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A Study of Ecommerce Risk Perceptions among B2C Consumers: A Two Country Study

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Abstract

*The ecommerce environment is fairly new, and several risks associated with it are novel to consumers. Consequently, e-consumers may not have developed an appropriate mental picture (i.e., a schema or a perceptual map) of these risks. For example, identity theft, a serious risk that became prominent after ecommerce has become popular, is still not well understood by most consumers. Thus, it is not clear how consumers participating in ecommerce perceive the risks. Existing ecommerce studies do not focus on **risk per se**; instead, they use very general constructs and measures of risk derived from general psychology and management studies in contexts other than ecommerce. Implicit in these studies is the assumption that the dimensions of perceived risk in ecommerce context are well understood. In this study, we use the psychometric paradigm to investigate how consumers organize novel online risks in memory. Data collected from consumers in two countries and analyzed using Multidimensional Scaling techniques shows significant differences in how consumers organize risks in their memory. This study is still in progress and preliminary analysis is presented.*

***Keywords**: Business-to-Consumer (B2C) ecommerce, perceived risk, ecommerce risk dimensions, Schema, Perceptual map, MDS, Psychometric paradigm*

1 Introduction and Research Questions

Consumers participating in ecommerce face several risks related to possible loss of financial and personal information, which may have significant consequences (Chua et al., 2005). Considerable research in the IS field has addressed risk perceptions, attitudes, intentions and behavior of consumers in the ecommerce context. The goal of such research is to eventually understand and minimize the incidence and consequences of risk, so as to enable ecommerce.

Existing research on ecommerce risk perception assumes that the dimensions of risk are well understood among consumers, and therefore utilize various instruments to measure the probability and magnitude of risk across the dimensions. However, from the perspective of a consumer, a novel risk such as identity theft arising from ecommerce is probably distinct from other risks the consumer is familiar with, such as a hurricane landfall. In the absence of objective data on the novel online risks (e.g., identity theft) and lack of an adequately developed perceptual schema for online risks, a consumer may not be able to judge risk probabilities and consequences accurately. Indeed, even researchers disagree about the incidence and severity of several online risks (Chua et al., 2005).

Psychological research, especially Schema Theory (Stein and Trabasson, 1992), suggests that consumers use schemas, defined as mental structures used to represent generic concepts in memory. Based on Schema Theory, we hypothesize that a schema for risks exists in consumer's memory. The purpose of this research is to recover such risk schema from consumers. We use a multivariate statistical technique called Multidimensional scaling to recover such schemas.

The purpose of this research is to recover ecommerce risk schemas from consumers. The first research question asks: how do consumers organize various online risks in their memory? The second research question asks: Are there significant differences among schemas between consumers from two different countries?

In this preliminary version, we present the motivation, research questions, literature review, theory, research method and preliminary analysis of data collected for pilot testing.

2 Literature Review

Risk is pervasive in economic and social life, and human beings use a variety of psychological mechanisms to understand and cope with uncertainties of life (Slovic & Weber, 2002). In practice, authoritative estimates of risks, which can be used as objective probability and loss estimates, are often unknown. Therefore, most decision makers develop and use subjective estimates of risks – that is, the perception of risk matters. A variety of cognitive processes may be involved in how decision makers arrive at a subjective estimate of a risk in a given context.

The ecommerce environment is fairly new, and it is well known that several risks associated with B2C ecommerce are novel for a typical B2C consumer (Featherman & Pavlou, 2002). Further, no objective data is available in most instances for consumers to develop a good understanding of the magnitude and severity of risks. For example, it is not clear how pervasive or significant a risk like identity theft is for consumers. Interestingly enough, there does not seem to be an agreement among researchers about the likelihood and severity of risks. The question of how consumers perceive risks, therefore, takes an important role in understanding B2C commerce.

2.1 General Notions of Risk

Risk is pervasive and a variety of views on risk are found in literature. In a risky situation, a decision maker, such as an ecommerce consumer, faces a choice among several alternatives where each alternative offers a payoff. The likelihood of the payoff may only be known up to a probability.

The standard notion of risk, commonly used in decision theory, economics and many applied business areas including IS, is modeled using utility theory. Utility theory states that, under some reasonable assumptions about human behavior (called axioms of choice in literature), a rational consumer ought to choose the alternative which maximizes the

expected utility, which is defined as the product of probability and payoff. Attitudes towards risk (risk aversion, risk seeking, risk neutrality) are represented using assumptions on the curvature of the utility function. Utility theory is the normative theory of choice.

