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Understanding flow and chunking constructs in self service technologies

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Abstract

When developing new services on SSTs it is very important to keep in mind what the user experience is when using it and that this experience will vary across different types of users. This study intends to investigate the flow experience of users when presented with different types of menu options (chunked / grouped vs. a listed menu) across different types of users.

The research is quantitative and causal in nature, and used an experimental factorial design in the conduct of the research. The TRI and flow scales were used in the questionnaire design and a total of 139 respondents were involved in the experiment. The study found that the impact of flow is greater with lower TRI respondents than with higher TRI respondents on SSTs

Keywords: Flow, Chunking, Technology Readiness, Technology Readiness Index (TRI), Self-Service Technologies (SSTs)

Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree of examination in any other university. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

Signature:

Full Name: Jacques Esterhuyse

Date: 11 November 2013

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CHAPTER 1: INTRODUCTION TO THE RESEARCH PROBLEM

1.1 Research title

Understanding flow and chunking constructs in self service technologies

1.2 Research problem definition

The purpose of this research is to understand if the chunking phenomenon could impact flow when using self-service technologies (SST). In this day and age business to customer service are becoming increasingly characterised by advanced technology. Due to ease of use and quicker turnaround time, amongst other reasons, customers prefer to interact with technology to create service outcomes instead of interacting with business employees.

Self-Service Technologies (SSTs) serves as the interface between technology and the customer, some of these examples include Automated Teller Machines (ATM) and self service kiosks at airports. SSTs are no longer deemed as a differentiator for business, but are an integral part of it. SSTs are available in almost every consumer driven sector, from banking to aviation to travelling. (Meuter, Ostrom, Bitner, & Roundtree, 2003). Research has highlighted that it is important to understand how customers experience SST as this has an effect on customer satisfaction that leads to customer retention and profitability (Meuter, Ostrom, Roundtree, & Bitner, 2000). Customers have differing levels of education and tolerance for advance technology. Thus it's important that businesses develop their SSTs knowing what technology limits exist and how they can market their services appropriately.

In order to determine customer satisfaction and tolerance for technology, it's necessary to investigate some psychological concepts, one of these being positive psychology. Positive psychology focuses on emotional human behaviour. Nakamura & Csikszentmihalyi (2002) introduced the eight dimensions of experience of which the flow construct is one. Flow is described as a state where someone is fully immersed in a feeling of energised focus, involvement and enjoyment of the activity at hand (Csikszentimihalyi, 1977). Ideally a business would like to have their customers experiencing flow when dealing with them. This ensures that service encounters are pleasurable and that they retain customers.

Hoffman and Novak (1996) demonstrated that the flow construct is relevant to computer-mediated environments and Hermida & Chipp (2005) demonstrated that this construct is present

with SSTs as well. Therefore business, in using the construct of flow in their SST, can achieve pleasurable experiences using advanced technology.

Initially, SSTs only served a limited set of services to customers, like drawing cash from an ATM or booking a flight on a travelling website (Meuter *et al*, 2003). However, with the growing awareness about SSTs among customers, businesses are fast becoming innovative with making new services available on these technologies.

Even though businesses will endeavour to offer as many services as possible on SSTs, having too many choices can be overwhelming and thus lead to a decision paralysis (Aaker, Leslie, & Robin, 2010). On the other end of the scale having too little choice can also cause frustration and thus have a negative effect (Hoffman & Novak, 1996). This means that adding new services to SSTs or not having enough services available on SSTs can disturb the flow state of the customer using the SST.

A possible solution to cope with the problem stated above is to make use of logical grouping of services on SSTs. Miller (1956) suggests that by turning information into meaningful chunks, an individual can increase their short term-memory capacity. It can be argued that result of increasing short term memory capacity will lead to better learn-ability. Learn-ability is an important dimension in user interfaces, in that it promotes ease of use for a user to accomplish basic tasks the first time they encounter the design of the user interface (Nielsen & Hackos, 1993). Chunking is therefore a very important construct considered during the course of this study.

Flow and chunking become imperative when considering the development of the most innovative SST in the last decade, the development of applications (apps). The same trend is present in South Africa as a growing number of local businesses have created their own SSTs on tablet devices to serve its customers needs. Examples of this can be found in banking (Ndzamela, 2013), entertainment (Ferreira, 2013) and health care (NewsCentral Media, 2012) industries.

Based on the above trend it is safe to assume that there will be an upward trend in the number of SST services available on tablet devices in the South African market. Understanding the technology and its implication on its customers as a medium for service delivery will greatly benefit a company pursuing SSTs as an interface to its customers.

A number of studies exist, such as which investigate the phenomenon of chunking in software applications. This study will aim to bring the constructs of flow and chunking together

1.3 Research aims

This research aims to answer the fundamental question: “Does chunking or grouping of menu options on SSTs play a role on how a consumer experience flow?” This research also aims to answer the question: “Will a consumer with low or high technology readiness prefer the same or different layout of menu options on SSTs?”

1.4 Research objectives

Based on the research aims, the main objective of this study are broken down as follows:

To empirically test whether or not flow will be present in consumers with different propensity to technology in different settings (structured and ungrouped/listed) of goals on SSTs

1.5 Research structures

The research will be structured as follows:

Chapter 1: Introduction to the research problem

This chapter indicates the need for conducting the research, the research problems and the research objectives.

Chapter 2: Literature review

A theoretical framework is established including the chunking theory as a phenomenon in working memory, identifying a flow as a relevant physiological state in computer mediated environments and technology readiness index as a measurement of the propensity of an individual to accept new technologies. This chapter provides a foundation for all theories related in this study.

Chapter 3: Research hypothesis and conceptual model

A number of hypotheses and a research conceptual model are constructed in order to answer the research aims and objectives.

Chapter 4: Research methodology

A description of the research methodology, sampling approaches and analysis techniques used in conducting this research is provided.

Chapter 5: Results

The detailed analytical results of the research are presented.

Chapter 6: Discussion of results

A discussion of research results and their implications for theory.

Chapter 7: Research conclusion

Final conclusions are drawn based on the research findings.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The following section gives an overview of the applicable literature pertaining to the problems identified in chapter 1. The major themes to be evaluated and reviewed are the importance of service marketing and technology, the flow state in positive physiology and how it links to computer-mediated environments, phenomenon of chunking in short term memory and theories to analyse usage intentions, usage or satisfaction with SSTs.

2.2 Background to service marketing and technology

Bitner (1990) explained that service encounter are critical moments of truths in which customers develop impressions of an organisation. Furthermore, Bitner, Brown, & Meuter (2000) expanded on this by claiming that service encounter is the moment of interaction between a customer and the organisation and could take many forms.

Each service encounter can be an opportunity to satisfy the customer or an opportunity to disappoint. Technology is a good alternative to service customer encounters and it's usually in a form of self-service technology (Bitner, *et al.*, 2000).

Self-service technologies (SSTs) are a form of service encounter and serve as an interface between technology and the customer. Initially, SSTs only served a limited set of services to customers, like drawing cash from an ATM or booking a flight on a travelling website. However, with the growing awareness of SSTs among customers, businesses are fast becoming innovative with making new services available on these technologies (Meuter, Ostrom, Bitner, & Roundtree, 2003).

There are numerous advantages for business and customers in using SSTs (Lin & Hsieh, 2011). Advantages such as lowering labour costs, improved productivity, enhanced efficiencies, and increased business performance (Bitner, Zeithaml, & Gremler, 2010; Dabholkar 1996). Customers using SST experience independence and more freedom (Meuter, *et al.*, 2000),

What's more is that SSTs are no longer deemed as a differentiator for business, but is an integral part of it. SSTs are available in almost every consumer driven sector, from banking to aviation to travelling. (Meuter, Ostrom, Roundtree, & Bitner, 2005).

Recent studies suggest that SSTs should form part of the core service offering by integrating the technology closely with the business process in order to enhance service experience (Ostrom, *et al*., 2010; Ordanini & Parasuraman, 2011). Example of such SSTs is the development of self-service technology in mobile devices (Kleijnen, de Ruyter, & Wetzels, 2007).

Research has highlighted that it is important to understand how customers experience SST as this has an effect on customer satisfaction that *inter alia* leads to customer retention and profitability (Meuter *et al.*, 2000; Gelderman, Ghijsen, & van Diemen, 2011). Thus it's important that businesses develop their SSTs knowing what technology limits exist and how they can market their services appropriately.

In spite of the benefits of SST to business, it would appear that not all customers prefer SST. Contradictory research findings exist and suggest that not all customers would prefer to use SST for service delivery and interpersonal interaction is preferred, "It would appear to be difficult for customers to have an enjoyable interaction with a service employee or feel there is a personal connection when there are no employees involved in the encounter" (Gremler & Gwinner, 2000, p. 101).

Dabholkar (1996) acknowledges this and suggests that a segment of customers prefer interpersonal service encounters over self service based encounters. It therefore follows that business will not be able to move completely to SST.

The above argument holds true in more recent studies (Gelderman *et al.*, 2011; Wang & Shih, 2009) and add that situational factors play a role in whether or not a customer will use a SST or not. The authors argue that even if the customer prefers interpersonal service, they will switch in cases where social influence is high, or effort expectancy is lower.

2.3 Importance for this study

Colby & Parasuraman (2003) argues that electronic services or SST should be designed in order for the least techno ready customer to comfortably use it. Thus the same argument should be applicable to SSTs.

From an attitude towards technology point of view, the work of Mick & Fournier, (1998) has proved that there are eight paradoxes:

- Control/chaos;

- Freedom/enslavement;
- New/obsolete;
- Competence/incompetence;
- Efficiency/inefficiency;
- Fulfils/creates needs;
- Assimilation/isolation; and
- Engaging/disengaging.

These paradoxes may trigger both positive and negative feelings toward SSTs. By leveraging off these paradoxes of technology business can sell more to customers (Ahearne & Rapp, 2010).

When studying feelings in greater detail, it is found that it can be linked to emotional human behaviour which partly is the study of positive psychology. Nakamura & Csikszentmihalyi (2002) introduced the eight dimensions of experience, of which the flow construct is one. Flow is described as a state where someone is fully immersed in a feeling of energised focus, involvement and enjoyment of the activity at hand (Csikszentimihalyi, 1977). Ideally, a business would like to have their customers experiencing flow when dealing with them. This ensures that service encounters are pleasurable and that they retain customers.

The work of Hoffman and Novak (1996) demonstrated that the flow construct is relevant to computer-mediated environments, and Hermida & Chipp (2005) demonstrated that this construct is present with SSTs as well. Schemenner (2004) has shown that operating system design can enhance customer flow experiences

Currently, research focus has been on testing different aspects of flow and customer expectations on SSTs (Bolton & Saxena-Iyer, 2009; Ding, Hu, Verma, & Wardell, 2010; Lin & Hsieh, 2011) in an attempt to better describe what would promote customer experience and thus flow. Some studies have found that consequences to flow includes increased learning, perceived behavioural control and positive subjective experience (Hoffman & Novak, 2009).

Therefore it can be argued that it is important to pay attention on how services are presented to the user and that there are factors that could positively or negatively affect the customer's experience using SSTs.

One of the factors that could negatively influence the experience is the amount of choices that is presented to the user. Aaker *et al*. (2010) explains that by having too many choices the impact

could be overwhelming to the user and thus lead to a decision paralysis, ultimately leading to confusion and breaking the flow state.

Miller's (1956) theory of chunking could be a possible alternative to the above problem identified by Aaker *et al*. (2010). Miller (1956) suggests that by turning information into meaningful chunks, an individual can increase their short term-memory capacity and the result can help overcome the issue of decision paralysis. However, there is little evidence of an explicit test of the relationship between these constructs and this research aims to explore the possibility of such a relationship.

It should be noted that not all people are the same and attitude towards technology will impact the experience when using SSTs (Gelderman, Ghijsen, & van Diemen, 2011). Therefore, the need to measure attitude towards technology becomes a critical factor. Various theories exist to analyse antecedents of usage intentions, usage or satisfaction with SSTs, but it's found that the technology readiness index (TRI) is best suited when analysing effects of attitudes towards technology and situational factors on customers using SSTs (Gelderman *et al.*, 2011).

Three constructs are identified in this study as of importance. Therefore, the literature review section is broken into these three distinct sections:

- Flow in SSTs;
- Chunking; and
- Technology readiness.

The flow in the SST section focuses on what flow is, what the benefits of flow are, how it links to SSTs as well as its relevance. The second section discuses the chunking theory and how its importance to the study. The last section considers the technology readiness theory and how it links to the study.

2.4 Flow construct

Csikszentmihalyi (1977) introduced the concept of flow as a state in positive psychology (Cowley, Charles, Black, & Hickey, 2008). An individual who is in the flow state is described as someone who is fully immersed in a feeling of energised focus, involvement and enjoyment of the activity at hand (Nakamura & Csikszentmihalyi, 2002)**.**

An individual in the flow state presents six experience characteristics (Nakamura & Csikszentmihalyi, 2002):

- An intense and focused concentration on the present moment;
- Merging of action and awareness;
- A loss of reflective self-consciousness
- A sense of personal control or agency over the situation or activity;
- A distortion of temporal experience, one's subjective experience of time is altered; and
- Experience of the activity as intrinsically rewarding, such that the end goal is just an excuse for the process.

Hoffman and Novak (1996) demonstrated that the flow construct is relevant to computer-mediated environments (CME). Firstly, two primary conditions are necessary for flow to be experienced:

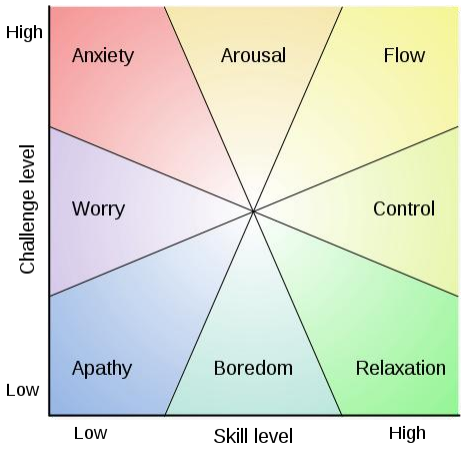
- Skills and challenges must be perceived as congruent (nether neither overmatching nor underutilizing) and above a critical threshold; and
- Focused attention must be present.

