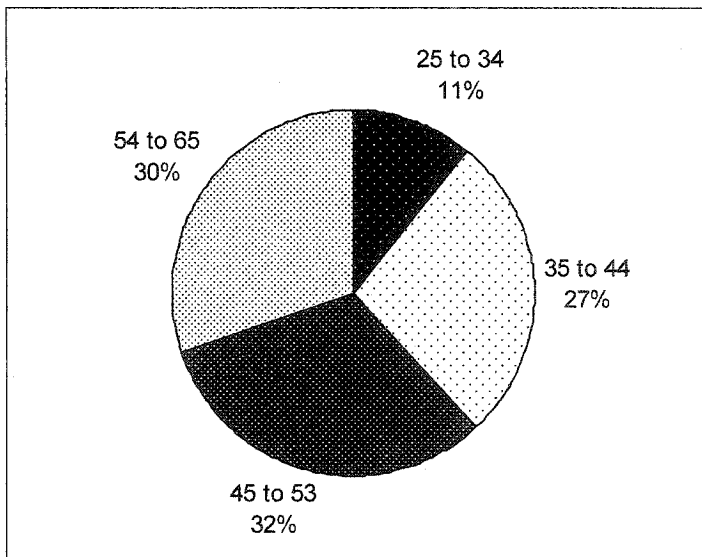
Figure 4 – Paper-first respondents Age distribution
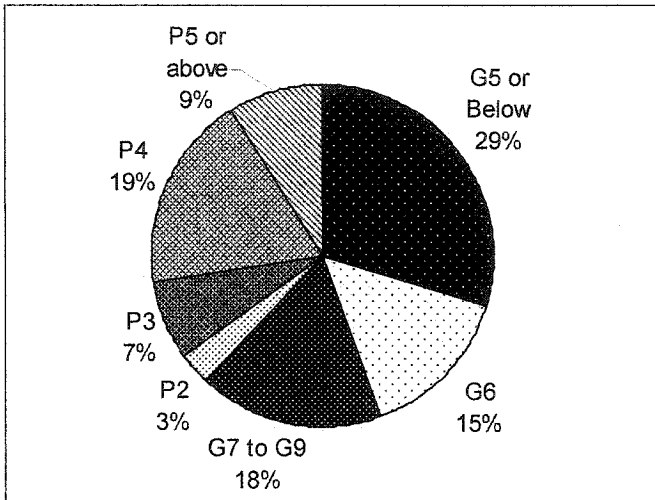
Figure 5 - Sample Job distribution

Participation at the various job levels displays a reduction on all the General Services categories, with the highest drop (5%) at the lowest rank (G5 or below) category. This reduction comes with an increased participation at all Professional levels, except for the P4 (senior officers, not at an executive level) category. The highest lift (5%) was at the P2 level.
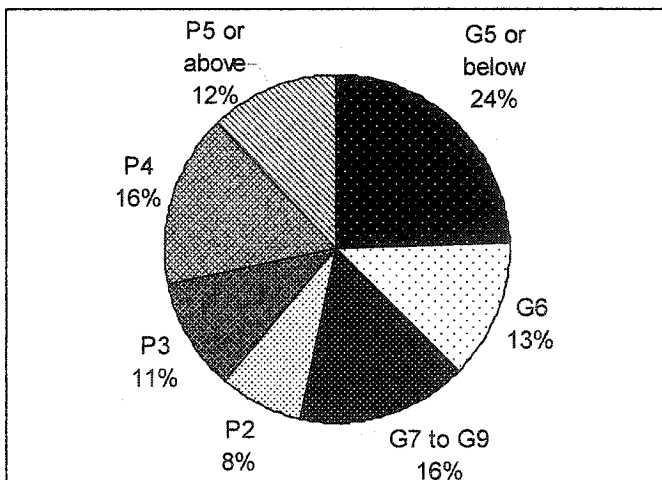
Figure 6 – Paper-first respondents Job distribution
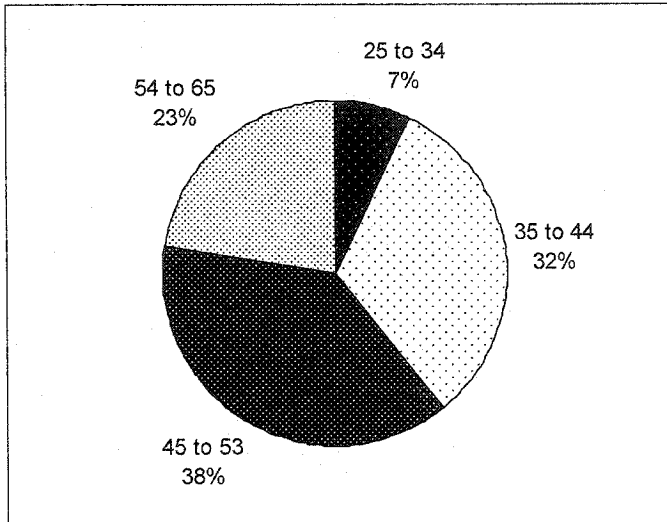
Figure 7 - Web-first respondents Age distribution