It is often the case that, in a realistic situation, the probabilities and payoffs may not be known with certainty. A variation of utility theory, called subjective expected utility theory, suggests that a decision maker can use *subjective* notions of payoffs and probabilities. The subjective version of utility theory (called Subjective Expected Utility Theory or SEU) requires that a decision maker be consistent with the axioms of choice, but is free to have idiosyncratic estimates for probabilities and payoffs. Winterfeldt and Edwards (1986) provides an excellent treatment of subjective utility theory.

In utility theory, the utility function contains both payoff and risk attitude information (in terms of the shape of the utility function). Also, the utility function contains the net cost-benefit information. In general psychology and business literature, and also in a majority of IS studies which use such research, risks are separated from benefits, and therefore, perceived risk is treated as a separate construct from perceived benefits.

In recent years, several objections have been raised about the descriptive validity of utility theory and several authors argue that utility theory cannot explain the behavior of realistic decision makers. An excellent example of such work is Prospect Theory by Kahneman and Tversky (1979). Two interesting assumptions of this theory relevant to this research are a) perception of risks, and b) perception of values. In prospect theory, decision makers are assumed to overweight small probabilities and underweight large probabilities. These weights, called decision weights in Prospect Theory, imply that subjects use distorted perceptions of probability in making decisions. With respect to values (i.e., payoff functions), subjects are assumed to use an S-shaped payoff function which makes perceived losses seem larger than similarly placed perceived gains. Such distorted weighting of probability and value lead to violations of rational choice behavior, even though these models fit real life data better than normative models.

Seminal work on risk perception in psychology literature has been done by Slovic and colleagues (Slovic et al., 1982). Slovic and colleagues popularized what came to be known as the psychometric paradigm. In this paradigm, careful attention is paid to understanding the psychological schemata used by lay consumers as well as experts in understanding perceived risks. Under this paradigm, multivariate techniques such as Multidimensional Scaling (MDS) and Factor Analysis are used to "uncover the risk dimensions" used by subjects in understanding risks.

Another notion of risk is that of "risk as feelings" (Lowenstein et.al, 2001). Recent advances in understanding human decision processes suggest that humans employ two different decision processes – an analytical process and an intuitive process. As the brief review above indicates, most current research assumes an analytical view of decision making and therefore, cognitive aspects of risk are emphasized. Under the analytical view, people are assumed to estimate the likelihood of probabilities and payoffs (probably, imperfectly) and combine them into a value judgment using an expectation type of operator. The "risk as feelings" literature suggests that, a) people use emotions in reacting to risk and therefore their behavior diverges from cognitive reactions, and, b) when they diverge, it is emotions rather than deliberation (cognition) that drives behavior. Table – 1 below briefly summarizes the various notions of risk.

Table 1: Different notions of Risk used in Research

S. No	Theory / Notion of Risk	Brief Summary / References	Comments
1	Rational Theories (Expected Utility Theory / Subjective Expected Utility Theory)	Von Winterfeldt and Edwards (1986) provides the history and an excellent summary of these theories	Commonly used in economics-based work in ecommerce
2	General Psychology / Business	Perceived Risk is a separate construct from Perceived Benefit / Discussed in detail in Table 2 below	Very popular in ecommerce risk studies
3	Prospect Theory	A more "descriptive" version of utility theory / Kahneman & Tversky (1979)	Very few IS articles use this theory (e.g., Nyshadham (2001), Wu et al. (2004))
4	Psychometric paradigm	The perceptual maps of decision makers are recovered using multivariate techniques, the goal is to understand the dimensions of risk and the cognitive schema / Slovic et al., (1982)	No IS research, to our knowledge, used this approach. **This approach is used in this paper.**
5	"Risk as feelings"	An emotional rather than a cognitive view is used to understand risk perceptions and behavior / Loewensteinet.al. (2001)	No IS research, to our knowledge, used this approach

2.2 Risk Studies in Ecommerce

There is considerable published work in the ecommerce literature on how perceived risk affects various constructs relevant in an ecommerce buying situation. Table –2 below contains a summary of 17 studies published in various conferences over the period 2000-2005. We summarize this research briefly in the next two paragraphs and provide details in Table –2 below.

Most research defines perceived risk in terms of likelihood of a loss (L) with a probability p. Studies differ considerably, however, on the assumptions they make about the dimensions of risk. Typically, risk dimensions are operationalized using earlier research in consumer behavior/marketing or general psychology. Specifically, dimensions of risk are operationalized based on the context of research (e.g., mobile versus non-mobile ecommerce). Context also enters very strongly in the operationalization of risk dimensions (e.g., performance risk, financial risk etc.). Researchers typically use Likert-scaled items in survey instruments to measure the probability of incidence and magnitude of potential loss. In all these studies, the dimensions of risk are assumed to be clearly understood.

