UNIVERSITY OF CINCINNATI

Date: 31-Mar-2010

I, Mitul Dasgupta, hereby submit this original work as part of the requirements for the degree of:

Master of Design

in Design

It is entitled:

DESIGN AGAINST STRESS:

Design’s methodological approach of dealing with the issue of stress

Student Signature: Mitul Dasgupta

This work and its defense approved by:

Committee Chair: Craig Vogel, MID

Craig Vogel, MID
DESIGN AGAINST STRESS
Design’s methodological approach of dealing with the issue of stress

A thesis submitted to the Graduate School
of the University of Cincinnati

In partial fulfillment of the
Requirements for the degree of

MASTER OF DESIGN

In the School of Design
Of the
College of Design, Architecture, Art, and Planning
2010

By

Mitul Dasgupta

Bachelor of Fashion Design and Information Technology
National Institute of Fashion Technology (NIFT)
New Delhi, India, 2003

Committee: Craig Vogel, MID (Chair)
Sean Sauber, MBA
Phyllis Borcherding, MS
ABSTRACT

Statistically stress is a major health issue in North America. It ought to be considered not only as a medical issue but also social. The need is to have the ability to reduce stress in any way possible or try not to induce it further, at least in this consumerist society. This thesis discusses what could be design’s role in handling this issue. The approach incorporated is that of stress checking. It talks about trying to make products and services less stress inducing by considering stress as an important factor. Mostly any New Product Development (NPD) process includes basic design research, conceptualization, ideation and base level consumer testing before it is ready for mass production and market retail. However in this process flow, the concern about checking for un-thoughtful stress inducers is not there. There isn’t much at present that ensures reduction or elimination of stress. Now the psychological (mental state and emotional responses) and physiological (physical changes/discomfort levels) stresses are the two aspects that could be a consideration for the design of less stress inducing products. In this thesis, some existing stress measuring tools are analyzed to check out the viability of their usage in the design process and the adaptability in industry/real life setting. Consequently the comparative deductions lead to choosing of psychological aspect of stress. This is seen as the potential direction for furthering this research due to factors of industry validation, return of investment and a more holistic approach. The need to incorporate the added step of stress checking to quantifiably reduce induced stress is identified, illustrated and necessary arguments are provided. The plausible potential answer is suggested through concept of a methodology / mechanism or tool – The Stress Check Mechanism (SCM). Depending on the kind of the product to be tested, this mechanism should be able to assess the potential problem in that product with the help of product related questions, feedback and task analysis, a standard stress state questionnaire (Dundee stress state questionnaire) etc. It can try to fit in any part of the NPD process, benchmarking, or upgrading process in the industry. Consequently if and when researched and developed further it can prove beneficial in giving options that the industry could potentially use.
I would like to thank my thesis chair, Professor Craig Vogel, for all his help and guidance as an extremely valuable mentor for this thesis. I would especially like to give thanks to Sean Sauber, my committee member and faculty with the college of business for his full support and guidance throughout the research process. This thesis wouldn’t have taken the shape that it has without his help and expertise in the area of design research and knowledge generation. I am also very grateful to Professor Phyllis Borcherding, who has been a helpful guide throughout my graduate education. I am especially very grateful to Dr. Gerry Matthews from the Department of Psychology, Teachers College-University of Cincinnati for his invaluable contribution in sharing his research interests and findings with me. I thank him for being kind enough to allow me to use the DSSQ for the tool implementation and usage which helped me in my thesis argument. Last but not the least; I would like to acknowledge the School of Design for giving me this opportunity to work on my research. I would also like to thank all my fellow classmates and friends over the years here at the University. Without the help and support of all these individuals, this research work would not have been possible.
# TABLE OF CONTENTS

## CHAPTER 1) Design adds stress: Design that doesn’t comply……………………………………………………………. 1

1.1) Design’s and its role........................................................................................................................................... 1

1.2) Bad Design Examples.....................................................................................................................................1

1.3) Why Should Designers care..........................................................................................................................8

   1.3 (a) Stress is a societal issue: A big one........................................................................................................8

   1.3 (b) What next: Approaching the issue........................................................................................................11

1.4) Takeaways ....................................................................................................................................................11

## CHAPTER 2) Stress added in society through design: It needs to stop.............................................................12

2.1) Stress is not explicitly called out in the Process..........................................................................................12

2.2) An Existing Product Example ....................................................................................................................12

2.3) The NPD Process And What It Means In This Context ..............................................................................13

2.4) What is Missing............................................................................................................................................16

2.5) Takeaways....................................................................................................................................................16

## CHAPTER 3) Need for a measure to check stress............................................................................................17

3.1) Proposal and need for such a mechanism.....................................................................................................17

3.2) Analyzing the field: The Physiological and Psychological........................................................................17

   3.2(a) Physiological Stress Measures ................................................................................................................17

   3.2(b) Psychological Stress Measures ................................................................................................................20

3.3) Post Analysis: The Better Direction Is Psychological Over Physiological..............................................22

3.4) A Stress Checking Tool and Methodology Needs to be developed in the Future.......................................24

3.5) Takeaways ....................................................................................................................................................26
CHAPTER 4) Potential suggestions for such a mechanism .................................................................27

4.1) The Elements under Consideration .......................................................................................27

4.2) A Stress Check Mechanism: Part by Part ............................................................................27

4.2 (a) Part1: DSSQ- Stress Measurement Tool .........................................................................28

4.2 (b) Part2: Product Task Questionnaire + Observational /Ethnographic method.................29

4.3) Real world example and actual test samples ......................................................................30

4.4) The Sequence of running the Stress Check Mechanism .....................................................34

4.4 (a) The Dundee Stress State Questionnaire .........................................................................34

4.4 (b) DSSQ 3 State Questionnaire: Pre Task .........................................................................35

4.4 (c) The Product Task Questionnaire .....................................................................................36

4.4 (d) DSSQ-3 State Questionnaire: post-task questionnaire.....................................................37

4.4 (e) Making the SCM more actionable for designers: different levels..............................38

4.4 (f) The observational / ethnographic approach at two stages .............................................38

4.5) Final step for SCM: The Results and Observations ...............................................................42

4.5(a) The DSSQ Part: Data Collection and Analysis .................................................................42

4.5(b) The DSSQ Result Analyzed .............................................................................................43

4.5 (c) The Product Task Questionnaire And Observational/Ethnographic Method ............45

4.6) Final Analysis: Gist of The Results and Observations of this SCM in totality .................45

4.7) Takeaways ............................................................................................................................49

CHAPTER 5) Part of the Process: The Full Scope .........................................................................50

5.1) The Full Scope: Putting In Context for Maximizing Potential ............................................50

5.2) SCM Incorporated: Putting It in the Broader Perspective ................................................51

5.3) Argument for Business ........................................................................................................53

5.4) Takeaways ............................................................................................................................54
CHAPTER 6) Conclusions

6.1) Summarization of the stress issue and its design solution

6.2) Final Takeaways

7) Appendix

A) Biofeedback Device Table

B) Paired sample T-test example

C) t-statistics table calculations 1) Wal-mart and 2) OXO respectively

D) Case In Point: Working through the Present NPD process with a design example (for Ch. 3)

8) Bibliography
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>8</td>
<td>24</td>
</tr>
<tr>
<td>9</td>
<td>27</td>
</tr>
<tr>
<td>10</td>
<td>28</td>
</tr>
<tr>
<td>11</td>
<td>28</td>
</tr>
<tr>
<td>12</td>
<td>29</td>
</tr>
<tr>
<td>13</td>
<td>29</td>
</tr>
<tr>
<td>14</td>
<td>32</td>
</tr>
<tr>
<td>15</td>
<td>33</td>
</tr>
<tr>
<td>16</td>
<td>34</td>
</tr>
<tr>
<td>17</td>
<td>39</td>
</tr>
</tbody>
</table>
18 Task analysis and observation part 1