Even if statistical significance was not reached, Web-first respondents' age showed a 4% increase on the 45 to 53 bracket, and a 4% drop on the 35 to 44 age group, in comparison to the baseline statistics. Participation was higher by 3 to 4% on almost all job categories except P4 that grew by 1%, at the expense of the lower general services categories, which fell 4% below the organization's frequency. This drop may be explained by poorer access to computers due to sharing.
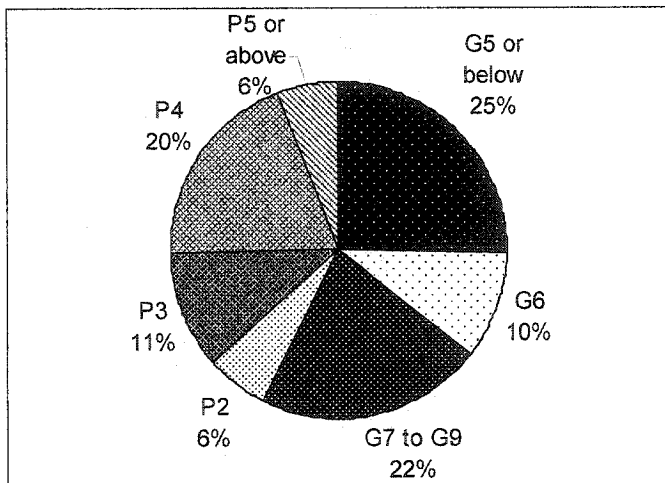
Figure 8 - Web-first respondents Job distribution

Chi-square tests on demographic variables were also run between the two groups (Paper/Web and Web/Paper) of first-questionnaire respondents. No significant differences were found.

5.3 Multivariate Analysis

Testing for differences in a crossover study (Dallal, 2000) involves three factors: *treatment* (medium: Web or paper), *period* (first or second questionnaire), and *sequence* (Web/paper or paper/Web). Given that only four combinations of these three factors are present, each estimate of a main effect also estimates a two-factor interaction: *sequence*treatment* equals *period*, *period*sequence* equals *treatment* and *treatment*period* equals *sequence*. Running multivariate comparisons (SPSS - GLM Repeated Measures) of the study variables measured on both paper and Web questionnaires resulted in significance for period and treatment. The behavioral intention to respond to future questionnaires (BI) showed a significant association with the period ($N_{Web/Paper}$=59, $N_{Paper/Web}$=75, p=0.021). This indicates that the expected value of the behavioral intention to respond is higher for the first questionnaire than the second, regardless of the treatment or the sequence. This result is expected, given the cumulative annoyance effect of responding to two similar questionnaires one week apart. BI did not show significance against treatment (Paper vs. Web), indicating that hypothesis H_5 should be rejected: participants

did not show a higher score for behavioral intention to respond to future surveys in either medium.

No significant differences were found for ease of use, portability or computer anxiety.

Since portability was defined as a single item scale, hypothesis H_2 – higher importance to portability on Web questionnaires – could not be addressed by PLS. A t-test mean comparison was made between portability scores of Web and paper questionnaires. A non-significant difference was found, thereby negating support to hypothesis H_2.

Perceived enjoyment indicated a strong significance (p=0.006) for treatment: Web questionnaires produced higher levels of enjoyment than paper questionnaires. This result lends some support to hypotheses H_{3c}, which postulated that Web questionnaires have a stronger association with ease of use than paper questionnaires.

5.4 PLS analysis

PLS models involve three methodological steps (Hulland, 1999): 1) Assessment of the reliability and validity of measures; 2) Identification of the nature of relationships between measures and constructs; 3) Assessment of the final structural model. The first step implies the calculation of item reliability, convergent validity and discriminant validity. The second step examines the model constructs through their estimated path coefficients, including sign and

strength of the relationships. For the items, weights and loadings indicate the contribution of the measures

The computer programs used for this analysis were PLS-GUI, a graphical interface developed by Yuan Li for the LVPLS (Latent Variables Path Analysis with PLS), also known as PLS-PC, version 1.8 developed by Jan-Bernd Lohmeöller (1987) and PLS Graph developed by Chin and Fee (1995).

5.5 Assessment of the reliability and validity of measures

Item Reliability estimates the unidimensionality of the measures of a variable, ensuring that the measures are more related to the variable in question than the other variables in the model.

Table 8 - Loadings for full models

Loadings (λ)	Item	Paper/Web		Web/Paper		
		Paper first	Web second	Web first	Web first (adjusted)	Paper second
ENJ	ENJ1	0.917	0.959	0.966	0.966	0.956
	ENJ2	0.940	0.968	0.940	0.941	0.954
	ENJ3	0.937	0.918	0.889	0.890	0.918
	CANX1	-	0.762	*0.375*	0.713	-
CANX[4]	CANX2	-	0.854	*0.070*	-	-
	CANX3	-	0.602	0.558	0.832	-
	CANX4	-	0.660	0.601	0.724	-
	CANX5	-	0.761	*0.102*	0.638	-
	CANX6	-	0.743	0.540	0.783	-
	CANX7	-	0.797	*-0.116*	-	-
	CANX8	-	0.711	*-0.213*	-	-
	CANX9	-	0.896	*-0.274*	-	-
PEOU	PEOU1	0.779	0.882	0.754	0.783	0.860
	PEOU2	0.926	0.945	0.916	0.899	0.930
	PEOU3	0.924	0.950	0.912	0.898	0.944
BI	BI1	0.974	0.978	0.867	0.869	0.997
	BI2	0.976	0.975	0.955	0.954	0.996

Item reliability can be evaluated through the loadings of the measures with their corresponding constructs (Hullan, 1999). Values above 0.7 indicate that more than 50% (square of the loading) of the variance in the observed variable originates from the associated construct. A generally accepted rule of thumb sets the threshold for validity at 0.5. Table 8 indicates the loadings that fail the criteria in italic and underline.

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[4] Computer anxiety was always measured on the second questionnaire.