In the comments section in the Table –2, we summarize the role of perceived risk in existing studies. As a review of Table-2 indicates, 16 out of 17 studies use a particular definition and operationalization of risk, in order to explain other constructs in a research model. Risk perception does not receive a primary focus in these studies, except as an explanatory variable. The one study which focuses on perceived risk (Lim, 2002) as a

central construct raises several interesting questions as to the nature and conceptualization of risk – however, the study does not offer a new conception of risk and adopts the same dimensions that other studies used.

Therefore, existing research suggests that perception of ***risk per se***, is not a central construct in most B2C ecommerce research – it has been used variously as an independent, mediating or moderating variable, in a larger model to explain variation in another dependent variable.

Table 2: Ecommerce Papers using Perceived Risk Construct

SNo	**Source (author/conference or journal)**	**Risk definition/ description**	**Dimensions used in Operationalization**	**Purpose of study**	**Comment on status of Perceived Risk in the Research**
1	Salam & Rao (AMCIS, 1998)	Uncertainty about outcome and consequences	Not provided	Relationship between risk, institutional trust and economic incentive	Used to explain other constructs
2	Kim & Prabhakar (ICIS, 2000)	Perceived risk as net of perceived benefits versus costs	Negative Consequences Relative Advantage	Impact of perceived risk on trusting behavior	Used to explain other constructs
3	Andrade (AMCIS, 2000)	Implicitly, probability of a loss and outcome of a loss	Performance risk Financial risk Convenience	Discriminate among online and offline buyers using risk	Used to explain other constructs
4	Featherman and Pavlou (AMCIS, 2002)	Potential for loss in pursuit of a desired outcome	Performance Risk Financial Risk Time Risk Psychological Risk Social Risk Privacy Risk Overall Risk	Adoption of e-services	Used to explain other constructs
5	Lim (PACIS, 2002)	Function of the probability of loss and consequence of loss	Financial Performance Social Physical Psychological Time-loss Personal Privacy Source/vendor	Clarify the definition of perceived risk in B2C ecommerce and identify sources of risk	*Perceived Risk is the central construct*

6	Kim et al. (AMCIS, 2003)	Belief about potential uncertain, negative outcome	Many empirical issues with negative consequences (e.g., email harassment, etc.) No clear operationalization!	Relationship among trust, risk and benefit	Perceived Risk used to explain other constructs
7	Lui and Jamieson (Bled, 2003)	Subjective probability of loss or injury	Questions in the instrument were concerned with likelihood of specific risks and magnitudes of risks	Integrates trust and risk with technology acceptance model	Perceived Risk used to explain other constructs
8	Kanungo and Jain (ECIS, 2004)	Implicitly, probability of a loss of some magnitude	Questions dealt with specific online risks such as credit card fraud, etc.	To explain the role of two control variables on the relationship between perceived risk and intention to purchase	Perceived Risk used to explain other constructs
9	Tibert and Yao-Hua (ECIS, 2004)	Implicitly, probability of a loss of some magnitude	Questions dealt with specific online risks such as transaction security	To explain the relationship between Trust and Risk, in an electronic market context	Perceived Risk used to explain other constructs
10	Wu, Cheng and Lin (PACIS, 2004)	Risk as objective probability (using lotteries in an experimental setting)	No ecommerce context was used	To study risky versus riskless framing on buyer decisions	Test of prospect theory's predictions (framing) on choices
11	Tibert, Yao-Hua and Meents (Bled, 2004) – extension of (9)	Implicitly, probability of a loss of some magnitude	Questions dealt with specific online risks such as transaction security – scales developed and validated	To explain the relationship between Trust and Risk, in an electronic market context	Perceived Risk used to explain other constructs
12	Belanger and Carter (AMCIS, 2005)	Subjective expectation of suffering a loss in pursuit of an outcome	Scale from Pavlou (2003) was used	A model of trust and risk, in the context of e-government	Perceived Risk used to explain other constructs
13	Xu, Teo and Tan (ICIS, 2005)	Focus on privacy risk defined as expectation of losses associated with release of personal information	Scales from earlier studies used, dealing with likelihood and magnitude of losses	Trust and Perceived Risk used to predict adoption of location-based services	Perceived Risk used to explain other constructs