19 Task analysis and observation part 2

20 Diagram representing correlation between design issues and stress dimensions
   in this example

21 Design Direction from SCM created from test results of the Wal-Mart travel mug

22 Design Direction from SCM created from test results of the OXO Liquiseal® travel mug

23 Diagram showing the suggested phase in the NPD process for placing the SCM

24 Placing the SCM for maximizing potential for different product areas in the market

25 Full Scope table showing where SCM can be placed in the industry with example
   of the travel mugs

26 A condensed view of SCM as standalone and as placed in the full scope of NPD
<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The main takeaway points of chapter 1-Design adds stress</td>
</tr>
<tr>
<td>2</td>
<td>The 4 phases of the integrated New Product Development process by Cagan &amp; Vogel</td>
</tr>
<tr>
<td>3</td>
<td>The main takeaway points of chapter 2: Stress is added in society through design</td>
</tr>
<tr>
<td>4</td>
<td>Comparison between different tools to gauge the best fit to incorporate in the stress checking methodology</td>
</tr>
<tr>
<td>5</td>
<td>Main takeaway pointers for chapter 3: Need for a measure to check stress</td>
</tr>
<tr>
<td>6</td>
<td>The Dundee Stress State SSHORT Pre Task Questionnaire</td>
</tr>
<tr>
<td>7</td>
<td>The Product Task Questionnaire comprising of (3) design and performance related tasks</td>
</tr>
<tr>
<td>8</td>
<td>The Dundee Stress State SSHORT Post Task Questionnaire</td>
</tr>
<tr>
<td>9</td>
<td>The Scoring table of DSSQ’s Pre and Post Task Questionnaire</td>
</tr>
<tr>
<td>10</td>
<td>The calculated values of engagement, distress and worry for the Wal-Mart and OXO Liquiseal</td>
</tr>
<tr>
<td>11</td>
<td>The T-values and significance values of the 2 mugs through SPSS paired sample T-tests</td>
</tr>
<tr>
<td>12</td>
<td>Areas where appropriate action can improve the design/usability of the respective mugs</td>
</tr>
<tr>
<td>13</td>
<td>Main takeaway pointers for chapter 4: Introducing the mechanism</td>
</tr>
<tr>
<td>14</td>
<td>Main takeaway pointers for chapter 5: Part of the iNPD process</td>
</tr>
<tr>
<td>15</td>
<td>Few Main takeaway pointers for thesis summarization</td>
</tr>
</tbody>
</table>
CHAPTER 1
DESIGN ADDS STRESS

DESIGN THAT DOESN’T COMPLY

1.1 Design’s And Its Role:

Design is meant to improve the lives of people. To create things that would make life easier for people. Nevertheless this doesn’t seem to be true all the time. Functionality is a realm that design is generally associated with but it is not the only attribute. The aesthetic aspect of a product, its touch and feel are as important to people. The behavioral and emotional aspect to design has grown in importance over the years. Designers try to think holistically to help them help people find that connection and value in their designs. In view of the fact that function comes first and foremost, the product must fulfill the needs it is expected to meet. As pointed out by Donald A. Norman of the book-Emotional Design and Design of everyday things, badly conceived design leads to lot of frustration and objects that result out of that have their own lives and they refuse to obey. This builds up irritations in people which have no excuse. In such cases the eventual stress caused is not due to the fault or incompetence of the user but the design. Good design should be expected to be human centered and find unarticulated needs that would go on to become a necessity in the future, e.g. cell phones, cup holders in cars etc.

However designers may sometimes forget that their actions and efforts, if not well thought out and executed, could lead the consumers into stressful situations. Designed products are supposed to enable people, but sometimes, something quite the opposite happens. The irony is that the end user starts to live with and adjusts to this. Following are some examples spread over various areas that show few things that try to be fruitful in one area but end up being a cause of concern in the others.

1.2 Bad Design Examples

Designed Medical Stress

In general, medical instrument design is expected to make things easier for the practitioners and their
patients. However, due to reasons of cultural issues, cost effectiveness amongst other things, it can prove to be the cause of stress in some areas. Sometimes due to targeting one section of the audience and completely neglecting the other in the end design delivered, high tech designs lead to stress. Such an example in the medical field is the Full body MRI scan machines. It is one of the most accurate and non-invasive procedures available to obtain images of the body. It proves to be useful for the doctors and specialists, but misses to keep in mind the ease of the patient.

‘During an MRI, the patient is positioned on a cushioned table that slides into a tube-like machine. In a typical MRI machine, the top and sides of the tube are only eight to 10 inches from the patient’s body and face. Once inside, patients must lie still during the exam, which can take anywhere from 30 minutes to an hour – a lifetime if you’re afraid of being enclosed in a tight space’. (Ask the Doctor - MRI Claustrophobia, 2006)

This stressful situation went on for some time, before the design researchers came up with a design solution for it in the form of Open MRI. An Open MRI has no sides, so the patients are not fully enclosed in a tube. They can move their arms or turn their face if it is necessary. It was also understood, that those patients who do not suffer from claustrophobia also found an Open MRI preferable to a closed machine. (Ask the Doctor - MRI Claustrophobia, 2006). Since patients are the ones who are the most affected, the need here is to give them a choice. The choice being that of a tradeoff between 100% accuracy in the traditional MRI procedure or of the less stressful experience of an Open MRI with less than 100% accuracy. If such choices are made available to the patients from the very beginning itself, then many people who have claustrophobia would get tested and not be stressed out. They ideally would have early diagnosis of their conditions which is more helpful

**Designed Banking Stress: Automation Transition**

‘The ATM machine came in to use in 1970 in the United States. “The literature shows that older adults have problems with and do not use new forms of automated technology such as ATMs, video cassette recorders and computers, despite a strong desire to do so,” - Richard Sit, a doctoral student conducting aging research at Georgia Tech in Atlanta.’ (Crowell, 97)

The Automatic teller machines are a bankable way to withdraw money. However some recent studies have shown that they’re not as easy as the banks would have people believe. Because of the lack human
interaction, there is less confidence in people, especially the older adults and they can find it confusing and intimidating. This leads to obvious yet unnecessary stress. For example when people get confused with their pins or are not as quick. The stress of performing for the person waiting in line after them adds to their stress. Generally tests are done to see the stress taking capacity of the machine itself in terms of the software that run it, the interface, the processing time etc. and of how well it can take on wrong numbers, pins, inaccurate information etc. However it is not common to see the makers taking the psychological stress aspect of the people–machine interaction into consideration before designing. Researchers from Georgia Tech University hope that their information about the older people and the statistics would help prompt the banks to have some sort of customer training to help them use the machines as well as improving on the present design through more informed designers.

**Designed Media Stress: Information or Scare**

Media is there to inform people about the happenings in the world. However, when they take this job and mishandle it, it becomes a source of stress. A classic example is the 9/11 media coverage all over the United States.

“Repeated viewing of horrific images may result in increased levels of stress and trauma in the general population as watching television replaces talking with others about such events, these undesired consequences may be amplified. In light of these findings, news broadcasters might consider whether repetitious broadcasting of traumatic images is actually in keeping with their goal of serving the public.” - Ruth Propper, PhD, an Associate Professor of Psychology at Merrimack College in North Andover.