This is followed by the secondary conditions which are:

- ➔ Interactivity or the speed of response must be acceptable. (Novak, Hoffman, & Yung, 2000); and
- ➔ Telepresence must be present, and it is defined as a feeling whereby a person is engrossed in the moment forgetting the real word reality (Novak *et al.*, 2000).

Hoffman and Novak (1996) states that when skills exceed the challenges, boredom will set in. Alternatively, if the challenges exceed the skills, anxiety will be experienced. This statement is in line with the Nakamura and Csikszentmihalyi's (2002) argument that an average actor's level and skill should be above the challenge otherwise apathy is experienced. The figure below is a summary of the eight dimensions of experience. The Midpoint on the graph is a person's average skills and challenges for an activity.

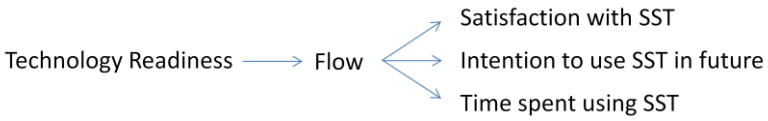
Figure 1 - Eight dimensions of experience (Nakamura & Csikszentmihalyi, 2002, p. 95)



Finally the outcomes of flow is strongly correlated with increased learning (Webster, Trevino, & Ryan, 1993), positive subjected experiences and perceived sense of control in interactions in a computer mediated environment (CME) (Hoffman & Novak, 1996). This links to what Parasuraman (2000) finds to be important to consumers when using technology, namely ease of use, control and fulfilment.

Hermida & Chipp (2005) found that a positive belief in technology will more likely result in the experience of flow. This means that the individual using the SST will experience satisfaction with it and will use it again in future. This is illustrated in the figure below.

Figure 2 - Relationship of TR and Flow (Hermida & Chipp, 2005, p. 17)



Recent studies show an increase in implementation of SSTs by companies to service customers (Kleijnen, de Ruyter, & Wetzels, 2007). Arguably, the increase in SSTs available leads to an increase in services available. As mentioned previously, having too many services to choose from can be overwhelming and as a result lead to a decision paralysis and ultimately to dissatisfaction (Aaker, Leslie, & Robin, 2010).

Novak *et al.* (2000) explains that dissatisfaction will lead to the customer not being interested in using the CME or in this case the SST. Arguably, this could lead to undesirable consequences for the company. To understand why a customer would be affected by the amount of services displayed on SST, it may be helpful to look at how the brain treat information from a neuro-physiological viewpoint. Bierderman & Vessel (2006) in Cowley *et al.* (2008) found that experiencing novelty can cause neuro-physiological pleasure similarly found in drug use. The authors explain that *mu-opioid* chemical receptor is activated by endorphins and that this is in the parts of the brain that mediates pain and pleasure, as well as parts that processes sensory information and memories. When an individual tries to interpret sensory information, they will experience pleasure.

Repetition decreases the above described effect, as information is no longer novel and this suggests that an individual is learning and thus collating the information presented. Collating information increases an individual's ability and thus a high challenge is needed (Cowley *et al*., 2008).

The behaviour to collate information can be better described by the chunking theory, discussed in the following section in greater detail.

As illustrated by figure 2, various studies link the constructs of flow and technology readiness (TR) (Meuter *et al*., 2000; Nysveen *et al*., 2005). A more detailed discussion on technology readiness follows the section of chunking.

2.5 Chunking construct

Csikszentmihalyi and Csikszentmihalyi (1990) in Cowley *et al*., (2008) claim that by nature an individual will try to maximise the rate of interpreting new information once the need of survival and procreation is satisfied. The phenomenon that maximise the rate of interpreting new information is described by Miller (1956) as chunking. This increases working memory by saving information into chunks and hence less comprehension is needed to complete a task.

Miller (1956) states that an individual performs a grouping phenomenon in working memory when performing a memory task. The groupings are known as chunks and it can be defined as a letter, digit, word or a unit of one bit that allows an individual to make a decision between two equally likely alternatives.

It seems that there is no consensus of what the capacity is of working memory to remember chunks of information. Miller (1956) argues that working memory can handle seven chunks of information with a range of plus or minus two. More recent research (2010) suggests that the real number of chunks in adults working memory is four.

Miller (1956) suggests that by turning information into meaningful chunks, an individual can increase their short-term memory capacity. Conversely, a reduction of short-term memory capacity is experienced when an individual tries to remember isolated digits or letters (Miller, 1956). Chunking provides leverage on the number of options that can be presented to an individual (Miller, 1956). Short-term memory is finite and thus grouping information can only be leveraged up to a point before an individual cannot remember and needs to comprehend what is displayed (Cowan, 2001).

Cowley *et al*. (2008) argues that there is a link between flow and chunking and various authors (Aaker *et al*, 2010; Hoffman and Novak, 1996) argue that the number of items has a significant impact on flow.

As previously discussed in section 2.4 Flow construct, technology readiness has a link to flow. The following section discusses it in greater detail.

2.6 Technology Readiness

Technology can evoke feelings of anxiety (Meuter *et al.,* 2003; Venkatesh, 2000) as well as fun (Cowley *et al.*, 2008), that directly or indirectly affects an individuals beliefs and behavour towards technology (Liljander, Gillberg, Gummerus, & van Riel, 2006). Parasuraman (2000) argues that this is linked to an individual's technology readiness.

Technology readiness (TR) is the propensity of an individual to accept new technologies for the execution of goals in their everyday life (Parasuraman & Colby, 2001). The technology readiness index (TRI) is a measurement scale that asses that propensity (Parasuraman, 2000).

The theory is based on the Dabholkar (1996) argument that people have different believes towards technology and that this affects their propensity to use the technology. Parasuraman (2000) states that optimism and innovativeness drives technology readiness while discomfort and insecurity inhibits it. Furthermore it is argued that the technology readiness of an individual

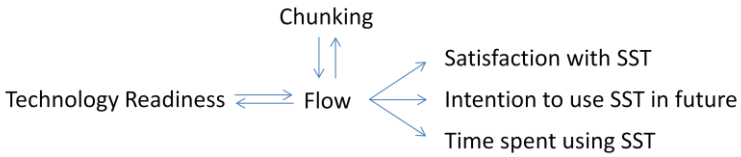
contains predictive power in terms of that person's technology adoption (Parasuraman & Colby, 2001).

2.7 Conclusion

Based on the above discussion, it's clear that control of technology could inhibit the technology readiness, and that by grouping options the control of technology gets affected. The technology readiness of an individual also plays a role in the tolerance of this, but there is a theoretical gap explaining this relationship and thus the question can be asked, whether or not, through the use of chunking, more options could be displayed to the user, without causing discomfort?

Hermida & Chipp (2005) found that there is a strong correlation (beta = 0.686) between technology readiness (TR) and flow in SSTs. Chunking provides leverage on the number of options that can be presented to an individual (Miller, 1956) and there is a link between flow and chunking (Cowley *et al*., 2008). Various authors (Aaker *et al*, 2010; Hoffman and Novak, 1996) argue that the number of items has an impact on flow. Based on the above arguments that there could be an interaction between chunking and flow following relationship is proposed in the figure below.

Figure 3 - Proposed relationship with chunking, TR and flow



Therefore it can be derived that the degree of technology readiness, together with the number of options (chunking), will have an impact on the flow experience of the individual.

The following chapter will discuss the research hypothesis in greater detail as well as the conceptual model used.

CHAPTER 3: RESEARCH HYPOTHESIS AND CONCEPTUAL MODEL

3.1 Introduction

This chapter proposes a number of hypotheses to explain the aims of this research that is, to explore the role of technical skill of a consumer as a determining factor for grouping goals on SSTs and to determine its impact on the flow state of that consumer. A mapping of hypotheses and variables derived from the conceptual introduced in the previous chapter will also be discussed.

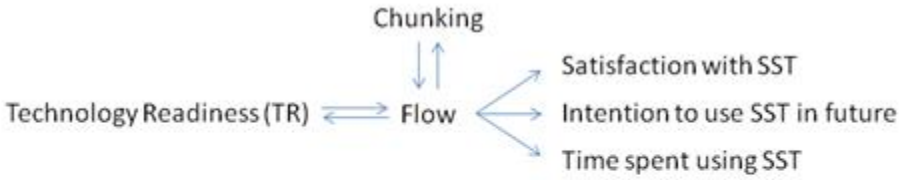
3.2 Research hypotheses

To be in the flow state the challenges and skills of that individual needs to be in equilibrium (Hoffman & Novak, 1996). Miller (1956) suggests that by turning information into meaningful chunks, an individual can increase their short-term memory capacity

Thus chunking provides leverage on the number of options that can be presented to an individual. The increase of short-term memory is finite and thus grouping information can only be leveraged up to a point before an individual is discomforted or overwhelmed with number of options available. Having too many services to choose from can be overwhelming and thus lead to a decision paralysis and ultimately to dissatisfaction (Aaker, Leslie, & Robin, 2010).

In terms of the above research hypothesis, the conceptual model for conducting this research can be drawn as below:

Figure 4 - Research model



H1 – is there a correlation between TR, chunking and flow?
H2 – Does no chunking = Flow?
H3 – Does high TR = Flow?

3.2.1 Hypothesis 1

Null hypothesis ($H1_0$)

There is no interaction between the technology readiness of a consumer, the structured and unstructured / listed goals presented on a SST and the flow experience of the consumer.

Alternative hypothesis ($H1_A$)

There is an interaction between the technology readiness of a consumer, the structured and unstructured / listed goals presented on a SST and the flow experience of the consumer.

3.2.2 Hypothesis 2

Null hypothesis ($H2_0$)

Consumers are not more likely to experience flow in an unstructured / listed SST

Alternative hypothesis ($H2_A$)

Consumers are more likely to experience flow in an unstructured / listed SST

3.2.3 Hypothesis 3

Null hypothesis ($H3_0$)

Consumers with high TRI do not/are not more likely to experience flow in a SST

Alternative hypothesis ($H3_A$)

Consumers with high TRI are more likely to experience flow in a SST

3.3 Conclusion

Based on the discussion in this chapter, this research focuses on identifying if there is a correlation between technology readiness, flow and chunking. The next chapter will focus on the methodology for this study.

CHAPTER 4: METHODOLOGY

4.1 Introduction

This chapter discusses the methodology adopted for conducting this study, this includes the research methodology, research design, population and sampling, research experiment assumptions, measuring instrument, data collection process, data analysis, validity and reliability, as well as research limitations.

4.1 Proposed methodology

The research methodology adopted in this study was quantitative in nature. Page and Meyer (2000) states that the preferential use of quantitative approaches are the traditional scientific approach to research. Quantitative approaches place greater value upon information that can be numerically manipulated in the meaningful way. The information gathered in this study was quantified hence the quantitative research methodology was adopted and designed.

4.2 Research design

The purpose of causal research is to identify cause-and-effect relationships between variables (Zikmund, 2003, p. 53). Based on the nature of the research question posed it would therefore follow that this study will take on a causal research design. In causal research the researcher manipulates one or more independent variables to test the effect on the dependant variable (Malhotra, 2008, p. 81). According to Bagozzi in Hulland, Chow, and Lam (1996) there are four key advantages to causal models:

- Causal models make the assumptions, constructs and hypothesised relationships in a researcher's theory clear;
- Causal models add an amount of precision to a researcher's theory, due to the apparent definitions of constructs, operationalisations and the functional relationships between constructs;
- Causal models allow a more comprehensive representation of complex theories; and
- Causal models offer a formal framework for constructing and testing both theories and measures.

Malhotra (2008, p. 91) argues that not every study needs to start with exploratory research. It depends on the precision of the problem defined and the degree of the researcher's conviction about the problem. The aim of the research is to determine if the flow will be impacted if the options on the SST through is manipulated. The problem of this study is well defined and seeks to establish evidence of a causal relationship. The conditions for causality are (Malhotra, 2008, p. 221):

- Concomitant variation, which is the extent to which a cause (technology readiness level, chunked and listed options) and effect (experience of flow) occur together and vary together, in the way predicted by the hypothesis under consideration;
- Time order of occurrences of variables, which states that the causing event (technology readiness level, chunked and listed options) must occur either before or at the same time as the effect (experience of flow) and not occur afterwards; and
- Elimination of other causal factors. Unfortunately, these can never be completely excluded. The hypothesis testing aims to provide statistical details.

This study aimed to meet two of the above requirements. As explained above, the third condition is impossible to meet. The study is quantifiable and therefore causal research is appropriate.

Within causal research methods, an experimental research approach was deemed appropriate. This research method seeks to establish cause-and-effect relationships between variables (Page & Meyer, 2000, p. 14). Saunders and Lewis (2012) add to this, by defining the essential components of an experiment as:

- Manipulating the independent variable;
- Controlling the experiment by holding all other variables, except the dependant variable constant;
- Studying the effect of the manipulation of the independent variable on the dependent variable; and
- Forecasting the events that will occur in the experimental setup.

Based on the above discussion, the design will take on a classic two by two factorial design. The independent or causal variables are grouped or chunked menu options versus a list of menu options. The dependant variables are the level of technology readiness. This is illustrated in the table below.

Table 1 - Causal variables - Chunked and technology readiness

	Structured / Grouped (Chunked) menu options	Listed menu options
High Technology Readiness	Will experience flow	Will not experience flow
Low Technology Readiness	Will not experience flow	Will experience flow

A factorial design within the experimental approach is deemed appropriate, since factorial designs allow for testing the effects of two or more factors at various levels (Zikmund, 2003, p. 283).

4.3 Population and sampling

The research scope was limited to a study investigating the effects of chunking in SSTs on flow experienced by individuals with high and low technology readiness levels.

4.3.1 Population

Zikmund (2003) defines a population or universe as a complete group of entities sharing some common set of characteristics. A target population is the complete group of specific population elements relevant to the research problem (Zikmund, 2003). The target population for this study consisted of all individuals who have used a banking channel (i.e. an ATM, branch, online banking) before and who understood basic banking concepts (i.e. transfer funds, once off payments etc.).

The reason for this population was that the SST should be based on a goal driven application. A common example of such a goal driven application is banking (Meuter, *et al.*, 2003; Meuter, *et al.*, & Bitner, *et al.*, 2000)

4.3.2 Sampling method

Due to the nature of the population specified for this study, it is expensive to do a probability sampling (Saunders & Lewis, 2012). It therefore follows that only a non-probability method sampling can be done.