14	Corritore et. Al (AMCIS, 2005)	Likelihood of an undesirable outcome	Items ask questions about the magnitude and likelihood of losses	Credibility, Perceived Risk and Ease of Use to predict trust in web sites	Perceived Risk used to explain other constructs
15	Heijden, Ogertsching and van der Gaast (ECIS, 2005)	Likelihood and magnitude of adverse consequences	Not reported, but based on prior work	Effect of context relevance and perceived risk on user acceptance of mobile information systems	Perceived Risk used to explain other constructs
16	Jahner and Krcmar (AMCIS, 2005)	The focus of this paper is more on a construct called "risk culture" – which is defined as shared, underlying norm and value framework of an organization.	Not reported, but based on prior work	Risk culture is used to explain IT risk management success	Perceived risk is not a construct in this research
17	Corbitt and Canh (PACIS, 2005)	Implicitly, probability of a loss of a certain magnitude	Environmental Legal Operational Informational Business Financial Technical Strategic	How do different risk types affect purchase of low cost air tickets	Perceived Risk used to explain other constructs

Psychological research, especially Schema Theory (Stein and Trabasson, 1992), suggests that consumers use schemas, defined as mental structures used to represent generic concepts in memory. Schemata (plural of schema) contain generic or abstract knowledge of concepts and are used to guide encoding, organization and retrieval of information. Schema may be formed with or without conscious awareness and reflect the prototypical properties of experiences encoded by an individual. Once formed, schemata tend to be stable over time. Schemata are modified using three distinct processes called accretion, tuning and restructuring. Accretion suggests that new information is remembered in the context of an existing schema, without altering the existing schema. Tuning refers to how a schema incorporates new information into an existing schemata and generally it is believed that new information, which is not consistent with existing schema is "tuned" or partially incorporated. Restructuring refers to the overhaul of an existing schema when new information is encountered.

In the context of ecommerce risks, the following example can be used to explain the role of a schema. Imagine a consumer, who is not quite familiar with online ecommerce. She is likely to have a schema for risks that is based on her individual and social experiences with offline risks. When the first online risk becomes known (say, credit card fraud), she

needs to fit this into an existing schema of offline risks and it may not fit very well. This might lead to tuning (partial incorporation) or restructuring (creation of a separate schema for online risks, or a joint schema with both online and offline risks). As she learns more and more about novel risks, she will continually adapt her schema for risks. For example, if she later learns about privacy risks in ecommerce, she will try to associate it more with another online risk (e.g., credit card fraud) rather than a natural risk (e.g., tsunami). Next, suppose she learns about identity theft – she will try to correlate it with credit card fraud and privacy risk.

The focus of this study is to uncover such existing schemata for online risks among consumers at a particular point in time. We assume that such schemata exist and seek to recover them using a specific research design. The schema theory suggests a possible solution to the question: if there is no objective information on risks and even experts don't know, then how do consumers perceive risks? One possible answer is that consumers group these risks in their memory using schemas or perceptual maps. By understanding how the online risks stand in relation to other online risks and offline risks, one could get a sense of how risks are perceived.

2.3 Research Design

We use the standard method used in psychology risks to recover cognitive schema as perceptual maps. Briefly, in this method, the researcher first identifies a set of ecommerce risk objects based on prior literature. Next, a scale is created which allows a subject to indicate how similar/dissimilar two risk objects are, e.g., identity theft and credit card fraud. The information that is asked is of a very primitive nature, for example, how similar/dissimilar is identity theft compared to credit card fraud. Subjects are not asked about frequency and consequences of such risks, because such information may not be encoded well in schema for novel risks.

In the instrument, the subjects compare the risk objects, pair-wise, on the dissimilarity scale (See Appendix for a sample). The dissimilarity matrix, containing pair-wise comparisons by a specific subject across all objects, is used as input to an MDS algorithm. The MDS algorithm tries to fit the dissimilarity data into a small, multidimensional space while minimizing errors or inconsistencies. For example, with n objects and pair-wise dissimilarity across all n objects, the data would contain n*(n-1)/2 ratings per subject. It is clear that n objects fit without errors in an n-1 dimensional space – the question however, is whether subjects indeed use so many dimensions. The MDS algorithm tries to fit the dissimilarity data for all dimensions from 1 to n-1. The researcher then picks the dimensional solution based on a measure of fit. In an optional next step, a researcher then provides descriptive names for the dimensions, based on how objects load across axes. The procedure is repeated for each subject and groups of subjects (by aggregating dissimilarity matrices) as needed. A detailed summary of the technique is available in Hair et.al (2005).

Table-3 below contains a preliminary list of risk objects derived from existing literature. We chose 15 commonly occurring online risks and phrased them as nouns. Next, we chose 5 offline risks and included them in the list. An advantage with using offline risks is that, risk perceptions of online risks can be compared with offline risks, which are relatively well understood.