Computer anxiety, a construct applicable to the Web questionnaires model only, was always measured on the second questionnaire, for the reasons outlined in the methodology section (Questionnaires Design). This constraint led to a situation where the measurement was not made at the same time as the other variable of interest. On the Web/paper group, the Web questionnaire items were presented on the first questionnaire, and the anxiety scale was given on the second questionnaire. If computer anxiety scores vary with time, there is potential for measurement inconsistencies. The reliability tests show problems on several items of the Web questionnaire in the Web/paper sequence group.. For that particular group, we took a stepwise approach to drop items with poor reliability. The item with the lowest loading was removed from the model; loadings were re-calculated; the next item with the lowest loading was removed; and so forth, until all loadings were above 0.5. This procedure resulted in the loadings presented on Table 8 under *Web first (adjusted)*.

Convergent Validity estimates the extent to which the item measures of a variable agree. This consistency can be assessed by Cronbach's alpha or by the internal consistency measure (Rho - ρ) developed by Fornell and Larcker as cited by Hulland (1999). This indicator is derived from the PLS loadings (λ), as indicated on Equation 1. On Table 9, all constructs produced ρ values above 0.7, the rule of thumb threshold for good validity (Hulland, 1999).

$$\rho = \frac{\left(\sum \lambda_i\right)^2}{\left(\sum \lambda_i\right)^2 + \sum\left(1 - \lambda_i^2\right)}$$

where $\sum(1 - \lambda_i^2) = \sum \text{var}(\varepsilon_i)$ *and* $\lambda_i = item\ loading\ on\ each\ construct$

Equation 1- Rho coefficient

Table 9 – Convergent validity

Rho (ρ)	paper first	paper second	WEB First	WEB second
ENJ	0.952	0.960	0.953	0.964
CANX	-	-	0.858	0.923
PEOU	0.911	0.937	0.896	0.948
BI	0.974	0.996	0.908	0.976

Discriminant Validity

A criterion to evaluate how the measures of a given construct differ from other measures in the model is that the construct should share more variance with its measures than with other constructs. Fornell and Larcker (1981) introduced the use of the Average Variance Extracted indicator (Equation 2) that measures the average variance shared between a construct and its associated measures.

$$AVE = \frac{\sum \lambda_i^2}{\sum \lambda_i^2 + \sum \left(1 - \lambda_i^2\right)}$$

$where \quad \sum (1 - \lambda_i^2) = \sum \text{var}(\varepsilon_i) \quad and \quad \lambda_i = item\ loading\ on\ each\ construct$

Equation 2 - Average Variance Extracted

The validity can be shown by a triangular matrix where the lower off-diagonal elements are the squares of the correlations between the constructs, and the diagonal is populated with the AVE for the corresponding construct. Discriminant validity will be adequate if each diagonal element is significantly greater than the off-diagonal correlations in the corresponding row and column of the matrix. This criterion is satisfied for all constructs in the paper and Web data sub-samples (Table 10 to Table 13).

Table 10 – AVE and Web construct correlations - Web first

	W_ENJ	W_PEOU	W_BI	CANX
W_ENJ	0.870			
W_PEOU	0.108	0.743		
W_BI	0.063	0.153	0.833	
CANX	0.018	0.002	0.032	0.549

Table 11 – AVE and Web construct correlations - Web second

	W_ENJ	W_PEOU	W_BI	CANX
W_ENJ	0.900			
W_PEOU	0.194	0.858		
W_BI	0.265	0.163	0.954	
CANX	0.020	0.000	0.080	0.576

Table 12 – AVE and paper construct correlations - paper first

	P_ENJ	P_PEOU	P_BI
P_ENJ	0.867		
P_PEOU	0.276	0.773	
P_BI	0.172	0.306	0.951

Table 13 – AVE and paper construct correlations - paper second

	P_ENJ	P_PEOU	P_BI
P_ENJ	0.889		
P_PEOU	0.219	0.832	
P_BI	0.319	0.203	0.993

5.6 Assessment of the Structural Model

Two structural models were assessed, one for the Web questionnaires and another for the paper questionnaires. The computer anxiety construct is a potential negative factor for the Web that should not bear any association with paper questionnaires. Each model was assessed two times, due to the crossover design. The significance of the path coefficients was calculated through the