**Designed Product Stress: Good for One, Problem for Others**

The case in point here is the design of childproof medicine caps. Those are safe for preventing the children from using it, but on the other hand, they have been designed in such a way that even adults, especially the ones with any arthritis conditions or old age problems, find it a stressful task to take their daily pills. So when the designers don’t pay attention to the detail, people start coming up with their own solutions to live and deal with the issue. For example, there is a website that deals with the issue of showing how to open the child proof bottles, through all the tricks in the book they can think of.
It showcases how people have accepted un-thoughtful design and thinking of problem solving themselves. Clearly this should be the task of a designer.

Figure 1: This picture and description below tells the stressful story of websites coming up with home-made ways for opening medicine bottles. (Instructables)

‘The Consumer Product Safety Commission has exempted an arthritis drug from packaging requirements that make container caps difficult to remove. Dexterity: Difficulty opening bottles, inability to break tablets, problems handling medicines such as eye drops, inhalers for asthma and other lung disease, and insulin injections. These problems are common for people with arthritis and certain types of disabilities. Large, easy-open bottle tops are available for prescription medicines.’ (Kathleen A. Cameron, 2004)

So finally a solution to reduce the stress associated with this daily issue and the rising problem was found. Patented technologies and other criteria’s have made this issue come into forefront a bit more than it used to, and so now drugstores are selling bottle caps of two varieties, which would have less stressful impact on the consumer. Evidently here, something which was meant to do good, like preventing children from swallowing potential dangerous medication, led to a stress situation amongst adults who were unable to open this cap, due to arthritis or any other such medical condition. It helped here that the designers tried to design for all. This is a good example of design intention being right for one segment, but causing stress in the other. Holistic thinking is very important which is what led to the better design option of two cap choices.
**Designed Product Stress: Where User is Not Important**

Stress can also be generated through product design, especially when the user is not kept under consideration.

‘Sam's Club® Moves To New Milk Container- A square shaped gallon that represents a packaging change consistent. Today’s new square or case-less milk jugs does not require crates or racks for shipping and storage. At a time when the impact of food inflation appears on every grocery receipt, the new case-less jug also delivers a cost savings of 10 to 20 cents.’ (Room, 2008)

![New designed containers](image-url)

**Figure 2**: New designed containers depicting difference in milk packaging norms. (Source website: www.sustainableisgood.com)

According to the designers and the manufacturers, it’s thought of as a package that provides environmental and health benefits and costs less. However as brought forward in a design research site by Sam Ladner (Ladner, 2008), it has lots to be yearned for. For example, it’s pointed out how the jugs have no real spout, and their unorthodox shape makes consumers feel like novices at the simple task of pouring a glass of milk. Things like this could probably give people the sense of helplessness or incompetence and induce stress. Nevertheless since the industry saves money on shipping costs, the design has reason to be launched. Basically it can potentially stress out the user with its design failings and the benefits of the product don’t seem to alleviate any of those. This can be seen as misplaced design directives that lead to innovations in one area causing concerns in the other. This is a case of choosing the tradeoff between cost saving or consumer satisfaction.
**Design Interface Stress:**
The SAP design guild (a website which offers its interface design tools and methods to the user interface community at large) talks about ‘mindless or careless’ design and how user Interfaces nowadays work with the anti-simplification mode. It means purposefully making something complex and as a result, less intuitive. One of the examples that can relate to making life more stressful for the user is in the realm of control buttons in user interfaces, especially since the user’s interaction with control buttons is a very old established behavior. A control is referred to as object representing the interface to the software that lies underneath. Therefore like in the figure below, if the expectation of a hand which denotes clickable, doesn’t show up and instead there is a cursor, people would surely be confused whether they are doing the right thing. It would have defied the logic of obvious reasoning and learned expectations.

![Figure 3](image.png)

**Figure 3:** Image showing different cursor/pointers to the same function of a button. On the left, the button control with an I-bar cursor, on right the same button control with the hand cursor (Esther Blankenship, 2003)

**Design Banking Stress:** Stress examples can be shown in the realm of service design as well. Like Banks and their transactions which generally lack in the area of good innovative design. Big multi-corporation banks can tend to not regard their transactions with their clients at a personal level. This especially stands out in their talks about retirement plans and lifelong earning investments of the customers. It requires certain sensitivity and the banks fail to show it. The discussions about their future feel impersonal and dry to them. There are confusing forms, impersonal financial advisors, unpleasant and complex personal data that need to be filled out, unknown terminology and intimidating surroundings etc. Finances and worrying about money has always been an uncomfortable dynamic. As a result, if the banks make a more conscious effort to design their services and products, it might help reduce the
tension and make it a less stressful exercise. This would lead to having more satisfied customers and possibly more profit. This can only be done if the banks are more emphatic and try harder to reduce stress from the user’s perspective.

**Figure 4**: Designed Stresses- Social, Medical, Product, Service/banking
1.3 Why Should Designers Care?

- Stress is a big social problem.
- People are looking for stress free lives and are prepared to work towards achieving it.
- Design as a field doesn’t need to add to this existing problem.

Stress is a major problem in society today and is of major social relevance. The impact it has on various areas in society is something that can be seen. The plan should be to identify the opportunity areas that may exist and then check for the possibility of design to step in. Socially responsible design is growing as an area to be looked into. The major causes for stress in America and supporting statistics serve as a benchmark that show the opportunity gaps that can be used in focusing any remedial solutions for the future. (American Psychological Association, 2007)

1.3 (a) Stress Is A Societal Issue: A Big One (American Psychological Association, 2007)

Stress Across The Board: Inferences And Suggestions Drawn From Statistics Available:

- The statistics point towards the need to channelize efforts in the workplace arena as a priority.
- Women experience more stress than men, report more physical symptoms of stress and are more likely to think they manage their stress poorly and willing to try out things to improve wellbeing. In the stress reducing product market. Targeting women can provide a bigger potential to succeed.
- Those with lower incomes manage their stress in less effective ways and are more likely to report physiological and psychological symptoms of stress.
- Those working in the education and health services industries experience higher than average levels of stress.
- The sandwich generation (ages 35-54) is known to be m the most stressed, but younger people encounter the more negative consequences of stress. Energy can be focused on tapping the young professional market segment as it has good business potential.
Young and school-aged children are a major source of stress. So channelizing stress reduction efforts for nipping by designing programs or social initiatives that involve the parents in the stress health and mental wellbeing of their children. This can prove beneficial.

The medical field, demographic differences, banking industry, educational institutes or alternative lifestyle choices of health and wellness etc. provide for the other segments that are stressed out. (American Psychological Association, 2007)

---

**Figure 5: Identifying statistics and inference: Stress as a social problem**

The above diagram incorporates the statistics from various areas in society and points out the opportunity areas by drawing inferences from the current situation of stress and society.
Alternative /New Ways of Dealing with Stress: People looking towards stress free existence

People nowadays are adapting to newer, diverse, intercultural, innovative and alternate approaches to stress reduction. Alternative therapies have become huge. People have started believing in things like the Chinese practice of qigong that uses chi or energy to heal sickness as being actually more effective than the traditional methods for detoxification. Laughter therapy which originated in India is another alternative form of tension releaser and health booster that originated in India and is steadily becoming popular. Laughter is found to lower blood pressure, reduce stress hormones, increase muscle flexion, and boost immune function. It produces disease-destroying antibodies. ‘Laughter also triggers the release of endorphins, the body’s natural painkillers and produces a general sense of well being’. ((AATH), 2007) On the other hand there are more and more consumers who receive massage therapy and use it for stress relieve. Massage aids in blood circulation and lowering of blood pressure, reduction in fatigue, increased restfulness of sleep, and increased sense of well being and elevated mood. Another example of one of the major signs and symptoms of stress is the issue of Insomnia and depression. Some of the prevalent neurological disorders in the U.S, with about one-half of the adult population reporting trouble sleeping a few nights for week or more due to insomnia and depression being a relatively major cause of stress of the mind. People try to better it with use of sleep therapy. Environmental escapades, relaxation therapies, self-esteem- enhancing books etc. are examples that show the seriousness in people to deal with stress issues albeit taking an unconventional route. The above facts throw light into a few directions that design companies can take into account for gauging the variety, behavior and adaptability of their market.
1.3 (b) What Next: Approaching the Issue

All the above examples coerce one to think about what kind of intervention is needed to stop this. Consider the need in the product development or the design process. The requirement is of trying to make everyday products intuitive and not adding on to the stress of everyday life. The human factors and ergonomic issues being considered in the design process have surely helped. However the objects and services that cause stress cannot just be identified through them alone. Be it the physiological or the psychological aspect, stress or lack of it has seldom been looked at as a design attribute in the design process. So when design and stress are taken and an attempt is made to put them together, the solution is plausible in the realm of keeping a check on stress inducers and designing products and services that don’t make people stress so much.