Non-probability purposive sampling method was adopted for this study. Zikmund (2003) states that non-probability sampling as a sampling technique in which units of the sample is selected on the basis of personal judgement or convenience. Furthermore purposive sampling refers to a non-probability sampling technique in which an experienced individual selects the sample based on his or her judgement about some characteristic required of the sample members. The sample is selected to serve a specific purpose and is also applicable even if this makes a sample less than fully representative.

4.3.3 Sampling technique

Zikmund (2003) defines a sample as a small number of items or a proportion of a population to arrive at a conclusion regarding the whole population. The sampling technique for this study was quota sampling. The quota consisted firstly of individuals who had online access and were able to access the internet and emails using any device of their choice (i.e. laptop, PC or iPad). The reasoning for this sample was that the individuals who have online access should display favourable technology readiness level.

A second quota consisted out of a domestic workers, gardeners and security guards in a nearby area. The reasoning for this sample was that the individuals do not have online access (and therefore show a less favourable technology readiness level) however, they still have regular banking interactions.

4.3.4 Unit of analysis

Zikmund (2003, p. 373) describes the unit of analysis as the level of investigation that is focused on the collection of data about the population. The unit of analysis was whether or not the user experienced flow and the unit of response was the users in the sampling frame.

4.3.5 Sampling size

A sample of at least 20 units is suggested per cell for MANOVA (Hair, Black, Babin, & Anderson, 2010). Based on the four different conditions for the hypothesis a total number of 80 units is required in order to be statistically significant.

It's also important to take note of the degrees of freedom involved in the study. If the degrees of freedom is a low figure, the resulting prediction may be less generalisable because most of the

observations were incorporated in the prediction. On the contrary, if the number of degrees of freedom is a high number then the prediction is considered robust (Hair *et al.,* 2010).

4.4 Research experiment – Variable operationalisations: Grouping function

SSTs are commonly found in the banking sector (Meuter, Ostrom, Bitner, & Roundtree, 2003) and it's assumed that banking customers are familiar with the services that banking SSTs provide.

A study was done on the SSTs (specifically on the mobile website) of the four major banks in South Africa. The table below contains a list of basic banking services commonly found on these SSTs.

Table 2 - List of basic banking services provided by South African SSTs

Find ATM/Branch Map	Stop debit order	Purchase limit settings
Financial Calculator	Buy Airtime	Transfer limit settings
Balance for an account	Buy Bundles	Payment limit settings
Transfer money from one account to another account	Buy electricity	Change pin
Pay recipient	Buy funeral cover	
Pay once off to account	Buy lotto	

An individual using an SST would usually request a service from the SST (similar to the table above), based on their needs. The user was requested to perform a certain request, e.g asked to do a transfer or buy airtime etc.

The following tasks were provided to the user to perform:

- Transfer R100.00 from Cheque to Savings;
- Buy R50.00 prepaid airtime;
- Perform a onceoff payment of R100 to account 123450; and
- Change transfer limit to R500.00 per day.

The application recorded the time taken to perform the task, the amount of "clicks" as well as if the task was performed correctly.

To support the hypothesis, two versions of this application were created. The first version displayed the list of services, whereas the second version contained a logical grouping of the options into a menu structure (see Appendix B).

This application was made available on the internet so that anyone familiar with banking via online or mobile would be able to access it.

4.5 Independent variable test

In order to support the hypothesis, the dependant variable had to be determined. Thus a questionnaire was used to determine the technology readiness. The questionnaire had to be completed before the individual started the experiment. After completion of the experiment, the individual completed a questionnaire that determined whether or not the individual experienced flow. Since the experiment was an online application the questionnaires was included as part of the application.

Both questionnaires included closed items, measuring the reactions on statements on a 5-point Linkert-type scale (agree/disagree). The following subsections discuss the questionnaires used in this study in greater detail.

4.5.1 Technology readiness

As discussed previously, the technology readiness index is a measurement scale that assesses the propensity of an individual to accept new technologies for the execution of goals (Parasuraman, 2000). The TR scale is clustered into four dimensions that cover technology paradoxes with which consumers are faced with:

- Optimism – the positive view of technology and belief of its offering of increased control, flexibility and efficiency;
- Innovativeness – the tendency to be a technology pioneer and thought leader;
- Discomfort – the lack of control over technology and feeling of being overwhelmed; and
- Insecurity – the distrust of technology and scepticism of the technology to work properly.

The original questionnaire created by Parasuraman (2000) contains a list of 66 questions. The survey for this study was adopted from Gelderman *et al.* (2011) who created a shortened version of Parasuraman (2000)'s original questionnaire.

The reported reliability statistics on Gelderman *et al.* (2011) are found appropriate for research purposes, the table below lists the Cronbach alphas, number of items and means for each section:

Table 3- Reliability statistics on Gelderman et al. (2011)

Item	Cronbach alpha	Number of items	Mean
Optimism	0.61	3	3.67
Innovativeness	0.63	3	3.07
Discomfort and Insecurity	0.67	6	2.82

4.5.2 Flow

Wang & Shih (2009) measured the acceptance of respondents using an e-government system and found that geographical information important. A geographical questionnaire was included in the application.

Nakamura & Csikszentmihalyi (2002) reports that an individual displays six characteristics when experiencing flow, this includes focused concentration, merging of action and awareness, a loss of reflective self-consciousness, control over the situation, distortion of temporal experience, loss of time and lastly the experience of the activity as intrinsically rewarding.

The survey used to measure flow was adopted Koufaris (2002). The author argues that one of the reasons why customers would return to use a service is because they have experienced the different dimensions of flow. Furthermore to measure flow successfully the following dimensions needs to be assessed:

- Concentration
- Enjoyment
- Perceived Control
- Challenges
- Perceived Ease of Use
- Perceived Usefulness

The reported statistics for the dimensions are reported in the table below (See appendix C for questions):

Table 4 - Reliability statistics on Koufaris (2002)

Dimension	Cronbach alpha	Standard deviation	Mean
Concentration	0.91	1.46	4.52
Enjoyment	0.944	1.52	4.30
Perceived Control	0.813	1.52	4.98
Challenges	0.803	1.44	2.96
Perceived Ease of Use	0.927	1.61	5.16
Perceived Usefulness	0.924	1.57	4.15

4.6 Data collection process

As discussed in the previous sections the application created for this study recorded all responses of the surveys along with the experiment conducted. In most of the low TRI cases questions were asked to be clarified and to provide some examples.

4.7 Data preparation

4.7.1 Data cleaning

Due to limited inconsistencies in the data, minimal data cleaning was considered necessary. Incomplete TRI surveys were discarded. However, incomplete flow surveys were taken into consideration as it could be indicative that the individual got frustrated in completing the survey, which is a valid outcome.

4.7.2 Data coding

The data was coded based on the experimental design method of the study. Each response in the questionnaire was coded into a numerical form in order to allow quantitative analysis (Page & Meyer, 2000, p. 55).

4.8 Data analysis

Data obtained from the application (created for the study) was loaded into a statistical software package (namely IBM SPSS Statistics software), and analysed by the statistical methods discussed in the subsections to follow.

4.8.1 Descriptive statistics

Descriptive analysis statistics refers to the transformation of raw data into a form that is easy to understand and interpret (Zikmund, 2003, p. 473). The data captured was processed and displayed using descriptive statistics.

4.8.2 Instrument validity and reliability

Reliability in this context refers to the degree in which data collection methods and analysis procedure will produce consistent finding (Saunders & Lewis, 2012, p. 128). Most of the construct measures in this study have been tested in previous studies. However, the validity and reliability will be retested in within the context of this study.

The Cronbach's Alpha analysis technique was used to test the reliability of the hypothesis stated in Chapter 3.

4.8.3 Analysis of variance (ANOVA)

Analysis of variance (ANOVA) is concerned with the differences in means between groups. It compares the mean of one dependent variable (Hair *et al.*, 2010). A two-way ANOVA means that there is two independent variables in the test (Pallant, 2011).

4.8.4 Multivariate analysis of variance (MANOVA)

Multivariate analysis of variance (MANOVA) "is an extension of analysis of variance (ANOVA) to accommodate more than one dependent variable" (Hair *et al.*, 2010, p. 439). It provides a simultaneous significance test of mean differences between groups (Zikmund, 2003, p. 584).

For MANOVA to work the number assumptions need to be adhered to (Pallant, 2011):

- Sample size for each cell must be more than the absolute minimum (20 each);
- Normality – the sample must follow a normal distribution;
- Outliers must not be present;

- Linearity, the sample should not contain any evidence of non-linearity;
- Homogeneity of regression;
- Multicollinearity, MANOVA works best when dependent variables are moderately correlated; and
- Homogeneity of variance-covariance matrices.

4.8.5 Factor analysis

Factor analysis is an interdependence technique that is primarily used “to define the underlying structure among the variables in the analysis” (Hair *et al.*, 2010, p. 94). This reseach follows a expolorary factor analysis that attempts to factor the flow varables (Hair *et al.*, 2010).

4.10 Research limitations

A limitation to this study is the research design that was implemented. The purposive (judgement) sampling technique was implemented and the limitation that it imposes is the representivity of the sample that diminishes. This study takes place in South African and for the most part in the Gauteng area.

A further limitation to the research design is the time horizon used for this study. This study takes on a cross-sectional sampling approach which means that the sample will only be measured at a specific point in time. It can be argued that as the proliferation of SSTs continue more and more people would become technology ready and thus the outcomes of this study could change.

CHAPTER 5: RESULTS

5.1 Introduction

The results from the research will be presented in this chapter. The research objective was to empirically test whether or not flow will be present in consumers with different propensity to technology in different settings of goals on SSTs:

- Discussion of the results of the descriptive analysis with regards to the study;
- Discussion on the scale of validity and reliability for measuring the dependent variable;
- Interpretation of the descriptive statistic for the dependent and independent variable;
- Results for the MANOVA analysis to test the hypothesis (formulated in chapter 3); and
- Discussion of the results of the multivariate and univariate ANOVA analysis.
- Results on the factor analysis.

5.2 Descriptive analysis results

5.2.1 Overview of the response rates

A total sample of 139 respondents were analysed in the study as illustrated by the table below.

Table 5 - Response rate by experimental condition

Description	n	%
Condition 1 (Listed items and low TRI)	38	27%
Condition 2 (Listed items and high TRI)	39	28%
Condition 3 (Grouped items and low TRI)	33	24%
Condition 4 (Grouped items and high TRI)	29	21%
Total	139	100%

Based on the table above the respondents allocated to each condition were reasonably even. The highest rate was condition 2 with 39 respondents (28%), versus the lowest response rate was condition 4 with 29 respondents (21%). A marginally difference in response rate between condition 1 and 2 exists.

The table below illustrates the overall demographical summary for the entire sample.

Table 6 - Demographics of respondents

Gender		
	n	%
Male	64	46%
Female	75	54%
Total	139	100%
Age		
	n	%
Younger than 18	3	2%
18-29	35	25%
30-39	51	37%
40-49	13	9%
50 and older	37	27%
Total	139	100%
Highest level of education		
	n	%
University/Technicon >=3 years	61	44%
University/Technicon < 3 years	25	18%
Secondary Schooling (Matric)	33	24%
Primary Schooling	19	14%
Other	1	1%
Total	139	100%
Job Classification		
	n	%
Skilled	40	29%
In Management	23	17%
A Professional	36	26%
Other	40	29%
Total	139	100%

Majority of the respondents were female (54%) versus male respondents of (46%), the difference is however marginal.

From an age point of view, the majority of respondents were between the age of 30 – 39 years old (37%), followed by respondents 50 and older (27%). Respondents between the ages of 18 –

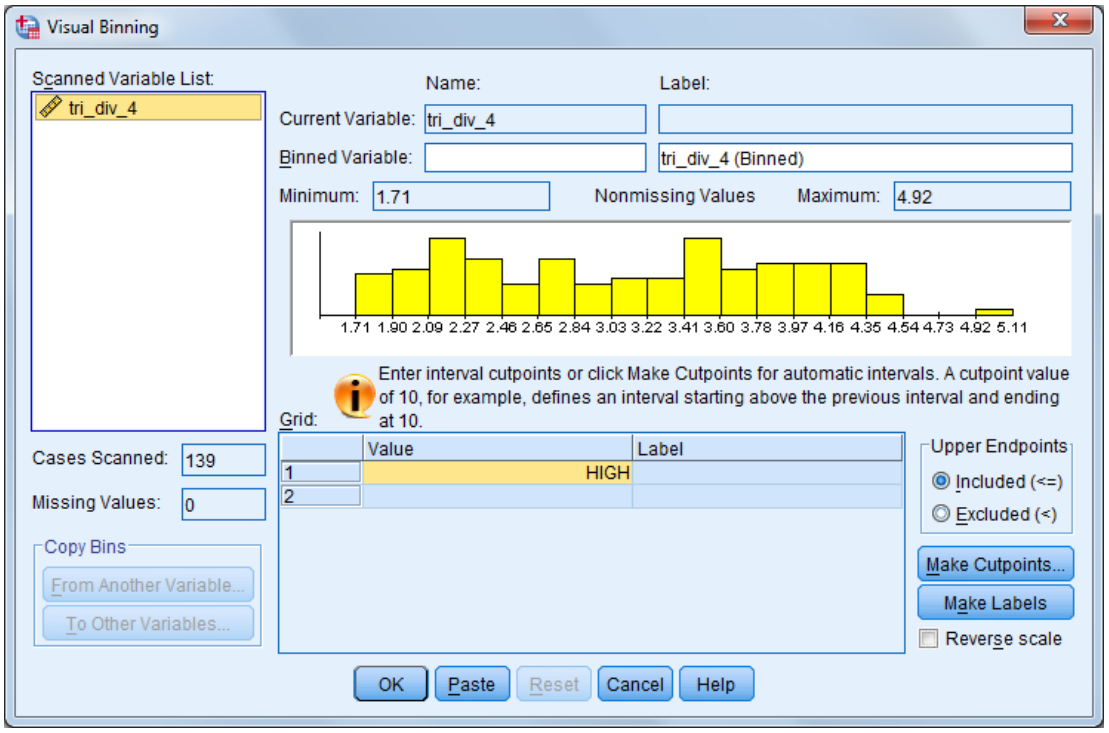
29 years old were marginally lower (25%) than the 50 and older category. A large much smaller amount of respondents were between the ages of 40 – 49 year old (9%) and younger than 18 years old (2%).