jackknife method (Wildt et alli, 1982), a non-parametric re-sampling technique that produces a t statistic for each path coefficient in the model. The R-square for each endogenous variable is also included to estimate the ratio of their variance that can be attributed to the exogenous (source) variables in the model. These results are presented on Figure 9 for the Web and Figure 10 for paper.
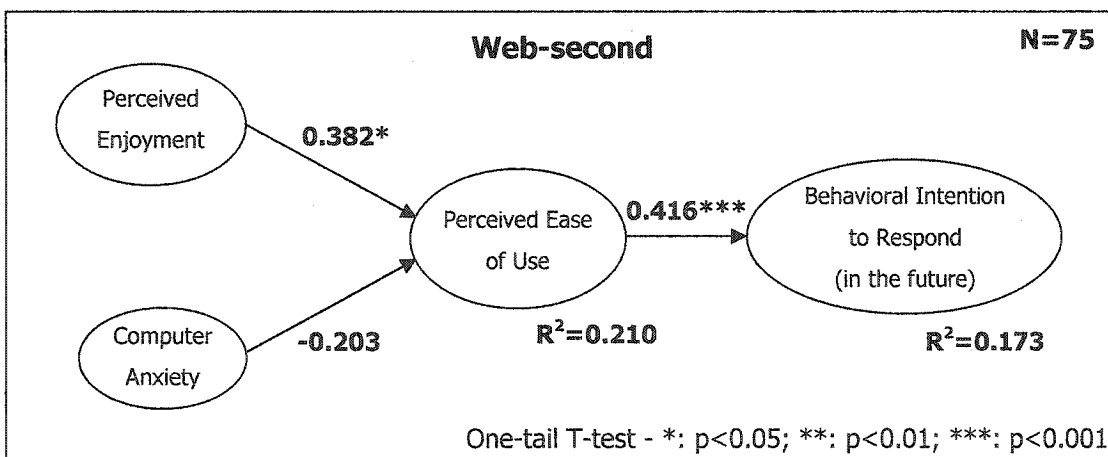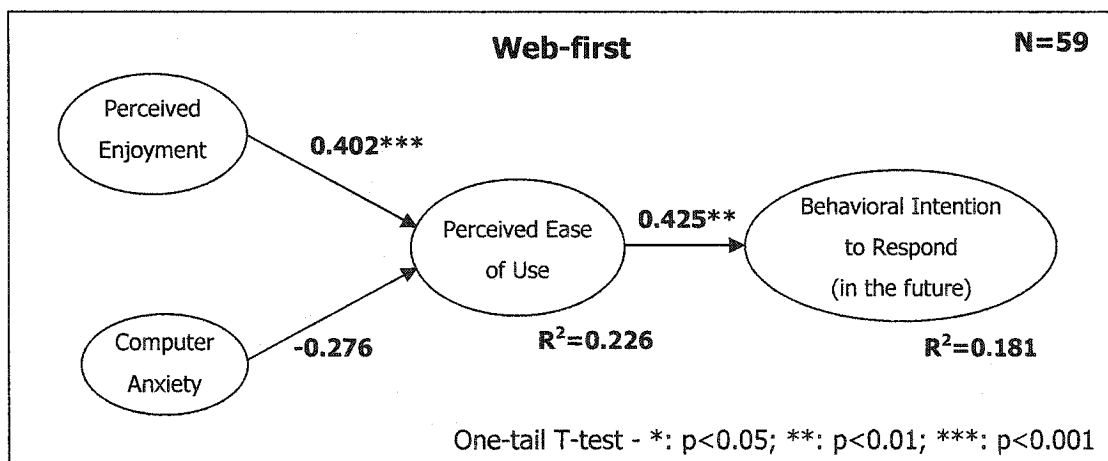
Figure 9 – Structural models (Web)

Paper-first   N=75

Perceived Enjoyment → 0.521*** → Perceived Ease of Use → 0.564*** → Behavioral Intention to Use (in the future)

R²=0.272   R²=0.319

One-tail T-test - *: p<0.05; **: p<0.01; ***: p<0.001

Paper-second   N=59

Perceived Enjoyment → 0.470*** → Perceived Ease of Use → 0.450*** → Behavioral Intention to Use (in the future)

R²=0.221   R²=0.203

One-tail T-test - *: p<0.05; **: p<0.01; ***: p<0.001
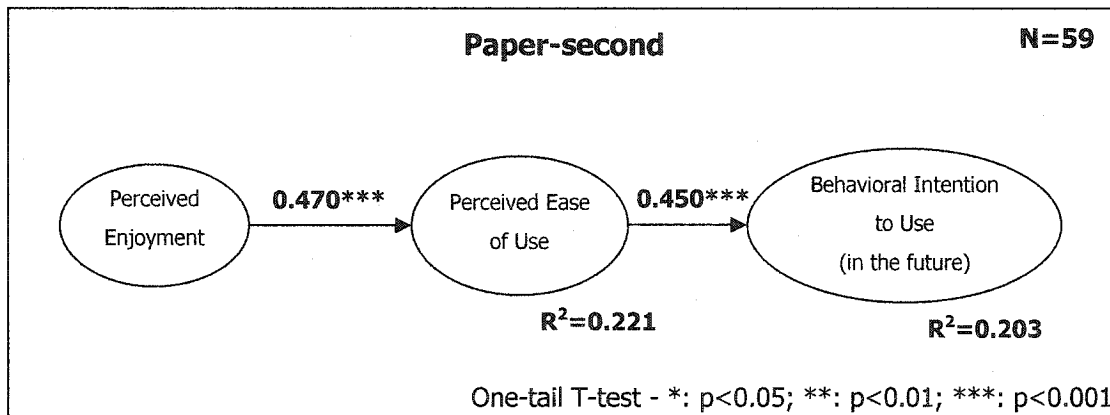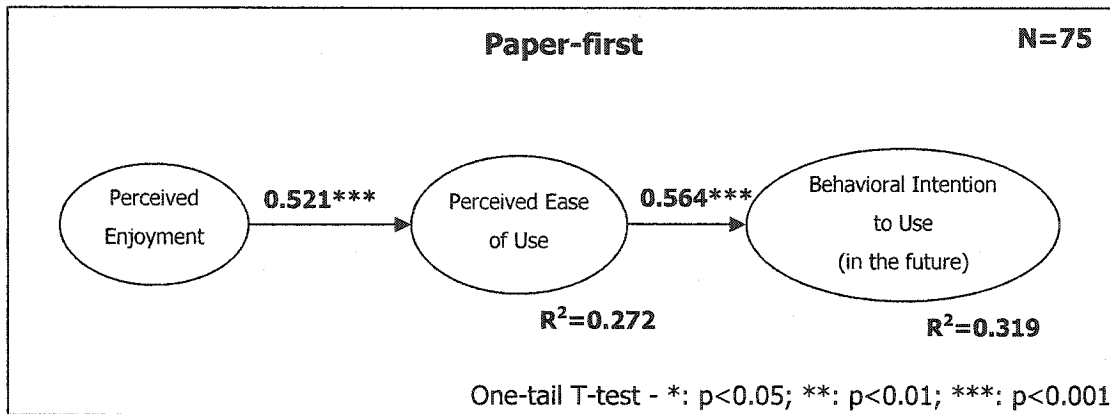
Figure 10 – Structural models (paper)

Hypotheses H_{1a} and H_{1b} address the relationship between PEOU and BI for the Web and paper questionnaires. The analysis suggests that all questionnaires have a positive and significant association between ease of use and intention to use future questionnaires; therefore the two hypotheses are supported. The H_{1c} hypothesis has not been confirmed, since the strengths of the association between the two constructs and their significance are higher for the paper questionnaires than the Web questionnaires.