1.4) Takeaways:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Design’s role has traditionally meant to help people, but there are examples of products and services in the market, there seem to be a role reversal- Design causes stress</td>
</tr>
<tr>
<td>2</td>
<td>Stress is a societal issue: this inference can be drawn from available and published statistics.</td>
</tr>
<tr>
<td>3</td>
<td>There are many design problems in products that can be corrected simply through taking some very basic design suggestions into account.</td>
</tr>
<tr>
<td>4</td>
<td>People want to find ways of solving the problem of stress that affects their lives and are willing to try new things to be able to prevent it.</td>
</tr>
</tbody>
</table>

Table 1: The main takeaway points of chapter 1-Design adds stress
CHAPTER 2
STRESS IS ADDED IN SOCIETY THROUGH DESIGN: IT NEEDS TO STOP

2.1) Stress Is Not Explicitly Called Out In the Process

As mentioned in the previous chapter, stress needs to be called out as a design attribute to watch out for. There is a big opportunity area for designers to help in addressing this issue in their own way. In general, dealing with stress has been the domain of medical and wellness industry. However designers in all product and service firms, companies and other areas should have the responsibility to ensure that products are easily understandable and usable. In the design process in the industry today, there isn’t any kind of stress checking for products. Besides physiological stress, there also needs to be a discussion in the context of psychological stress which is caused due to the difficulty in the use of certain kinds of products or services. Today other than ergonomic standards for the physical ‘ease of use’, any other area pertaining to psychological ease of use is not given much importance in product or service design. However the statistics show that there is a need to lessen stress and have a check on it. Hence designers can make it a point to see where designs can be a cause of stress for the consumer.

Therefore taking the step in the right direction would be to have the process think about stress as an issue all throughout. Here the example of an NPD process is taken and the earlier identified area of workplace is the one to be designed for. Though it is the design of a stress reducing product, nevertheless the process is the same for it as is for other products. Therefore in this way it can be seen as an example to design looking out for the element of stress throughout.

2.2) An Existing Product Example

Let us look at first example cited in the bad design section of the previous chapter. (Chapter 1, Page 4) The Full body MRI scan machines are one of the most accurate and non-invasive procedures available to obtain images of the body. It proves to be useful for the doctors and specialists, but misses to keep in mind the ease of the patient. Most of the patients found it uncomfortable to be tested in the closed and claustrophobic atmosphere of the scanner. The designers and manufacturers clearly did not consider
stress as an aspect to be kept in mind while designing. Especially if they had considered stress in the understanding and conceptualizing phase, then they would have realized how much of a problem users/patients would be having.

2.3) The NPD Process And What It Means In This Context:

Any new designed product is introduced after being created by following a New Product Development process. This process is same for most parts all over the board. For the purposes of this paper, the Cagan Vogel model of iNPD process is elaborated here, to show what all is incorporated in each phase of the NPD cycle and to analyze how stress as an element can and should be a part of it.

Any NPD process is made up of different stages or parts that together lead to a cohesive decision of making a new product for the market.


<table>
<thead>
<tr>
<th>1</th>
<th>Identifying</th>
<th>2</th>
<th>Understanding</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The first phase focuses on the identification of, and selection of, product opportunities. The main tool used in this phase is the SET (Social Economic and Technological Factors). For those seeking new product opportunities, those who have already identified a product opportunity, or for those involved in the modification of an existing product, this phase can still lend insights into directions to take to refine and specifically define the opportunity.”</td>
<td>“The second phase focuses on the understanding of the product opportunity. A POG was identified in the first phase, but how does that opportunity translate into criteria for a product? The focus is the user. The main tool to understand user are set of qualitative research techniques than statistical overview of mass population.”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3</th>
<th>Conceptualizing</th>
<th>4</th>
<th>Realizing</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The third phase shifts into more traditional product conceptualization, with the outcome of single concept realized in the fourth phase. It builds on standard approaches found in the literature on product development. iNPD’s factors differentiating from other approaches are: Connection to the user, the product definition and the integrated framework.”</td>
<td>“Fourth phase is the realization of the product, a proof of concept phase. It details the third phase concept into functional model, a form model, a manufacturing plan, an initial marketing plan etc. The goal is to prove feasibility of the product, and articulate function and form innovation that differentiate the product from the competition.”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: The 4 phases of the integrated New Product Development Process (i)NPD by Cagan & Vogel (Cagan & Vogel, 2002)
The previous table (Table 2) describes in short this particular NPD process and thereafter it can be pointed out, what, where and how in my opinion, stress can be accountable in this overall process or as a standalone issue. The figure below depicts how stress can be a possible checkpoint through certain design tools that are used in product development. E.g.: (Cagan & Vogel, 2002)

**STRESS CAN BE MADE ACCOUNTABLE IN DESIGN PROCESS METHODS**

![Diagram](image)

**Figure 6:** Existing process methods in the NPD describing how stress can be added as additional factor.
Figure 7: Pointers depicting how Stress can/should be part of different phase methods while designing.
2.4) What is Missing in this Scenario?

- A measure that can validate how much stress is being induced by a product designed.
- Help in deciding the trade-offs to choose one over the other to make things more stress free.
- Something that can fit in any company’s NPD process seamlessly or give scope to improvise and adapt.
- How would one know that such a mechanism would work?
- As designers, there can be more than one way of seeing it. Either by trying to incorporate the added step of stress checking and trying to quantifiably reduce the stress inducing factor of the products designed or by designing newer innovative stress reducing products for the market.

2.5) Takeaways:

<table>
<thead>
<tr>
<th></th>
<th>Stress is a design issue that must be addressed, no matter what is being designed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>A missing link is identifiable when it comes to checking for stress caused by the product before it’s launched in the market.</td>
</tr>
<tr>
<td>3</td>
<td>The next ideal step identified can be about working on ideating some such mechanism that could help in keeping stress in check.</td>
</tr>
</tbody>
</table>

Table 3: The main takeaway points of chapter 2: Stress is added in society through design
CHAPTER 3

NEED FOR A MEASURE TO CHECK STRESS

3.1 Proposal and Need for Such a Mechanism

Parameters that define checking for stress are different and varied. As explained earlier, there haven’t been much directed efforts to solve this problem by design process or by NPD process. Especially the psychological aspect of stress has been neglected. It ought to be incorporated in the design and development process of a product being designed. The NPD process varies from industry to industry with either the kind of products or services they deal with or the brand equity and relevant policies they follow. However the underlying idea remains the same. The relevance of placing such a stress checking system would be greater in a process that is innovative enough. It should have the potential to seamlessly fit in as the required extra step. It would guarantee that much more credibility for such a system to work. However it should be dynamic enough to be adaptable to the process in any industry.