Table 3: List of Risk Objects

S.No	Risk Object	Brief Description
1	Identity Theft	Another person steals customer's information to assumer the customer's identity.
2	Online Credit Card Fraud	Stealing credit card information, or billing more than customer authorized.
3	Online Hacker	Unauthorized access to Website to steal customer data.
4	Fake Website	Inauthentic Website, or one that goes out of business without filling orders.
5	Online False Information	Misleading information about a product or service.
6	Online Return	Difficulty obtaining return authorization, time loss, or made to pay return cost.
7	Online Login	Customer's login information stolen and used by authorized person.
8	Online Auction	Inferior goods auctioned as genuine.
9	Online Bargain	Customer finds the same product cheaper elsewhere after an online purchase.
10	Online Privacy	Risk of customer's name, address, phone being sold to other companies.
11	Online Delivery	Items not delivered timely, delivered to wrong address or lost in transit.
12	No Tactile	Lack of physical touch or feel of product to determine authenticity.
13	Bad Product Received	Product not functioning as expected.
14	Wrong Product Received	Getting the wrong item in shipment.
15	No Product Received	Order not filled/shipped after payment was made.
16	Smoking	Risks involved with smoking, e.g. lung cancer.
17	Space Exploration	Risks associated with space exploration, e.g. shuttle explodes in orbit.
18	Terrorism	Risks associated with terrorism, e.g., suicide bombers.
19	Nuclear Power	Mass destruction of lives via nuclear plants.
20	Motorcycles	Risks of motorcycle accidents.

In a typical MDS type of study, statistical significance is difficult to establish for two reasons. First, each subject may be using an idiosyncratic set of dimensions so that the dissimilarity matrices generated by two subjects are not strictly comparable. Therefore, since measurements are not taken across a standardized scale, strictly speaking, no statistical explanation of differences in variation is possible. Second, data collection is difficult because each subject rates objects two-at-a-time (i.e., if there are 20 objects, then 20*19/2 = 190 ratings). It is standard practice in MDS type of studies to use a small sample (e.g., 5-6 subjects) for each treatment. The small data samples make it difficult to use standard statistical tests, even if one were to assume standardized scales.

2.4 Data Analysis

Data was collected from subjects in two countries, the US and Nigeria. Table –4 below summarizes the sample characteristics. The MDS technique is an exploratory technique and is used when one is trying to understand how people organize risks in their memory and to recover the perceptual map. Therefore, a heterogeneous sample is beneficial because diversity in subject profiles allows a researcher to derive new spatial representations and recover novel dimensions. Unlike factor analysis, MDS technique does not provide a list of factors (dimensions) – instead, based on the organization of risk objects in the perceptual maps, a researcher defined the various axes as dimensions. In this sense, MDS is exploratory because it asks the more fundamental question as to what the dimensions are.

We used subjects in the 30's or higher, because these people would already have well developed schema for offline risks. We also preferred to have educated people, because they are more likely to have some experience with technology in general. Subjects rated risks, one against the other (pair-wise) using a Likert scale anchored on "Very similar" and "very dissimilar". A copy of a sample question is provided in the Appendix. A typical data collection session lasted more than an hour, given that each subject had to make 190 comparisons.

Table 4: Sample Characteristics

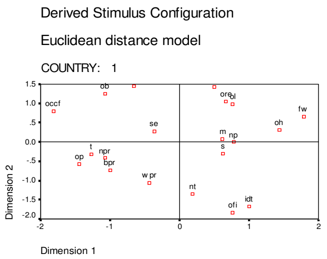
	US Sample	Nigeria Sample
Number of Subjects	n = 6	n = 5
Demographic Data		
Family Size (number of people in household)	3.83	6.20
Gender	4 female, 2 male	3 female, 2 male
Age (average)	36.7	42
Highest Level of Education Completed	All bachelors or higher	4 Masters, 1 Bachelors
Internet Experience		
How Long Used Internet	All more than 1 year	All more than 1 year
Ever Visited Online Shopping Store	4 visited, 2 did not	4 visited, 1 did not
Ever Purchased Goods via Internet	4 did, 2 did not	All purchased
Ever Experienced Problem with Online Purchase	No	4 did not, 1 did

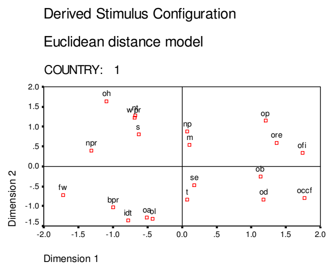
3 Results

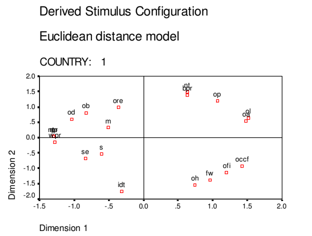
[We are still analyzing the data and therefore, the analysis and interpretation to follow should be considered preliminary. We present two-dimensional maps only with this version.]