In terms of education, the majority of respondents have studied a basic degree / diploma after school (44%), followed by respondents who only completed matric (24%). A fair amount of respondents had a certificate after matric (18%), followed by a number of respondents with only primary schooling (14%). Only one respondent had “other”.

5.2.2 Demographic summary of TRI value

The figure below illustrates the spread of the TRI calculated prior to the experiment for each candidate. Based on a median split the TRI score equal and lower than 3.13 was regarded as low TRI and a score of 3.14+ was regarded as high TRI.

Figure 5 - Binomial split for TRI



5.2.3 TRI Demographics

Table 7 presents the TRI demographic split by age and gender for the sample as follows:

Table 7 - Tri Results split by age and gender

			TRI Split (in %)		
Test Type	**Age Group**	**Gender**	**Low**	**High**	**Grand Total**
Listed Items	Younger than 18	Female	0%	100%	1%
		Total		0%	
	18-29	Male	14%	86%	5%
		Female	44%	56%	12%
		Total	8%	35%	
	30-39	Male	11%	89%	6%
		Female	31%	69%	9%
		Total	5%	23%	
	40-49	Male	100%	0%	4%
		Female	100%	0%	1%
		Total	6%	100%	
	50 and older	Male	77%	23%	9%
		Female	75%	25%	9%
		Total	19%	76%	
Listed Items Total			**49%**	**51%**	**55%**
Grouped Items	Younger than 18	Female	50%	50%	1%
		Total	1%	50%	
	18-29	Male	100%	0%	1%
		Female	30%	70%	7%
		Total	5%	42%	
	30-39	Male	53%	47%	12%
		Female	67%	33%	9%
		Total	17%	59%	
	40-49	Male	33%	67%	2%
		Female	50%	50%	3%
		Total	3%	43%	
	50 and older	Male	63%	38%	6%
		Female	50%	50%	3%
		Total	7%	58%	
Grouped Items Total			**53%**	**47%**	**45%**
Grand Total			**51%**	**49%**	**100%**

A fairly even split between low (51%) and high (49%) TRI is represented in the sample. In each of the test types the TRI split is also representative with low (49%) and high (51%) for listed items and for grouped items low is 53% and high is 47% of the sample.

Table 8 illustrates the TRI split by education, where by the majority of high TRI was found in higher education groups than low TRI. Low TRI is evident in matric and lower education groups.

Table 8 - TRI split by education

		TRI Split		
Test Type	**Education_group**	**Low**	**High**	**Grand Total**
Listed Items	University/Technicon >=3 years	26%	74%	22%
	University/Technicon < 3 years	31%	69%	9%
	Secondary Schooling (Matric)	61%	39%	13%
	Primary Schooling	100%	0%	11%
Listed Items Total		**49%**	**51%**	**55%**
Grouped Items	University/Technicon >=3 years	27%	73%	22%
	University/Technicon < 3 years	50%	50%	9%
	Secondary Schooling (Matric)	93%	7%	11%
	Primary Schooling	100%	0%	3%
	Other	100%	0%	1%
Grouped Items Total		**53%**	**47%**	**45%**
Grand Total		**51%**	**49%**	**100%**

Table 8 Illustrates the TRI split by job classification, for listed items majority that were skilled had high TRI (35% vs. 65%). For test type grouped items the inverse hold true (64% for low versus 36% for high). Another outlier is the in management job classification, for test type listed this was low (36%) versus high (64%), but for test type grouped items that was an even split. Professional and other job classifications had similar demographics across test types.

Table 9 - TRI Split by job classification

		TRI Split		
Test type	**Job Classification**	**Low**	**High**	**Grand Total**
Listed Items	Skilled	35%	65%	19%
	In Management	36%	64%	8%
	A Professional	35%	65%	12%
	Other	83%	17%	17%
Listed Items Total		**49%**	**51%**	**55%**
Grouped Items	Skilled	64%	36%	10%
	In Management	50%	50%	9%
	A Professional	21%	79%	14%
	Other	82%	18%	12%
Grouped Items Total		**53%**	**47%**	**45%**
Grand Total		**51%**	**49%**	**100%**

Table 10 illustrates the split of TRI across primary banking channels. Both test types had similar demographics for the type of channel and TRI, except for “Nothing” and “Cellphone banking”. “Nothing” for listed items had high TRI (100%) and grouped items had a 2/3 low TRI and 1/3 high TRI. Cellphone banking for listed items had majority high TRI versus grouped items with an even split.

Table 10 - TRI Split by primary banking channel

		TRI Split		
Test Type	**Primary Banking Channel**	**Low**	**High**	**Grand Total**
Listed Items	Nothing	0%	100%	1%
	A Branch	100%	0%	4%
	An ATM	86%	14%	16%
	The Internet	33%	67%	26%
	Cellphone	8%	92%	9%
Listed Items Total		**49%**	**51%**	**55%**
Grouped Items	Nothing	67%	33%	2%
	A Branch	100%	0%	3%
	An ATM	93%	7%	11%
	The Internet	31%	69%	26%
	Cellphone	50%	50%	3%
Grouped Items Total		**53%**	**47%**	**45%**
Grand Total		**51%**	**49%**	**100%**

Table 11 highlights that the majority respondents in test type listed items banked 1 – 5 times per month (36%) versus a fair split between 1 – 5 times per month (15%) and 6 – 10 times per month (14%) for grouped items. The other categories did not deviate too much in the different test types.

Table 11 - TRI Split by number of banking interactions per month

		TRI Split		
Test Type	**Banking per month**	**Low**	**High**	**Grand Total**
Listed Items	0 times	0%	100%	1%
	1 - 5 Times	72%	28%	36%
	6 - 10 Times	0%	100%	12%
	11 - 15 Times	33%	67%	4%
	More than 15 times	0%	100%	3%
Listed Items Total		**49%**	**51%**	**55%**
Grouped Items	0 times	83%	17%	4%
	1 - 5 Times	71%	29%	15%
	6 - 10 Times	35%	65%	14%
	11 - 15 Times	40%	60%	7%
	More than 15 times	40%	60%	4%
Grouped Items Total		**53%**	**47%**	**45%**
Grand Total		**51%**	**49%**	**100%**

5.3 Validity and reliability scale to measure dependent variable

5.3.1 Reliability analysis results

Cronbach's alpha is a reliability coefficient that assess the consistency of the entire scale. It is the most widely used measure for reliability(Hair, Black, Babin, & Anderson, 2010). Malhotra (2008) and Parasuraman (2000) recommends a scale greater than 0.7 across dimensions for reliable data. Hair *et al.* (2010) advises that the lower limit of an acceptable Cronbach's alpha is 0.7 but that it may decrease to 0.6 in exploratory research. For this research, the overall Cronbach's alpha was 0.771 (see Table 12) indicating high reliability.

Table 12 - Cronbach's alpha analysis

Reliability Scale					
Cronbach's Alpha		Cronbach's Alpha Based on Standardized Items		N of Items	
.771		.760		6	
Item-Total Statistic					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
CONCENTRATION	17.8333	16.383	.296	.391	.787
ENJOYMENT	18.5051	12.025	.819	.757	.651
PECEIVED_CONTROL	17.9487	13.641	.627	.720	.709
CHALLENGES	19.2769	17.483	.146	.356	.818
PERCEIVED_USEFULNESS	18.4821	11.309	.726	.747	.673
PERCEIVED_EASE_OF_USE	17.5051	14.951	.535	.508	.735

5.3.2 Correlation analysis results

To understand the relationship amongst the six dependent variables better a correlation coefficient was computed. Wegner (2007, p. 418) states that Pearson's correlation coefficient computes the correlation between two ratio-scaled random variables. The direction of the relationship is also indicated in this coefficient (Hair, Black, Babin, & Anderson, 2010). Table 13 summarises the correlation coefficients of the six variables.

Table 13 - The correlation coefficients of dependent variables

	CONCEN-TRATION	ENJOY-MENT	PECEIVED CONTROL	CHALLE NGES	PERCEIVED USEFULNE SS	PER-CEIVED EASE OF USE
CONCEN-TRATION	1.000					
ENJOYMENT	.329	1.000				
PECEIVED CONTROL	.497	.623	1.000			
CHALLENGES	.024	.284	-.172	1.000		
PERCEIVED USEFULNESS	.119	.824	.517	.347	1.000	
PERCEIVED EASE OF USE	.124	.497	.645	-.020	.536	1.000

Majority of the depended variables were positively correlated except for Challenges and Perceived Control that were negatively correlated (-0.172). Perceived usefulness and enjoyment had the strongest correlation (0.824) followed by Perceived Control and Enjoyment (0.623). The other dependent variables had fair to weak correlations.

5.3.3 Means calculation of dependent variables

Tables

Table 14 and Table 15 report the detailed mean calculation of the six dependent variables.

Table 14 - Means per dependent variable

Descriptive Statistics					
	Test Type	**TRI Split**	**Mean**	**Std. Deviation**	**N**
CONCENTRATION_SCORE	**Listed**	<= 3.13	4.5405	.52910	37
		3.14+	4.0202	.88952	33
		Total	4.2952	.76253	70
	Grouped	<= 3.13	3.4949	1.20796	33
		3.14+	4.2222	.91987	27
		Total	3.8222	1.13905	60
	Total	<= 3.13	4.0476	1.04840	70
		3.14+	4.1111	.90128	60
		Total	4.0769	.98002	130
ENJOYMENT_SCORE	**Listed**	<= 3.13	3.2973	1.04167	37
		3.14+	3.8990	1.14408	33
		Total	3.5810	1.12458	70
	Grouped	<= 3.13	2.8182	1.13373	33
		3.14+	3.6667	.87217	27
		Total	3.2000	1.10162	60
	Total	<= 3.13	3.0714	1.10466	70
		3.14+	3.7944	1.02894	60
		Total	3.4051	1.12599	130
PECEIVED_CONTROL_SCORE	**Listed**	<= 3.13	4.1261	.98867	37
		3.14+	4.3939	.86384	33
		Total	4.2524	.93498	70
	Grouped	<= 3.13	3.1717	1.16703	33
		3.14+	4.1728	.73595	27
		Total	3.6222	1.10889	60
	Total	<= 3.13	3.6762	1.17128	70
		3.14+	4.2944	.80976	60
		Total	3.9615	1.06275	130

Table 14 (continued)

CHALLENGES_SCORE	**Listed**	<= 3.13	2.7838	1.05765	37
		3.14+	2.6465	1.10221	33
		Total	2.7190	1.07322	70
	Grouped	<= 3.13	2.9697	.84312	33
		3.14+	2.0000	.64051	27
		Total	2.5333	.89611	60
	Total	<= 3.13	2.8714	.96023	70
		3.14+	2.3556	.97205	60
		Total	2.6333	.99599	130
PERCEIVED_USEFULNESS_SCORE	**Listed**	<= 3.13	3.0180	1.71224	37
		3.14+	3.8889	1.22663	33
		Total	3.4286	1.55536	70
	Grouped	<= 3.13	3.0202	1.20744	33
		3.14+	3.9259	.54954	27
		Total	3.4278	1.06315	60
	Total	<= 3.13	3.0190	1.48518	70
		3.14+	3.9056	.97442	60
		Total	3.4282	1.34570	130
PERCEIVED_EASE_OF_USE_SCORE	**Listed**	<= 3.13	4.3604	1.18212	37
		3.14+	4.3333	1.11492	33
		Total	4.3476	1.14269	70
	Grouped	<= 3.13	4.3232	.63182	33
		3.14+	4.6543	.54288	27
		Total	4.4722	.61154	60
	Total	<= 3.13	4.3429	.95633	70
		3.14+	4.4778	.91105	60
		Total	4.4051	.93454	130

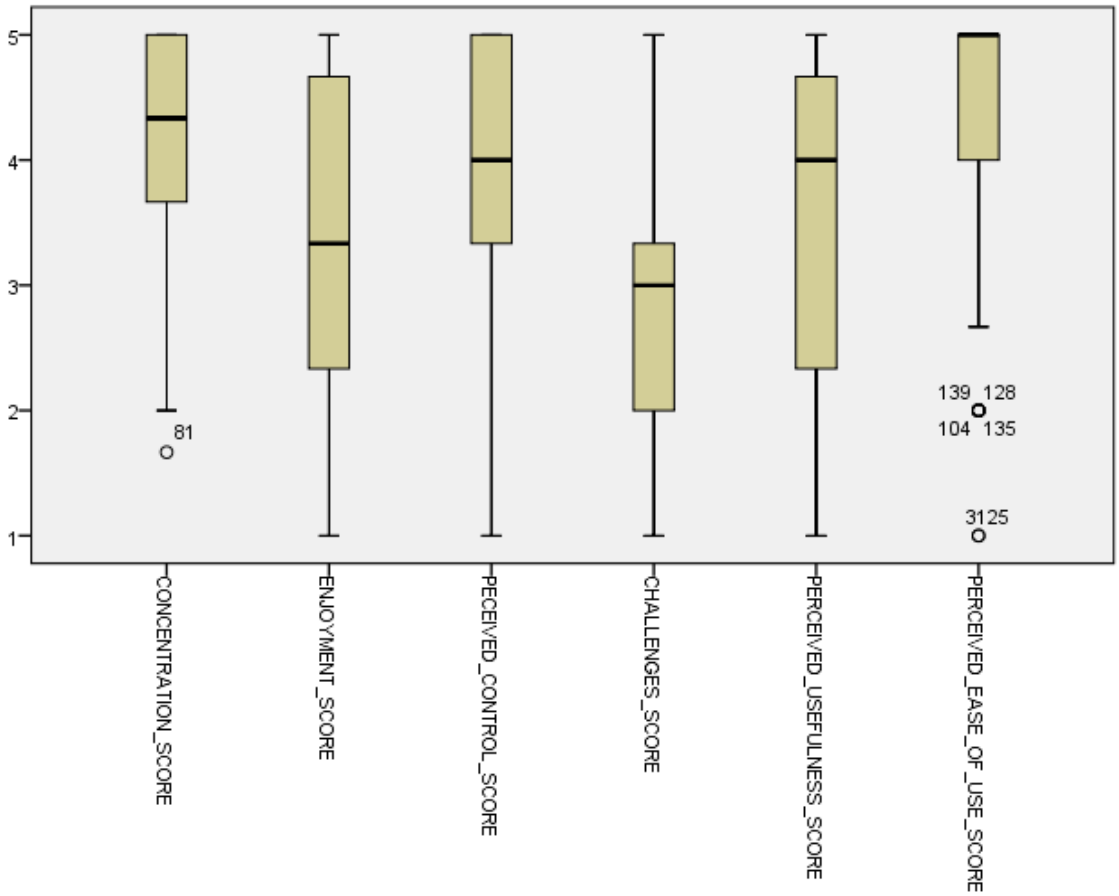
Table 15 - Grand mean of sample

Grand Mean				
Dependent Variable	**Mean**	**Std. Error**	**97.5% Confidence Interval**	
			Lower Bound	**Upper Bound**
PERCEIVED_EASE_OF_USE_SCORE	4.418	.083	4.230	4.605
PERCEIVED_USEFULNESS_SCORE	3.463	.113	3.206	3.721
CHALLENGES_SCORE	2.600	.083	2.411	2.789
PECEIVED_CONTROL_SCORE	3.966	.085	3.773	4.159
ENJOYMENT_SCORE	3.420	.094	3.208	3.633
CONCENTRATION_SCORE	4.069	.080	3.887	4.251

5.3.4 Distribution of dependent variables

Figure 6 shows the distribution of ratings for the six dependent variables. Concentration has an even split with one extreme value, Enjoyment, Perceived control is slightly skewed to the one side where as Challenges and Perceived usefulness is skewed to the other side. Perceived ease of use is extremely skewed with 2 extreme values as they converse to control.