PROPOSAL: A way (or direction) showing how a stress checking mechanism can be potentially designed to help in preventing stress from being added through design.

3.2 Analyzing the Field: The Physiological and Psychological

Stress in general can be measured in two ways: the psychological and the physiological.

‘Stress refers to that quality of experience, produced through a person environment transaction, that, through either overarousal or underarousal, results in psychological or physiological distress.’ (Aldwin, Stress, Coping, and Development, 2007)

3.2(a) Physiological Stress Measures:

Those are the ones that are thought about first when stress measurement is an issue to be considered. Physiological testing of most kinds in the past have been a combination of invasive and non invasive techniques to get the desired result. The most common and widely accepted non-invasive tools are in the realm of biofeedback. Bailey & Bhagat, authors of many articles on stress research, pointed out (in
the fact that physiological measures of stress is significantly more of an objective approach than any self report measure since they are prone to be more subjective in their approach. Some of the more common ones are explained in detail below: **Biofeedback Devices:**

‘Biofeedback is a process that enables an individual to learn how to change physiological activity for the purposes of improving health and performance. Precise instruments measure physiological activity such as brainwaves, heart function, breathing, muscle activity, and skin temperature. These instruments rapidly and accurately “feedback” information to the user. The presentation of this information — often in conjunction with changes in thinking, emotions, and behavior — supports desired physiological changes.’ (Applied psychophysiology and biofeedback official website, 2008)

Biofeedback devices are generally used by physicians or psychologists for treating and understanding their patients. It enables them to gauge the psychophysiology issues of the patient in general or help delve into specific problems. What is of concern here is to look at some biofeedback devices around and see if they can prove to be of some relevance in the issue of stress measurement or not. In most cases biofeedback signals deal with measuring skin temperature, muscle tension, brainwave functions, anxiety, heartbeat rates, blood pressure rates etc. It’s a broad spectrum and in fact, a person who has taken his or her temperature has in fact interacted with a biofeedback device. Some of these devices start from the simpler ones like the Stress dots, temperature thermometer, Galvanic stress response, heart rate monitor and go up the range with devices like **X-rays, EEG’s, EKG’s, PET’s, MRI’s, fMRI’s.**

All these can fall into the realm of general biofeedback devices, along with being geared towards having more focused in the realm of stress and anxiety as all of these give information regarding the bodily workings of people. How changes appear when stressful situations are encountered or stress inducing products are dealt with. This falls under the realm of measuring and understanding the physiological aspect of stress in a person.

(See APPENDIX : Pages 58-60 for detailed description of certain biofeedback devices)
Other Minimally Invasive Devices:

Voice Stress Analysis

‘Voice stress analysis: It’s a newer form of stress detection technology, specifically resulting from lying. This new technology is different than polygraph. It records psycho-physiological stress responses that present in human voice, when a person suffers psychological stress in response to a stimulus or question. The real world example of this is the X13-VSA which is a Voice Stress Analysis Lie Detector Software’. (program home, 2008)

The voice is an integral part of the human senses. It can sometime give away signals of changes when people are stressed or under pressure. It has been used for legal crime solving help in the past. Nowadays it’s been modified to use it for psycho-physiological stress analysis and can prove to be of help in the kind of stress checking that is being discussed here. However its true relevance in everyday life situations is not yet established.

The Trier Social Stress Test: The TSST is a procedure which was developed at the University of Trier to be used under laboratory conditions for induction of moderate psychosocial stress with special emphasis on changes in HPA (Hypothalamus-Pituitary-Adrenal). It is a key part of the neuroendocrine system that controls reactions to stress. (Kirschbaum & Hellhammer, 2000) It checks on physiological responses of psychological stress.

‘The TSST was therefore introduced as a standardized protocol for the induction of moderate psychosocial stress in laboratory settings. Over the last decade, several thousand TSST sessions were performed in many laboratories world-wide. Thus, the TSST has become a standard tool for the experimental induction of psychological stress in healthy subjects as well as clinical populations, investigating a wide range of different outcome variables ranging from subjective-verbal stress reports to objective behavioral and biological stress responses.’ (Kudielka, 2008)

The TSST is one of the few stress tests that have a social as well as a cognitive stressor. It is useful when it comes to amalgamating the physiological and psychological aspect of stress, albeit in controlled conditions.

Skin Conductance Test

‘The skin conductance is one of the fastest responding measures of stress response and has been previously used to measure the difficulty of driving tasks. It has been found to be one of the most robust and non-invasive physiological measures of autonomic nervous system activity.’
It is useful in measuring skin’s electrical resistance. Also known as Galvanic Skin response. It has been linked to autonomic nervous system arousal and therefore stress in the process.

3.2(b) Psychological Stress Measures:

There are psychological tools in the industry today that deal with the issue of stress, cognition, psychological symptoms etc. Their usage is mostly in the medical testing field, but some do have the potential to be altered to meet the product interaction testing that gauge the issue of stress. Some of the validated tests in the medical and psychology field are more general than specific when it comes to testing for stress. They mostly deal with the social aspect and clinical problems. The better known ones are those that can be applicable from a stress measurement context.

**SRRS or The Social Readjustment Rating Scale** (Holmes & Rahe, 1967) was published 30 + years ago, and was reevaluated in 2000. It is one of the oldest and more recognized stress testing methodologies.

‘The SRRS consists of 43 life events, commonly reported as stressful, identified from clinical psychological experience. Each also requires personal adjustment. Each life event was selected based on the degree of change required, not psychological, emotional, or social desirability. The summary SRRS score indicated the change required in a person’s life as a function of life events.’ (Scully & Banning, 2000)

The re-evaluation here was basically for re-examining the original weights assigned to life events. It was also for evaluating the differences in association between stress-related symptoms and desirable vs. undesirable events. The research that was conducted in two phases (1st phase: new set of weights derived, 2nd phase: systematic evaluation of three content-related criticisms). The result of the research was mostly new weights and the measurements of better symptom scores that were analyzed. The questions here are that if these kinds of readjustments can take place on the social psychological scale, can they also be done at the user-product interaction scale? Would doing so specifically in the area of unsuccessfully designed or stress inducing products help in any way? A reconfiguring of these methods is required to focus on such areas. In the phase 2 of the SRRS research study, the researchers used the symptom checklist -90 (SCL-90) as the tool.
**SCL-90: The Symptom Checklist-90-R (SCL-90-R)**

‘This instrument helps evaluate a broad range of psychological problems and is also useful in measuring patient progress or treatment outcomes. It is used by clinical psychologists, psychiatrists, medical, and educational settings as well as for research purposes. The test contains only 90 items (can be completed in just 12-15 minutes). It helps measure 9 primary symptom dimensions and is designed to provide an overview of a patient’s symptoms and their intensity at a specific point in time.’ (Scully & Banning, 2000)

The SCL-90 has been used in many studies in the past. It demonstrates how there is a possibility of restructuring a tool to fit according to the required demand or need. For example, in the SRSS re-evaluation test (phase 2) in which all 90 items were not used; only 36 were. The researchers specifically omitted items relating to unneeded areas like that of mental illness (i.e., phobic anxiety, ideation, and psychoticism) or excluding items that were already included on the SRSS (e.g., overeating, sexual difficulties and other such).

**The Psychological Stress Measure PSM-9:**

‘Designed using 49 items drawn from descriptors generated by focus groups on stress. For content validity, a quantitative analysis of items selected was conducted as the best indicators of stress. Then it was tested for internal consistency, retaining the indicators that had inter-item and item-total correlations. The PSM’s responsiveness and normality of distribution give it statistical power in analysis; hence its usefulness in research designs.’ (Tessier, 2006)

Amongst the above tools the PSM 9 to some extent fits the psychological stress testing criterion being talked about in the general everyday context. Nonetheless, it is mostly geared towards the realm of family medicine /health more than relating to consumer and product interaction issues.