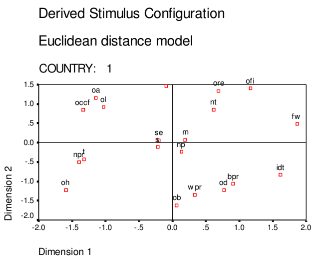
Tables 5 and 6 below contain the perceptual maps of individual subjects, by country. Table -7 contains the aggregate perceptual map by country. Aggregate perceptual maps are derived by averaging the score across subjects for each country. For example, the first perceptual map in Table – 5 corresponds to the subject US1 and can be considered an empirically-derived approximation of US1's schema for risks.

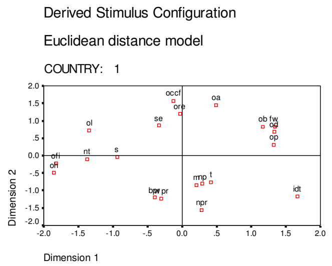
Table 5: Individual Perceptual maps for U.S. Subjects

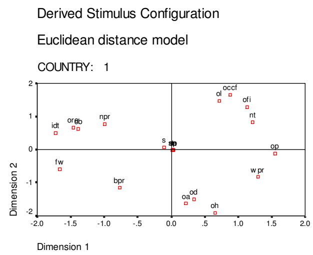








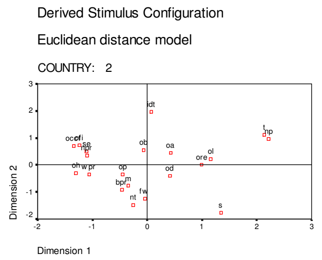


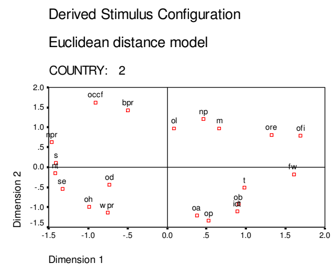


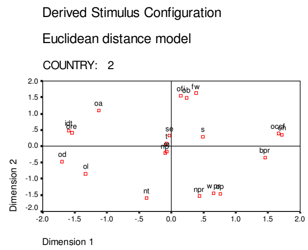
Key to Abbreviations

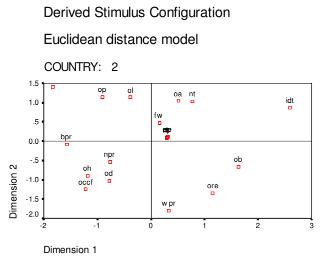
idt - IdentityTheft	od - Online Delivery
occf - OnlineCreditCardFraud	nt - No Tactile
oh - OnlineHacker	Bpr - Bad Product Received
fw - FakeWebSite	wpr - Wrong Product Received
Ofi - Online FalseInformation	Npr - No Product Received
ore - Online Return	s - Smoking
ol - Online Login	se - Space Exploration
Oa - Online Auction	t - Terrorism
Ob - Online Bargain	np - Nuclear Power
op - Online Purchase	m - Motorcycles