Figure 6 - Box Plot of the dependent variables



5.3.5 Outliers in sample

Hair *et al.* (2010) states that the MANOVA is sensitive to outliers, to find outliers Pallant (2011) recommends a Mahalanobis distance critical value not greater than 22.46 for six dependent variables.

A Mahalanobis distance was calculated for each of the depended variables and a total of two records were identified to exceed the critical value, these records were subsequently removed from the sample.

Table 16 reports on the Mahalanobis distance for the sample, a value of 21.814 were reported after removing the outliers from the sample. All other tests were updated after this alteration. A total of nine cases were excluded due to incomplete surveys.

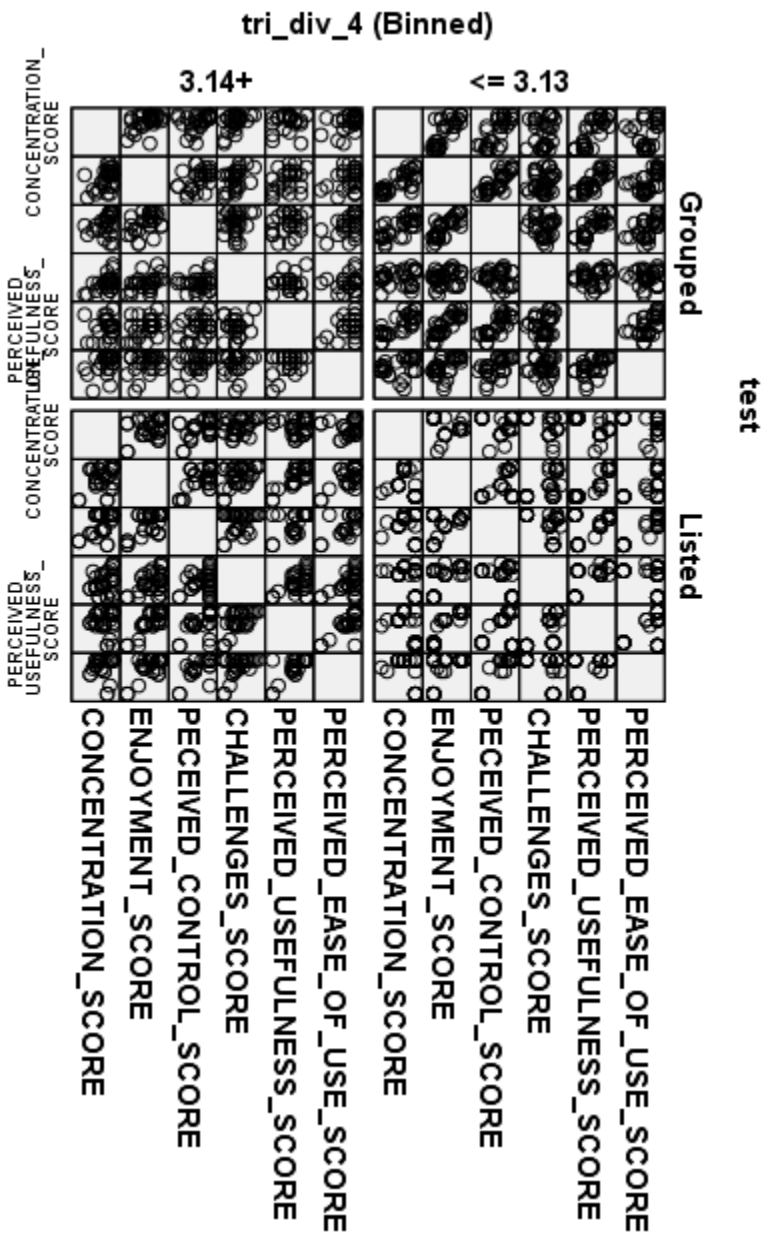
Table 16 - Residual statistics for the sample

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	20.69	107.89	72.58	18.913	130
Std. Predicted Value	-2.744	1.867	.000	1.000	130
Standard Error of Predicted Value	4.149	15.760	8.321	2.542	130
Adjusted Predicted Value	12.73	111.66	72.77	19.035	130
Residual	-79.491	72.454	.000	36.600	130
Std. Residual	-2.121	1.933	.000	.976	130
Stud. Residual	-2.178	1.956	-.003	1.001	130
Deleted Residual	-83.830	74.182	-.197	38.481	130
Stud. Deleted Residual	-2.212	1.979	-.003	1.006	130
Mahal. Distance	.588	**21.814**	5.954	4.220	130
Cook's Distance	.000	.055	.007	.011	130
Centered Leverage Value	.005	.169	.046	.033	130

5.3.6 Linearity in sample

Hair et al. (2010) encourages the researcher to investigate for nonlinear relationship in the data. Figure 7 do not show any obvious evidence of non-linearity, thus the assumption of linearity is satisfied.

Figure 7 - Scatter Plots



5.3.7 Multivariate and univariate measures for testing homoscedasticity

Table 17 reports on the test for multivariate homoscedasticity, the significance of Box's M test is less than 0.05 and therefore there is a significant difference between groups on the six variables collectively.

Table 17 - Multivariate Test of Homoscedasticity

Box's Test of Equality of Covariance Matrices	
Box's M	374.521
F	5.426
df1	63
df2	33831.965
Sig.	**.000**

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + test + tri_split + test * tri_split

Tabachnick and Fidell (2007, p.281) in Pallant (2011) warns that Box's M tend to be too strict when having large sample sizes. Hair *et al.* (2010) states that violation of this assumption has minimal impact if the group sizes are approximate in size. The largest group size is 37 and smallest is 27, this equates to 37/27 = 1.37 which is less than the recommended 1.5 as per Hair *et al*. (2010, p.459).

Table 18 reports on the homoscedasticity for the dependent variables, from this all but one variable violated the assumption of homoscedasticity (on 0.05 alpha). Tabachnick and Fidell (2007) in Pallant (2011) recommends that if the assumption of equality of variances are violated a more conservative alpha should be used. A suggested 0.025 alpha was used rather than the conventional 0.05 alpha level.

Table 18 - Univariate Tests for Homoscedasticity

Levene's Test of Equality of Error Variances[a]				
	F	df1	df2	Sig.
CONCENTRATION_SCORE	13.989	3	126	.000
ENJOYMENT_SCORE	1.237	3	126	**.299**
PECEIVED_CONTROL_SCORE	3.498	3	126	**.018**
CHALLENGES_SCORE	4.583	3	126	**.004**
PERCEIVED_USEFULNESS_SCORE	23.175	3	126	.000
PERCEIVED_EASE_OF_USE_SCORE	5.554	3	126	.001
FLOW	3.709	3	132	**.013**

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + tri_split + test + tri_split * test

With an alpha level 0.025 majority of dependent variables were nonsignificant and only three dependent variables were significant. Given the large sample size and conservative alpha level corrective remedies were not needed for Concentration, Perceived Usefulness and Perceived Ease of Use. The aggregated variable of flow was also reported to be significant with a value of 0.013 (tested with ANOVA).

5.3.8 Factor analysis

Factor analysis is an interdependence technique that aims to define the underlying structure amount the variables in the analysis (Hair *et al.*, 2010). This section reports on the factors uncovered during the analysis.

Table 19 reports on whether the data set is suitable for factor analysis. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) value is above 0.6 (Pallant, 2011). The reported value is 0.637 and thus the data is suitable for factor analysis.

Table 19 - KMO and Bartlett's test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.637
Bartlett's Test of Sphericity	Approx. Chi-Square	399.277
	Df	15
	Sig.	.000

Table 19 reports on whether the data set is suitable for factor analysis. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) value is above 0.6 (Pallant, 2011). The reported value is 0.637 and thus the data is suitable for factor analysis.

Table 20 reports on the degree to which each variable is participating in the analysis (Hair *et al.*, 2010). Most of the variables are reported high except for concentration with a value of 0.343 this could indicate a problem in the fit of the component (Pallant, 2011).

Table 20 - Communalities to component solution

Communalities		
	Initial	Extraction
CONCENTRATION_SCORE	1.000	.343
ENJOYMENT_SCORE	1.000	.843
PECEIVED_CONTROL_SCORE	1.000	.887
CHALLENGES_SCORE	1.000	.795
PERCEIVED_USEFULNESS_SCORE	1.000	.844
PERCEIVED_EASE_OF_USE_SCORE	1.000	.582
Extraction Method: Principal Component Analysis.		

Table 21 reports that two factors have Eigenvalues greater than 1.0 therefore which describes 71.5% of the total variance.

Table 21 - Variance of factors

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3	49.992	49.992	3	49.992	49.992	2.566	42.764	42.764
2	1.294	21.567	71.559	1.294	21.567	71.559	1.728	28.794	71.559
3	0.938	15.639	87.198						
4	0.441	7.355	94.554						
5	0.184	3.067	97.621						
6	0.143	2.379	100						
Extraction Method: Principal Component Analysis.									

Figure 8 illustrates that component 1 has by far the higest total Eigenvalue, from this component 3 could also be included as it is close to 1. A curve turn is at component 3, but this figure confirms the observation in derived from the total variance explained table.

Figure 8 - Screen plot factor analysis flow

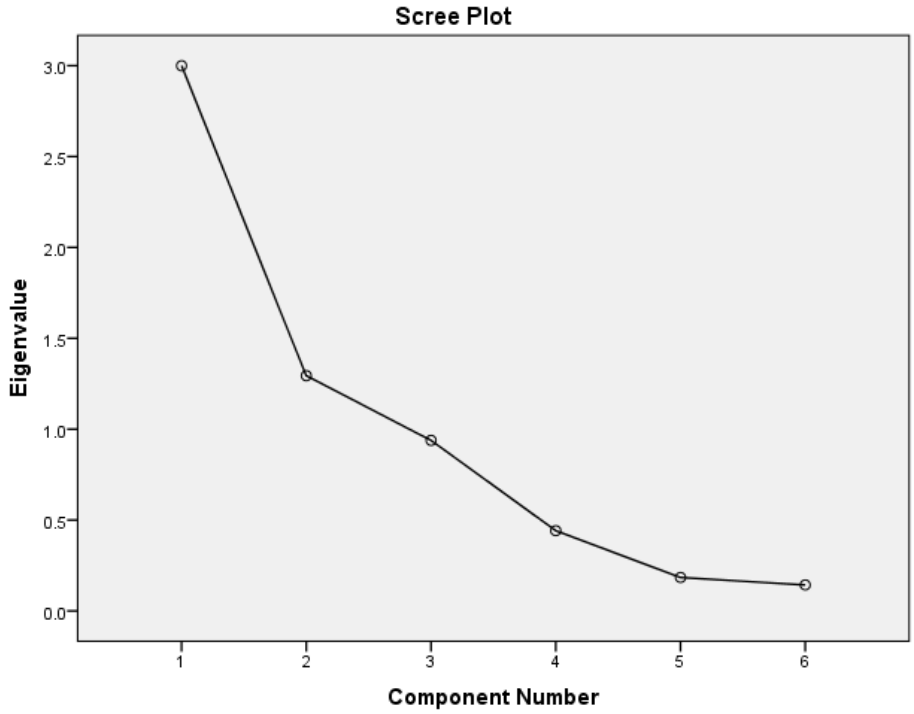


Table 22 is the unrotated component matrix and reports the values in the array that have correlation between the variables and components (Hair *et al.*, 2010). The rotated component matrix (reported in Table 23) displays variables ordered by correlation with each of the component listed below:

- Component 1 – Primarily measure for Perceived control (0.941), followed by Perceived ease of use (0.729), Enjoyment score (0.668) and Concentration (0.578)
- Component 2 – Primarily measure for Challenges (0.851) and Perceived usefulness (0.739).

Table 22 - Unrotated component matrix

Component Matrix[a]		
	Component	
	1	2
CONCENTRATION_SCORE	.452	-.372
ENJOYMENT_SCORE	.894	.207
PECEIVED_CONTROL_SCORE	.831	-.443
CHALLENGES_SCORE	.200	.869
PERCEIVED_USEFULNESS_SCORE	.844	.362
PERCEIVED_EASE_OF_USE_SCORE	.743	-.174
Extraction Method: Principal Component Analysis. a. 2 components extracted.		

Table 23- Rotated component matrix for flow

Rotated Component Matrix[a]		
	Component	
	1	2
CONCENTRATION_SCORE	**.578**	-.094
ENJOYMENT_SCORE	**.668**	.630
PECEIVED_CONTROL_SCORE	**.941**	.037
CHALLENGES_SCORE	-.265	**.851**
PERCEIVED_USEFULNESS_SCORE	.546	**.739**
PERCEIVED_EASE_OF_USE_SCORE	**.729**	.224
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 3 iterations.		