**The Dundee stress state questionnaire:** It is a questionnaire developed for the assessment of transient subjective states experienced during task performance which is defined by the short period of time that goes into performing any particular task and the mental state of the person during the interaction time of doing the task. The questionnaire measures multiple dimensions of state that relate to disturbances in mood, motivation and cognition. (Engagement, Distress and Worry). This test deals with the fact that it is better to rate immediate and not the subjective experiences. This gives more accuracy in checking levels of stress than any of the other measures.
3.3) Post Analysis: The Better Direction is Psychological over Physiological

Even though biofeedback and similar methods have self report criteria’s, it cannot be ignored that for most physiological devices like the TSST or the VSA, the conditions for testing are highly controlled or restricted. Psychological measures are freer in comparison in their approach. Since stress is a subjective phenomenon, objectifying and narrowing it down with some psychological method can prove more useful and that is what is being proposed here.

**Reasons For Choosing Psychological Stress Measures Analyzed Through The Above Examples:**

- The fact that they provide a possibility of measuring or quantifying stress at different dimensions.
  - As pointed out through the example of DSSQ, it provides the ability to quantify multiple dimensions of state that relate to disturbances in mood, motivation and cognition.  
    
    *(pg 21, 28)*
  - Psychological measurement can include the social context of the subject in question. The responses generated can thus be analyzed accordingly.
    - For example in SRSS, stress evaluation is based on social life events etc. So is SCL 90 etc.
      
      However tools like Skin conductance tests etc. do not have to regard surroundings so much despite being so robust in other ways. *(pg. 20)*

    - Biofeedback devices in general do not have anything to do with the social context.
      
      They are more clinical in their approach *(Reference pg.58-60)*

- Psychological measurement of stress can try to detect things which cannot just be adjudged with physical responses alone.
  - The DSSQ is an example of such a tool that takes into aspect the psychological aspect of stress and its dimensions very clearly. It involves tasks and interactions and works towards gathering the nuisances of moods and coping strategies. *(pgs. 21,41-42, 47,52)*
- The combination of the physiological and psychological which can be seen as ideal is actually not very feasible in the real business capacity of most companies. It won’t be as easily adaptable in the industry.

- The reasons being that of cost effectiveness, negative ROI etc. High costs would be involved in amalgamating the two measures. It would not just need high startup costs but also more investment in terms of training individuals to successfully run these lab setting tests. Physiological tests require such measures. For e.g. TSST, Biofeedback devices like fMRI, ECG’s etc. (pg. 36, pg 58-60).

- Also in terms of physiological measures like Biofeedback devices, some of them are expensive and may require skilled labor to operate them (Reference : Biofeedback Table : pg. 58-60).

- With the ever-growing and ever-changing society of today, there is a periodic need to re-evaluate the basis of such tests. While both physiological and psychological can change accordingly, physiological measure cannot actually determine the cause of this change. However the psychological can.

- Psychological measures provide more adaptability and customization.

- For example, the psychological measuring tool SCL 90 is open to re-categorize the social situations for psychological measures depending on the time, context and their relevance (pg. 37). Considering all the above points and the fact that the psychological measures can bring into play the emotional aspect of stress which the physiological cannot, makes it the more fitting choice and the better direction to go forward in dealing with this issue of stress.
3.4) A Stress Checking Tool And Methodology Needs To Be Developed In The Future:

Following attributes need to be incorporated in such a mechanism:

- Helps not only in having products or services tested for usability alone but also the psychological aspect that may be involved in the interaction of the user with that product.
- Depending on the context of how the user would generally use the products, testing by tasks set in regular situations accordingly (the variable being the control or normal conditions).

- It should take into account the aspect of stress holistically. Look deeper for the different dimensions of moods and personalities as they all make up the psychological stress factors in an individual.

- The return of Investment (ROI) opportunity depends on the kind of testing done for the design of the product. In most cases, corporations should not find it too difficult to set aside resources for such kind of stress checking/testing, especially if they can make it quantitative and provide the probability of claiming their products as being a certain percent (%) stress free.

The comparative table below puts together all the attributes required for any such mechanism and the present tools that can possibly better serve the expectations tabled below. The one that meets the maximum criteria is the one selected to be part of the mechanism to be designed.

<table>
<thead>
<tr>
<th>Psychological Aspect Consideration</th>
<th>Validated</th>
<th>Tasks as tests</th>
<th>Easily Adaptable (ROI)</th>
<th>Looking holistically-diff. dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSSQ</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>SRRS</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>SCL 90</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>PSM 9</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

*Table 4*: Comparison between different tools to gauge the best fit to incorporate in the stress checking methodology
### 3.5) Takeaways:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The stress field is analyzed with the physiological and psychological measures.</td>
</tr>
<tr>
<td>2</td>
<td>However the psychological measurement of stress seems a more feasible direction to go forward for the stress checking methodology due to reasons of cost effectiveness, better adaptability in NPD processes as well as the ability to look into stress from an innovative yet comprehensible angle.</td>
</tr>
<tr>
<td>3</td>
<td>Different psychological stress tools and measures that are validated in different areas and aspects in the market today can be analyzed for furthering ideation.</td>
</tr>
<tr>
<td>4</td>
<td>A set of attributes are narrowed down upon which should be there in the proposed tool so that it is an apt help in the NPD process.</td>
</tr>
<tr>
<td>5</td>
<td>The psychological measures and tools are then pitted against these attributes to find the right fit. The DSSQ (Dundee Stress State Questionnaire) seems the most fitting of the requirements.</td>
</tr>
</tbody>
</table>

**Table 5:** Main takeaway pointers for chapter 3: Need for a measure to check stress
4.1) The Elements Under Consideration:
In the realm of product or service design, certain aspects are to be considered in creating a useful mechanism. For real world products and services, the stress aspect has to be actionable for designers and the design process. The designs should be checked for:

- Psychological stress through validated test measuring (this case DSSQ) that is quantifiable.
- The task related questions that handle the design usability aspect.
- The close observations and feedbacks on the aesthetic element of the design.
- The issues that are present but are unaccounted for can be assessed by observing people using the particular product or service closely.

Keeping the attributes and requirements in mind, this e.g. of a Stress Check Mechanism is explained:

4.2) A Stress Check Mechanism: Part by Part

This kind of mechanism can potentially help in checking for stress in products and services. So for all practical purpose, this methodology or mechanism here is named as the Stress Check Mechanism.

When researched furthermore, it could possibly help in making designs of products less stress inducing.