Table 6: Individual perceptual maps of Nigerian Subjects









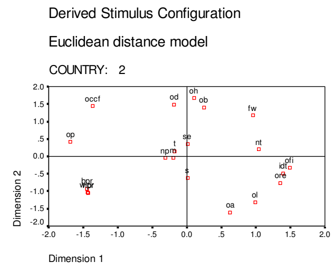


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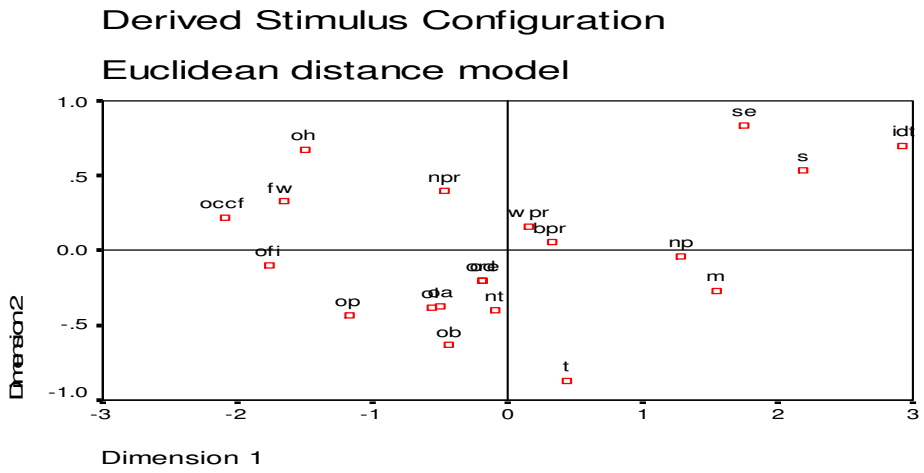
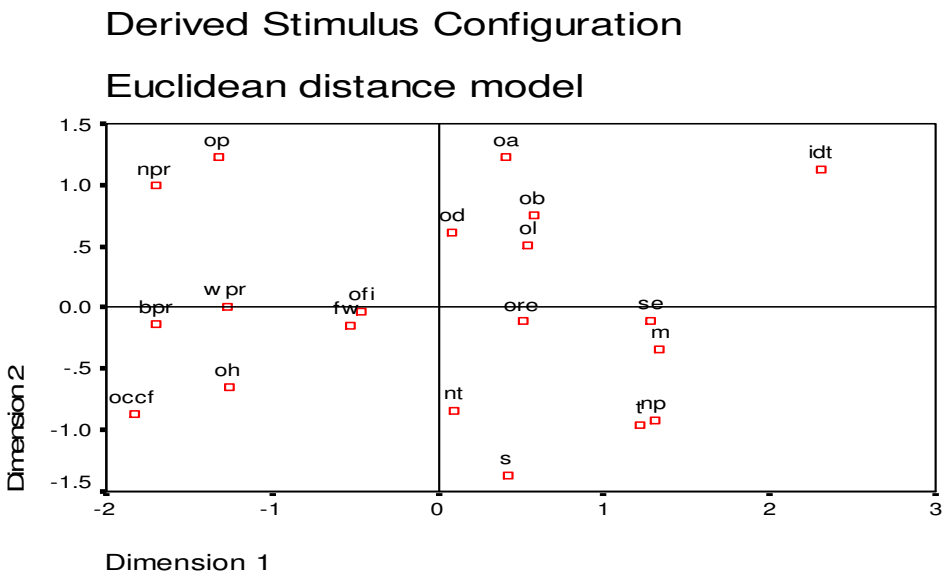
Table 7: Aggregate Perceptual maps of U.S. and Nigerian Subjects

U.S. Subjects



Nigerian Subjects



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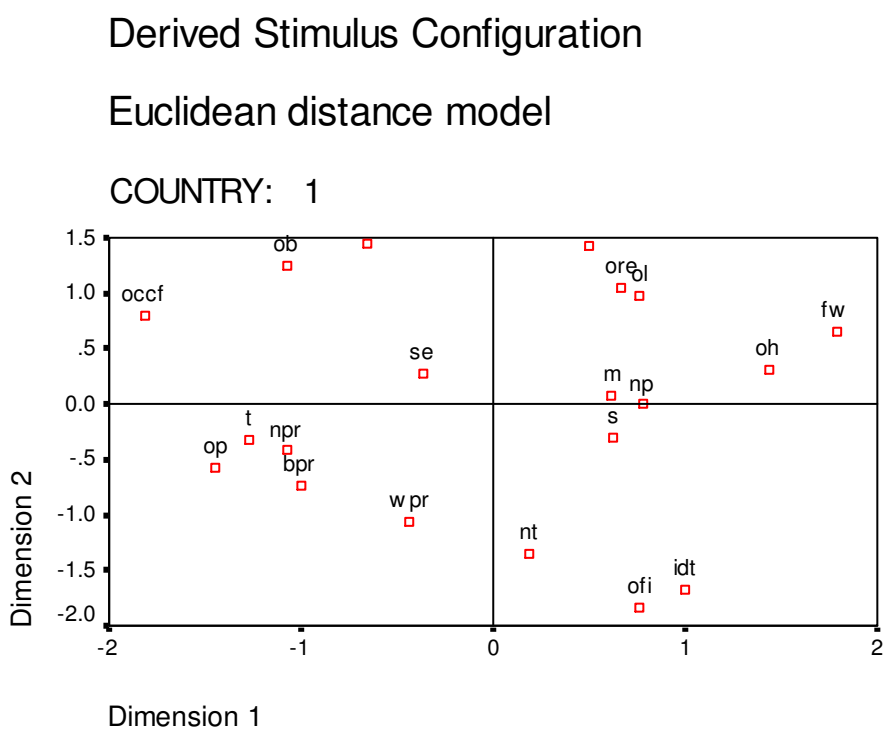
3.1 Preliminary Findings

We analyze US1 in some detail below and analysis of perceptual maps of other subjects would be similar. An exploded diagram of the perceptual map of the subject US1 is presented below. This analysis is representative and not completed.