Table 24 - Component transformation matrix for flow

Component Transformation Matrix		
Component	1	2
1	.864	.504
2	-.504	.864

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

5.4 Hypothesis testing

5.4.1 Hypothesis 1 results

The null hypothesis ($H1_0$) stated that there is no interaction between the technology readiness of a consumer, the grouped and ungrouped goals presented on a SST and the flow experience of the consumer. The alternative hypothesis ($H1_A$) stated that there is an interaction between the technology readiness of a consumer, the grouped and ungrouped goals presented on a SST and the flow experience of the consumer.

The significant values are the p-values for the multivariate testes, these tests are Pillai's Trace, Wilks Lambda, Hotelling's Trace and Roy's Largest Root. These tests are the common multivariate tests associated with MANOVA testing. Hair et al. (2010) explains that if the significant values are less than 0.05 level of significance, there will be a significant effect on the different groups.

Tabachnick and Fidell (2007) in Pallant (2011) recommend Wilks' Lambda for general use. However, if there any data problems exist (small sample size, unequal N values, violation of assumptions), Trace will be more robust. Due to violations of assumptions stated earlier, a more conservative level of 0.025 was adopted. The MANOVA analysis results for hypothesis 1 is presented in the table below:

Table 25 - Multivariate Test for group differences in TRI levels across test types (listed and grouped items)

Multivariate Tests[a]							
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
TRI Split * Test Type	**Pillai's Trace**	**.170**	**4.137[b]**	**6.000**	**121.000**	**.001**	**.170**
	Wilks' Lambda	.830	4.137[b]	6.000	121.000	.001	.170
	Hotelling's Trace	.205	4.137[b]	6.000	121.000	.001	.170
	Roy's Largest Root	.205	4.137[b]	6.000	121.000	.001	.170

a. Design: Intercept + tri_split + test + tri_split * test

b. Exact statistic

c. Computed using alpha = .025

Table 25 reports a p-value of 0.01 which is less than the proposed alpha level of significance of 0.025, thus the null hypothesis ($H1_0$) can be rejected in favour of the alternative hypothesis ($H1_A$), thus there was a statistical significant difference between groups on the combined dependent variables. F(4.137) and p = 0.001.

Table 26 - Test of between subjects effects

Tests of Between-Subjects Effects							
Source		**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Observed Power[g]**
Corrected Model	PERCEIVED_EASE_OF_USE_SCORE	2.142[a]	3	.714	.814	.488	.081
	PERCEIVED_USEFULNESS_SCORE	25.411[b]	3	8.470	5.126	.002	.773
	CHALLENGES_SCORE	15.407[c]	3	5.136	5.749	.001	.833
	PECEIVED_CONTROL_SCORE	28.964[d]	3	9.655	10.421	**.000**	.990

	ENJOYMENT_SCORE	21.694[e]	3	7.231	6.423	**.000**	.883
	CONCENTRATION_SCORE	19.806[f]	3	6.602	7.991	**.000**	.952
TRI Split	PERCEIVED_EASE_OF_USE_SCORE	.742	1	.742	.845	.360	.048
	PERCEIVED_USEFULNESS_SCORE	25.317	1	25.317	15.322	**.000**	.901
	CHALLENGES_SCORE	9.830	1	9.830	11.004	**.001**	.757
	PECEIVED_CONTROL_SCORE	12.916	1	12.916	13.941	**.000**	.866
	ENJOYMENT_SCORE	16.869	1	16.869	14.983	**.000**	.893
	CONCENTRATION_SCORE	.343	1	.343	.416	.520	.027
Test Type	PERCEIVED_EASE_OF_USE_SCORE	.646	1	.646	.737	.392	.042
	PERCEIVED_USEFULNESS_SCORE	.012	1	.012	.007	.931	.010
	CHALLENGES_SCORE	1.701	1	1.701	1.905	.170	.112
	PECEIVED_CONTROL_SCORE	11.084	1	11.084	11.964	**.001**	.799
	ENJOYMENT_SCORE	4.060	1	4.060	3.606	.060	.241
	CONCENTRATION_SCORE	5.708	1	5.708	6.909	**.010**	.507
tri_split * test	PERCEIVED_EASE_OF_USE_SCORE	1.029	1	1.029	1.173	.281	.066
	PERCEIVED_USEFULNESS_SCORE	.010	1	.010	.006	.939	.010
	CHALLENGES_SCORE	5.557	1	5.557	6.221	**.014**	.454

	PECEIVED_CONTROL_SCORE	4.313	1	4.313	4.656	.033	.328
	ENJOYMENT_SCORE	.489	1	.489	.434	.511	.028
	CONCENTRATION_SCORE	12.485	1	12.485	15.113	**.000**	.896
Error	PERCEIVED_EASE_OF_USE_SCORE	110.521	126	.877			
	PERCEIVED_USEFULNESS_SCORE	208.197	126	1.652			
	CHALLENGES_SCORE	112.560	126	.893			
	PECEIVED_CONTROL_SCORE	116.733	126	.926			
	ENJOYMENT_SCORE	141.858	126	1.126			
	CONCENTRATION_SCORE	104.092	126	.826			
Total	PERCEIVED_EASE_OF_USE_SCORE	2635.333	130				
	PERCEIVED_USEFULNESS_SCORE	1761.444	130				
	CHALLENGES_SCORE	1029.444	130				
	PECEIVED_CONTROL_SCORE	2185.889	130				
	ENJOYMENT_SCORE	1670.889	130				
	CONCENTRATION_SCORE	2284.667	130				

Corrected Total	PERCEIVED_EASE_OF_USE_SCORE	112.663	129
	PERCEIVED_USEFULNESS_SCORE	233.608	129
	CHALLENGES_SCORE	127.967	129
	PECEIVED_CONTROL_SCORE	145.697	129
	ENJOYMENT_SCORE	163.552	129
	CONCENTRATION_SCORE	123.897	129

a. R Squared = .019 (Adjusted R Squared = -.004)

b. R Squared = .109 (Adjusted R Squared = .088)

c. R Squared = .120 (Adjusted R Squared = .099)

d. R Squared = .199 (Adjusted R Squared = .180)

e. R Squared = .133 (Adjusted R Squared = .112)

f. R Squared = .160 (Adjusted R Squared = .140)

g. Computed using alpha = .025

Table 27 - Tests of Between-Subjects Effects (Flow Aggregated)

Dependent Variable: FLOW

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4.543[a]	3	1.514	2.219	.089	.048
Intercept	1743.246	1	1743.246	2554.765	.000	.951
test	.856	1	.856	1.255	.265	.009
tri_split	3.192	1	3.192	4.678	.032	.034
test * tri_split	.577	1	.577	.845	.360	.006
Error	90.070	132	.682			
Total	1855.415	136				
Corrected Total	94.614	135				

a. R Squared = .048 (Adjusted R Squared = .026)

Hair *et al.* (2010) explains that the tests of between subjects are helpful in understanding the ANOVA and MANOVA results. If the p-value of a dependent variable is less than 0.025, the null hypothesis for that variable is rejected in that effect or interaction, and thus the factor, is deemed significant and important.

Table 26 reports on the univariate tests for each of the dependent variables. Majority of the univariate tests are not statistical significant (with an alpha of 0.025). The interaction of TRI split by test type had two variables with statistical significance (Challenges with p = 0.014 and Concentration with p = 0.000). The main effect of TRI split had four variables that were statistical significant (Perceived usefulness, Challenges, Perceived control, Enjoyment). Lastly the main effect of test type had one variable that was statistical significant (Perceived control with p = 0.001 and Concentration with p = 0.010).

Table 27 confirms the above observation with only the main effect (TRI) being statistically significant at 0.05 alpha.

5.4.2 Hypothesis 2 results

The null hypothesis ($H2_0$) stated that consumers are not more likely to experience flow in an ungrouped SST. The alternative hypothesis ($H2_A$) stated that consumers are more likely to experience flow in an ungrouped SST.

Table 28 - Main effect for test type

Multivariate Tests[a]							
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Test Type	**Pillai's Trace**	**.293**	**8.357[b]**	**6.000**	**121.000**	**.000**	**.293**
	Wilks' Lambda	.707	8.357[b]	6.000	121.000	.000	.293
	Hotelling's Trace	.414	8.357[b]	6.000	121.000	.000	.293
	Roy's Largest Root	.414	8.357[b]	6.000	121.000	.000	.293

Table 28 reports a p-value of 0.00 which is less than the proposed alpha level of significance of 0.025, thus the null hypothesis ($H2_0$) can be rejected in favour of the alternative hypothesis

($H2_A$), thus there was a statistical significant difference between groups on the combined dependent variables. F(8.357) and p = 0.000.

5.4.3 Hypothesis 3 results

The null hypothesis ($H3_0$) stated that Consumers with high TRI do not/are not more likely to experience flow in a SST. The alternative hypothesis ($H3_A$) stated that consumers with high TRI are more likely to experience flow in a SST

Table 29 - Main effect for TRI split

Multivariate Tests[a]							
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
TRI Split	Pillai's Trace	.355	11.108[b]	6.000	121.000	.000	.355
	Wilks' Lambda	.645	11.108[b]	6.000	121.000	.000	.355
	Hotelling's Trace	.551	11.108[b]	6.000	121.000	.000	.355
	Roy's Largest Root	.551	11.108[b]	6.000	121.000	.000	.355

Table 29 reports a p-value of 0.00 which is less than the proposed alpha level of significance of 0.025, thus the null hypothesis ($H3_0$) can be rejected in favour of the alternative hypothesis ($H3_A$), thus there was a statistical significant difference between groups on the combined dependent variables. F(11.108) and p = 0.000.

Table 30 - Summary of hypotheses results

Null Hypothesis	Reject or do not reject	Conclusion
$H1_0$	Reject	Pillai's Trace value of .170, with a significance value of .001. This is less than .025; therefore, there is statistically significant difference and indicates that there is an interaction between TRI groups and grouped and ungrouped goals presented on a SST and the flow experience.
$H2_0$	Reject	Pillai's Trace value of .293, with a significance value of .000. This is less than .025; therefore, there is statistically significant difference and indicates that there is an interaction between TRI groups and grouped and ungrouped goals presented on a SST and the flow experience.
$H3_0$	Reject	Pillai's Trace value of .355, with a significance value of .001. This is less than .025; therefore, there is statistically significant difference and indicates that there is an interaction between TRI groups and grouped and ungrouped goals presented on a SST and the flow experience.

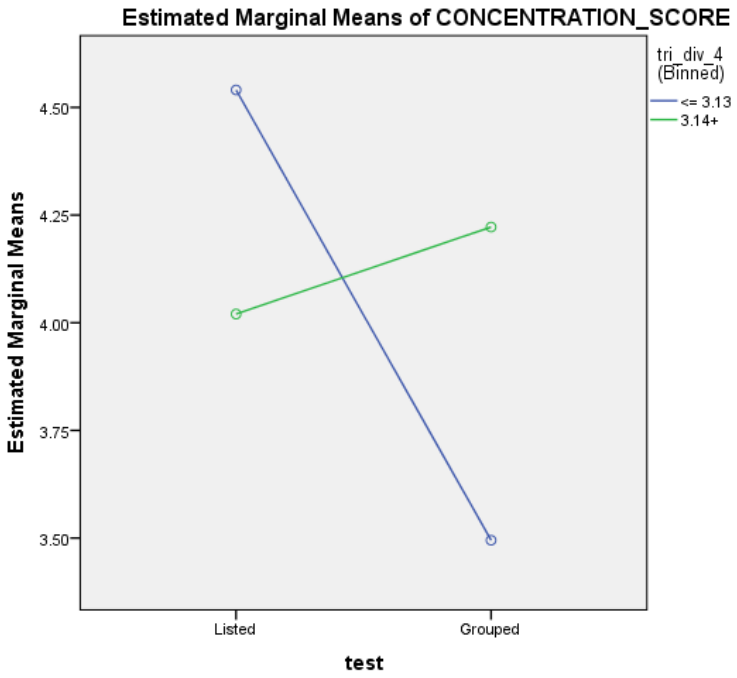
5.4.4 Marginal means of dependent variables

Hair et al. (2010) explains that when the differences between levels switch from one treatment to another, the interaction it's deemed as a disordinal interaction. If the effects of the treatment are not equal across all levels of treatment, it's deemed as an ordinal interaction. Lastly, if the effects of the treatments are in parallel across all levels of treatment, it's deems to have no interaction.

(1) Marginal means of concentration

Figure 9 indicates a disordinal interaction; this suggests that differences in test types on concentration have an opposite effect on the different TRI levels. In the test type listed items, the mean is much higher than with test type grouped. The opposite effect holds true for high TRI groups where test type has a lower margin than with grouped test type.

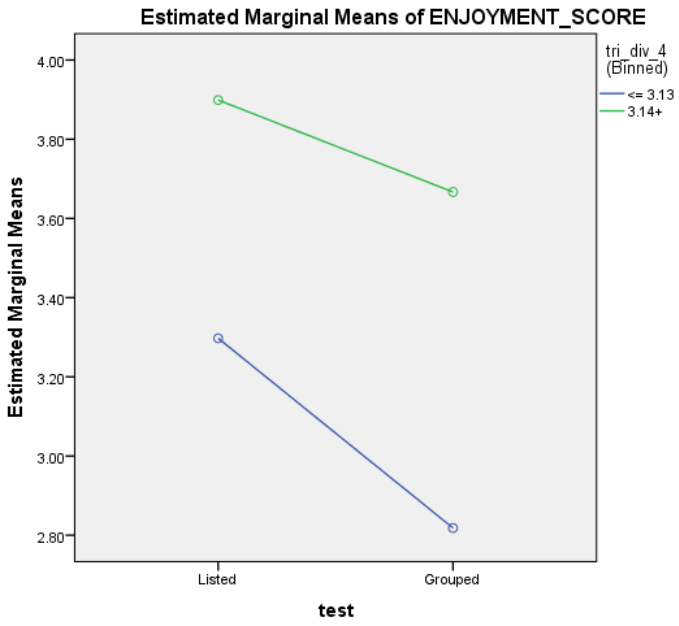
Figure 9 - Estimated marginal mean of Concentration



(2) Marginal means of enjoyment

Figure 10 shows that both the TRI levels (high and low) do not meet each other, suggesting no interaction and thus each treatment is consistent at each level. Low TRI tends to have higher means than high TRI for the same types of tests.