Hypotheses H_{3a} and H_{3b} examine the association between perceived enjoyment and perceived ease of use. This association was significant for all questionnaires, confirming both hypotheses. However, paper questionnaires displayed higher loadings, significance and variance explanation than the Web counterparts, a finding opposed to hypothesis H_{3c}. These outcomes seem to contradict the multivariate analysis result of higher perceived enjoyment scores for Web questionnaires over paper.

The negative association of computer anxiety with Web questionnaires (H_4) did not attain the significance level in either run of those questionnaires. This hypothesis should also be rejected.

6. DISCUSSION

This research work attempted to model and compare user acceptance of Web and paper surveys in an organizational environment, and identify potential explanatory variables to account for differences between the two media. More specifically, the following constructs were measured: behavioral intention to respond, perceived ease of use, perceived enjoyment and computer anxiety (for Web only). Portability value for respondents and time to respond the questionnaires were also assessed, although they were not included in the model.

A crossover design was used to avoid confounds, order and medium effects and heterogeneous impressions of Web surveys. All participants were exposed to the same questionnaires, and 134 responses for both questionnaires were obtained. Overall, the models displayed limited explanatory power for acceptance, ranging from 17.3% to 31.9%.

6.1 Survey acceptance

The main objective of the study, user acceptance of surveys, was operationalized through the behavioral intention to respond to future surveys (BI) construct. The data analysis did not support a significant difference in acceptance between the two media; all the same, a stronger association between ease of use and BI for paper questionnaires emerged from the PLS

analysis. Furthermore, larger response rates (39% vs. 25% for the first and 66% vs. 57% for the second runs) for paper questionnaires raise questions about the effective acceptance of each medium. The Web questionnaires gave an immediate response, and a single reminder message prompted a surge of additional responses. A few days after the reminder, however, no further answers were provided. On the other hand, paper questionnaires had a lingering character, and return envelopes continued to arrive for more than a month after the survey was issued.

The invitation method chosen for the Web surveys (e-mail) has been popularized over the last years, mainly due to spam and instant messaging. Users tend to quickly browse and discard messages over a few days. In contrast, paper questionnaires may benefit from a quasi-official appearance that renders them less susceptible to disposal. Respondents have not reported relevant differences between the two media; it seems plausible to assume that the invitation method played a significant role in the distinct response rates obtained.

6.2 Perceived Ease of Use

Scores of perceived ease of use were not significantly different between the two questionnaire media. This could be explained by the popularization of the Web, which may already be at par with paper surveys from the ease of use standpoint. On the other hand, the association of PEOU with behavioral intention to respond was higher for the paper questionnaire models (0.564 and 0.450 vs.

0.425 and 0.416), and this linkage may be responsible for the slightly higher explanatory power of these models (31.9% and 20.3%, over 18.1% and 17.3% for Web models).

6.3 Perceived enjoyment

Perceived enjoyment scored higher on Web surveys than on paper. Nevertheless, a stronger association with ease of use was shown on the paper survey models. It is apparent that this construct has an important role in the mechanism of survey acceptance.

6.4 Portability

Portability did not appear to have an important role in the acceptance of Web or paper surveys. For lack of theoretical support in the literature, portability was measured with a single item scale, and this approach could want for power or validity.

6.5 Computer anxiety

Computer anxiety did not show significant value on the acceptance model or the differentiation of Web and paper surveys. Problems with the computer anxiety variable in the Web/paper group stress validity issues with mixing measures obtained from different media at different times. Here also, the

population under study may be so intimate with the use of computers already that this construct may lack relevance.

7. LIMITATIONS OF THE STUDY

This study was performed on a particular organization with an international, multicultural character that may not be easily generalized to the average enterprise. Recruitment is performed on a local basis for the general services staff, while professionals are hired worldwide, within a well-defined country quota system. The study could have taken into account cultural factors to better understand survey acceptance.

Time to complete a questionnaire could also explain different acceptance levels for paper or Web. Web survey responses can be timed to the second, while mailed paper questionnaires rely on user reporting the time (in minutes) to complete the questionnaire. Rounding effects and perception biases are likely to affect the latter. Asking the users to note the time at the beginning of the paper questionnaire might have improved timing accuracy, at the expense of demand characteristics. These limitations led to the decision of keeping the variable outside the model.

The methodology adopted did not require time stamping the return of paper questionnaires. This limitation prevented accurate comparison of the turnaround times of the different media. A more elaborate procedure could provide insights about the temporal evolution of the responses for each media.

Portability value could probably have a more accurate measure if an adequate scale were available. The single item measurement results in a low validity due to poor accuracy and reliability.

Furthermore, the decision to keep the period between the two questionnaires short (one week) might have adversely affected the measurements. The deception plot suggested a study of well-being over time, and participants could have more reasons to doubt this ruse due to the proximity of the two surveys.

Privacy and anti-spam concerns about Web questionnaires (*Web anxiety*) might have been included in the study, as they are probably more contemporary and relevant to participants than computer anxiety.

Overall, the reasoning processes that drive an individual to respond (or not) to a survey are varied and complex. Frequency and time elapsed since the last survey are strong candidates for explanatory variables. Affinity or empathy with the survey theme is also a motivating factor. In the workplace environment, traditional paper surveys can benefit from an "official" connotation that may be lacking on an electronic (Web) survey. The decision of deleting an e-mail message may also be more comfortable in the mindset of our society than the corresponding disposal of a paper letter. Future studies could be made to address these aspects.