Figure 9: A Sample look of how an SCM logo /identity can be designed
The Stress Check Mechanism Here For Further Study Purposes Is Made Up Two Parts:

4.2(a) Part 1: DSSQ- Stress Measurement Tool

As mentioned above, the DSSQ is a psychological stress measuring tool that is best suited to be included in such a mechanism. It was able to meet the maximum attributes that were required by such a mechanism. The DSSQ test designed by Professor Gerry Matthews et al is validated and based on a premise that once administered, can provide accurate results as it takes into account different dimensions while testing the psychological stress. Its shorter version used in this thesis has a set of 30 questions that test the user in the 3 dimension of stress states of engagement, distress and worry. It has a more detailed version depending on the kind of testing and involvement a company wants. The figure describes these dimensions and their importance:

<table>
<thead>
<tr>
<th>ENGAGEMENT</th>
<th>DISTRESS</th>
<th>WORRY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>It basically denotes commitment to effort.</strong> Task engagement signals a patterning of appraisal and coping that promotes effortful striving directed toward task goals. The motivational and cognitive attributes of task engagement match the conception of energetic arousal as representing mobilization for vigorous action.</td>
<td>Distress may relate to a theme of <em>Overload of processing capacity</em>. A person may aim for “damage limitation” rather than successful performance through doing as well as the situation allows (e.g., performance under time pressure), or through simply enduring suboptimal performance.</td>
<td>The requirement to perform an unfamiliar task may tend to generate anticipatory worry, which dissipates in control conditions, and in tasks requiring near-continuous information processing that may suppress worry. Worry may be associated with a transactional theme of <em>Self-evaluation</em>.</td>
</tr>
<tr>
<td>Sometimes, high short-term efforts enhance task engagement, whereas longer duration monotonous tasks reduce task engagement.</td>
<td>Distress resembles tense arousal. It links two mood dimensions, tension and unpleasant mood to the cognitive state of lack of confidence and control.</td>
<td>Worry is one of the stress states important in itself. Worry generally declines during performance, but the magnitude of decline varies across tasks.</td>
</tr>
<tr>
<td>High task engagement may sometimes be directly adaptive in performance settings. Energy, one of the components of task engagement, is associated with superior performance on a variety of attentionally demanding tasks.</td>
<td>Distress corresponds to overload mode of control, in which the person attempts to maintain performance under high task or environmental load at the cost of subjective strain.</td>
<td>The fissure between worry and emotional distress is wide enough to define two separate state syndromes.</td>
</tr>
<tr>
<td>However both task demands, such as duration and monotony, and personal characteristics, such as conscientiousness may influence this pattern of processing.</td>
<td>Speculatively, distress may also relate to escape motivations, although this is a difficult construct to operationalize in the constrained performance setting.</td>
<td>Demanding tasks requiring rapid information processing. Such tasks may be described as anxiety-inducing, but separation of distress from worry provides a more accurate picture of state change.</td>
</tr>
</tbody>
</table>

WHAT THESE DIMENSIONS CAN MEAN FOR DESIGNERS

- This aspect of the DSSQ can help in deciding which dimension of stress is more relevant to that design situation and how more research and data can help to keep in mind design of a particular product or service. This mechanism can aid in determining which is Most Important and which is the Greatest Differentiator.

- It provides quantifiability and the freedom to choose what is important and where. Allocating resources etc. accordingly, can prove to be beneficial for not only the designers but also the marketing and business side.

- This dimensionality of states is unique. If incorporated and exploited to its full potential, the DSSQ could provide a certain USP to the product going through this process and provide it with an uniqueness. For e.g: If a product can claim to be 80% more task engaging than its competitor.

- It can provide designers/marketers with additional information. For e.g if a company thinks their products are feasible because of them being less worry-some, sometimes the results of the DSSQ can provide a broader answer. Like people might find their product more engaging than the competitors product and this gives them the opportunity gap to grow by acting on it.

- It can even help in answering some obvious and not so obvious doubts about choosing the best way to go forward with a particular product. For e.g: What if one tests between three name brand lighters. The consumer may be familiar with all three brands and already know that all three are safe - there have never been any reported issues and all three have some sort of third party endorsement like "UL Approved". So worry may not be dominate either as a concern or as a differentiator. But if one of the lighters is made by Zippo - a brand with a lot of heritage versus a store brand - the Zippo lighter may show up as more engaging.

Figure 12: List of pointers of how these dimensions can be useful for designers.

4.2 (b) Part2: Product Task Questionnaire

Figure 13: Another Part of this SCM

The second part deals with the using of the actual product and answering the questions related to the interaction experience that follows. The idea behind this part is to point out how it could help the designers restrict any aspect of their design and prevent their product from being stress inducing. This is where different companies with different products can do further research, develop, test and study more to design such questionnaires to fit their needs exactly. This could make this mechanism usable in the (new) product development or design process of any company. The design department along with the marketing or R&D department can come up with questions based on their product and can take it to
as much depth and detailing as they want depending on the product cost or ROI (return on investment) of taking this extra step.

**Observational /Ethnographic Method**

- At a different level than this base SCM (Not in the base SCM)

This process over here involves an interviewer who talks to the consumer and gets to know of how exactly they interact with the product. In methods like self reporting and questionnaire, sometimes certain details and pointers are neglected or missed out. These can be caught on by this observational/ethnographic approach or method. Observation is a very important tool that designers can use for seeing discrepancies which are difficult to fathom in other forms of feedback. A good observer in such research can also spot incongruity in answers of people, who probably feel one thing and say something else. It might be for their compliant nature or the fear of looking incompetent as many people blame themselves instead of bad design. More and more design departments of corporations are adapting to the idea of ethnography and in-depth interview research. It provides a different angle through which stress can be adjudged. There is a requirement for the keen eye that picks on the cue and observes while the subjects are provided and perform the other part of this mechanism, which is the Product Task Questionnaire.

**4.3) An Example To Illustrate The Use Of Such A Tool:**

This would help in seeing for purposes of this thesis, how sample data can be collected and what could lead to further study possibilities for such a mechanism to be ready to use in general design and development process.

**Study Design:** To check stress (through this SCM) on (two) travel coffee mugs and to analyze the level of stress caused or not by them and show the process and procedure of how it is done in this case.

**Target market:** Demographic: 20 University students between the ages of (18-25) who move around in the university and in between campuses. Other Requirements: Coffee drinkers (~2 cups a day).
Data Collection and Analysis

The sample size is in total of 20 participants since this example is more for observational and qualitative purposes than being data driven. This is so because this study is more for demonstrating how the mechanism would work rather than being about large numbers.

Study Execution: Out of the 20, 10 are allotted to work/test with the OXO mug and the other 10 with the Wal-Mart mug.

Examples Chosen to Test the SCM: Travel Coffee Mugs: For demonstrating the mechanism, the consumer product chosen here is from the mid-level price point. For the purposes of this thesis, the two mugs in question here, the Wal-Mart coffee mug and the OXO Liquiseal® travel coffee mug are pre evaluated from an overall perspective to know which products exactly are being talked about.
WAL-MART TRAVEL COFFEE MUG

ERGONOMICS: Black top with a clamp for control of opening and closing

AESTHETICS: Top made of medium grade plastic

MANUFACTURING:
- Stainless steel construction

ERGONOMICS
- The handle is with finger ridges
- Slightly Tapered bottom

AESTHETICS: Stainless steel finish

Figure 14: Description of the Wal-Mart coffee mug
OXO LIQUISEAL® TRAVEL COFFEE MUG:

**ERGONOMICS**: Three silicone seals
One-handed, one-click activation

**AESTHETICS**: Smooth plastic finish.
Push and Drink button

**MANUFACTURING**: Double wall stainless steel construction
- Vacuum insulation

**ERGONOMICS**
- Soft, non-slip grip
- Tapered bottom

**AESTHETICS**: Metallic finish

*Source (pictures) - websites: amazon.com, oxo.com

**Figure 15**: Description of OXO Liquiseal® Travel Mug
4.4) The Sequence Of Running this Stress Check Mechanism:

SCM: THE DSSQ (PRE TASK) + PRODUCT STRESS STATE QUESTIONNAIRE +DSSQ (POST TASK)

Figure 16: A Diagrammatic representation of this SCM flow

4.4 (a): The Dundee Stress State Questionnaire:

As mentioned before, there is a need for measuring the psychological states associated with stress. In this case it is a validated questionnaire that can provide some quantifiable data. It is in 2 parts, the Pre-task and the Post task questionnaires. They are explained how to be used in sequence of their use in a task related situation below.
4.4 (b) DSSQ-3 State Questionnaire: Pre-Task

**PRE-TASK QUESTIONNAIRE**

Instructions. This questionnaire is concerned with your feelings and thoughts at the moment. Please answer every question, even if you find it difficult. Answer, as honestly as you can, what is true of you. Please do not choose a reply just because it seems like the 'right thing to say'. Your answers will be kept entirely confidential. Also, be sure to answer according to how you feel AT THE MOMENT. Don't just put down how you usually feel. You should try and work quite quickly: there is no need to think very hard about the answers. The first answer you think of is usually the best.