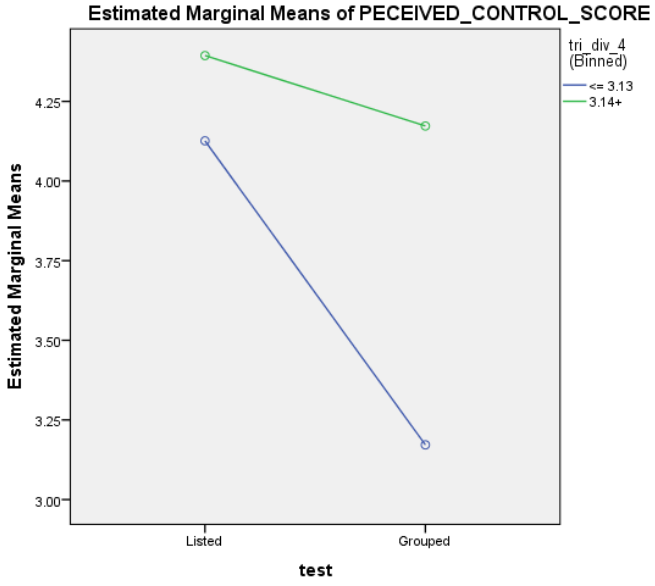
Figure 10 - Estimated marginal mean of Enjoyment



(3) Marginal means of Perceived Control

Figure 11 shows an ordinal interaction between TRI levels, suggesting a decline in perceived control for the two tests (from listed to grouped tests). The decline is much sharper with low TRI respondents than with high TRI respondents.

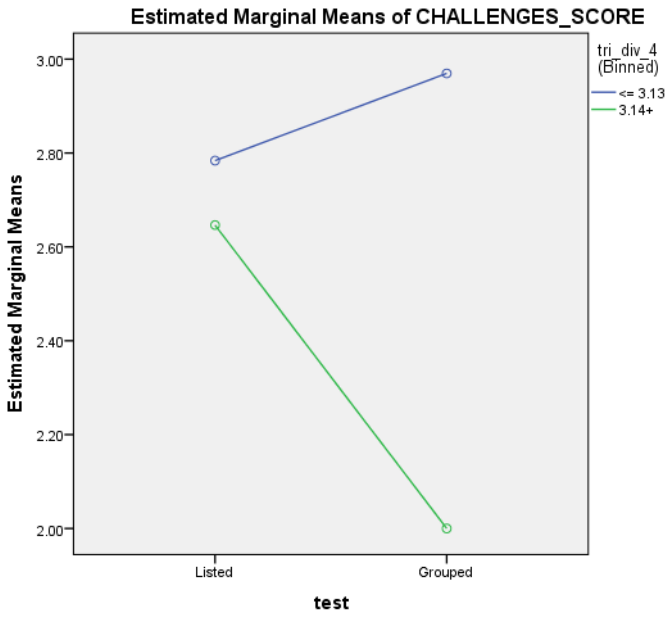
Figure 11 - Estimated marginal mean of Perceived Control



(4) Marginal means of challenges

Figure 12 displays a disordinal interaction between TRI levels for challenges. For low TRI respondents the mean of challenges are higher when presented with a grouped test type, the opposite is true for high TRI respondents.

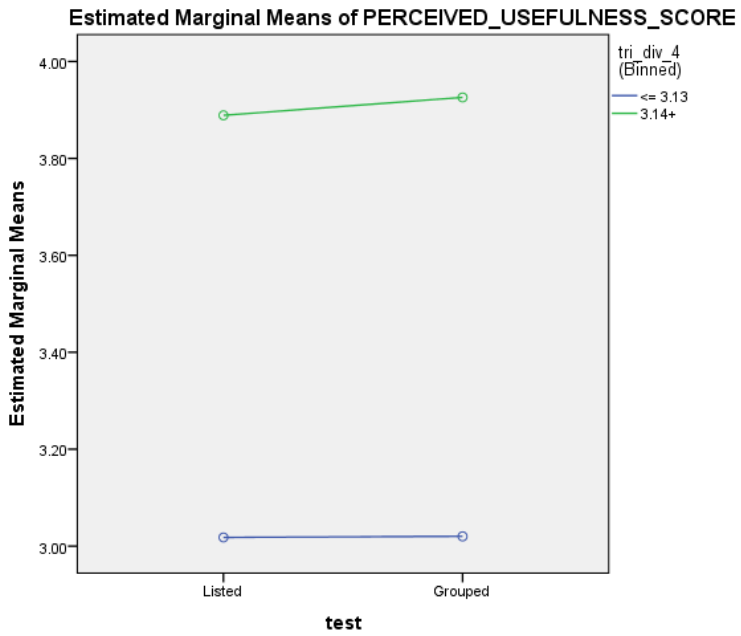
Figure 12 - Estimated marginal mean of Challenges



(5) Marginal means of perceived usefulness

Figure 13 displays a parallel between low and high TRI respondents for perceived usefulness, this suggests that there is no interaction between the different TRI respondents and the test type used.

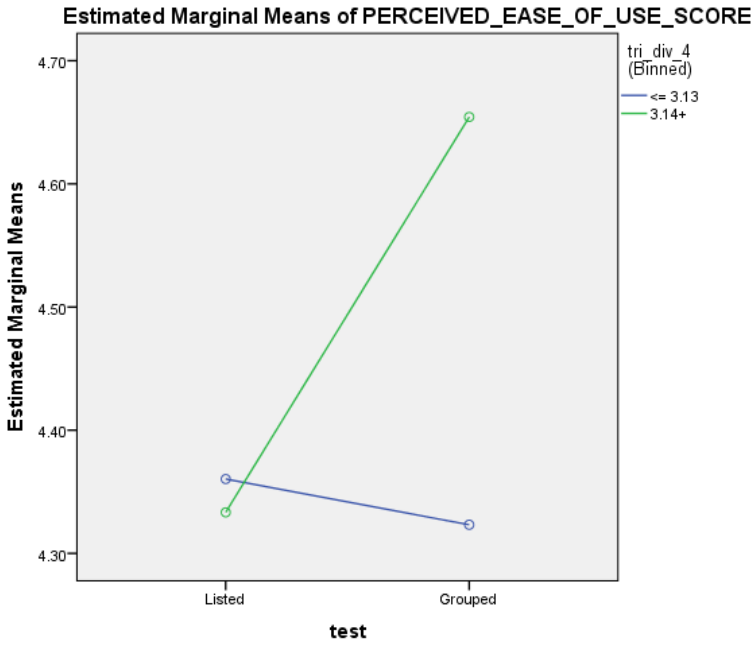
Figure 13 - Estimated marginal mean of Perceived Usefulness



(6) Marginal means of perceived ease of use

Figure 14 indicates a disordinal interaction between low and high TRI respondents for perceived ease of use.

Figure 14 - Estimated marginal mean of Perceived ease of use

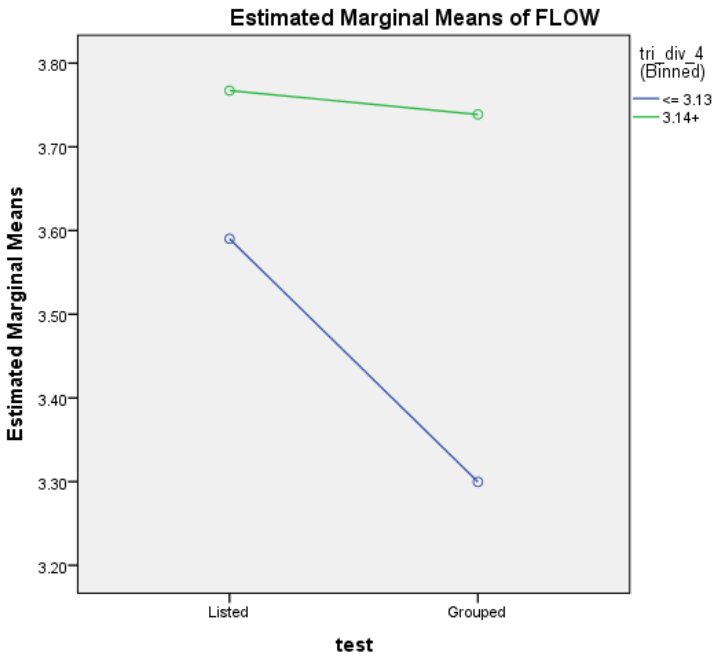


Low TRI respondents tend to have higher means for perceived ease of use within a grouped test type than with a list test type. The opposite holds true for high TRI respondents with a slightly lower margin for perceived ease of use in grouped test versus listed test type.

(7) Marginal means of perceived overall flow

Figure 15 shows an ordinal interaction between TRI levels, suggesting a decline in overall flow for the two tests (from listed to grouped tests). The decline is much sharper with low TRI respondents than with high TRI respondents.

Figure 15 - Estimated marginal mean of Perceived for overall flow



5.5 Conclusion

As demonstrated by Table 25, Table 26,Table 28 and Table 29 the independent variables does have an effect when evaluated as a whole, however, if evaluated separately, the independent variable by itself does not seem to have any significance.

CHAPTER 6: DISCUSSION OF RESULTS

6.1 Introduction

Based on the results presented in the previous chapter, this chapter discusses the implications of the results in terms of the hypothesis formulated in chapter 3. Each hypothesis contains a discussion on whether or not the hull hypothesis should be rejected, followed by a conclusion from each statement and a justification for each of the conclusions made. A summary of the results will be presented at the end of the chapter.

Due to some violations on assumptions of homoscedasticity in the sample a more conservative alpha value of 0.025 was used (instead of the traditional 0.05 value) with the MANOVA tests.

6.2 Research hypothesis 1

The dependent variables used for the MANOVA was based on Koufaris (2002). According to the author in order to measure flow successfully, the following dimensions need to be assessed:

- Concentration;
- Enjoyment;
- Perceived Control;
- Challenges;
- Perceived Usefulness; and
- Perceived Ease of Use.

An aggregate value of flow was created from the above variables and analysed with ANOVA.

To be in the flow state, the challenges and skills of that individual needs to be in equilibrium (Hoffman & Novak, 1996). As mentioned previously, the technology readiness index (TRI) is a measurement scale that asses the individual's skill in a computer mediated environment. It measures the propensity of an individual to accept new technologies for the execution of goals (Parasuraman, 2000).

The second set of independent variables was based on the chunking theory. Miller (1956) defines this as an activity of grouping information and by turning information into meaningful chunks, this increases an individual's short-term memory capacity. Chunking is a way of increasing the challenge level of interaction with the SST.

A set of instructions were asked to be performed, one sample had their functions grouped logically into a menu whilst a second group had their functions listed. The listed functions test the impact of having too many options to choose from. As mentioned previously, having too many options/services to choose from, can be overwhelming and thus lead to a decision paralysis and ultimately to dissatisfaction (Aaker, Leslie, & Robin, 2010).

The null hypothesis ($H1_0$) stated that there is no interaction between the technology readiness of a consumer, the grouped and ungrouped goals (chunking) presented on a SST and the flow experience of the consumer. The alternative hypothesis ($H1_A$) stated that there is an interaction between the technology readiness of a consumer, the grouped and ungrouped goals presented on a SST and the flow experience of the consumer.

The assumption of homoscedasticity was not satisfied (Box's M = 374.521, F(5.426), p= 0.000) therefore a more conservative alpha was used (0.025) and the results of Pillai's Trace = 0.170 F(4.137) and p = 0.001. This is less than 0.025 and therefore the null hypothesis can be rejected in favour of the alternative hypothesises, thus collectively there is a statistically significant difference and interaction between TRI groups and the different test types (grouped and ungrouped) goals presented on a SST and the flow experience. This outcome seems to be in line with the given theory.

Implications of a type I error is that there is no difference between the groups, that means in the context of this study that there would be no difference in the flow experience of respondents between menu options displayed on SSTs regardless of their TRI being high or low.

6.2 Research hypothesis 2

The null hypothesis ($H2_0$) stated that consumers are not more likely to experience flow in an ungrouped SST. The alternative hypothesis ($H2_A$) stated that consumers are more likely to experience flow in an ungrouped SST.

Perceived Control (p= 0.001) and Concentration (p=0.010) were the only dependent variables that were statistically significant (alpha = 0.025) by the type of test (grouped or listed) conducted.

The main effect of test type had more statistically significant variables (Perceived usefulness p= 0.00, Challenges p= 0.001, Perceived Control p= 0.000 and Enjoyment p= 0.000) suggesting that there is a difference between groups taking all the dependent variables into consideration, but when analysing on its own there is little significance.

Hence a conclusion can be drawn that respondents are likely to experience flow experience in a listed menu SST.

This outcome seems not to be supporting Aaker *et al.* (2010) statement about having too many options / services to choose from can be overwhelming and thus lead to a decision paralysis and ultimately to dissatisfaction.

Implications of a type I error is that there is no difference between the groups, this means that a listed menu option SSTs, is just as good as grouped menu one.

6.3 Research hypothesis 3

The null hypothesis ($H3_0$) stated that consumers with high TRI do not/are not more likely to experience flow in a SST. The alternative hypothesis ($H3_A$) stated that consumers with high TRI are more likely to experience flow in a SST.

Majority of the independent variables were statistical significant (alpha = 0.025) except for Perceived ease of use (p= 0.360) and Concentration (p= 0.520) by TRI split. The main effect of test type had more statistically significant variables (Perceived usefulness p= 0.00, Challenges p= 0.001, Perceived Control p= 0.000 and Enjoyment p= 0.000) suggesting that there is a difference between groups taking all the dependent variables into consideration.

This is further supported by the ANOVA test where the difference between subjects is also statistically significant (p= 0.032) for alpha = 0.05.

Hence a conclusion can be drawn that respondents will have difference in flow experience in a grouped or listed function set on a SST depending on their TRI level.

For this study a TRI split was calculated at 3.14 mean, thus TRI scores equal and lower than 3.13 was deemed as low TRI while a TRI higher than 3.14 was deemed as high TRI. The hypothesis seems to be supporting the TRI theory (Parasuraman, 2000) which will reflect the propensity to accept technology of an individual. The distinction between high and low TRI respondent is evident. It seems that there is greater variance in the flow variables on lower TRI respondents, than with high TRI respondents. In respects to the study it means that the impact of flow is greater with lower TRI respondents than with higher TRI respondents on SSTs.