8. CONCLUSIONS AND RESEARCH AVENUES

The main objective of this study is to examine acceptance of Web and paper surveys within an organization (Intranet). The results of the modelling and comparisons help to understand the role of some of the factors in survey acceptance, and to analyze the effect of survey medium on the response rates. The results provide guidance both to researchers and practitioners in the Information Science field. Specific findings are:

1. The Technology Acceptance Model can be successfully adapted to Web and paper surveys, with the omission of the perceived usefulness construct. More research will be required to explore other models and augment the acceptance explanatory power.

2. Behavioral intention to respond to future surveys does not show variation for the two media under study. Actual usage (response rates) shows an advantage for paper instruments. These results suggest caution with surveys where participation levels are critical: paper seems to produce higher response than Web.

3. Perceived ease of use does not get affected by the survey medium, although a stronger linkage exists between this construct and behavioral intention to respond for paper questionnaires. The implication seems to be that ease of use is no longer an issue for Web surveys in contemporary organizations.

4. Perceived enjoyment plays a significant role on the ease of use construct of survey models. This result could be interpreted in the sense that well-thought, aesthetically pleasant questionnaires are likely to be perceived as easier to respond to, and therefore attract better response rates.

Additional studies are required to explore other models and to confirm those proposed in this study. A significant characteristic of path analysis lies in its ability to validate models, but not necessarily to indicate the best model.

In hindsight, the crossover design may not have addressed a potential confounder: invitation method. Without denying the cost and time benefits of distributing invitations through e-mail, one could argue that printed letters, forms and envelopes confer a distinctive character to paper surveys that may explain a higher response rate. Therefore, it is conceivable to employ a hybrid questionnaire method to benefit from the ease of processing of Web surveys and to avoid the pitfalls of e-mail invitations, at the expense of printing letters, labels, and envelopes and using traditional internal couriers. The printed invitation would provide instructions and directions to fill a Web survey. In the case of Internet surveys aimed at specific organizations, this approach would have the added benefit of circumventing anti-spam measures. The effectiveness of such procedures should be examined in future studies, before a compelling recommendation could be made.

Web surveys open a wide path to the study of participant behavior, given their potential for recording navigation and answering patterns. This information could be useful to investigate associations between response pattern and instruments quality, both in terms of reliability and validity. For instance, responses could be classified and/or weighed according to the physical time taken to answer them. Alternatively, the number of answer changes in a given question could be used to estimate a degree of confidence attributable to the final answer.

Another point of interest for future studies is the survey response distribution. A more detailed record of the temporal distribution of paper responses is needed to assess the differences between the two administration media. For instance, three days after the Web questionnaire reminder was issued, no additional responses were received. If we apply the same time frame to paper questionnaires, the response rates would not be so different. Paper questionnaires showed a lingering effect: the responses kept coming weeks after the issue date. Therefore, if the time window of the survey is short, Web questionnaires may yield a response rate as good as paper, for a fraction of the cost and effort.

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10. APPENDIX 1 – PAPER-FIRST SURVEY

Welfare status questionnaire I

John Molson
School of Business
Concordia University

Dear Sir/ Madam,

I am a graduate student at Concordia University, Montreal, completing a Master of Science in Administration degree in Management of Information Systems and Decision Sciences. I am currently performing a study (under the supervision of Dr. Anne-Marie Croteau and Dr. Linda Dyer) on the factors affecting the individual perception of well-being/welfare over time. Our organization has authorized and encouraged this initiative, and now you have the opportunity to contribute to the research with your views. The results of this research could help to improve the working environment and they will be made available to you through the organization.

This study will require that you answer two questionnaires, and the first one is attached to this letter. The first part of the second questionnaire has the same questions as the first, and will allow us to see how your sense of well-being might change over time. This second questionnaire will be made available to you via the Internet, to reduce the chance of repeating the answers from memory. Responding should not take more than fifteen minutes of your time. Please read the questions carefully before answering them, and return the questionnaire in the envelope provided. The second questionnaire will be sent to you one week after we receive the first one. Your participation in responding and all information that you provide in the questionnaires *will be kept rigorously confidential*. Your participation in this study is strictly voluntary and therefore you have no obligation to answer.

Thank you in advance for your time.

Marco Miguel
MScA in MIS/DS,
Concordia University
Tel.: (514) 954-8219 Ext. 6264
E-mail: marco_miguel@msn.com

Part I

> *To what extent did each of the following economic, political and environmental factors affect your feelings of well-being over the past week?*

Significantly undermined	Moderately undermined	Somewhat undermined	Had no impact	Somewhat enhanced	Moderately enhanced	Significantly enhanced
1	2	3	4	5	6	7

Please circle the number that best corresponds to your opinion.

1. Value of the Canadian dollar against the American dollar 1 2 3 4 5 6 7

2. Impact of military action in the Middle East 1 2 3 4 5 6 7

3. Current level of interest rates...1 2 3 4 5 6 7

4. Recent actions of the Canadian government 1 2 3 4 5 6 7

5. Recent actions of the Quebec government..1 2 3 4 5 6 7

6. Climate / weather 1 2 3 4 5 6 7

7. Possibility of public health problems (West Nile virus, SARS, mad cow
    disease)..1 2 3 4 5 6 7

8. Housing prices in Montreal..1 2 3 4 5 6 7

9. Announcements about job losses or job creation 1 2 3 4 5 6 7

10. Activity of the stock market 1 2 3 4 5 6 7

Please evaluate your spending over the past week for each category listed.