Table 8: Perceptual Map of subject US1 – 2 dimensional solution



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ol - Online Login	se - Space Exploration
Oa - Online Auction	t - Terrorism
Ob - Online Bargain	np - Nuclear Power
op - Online Purchase	m - Motorcycles

We infer the following from the map:

a) We first look at natural risks (**s**moking, **s**pace **e**xploration, **t**errorism, **n**uclear **p**ower and **m**otorcycles) and compare them with online risks.
   a. Smoking and terrorism are spaced out on the X-axis and show no variation on Y- axis. Nuclear Power is close to Smoking as a risk and so is motorcycles. We also note that the remaining natural risk, Space Exploration, is close to the origin.

      An immediate observation is that none of the natural risks score high on Y-axis. Therefore, for this subject, Y-axis represents the online nature of the web.

      We also note that three risks (m, np, s) are clustered together , so US1 believes that the risks associated with these three natural risks are similar.
   b. Next, we observe variations across the Y-axis. Analysis above suggest that variation across Y-axis corresponds to some significant aspects of the online dimension. We look first at risks that load very high and very low on the Y-axis, so as to understand what the axis means. Online Bargain and Online Return score high on Y-axis and No tactile and Online false Information score low, among the online risk objects. A tentative interpretation is that US1 is more concerned with bargains and does not seem to have strong reservations about the virtual nature of the online medium or false information.
   c. A third observation is that terrorism, no product received, bad product received and online purchase cluster together with similar scores. One interpretation may be that these risks have a similar expected negative consequence. More likely, a three dimensional may have to be examined to see if terrorism loads to a new dimension.
   d. An interesting observation, which validates our approach, is that neither of the dimensions can be interpreted as a likelihood of risk or consequence of risk. Much of the existing work, as our review shows, implicitly assumes that the two dimensions of probability and value are sufficient to summarize consumer notions of risk.
   e. Further analysis is needed to arrive at a definition of dimensions.

4 Conclusions and Future Work

Our preliminary analysis suggests that a) dimensions, other than perceived probability and perceived loss from a risk, may be involved in online risk perception, and, b) risks are perceived differently by different subjects, and further analysis can potentially reveal new dimensions of risk. Pending further analysis, the data suggests that some online risks are perceived no differently than offline risks, which enables us to use existing research on offline risks to understand the perception of novel risks.

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Appendix: Sample Instrument for the study

Instruction: In terms of ***Riskiness***, please compare the Risk on the Left side to the one on the Right side using the dissimilarity/similarity scale of 1 to 7 given below. Circle your choice.

1 – Extremely Dissimilar

2 – Somewhat Dissimilar

3 – Slightly Dissimilar

4 – Neutral

5 – Slightly Similar

6 – Somewhat Similar

7 – Extremely Similar

Question 1: Identity Theft

Risk 1:	Extremely Dissimilar						Extremely Similar	Risk 2
Identity Theft	1	2	3	4	5	6	7	Online Credit Card Fraud
Identity Theft	1	2	3	4	5	6	7	Online Hacker
Identity Theft	1	2	3	4	5	6	7	Fake Website
Identity Theft	1	2	3	4	5	6	7	Online False Information
Identity Theft	1	2	3	4	5	6	7	Online Return
Identity Theft	1	2	3	4	5	6	7	Online Login
Identity Theft	1	2	3	4	5	6	7	Online Auction
Identity Theft	1	2	3	4	5	6	7	Online Bargain
Identity Theft	1	2	3	4	5	6	7	Online Privacy
Identity Theft	1	2	3	4	5	6	7	Online Delivery
Identity Theft	1	2	3	4	5	6	7	No Tactile (No Physical Touch)
Identity Theft	1	2	3	4	5	6	7	Bad Product Received
Identity Theft	1	2	3	4	5	6	7	Wrong Product Received
Identity Theft	1	2	3	4	5	6	7	No Product Received
Identity Theft	1	2	3	4	5	6	7	Smoking
Identity Theft	1	2	3	4	5	6	7	Space Exploration
Identity Theft	1	2	3	4	5	6	7	Terrorism
Identity Theft	1	2	3	4	5	6	7	Nuclear Power
Identity Theft	1	2	3	4	5	6	7	Motorcycles