6.4 Other observations

There were some other observations worth noting in terms of the results of the descriptive analysis of the sample. Looking at the total sample, skewness for the type of test (0.219) and TRI level (0.044) was evenly distributed. Ease of Use and Concentration was significantly skewed negative (-1.874 and -1.043 respectively) with a high mean of 4.41 and 4.03, yet the Enjoyment score was evenly distributed (Skewness = -0.137 mean of 3.38). The idea behind using different test types with different levels of TRI was aimed at manipulating these variables, yet it did not seem to have a significant effect on Ease of Use or Concentration. This would suggest that an external factor might have played a role during the test that could have impacted the results.

One suggestion could be that the simple user interface layout of the SST was simple and easy to understand, and that the only level of concentration needed was to look for an item on the menu. A more complex user interface could have altered the scores to be more in line with each other

From a reliability point of view it the score for Enjoyment affects the Cronbach's alpha severely and if deleted could cause the overall reliably to be below 0.7 (Score if deleted = 0.651).

An exploratory rotated factor analysis was performed to assess the scale's discriminant validity. A principle component analysis was used to estimate the factors, followed by a varimax rotation. The rotated factor solution retained two factors explaining 71% of variance in data. Factor one represented Perceived Control and highly correlated with Perceived Ease of Ease, Enjoyment

and Concentration. Factor represented Challenges and only correlated with Perceived usefulness.

6.5 Summary of research hypothesis conclusions

Conclusions	Implications
There are interaction effects between the TRI level of an individual and the type of test (grouped vs. listed) on the flow experience	Research hypothesis 1 is supported, which implies that the TRI level and the type of UI presented will have an impact on the flow experience of the customer.
Majority of the dependent variables were not statistically significant	Research hypothesis 2 is supported, which implies that experience flow with a listed / ungrouped menu option SST.
Majority of the dependent variables were statistically significant	Research hypothesis 3 is supported, which implies that a higher TRI respondent will experience flow with a SST.

The research results therefore indicates that TRI and the test type (structured vs. listed items) in combination have an interaction with flow, but when the elements of flow is tested individually the effects are minimal.

CHAPTER 7: RESEARCH CONCLUSION

7.1 Introduction

The main purpose of this research was to investigate the role of flow and chinking in SSTs. The research aims and objections were met in the conduct of this research. This chapter summarises the major findings of the research, discusses both the managerial and academic implications, indicate the research limitations, provides a guideline for the future research, and finally draws a conclusion.

7.2 Summary of research findings

This research aims to understand differences in evaluating flow in terms of TRI levels (high and low) and menu options displayed (structured/grouped and unstructured/listed) to the user on SSTs. Hoffman & Novak (1996) found that the flow construct is relevant to computer mediated environments and Hermida & Chipp (2005) demonstrated that this construct is present with SSTs as well. Businesses will endeavour to offer as many services as possible on SSTs and having too many choices can be overwhelming and thus lead to a decision paralysis (Aaker, Leslie, & Robin, 2010). On the other end of the scale having too little choice can also cause frustration and thus have a negative effect (Hoffman & Novak, 1996). This means that adding new services to SSTs or not having enough services available on SSTs can disturb the flow state of the customer using the SST.

A possible solution to cope with the problem stated above is to make use of logical grouping of services on SSTs. Miller (1956) suggests that by turning information into meaningful chunks, an individual can increase their short term-memory capacity. It can be argued that result of increasing short term memory capacity will lead to better learn-ability. Learn-ability is an important dimension in user interfaces, in that it promotes ease of use for a user to accomplish basic tasks the first time they encounter the design of the user interface (Nielsen & Hackos, 1993).

Furthermore, Hermida & Chipp (2005) found that there is a strong correlation between technology readiness (TR) and flow in SSTs. Chunking provides leverage on the number of options that can be presented to an individual (Miller, 1956) and there is a link between flow and chunking (Cowley *et al*., 2008). Various authors (Aaker *et al*, 2010; Hoffman and Novak, 1996) argue that the number of items has an impact on flow. Therefore this research aims to infer that

the technology readiness of an individual together with number of options (chunking) displayed on a SST, will have an impact on the flow experience.

The first hypothesis finds that there is an interaction effect on the dependent variables between the TRI level of an individual and the type of menu option displayed (listed vs. grouped). Secondly there is a main effect on the type of test presented to the user. And thirdly there was a main effect on the level of TRI. An aggregated flow variable supported the last hypothesis, the research finds that there is a huge difference in variance with lower TRI groups on the different flow variables. This variance seems to less with higher TRI respondents.

Factorial analysis concluded that there is a strong link between Perceived Control, Perceived Ease of Ease, Enjoyment and Concentration. Furthermore a Cronbach's alpha analysis that a lot of the data is reliability lies in Enjoyment and if removed could cause the overall score to be below 0.7.

7.3 Managerial Implications

SSTs are no longer deemed as a differentiator for business, but are an integral part of it. SSTs are available in almost every consumer driven sector, from banking to aviation to travelling. (Meuter, Ostrom, Bitner, & Roundtree, 2003). Research has highlighted that it is important to understand how customers experience SST as this has an effect on customer satisfaction that leads to customer retention and profitability (Meuter, Ostrom, Roundtree, & Bitner, 2000). Customers have differing levels of education and tolerance for advance technology. Thus it's important that businesses develop their SSTs knowing what technology limits exist and how they can market their services appropriately.

From a managerial perspective, channel product developers should pay close attention on how they design SST interfaces, especially when the idea is to serve a low TRI market. From banking context special care needs to be taken when adding new product features are added to ATM's. The study reveals that the high-end (high TRI) users are not prone to suffer from new changes or new structures in menu options in SST, and regardless of what options are available they will most likely experience flow.

However the same cannot be said from low TRI users and that special care needs to be taken when introducing or feature in that market. This is especially applicable in the remittance market in banking, whereby the complexity of regulation forces the banks to adhere to certain terms and conditions to be displayed to the customer when accepting or using a service, which does

not always, makes sense to a low end TRI customer. On top of this are the physical limitations of the SST that requires the channel developers to do things a certain way that could cause the flow experience to suffer.

It clear from the factor analysis that control is a major requirement in assisting flow, thus when designing a SST, control should always be considered in every step of the goal or action being executed on the SST.

The Enjoyment Cronbach's alpha recommends that if the experience is fun the chances are greater to experience flow. Gamification is a prime example of how to increase the enjoyment factor on a goal oriented service. Having a gambling game on an ATM seems like a far out idea, but would definitely drive enjoyment (and thus flow) when withdrawing cash at an ATM, even if the customer is a low TRI customer.

7.4 Academic implications

The study aimed to add to the body of knowledge about chunking and flow constructs in SSTs. It found that there are certain significant and positive effects between these constructs, and furthermore, the results highlight the importance of TRI of respondents when evaluating flow.

The literature review of the study reveals that there is a theoretical gap between the TRI level and chunking of menu options in SSTs and that there is little research in this respect.

7.5 Limitations

The limitations of this research can be describes as follows:

- The study results are not fully representative of the population of South Africa, the sampling was limited to a small population in the Gauteng area. Non probability sampling was used, but the results cannot be accurate due to the unrepresentative sample.
- The study is limited to the limitations of the technology readiness index, other means of defining / detecting propensity for technology is available.
- Chunking is tested at a single depth level, if more complex structures can change the outcome of the results.
- This study was limited to the SSTs only, other means of computer mediated environments could have yielded other results.

7.6 Guidelines for future research

In terms of the research limitations and results, future research should be conducted to as per the list below:

- Future research could be undertaken amongst more South African consumers. The composition of high and low TRI respondents should be well balanced in the sample, which would be more representative if the population.
- Different definition of technology readiness should be explored and researched. Only when a list of different types of technology readiness studies exist will there be a true reflection of the impact of flow on chunking.
- Future research could look into the occurrences of flow during SST interactions and identify specific factors which cause people to experience boredom and anxiety instead of flow.
- The number of items that can be chunked can be tested by further exploring the limits of flow by creating more sub menu like structures and test at what level flow gets disrupted.
- Chunking is a grouping concept that could be impacting control further studies should be taken to confirm this.

7.7 Conclusion

Based on the above discussion, this research concludes that chunking plays a role in the flow experience on SSTs and is more applicable on certain types of individuals than others. High TRI consumers are more likely to experience flow than low TRI consumers. The negative effects on higher TRI respondents has a much lower outcome on flow than with low TRI respondents, therefore special consideration is needed when designing SSTs for low TRI consumers.

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Appendix A (General and TRI questionnaire)

Section A General Information			Scale			
Secion	Question					
A1	1	Age		18-29	30-39	40-49	50+
A2	2	Gender				Male	Female
A3	3	Education	University >= 3 years	University < 3 years	Secondary Schooling (Matric)	Primary Schooling	Other
A4	4	Job Classification		Skilled	Management	Professional	Other

Section B - Familiarity with banking			Scale			
Secion	Question	Strongly Agree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
B5	5	How many times do you bank per month	0	1-5	6-10	11-15	16+
B6	6	What is your primary channel for banking	None	Branch	ATM	Internet	Mobile

Section C - TRI Optimism			Scale			
Secion	Question	Strongly Agree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
C7	7	Technology gives people more control over their daily lives.				
C8	8	I feel confident that machines will follow through with what you instructed them to do				

Section D - TRI Innovativeness			Scale			
Secion	Question	Strongly Agree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
D9	9	Other people come to you for advice on new technologies.				
D10	10	It seems your friends are learning more about the newest technologies than you are.				
D11	11	You are always open to learning about new and different technologies.				

Section E - TRI Discomfort			Scale			
Secion	Question	Strongly Agree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
E12	12	I find that technology designed to make life easier usually has disappointing results				

E13	13	Technical support lines are not helpful because they don't explain things in terms you understand.

Section F - TRI Insecurity		Scale				
Secion	Question	Strongly Agree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
F14	14	You do not consider it safe to do any kind of financial business online or on mobile				
F15	15	Any business transaction you do electronically should be confirmed later with something in writing.				
F16	16	New technology makes it too easy for governments and companies to spy on people.				

Table 31 - Note:Sections C to F comprise the Technology Readiness Index which is copyrighted by A. Parasuraman and Rockbridge Associates, Inc., 1999. This scale may be duplicated only with written permission from the authors.

Appendix B (Layout for banking SST grouped and ungrouped versions)

Step 1	Step 2	Step 3	Step 4
Banking	Find ATM/Branch Map		
	Calculators	Financial Loan Calculator	
		Financial Vehicle Calculator	
	Balance	Balance for Account Savings Account	
		Balance for Account Cheque Account	
		Balance for Credit Card	
	Pay	Recipient	Pay recipient - Municipality
			Pay recipient - Utilities
			Pay recipient - School
		Pay once off to account	
	Transfer	Transfer money from Cheque to Savings Account	
		Transfer money from Savings to Cheque Account	
		Transfer money from Cheque to Credit Card	
	Stop Debit Order	Stop debit order - Insurance	
		Stop debit order - Policy	
Buy	Airtime	Buy Airtime	
		Buy Bundles	
	Buy electricity		
	Buy funderal cover		
	Buy lotto		
Prepaid	Airtime	Buy Airtime	
		Buy Bundles	
	Buy electricity		
	Buy funderal cover		
	Buy lotto		

Pay	Recipient	Pay recipient - Municipality
		Pay recipient - Utilities
		Pay recipient - School
	Pay once off to account	
Transfer	Transfer money from Cheque to Savings Account	
	Transfer money from Savings to Cheque Account	
	Transfer money from Cheque to Credit Card	
Settings	Purchase limit settings	
	Transfer limit settings	
	Payment limit settings	
	Change pin	

Step 1	Step 2	Step 3
Find ATM Map	Input	Results
Find ATM/Branch Map	Input	Results
Financial Loan Calculator	Input	Results
Financial Vehicle Calculator	Input	Results
Balance for Account Savings Account	Input	Results
Balance for Account Cheque Account	Input	Results
Balance for Credit Card	Input	Results
Transfer money from Cheque to Savings Account	Input	Results
Transfer money from Savings to Cheque Account	Input	Results
Transfer money from Cheque to Credit Card	Input	Results
Pay recipient - Municipality	Input	Results
Pay recipient - Utilities	Input	Results
Pay recipient - School	Input	Results
Pay once off to account	Input	Results
Stop debit order - Insurance	Input	Results
Stop debit order - Policy	Input	Results
Buy Airtime	Input	Results
Buy Bundles	Input	Results
Buy electricity	Input	Results
Buy funderal cover	Input	Results
Buy lotto	Input	Results
Purchase limit settings	Input	Results
Transfer limit settings	Input	Results
Payment limit settings	Input	Results
Change pin	Input	Results

Appendix C (Flow questionnaire)

Section G - Concentration			Scale				
Secion	Question		Strongly Agree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
G73	73	I was absorbed intensely in the activity					
G74	74	My attention was focused on the activity					
G75	75	I concentrated fully on the activity					
G76	76	I was deeply engrossed in the activity					

Section H - Enjoyment			Scale				
Secion	Question		Strongly Agree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
H75	75	I found this SST interesting					
H76	76	I found this SST enjoyable					
H77	77	I found this SST enjoyable					
H78	78	I found this SST fun					

Section I - Perceived Control			Scale				
Secion	Question		Strongly Agree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
I79	79	I felt confused					
I80	80	I felt calm					
I81	81	I felt in control					
I82	82	I felt frustrated					

Section J - Challenges			Scale				
Secion	Question		Strongly Agree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
J83	83	This SST challenged me to perform to the best of my ability					
J84	84	This SST provided a good test of my skills					
J85	85	this SST stretched my capabilities to the limits					

Section K - Perceived Usefulness			Scale				
Secion	Question		Strongly Agree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
K86	86	I find using this SST useful					
K87	87	Using this SST makes me save time					
K88	88	Using this SST makes improves my efficiency					

Section L - Perceived Ease of Use			Scale			
Secion	Question	Strongly Agree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
L89	89	Learning to use the SST would be easy for me				
L90	90	My interaction with the SST is clear and understandable.				
L91	91	It would be easy for me to become skillful at using the SST				
L92	92	I would use a SST like this in future				