I spent well above what I would have liked to	I spent more than I would have liked to	My spending was about right	I should have spent more	I should have spent much more
1	2	3	4	5

Please circle the number that best corresponds to your opinion.

1. Entertainment.. 1 2 3 4 5

2. Food 1 2 3 4 5

3. Household maintenance 1 2 3 4 5

4. Transportation.. 1 2 3 4 5

5. Personal items 1 2 3 4 5

6. Taxes.. 1 2 3 4 5

7. Health related.. 1 2 3 4 5

8. Travel and vacation 1 2 3 4 5

Part II

*Please indicate your **level of agreement** with the following views **about Part I of this questionnaire.***

Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6	7

Please circle the number that best corresponds to your opinion.

1. Clear and understandable 1 2 3 4 5 6 7

2. Did not require a lot of effort to complete............................... 1 2 3 4 5 6 7

3. Easy to answer 1 2 3 4 5 6 7

4. Enjoyable.. 1 2 3 4 5 6 7

5. A pleasant experience 1 2 3 4 5 6 7

6. Fun to answer... 1 2 3 4 5 6 7

7. I would prefer to fill the questionnaire out of the office 1 2 3 4 5 6 7

8. Assuming I receive a similar questionnaire, I intend to answer it..................1 2 3 4 5 6 7

9. Given that I receive a similar questionnaire, I predict that I would answer it ..1   2   3   4   5   6   7

10. Estimate the time it took you to answer the questionnaire to this point (in minutes) : ....

11. How many times you were interrupted while answering the questionnaire to this point? ....

Part III

1. My education level is
   - O Primary
   - O Secondary
   - O Undergraduate
   - O Graduate

2. My gender is:
   - O Graduate   O Male

3. My post is
   - O G4 or below   O P2
   - O G5   O P3
   - O G6   O P4
   - O G7 to G9   O P5 or above

4. My age is
   - O Below 25
   - O 25 to 34
   - O 35 to 44
   - O 54 to 65

After you answered the questions, please:

   1. Place this questionnaire in the return envelope you received with it,

   2. Send the envelope through the internal mail.

Thank you for the support!

11. APPENDIX 2 – PAPER-SECOND SURVEY

Welfare status questionnaire II

John Molson
School of Business
Concordia University
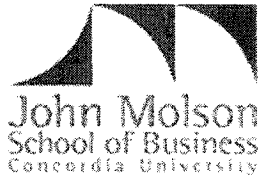
Dear Sir/ Madam,

As you already know, I am a graduate student at Concordia University, Montreal, completing a Master of Science in Administration degree in Management of Information Systems and Decision Sciences. I am currently performing a study (under the supervision of Dr. Anne-Marie Croteau and Dr. Linda Dyer) on the factors affecting the individual perception of well-being/welfare over time. Our organization has authorized and encouraged this initiative, and you have the opportunity to contribute to the research with your views. The results of this research could help to improve the working environment and they will be made available to you through the organization.

This study requires that you answer two short questionnaires, and you have already completed the first one a few days ago. The first part of the second questionnaire (attached) has the same questions as the first, and will allow us to see how your sense of well-being might change over time. This second questionnaire is on paper to reduce the chance of repeating the answers from memory. Responding should not take more than fifteen minutes of your time. Please read the instructions carefully before answering the questions.

Your participation in responding and all information that you provide in the questionnaires will be kept rigorously confidential. Your participation in this study is strictly voluntary and therefore you have no obligation to answer.

Thank you in advance for your time.

Marco Miguel
MScA in MIS/DS,
Concordia University
Tel.: (514) 954-8219 Ext. 6264
E-mail: marco_miguel@msn.com

Welfare status questionnaire II

John Molson
School of Business
Concordia University

Please answer all questions. There are no good or bad answers.
Indicate your first impression.

Part I

> To what extent did each of the following economic, political and environmental factors
> affect your feelings of well-being **over the past week?**

Significantly undermined	Moderately undermined	Somewhat undermined	Had no impact	Somewhat enhanced	Moderately enhanced	Significantly enhanced
1	2	3	4	5	6	7

Please circle the number that best corresponds to your opinion.

1. Value of the Canadian dollar against the American dollar 1 2 3 4 5 6 7

2. Impact of military action in the Middle East 1 2 3 4 5 6 7

3. Current level of interest rates 1 2 3 4 5 6 7

4. Recent actions of the Canadian government 1 2 3 4 5 6 7

5. Recent actions of the Quebec government 1 2 3 4 5 6 7

6. Climate / weather 1 2 3 4 5 6 7

7. Possibility of public health problems
   (SARS, mad cow disease) 1 2 3 4 5 6 7

8. Housing prices in Montreal 1 2 3 4 5 6 7

9. Announcements about job losses or job creation 1 2 3 4 5 6 7

10. Activity of the stock market 1 2 3 4 5 6 7

I spent well above what I would have liked to	I spent more than I would have liked to	My spending was about right	I should have spent more	I should have spent much more
1	2	3	4	5

Please circle the number that best corresponds to your opinion.

1. Entertainment.. 1 2 3 4 5

2. Food.. 1 2 3 4 5

3. Household maintenance... 1 2 3 4 5

4. Transportation.. 1 2 3 4 5

5. Personal savings... 1 2 3 4 5

6. Taxes.. 1 2 3 4 5

7. Health related.. 1 2 3 4 5

8. Travel and vacation... 1 2 3 4 5

Part II

*Please indicate your **level of agreement** with the following views **about Part I of this questionnaire.***

Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6	7

Please circle the number that best corresponds to your opinion.

1. Clear and understandable 1 2 3 4 5 6 7

2. Did not require a lot of effort to complete.................................... 1 2 3 4 5 6 7

3. Easy to answer 1 2 3 4 5 6 7

4. Enjoyable.. 1 2 3 4 5 6 7

5. A pleasant experience 1 2 3 4 5 6 7

6. Fun to answer.. 1 2 3 4 5 6 7

7. I would prefer to fill the questionnaire out of the office 1 2 3 4 5 6 7

8. Assuming I receive a similar questionnaire, I intend to answer it...........1 2 3 4 5 6 7

9. Given that I receive a similar questionnaire, I predict that I would answer it ..1 2 3 4 5 6 7

10. Estimate the time it took you to answer the questionnaire to this point (in minutes) : ....

11. How many times you were interrupted while answering the questionnaire to this point? ......

Part III

| Please indicate your **level of agreement** with the following views about computers. |

Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6	7

Please circle the number that best corresponds to your opinion.

1. Computers do not scare me at all 1 2 3 4 5 6 7

2. Working with a computer makes me nervous 1 2 3 4 5 6 7

3. I do not feel threatened when others talk about computers 1 2 3 4 5 6 7

4. It wouldn't bother me to take computer courses 1 2 3 4 5 6 7

5. Computers make me feel uncomfortable 1 2 3 4 5 6 7

6. I feel at ease in a computer class 1 2 3 4 5 6 7

7. I get a sinking feeling when I think of trying to use a computer 1 2 3 4 5 6 7

8. I feel comfortable using a computer 1 2 3 4 5 6 7

9. Computers make me feel uneasy 1 2 3 4 5 6 7
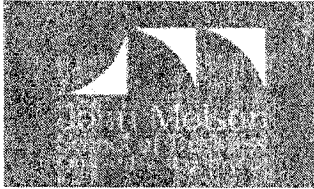
After you answered the questions, please:

1. *Place this questionnaire in the return envelope you received with it,*

2. *Send the envelope through the internal mail.*

Thank you for the support!

12. APPENDIX 3 – WEB SURVEY SAMPLE PAGES

 Survey - Welfare Questionnaire

Instructions

Please read it completely and click the button at the bottom of this page to answer the questionnaire.

This questionnaire can be completed in less than 15 minutes. The questions are grouped in three (3) parts. Each part contains a number of questions, and you are free to answer them in any order you want. All answers are valid, there are no good or bad answers, just select the answer that best represents your opinion. Please try to answer all questions; if you do not want to answer a question, use the Next button (see picture at the end of this page) to skip it and move on to the next question.

At the last question of each part you will see a message indicating that when you answer or skip that question, you will close the current part, and move to the next one. Once you move to the next part, you will no longer be able to review or answer questions from the previous part.

Each question is presented on a separate page. When you select or enter an answer, the information is immediately stored in the responses database, and if you need to stop answering the questionnaire at any point, you can always use the invitation e-mail link to resume responding from the last question that you answered.

Each questionnaire page has a top bar with information about the part and the question you are currently viewing. Below that bar, a number of buttons allow you to navigate back and forth within the part you are at. If you navigate to a question you have already answered, your response will be displayed - and you can modify it as you wish.

This questionnaire has three types of questions: scales, multiple choice or free-text (open). The first two types are answered by simply clicking the small button next to the selected answer. The free-text questions are answered by clicking on the white box below the question, typing your answer and pressing the Enter key.

The image below illustrates the different areas of the questionnaire pages. You may view these instructions anytime during the process of responding the questionnaire by clicking the "Instructions" link at the bottom of each questionnaire page.

In order to proceed to (or resume) the questionnaire, click the button at the bottom of this page.

Current question (Part length)
Current Part (Number of Parts)

First — Go to first question of current Part
Previous — Go to the previous question
Next — Go to the next question
Last answer — Go to last question already answered

To what extent did each of the following economic, political and environmental factors affect your feelings of well-being over the past week?

Question Area

Transportation problems such as traffic congestion, metro stoppages or bus delays

Significantly undermined | Moderately undermined | Somewhat undermined | **Answer Area** | Somewhat enhanced | Moderately enhanced | Significantly enhanced

I read and understood the instructions

Current question (Part length)
Current Part (Number of Parts)

First — Go to first question of current Part
Previous — Go to the previous question
Next — Go to the next question
Last answer — Go to last question already answered

To what extent did each of the following economic, political and environmental factors affect your feelings of well-being over the past week?

Question Area

Transportation problems such as traffic congestion, metro stoppages or bus delays

Significantly undermined | Moderately undermined | Somewhat undermined | **Answer Area** | Somewhat enhanced | Moderately enhanced | Significantly enhanced

13. APPENDIX 4 - DEBRIEFING MESSAGE

Dear Sir/Madam,

I would like to thank you very much for your support in completing the surveys I sent you. The response has been excellent, and although I have only just begun to perform my statistical analyses, I am sure that the results will be interesting and useful.

At this point I should clarify the major objectives of my research. I was actually examining acceptance factors for web questionnaires versus paper-and-pencil questionnaires. Thus, in addition to measuring your changes in well-being over time, I was comparing your preferences for web questionnaires vs paper-and-pencil questionnaires. I could not state this explicitly at the start since this might have led to artificial responses that would have invalidated the results.

The conclusions drawn from the study may guide future research to select the appropriate medium for a survey. Although there are many reasons to favor web questionnaires over paper, participant acceptance has priority. Understanding the factors that motivate participant reactions to each medium may help improve the quality of future surveys.

I have provided you with the response counts for the well-being questions in the first and second surveys. You may click on this link:

http://192.206.28.67/survey/results

to see the charts.

Once again, my sincere thanks for your participation!

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