Before you start, please provide some general information about yourself.

Age............ (years)                                                                nung
Occupation........................................
If student, state your course.........................

Sex. M F (Circle one)

Date today........................... Time of day now...........

For each statement, circle an answer from 0 to 4, so as to indicate how accurately it describes your feelings AT THE MOMENT.

| Definitely false = 0, Somewhat false = 1, Neither true nor false = 2, Somewhat true = 3, Definitely true = 4 |

1. I feel concerned about the impression I am making. 0 1 2 3 4
2. I feel relaxed. 0 1 2 3 4
3. The content of the task will be dull. 0 1 2 3 4
4. I am thinking about how other people might judge my performance. 0 1 2 3 4
5. I am determined to succeed on the task. 0 1 2 3 4
6. I feel tense. 0 1 2 3 4
7. I am worried about what other people think of me. 0 1 2 3 4
8. I am thinking about how I would feel if I were told how I performed 0 1 2 3 4
9. Generally, I feel in control of things. 0 1 2 3 4
10. I am reflecting about myself. 0 1 2 3 4
11. My attention will be directed towards the task. 0 1 2 3 4
12. I am thinking deeply about myself. 0 1 2 3 4
13. I feel energetic. 0 1 2 3 4
14. I am thinking about things that happened to me in the past 0 1 2 3 4
15. I am thinking about how other people might perform on this task 0 1 2 3 4
16. I am thinking about something that happened earlier today. 0 1 2 3 4
17. I expect that the task will be too difficult for me. 0 1 2 3 4
18. I will find it hard to keep my concentration on the task. 0 1 2 3 4
19. I am thinking about personal concerns and interests. 0 1 2 3 4
20. I feel confident about my performance. 0 1 2 3 4
21. I am examining my motives. 0 1 2 3 4
22. I can handle any difficulties I may encounter 0 1 2 3 4
23. I am thinking about how I have dealt with similar tasks in the past 0 1 2 3 4
24. I am reflecting on my reasons for doing the task 0 1 2 3 4
25. I am motivated to try hard at the task. 0 1 2 3 4
26. I am thinking about things important to me. 0 1 2 3 4
27. I feel uneasy. 0 1 2 3 4
28. I feel tired. 0 1 2 3 4
29. I feel that I cannot deal with the situation effectively. 0 1 2 3 4
30. I feel bored. 0 1 2 3 4

Table 6: The Dundee Stress State SSHORT Pre Task Questionnaire (provided by Dr. Gerry Matthews / (Matthews, et al., 2002)
4.4 (c) Product Task Questionnaire:

Task 1:
While talking on the phone, fill the travel coffee mug with a hot beverage and place the top on the mug. You have 20 seconds to complete this task.

Please rate each of the items below for how difficult or easy it was to accomplish. Place an X in the box that corresponds to your answer for that item.

<table>
<thead>
<tr>
<th>FILLING</th>
<th>Very Difficult</th>
<th>Difficult</th>
<th>Moderate</th>
<th>Easy</th>
<th>Very Easy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guessing the volume it can hold</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filling in the coffee mug with coffee</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closing the travel mug</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowing it was securely closed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Task 2:
While climbing up the stairs, take two sips at small intervals from the travel coffee mug. You have 25 seconds to complete this task.

Please rate each of the items below for how difficult or easy it was to accomplish. Place an X in the box that corresponds to your answer for that item.

<table>
<thead>
<tr>
<th>DRINKING</th>
<th>Very Difficult</th>
<th>Difficult</th>
<th>Moderate</th>
<th>Easy</th>
<th>Very Easy</th>
</tr>
</thead>
<tbody>
<tr>
<td>How was it to hold on to it while standing still</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How was it to hold and walk or run with</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How was it to drink from the mug while moving and not spilling the beverage?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carry or store while moving</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Task 3: Refill the travel coffee mug, sit down and taking a sip from the mug. You have 20 seconds to complete this task.

Please rate each of the items below for how difficult or easy it was to accomplish. Place an X in the box that corresponds to your answer for that item.

<table>
<thead>
<tr>
<th>SITTING AND REFILLING</th>
<th>Very Difficult</th>
<th>Difficult</th>
<th>Moderate</th>
<th>Easy</th>
<th>Very Easy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleanliness of opening</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refilling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting it on the counter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7: The Product Task Questionnaire comprising of (3) design and performance related tasks
DSSQ-3 STATE QUESTIONNAIRE
POST-TASK QUESTIONNAIRE

Instructions: This questionnaire is concerned with your feelings and thoughts while you were performing the task. Please answer every question, even if you find it difficult. Answer, as honestly as you can, what is true of you. Please do not choose a reply just because it seems like the 'right thing to say'. Your answers will be kept entirely confidential. Also, be sure to answer according to how you felt WHILE PERFORMING THE TASK. Don’t just put down how you usually feel. You should try and work quite quickly: there is no need to think very hard about the answers. The first answer you think of is usually the best.

For each statement, circle an answer from 0 to 4, so as to indicate how accurately it describes your feelings WHILE PERFORMING THE TASK.

Definitely false = 0, Somewhat false = 1, Neither true nor false = 2, Somewhat true = 3, Definitely true = 4

1. I felt concerned about the impression I am making. 0 1 2 3 4
2. I felt relaxed. 0 1 2 3 4
3. The content of the task was dull. 0 1 2 3 4
4. I thought about how other people might judge my performance. 0 1 2 3 4
5. I was determined to succeed on the task. 0 1 2 3 4
6. I felt tense. 0 1 2 3 4
7. I was worried about what other people think of me. 0 1 2 3 4
8. I thought about how I would feel if I were told how I performed. 0 1 2 3 4
9. Generally, I felt in control of things. 0 1 2 3 4
10. I reflected about myself. 0 1 2 3 4
11. My attention was directed towards the task. 0 1 2 3 4
12. I thought deeply about myself. 0 1 2 3 4
13. I felt energetic. 0 1 2 3 4
14. I thought about things that happened to me in the past. 0 1 2 3 4
15. I thought about how other people might perform on this task. 0 1 2 3 4
16. I thought about something that happened earlier today. 0 1 2 3 4
17. I found the task was too difficult for me. 0 1 2 3 4
18. I found it hard to keep my concentration on the task. 0 1 2 3 4
19. I thought about personal concerns and interests. 0 1 2 3 4
20. I felt confident about my performance. 0 1 2 3 4
21. I examined my motives. 0 1 2 3 4
22. I felt like I could handle any difficulties I encountered. 0 1 2 3 4
23. I thought about how I have dealt with similar tasks in the past. 0 1 2 3 4
24. I reflected on my reasons for doing the task. 0 1 2 3 4
25. I was motivated to try hard at the task. 0 1 2 3 4
26. I thought about things important to me. 0 1 2 3 4
27. I felt uneasy. 0 1 2 3 4
28. I felt tired. 0 1 2 3 4
29. I felt that I could not deal with the situation effectively. 0 1 2 3 4
30. I felt bored. 0 1 2 3 4

Table 8: The Dundee Stress State SSHORT Post Task Questionnaire (provided by Dr. Gerry Matthews)/(Matthews, et al., 2002)
Scoring:

Engagement = d5 + d11 + d13 + d25 - d3 - d18 - d28 - d30 + 16.

Distress = d6 + d17 + d27 + d29 - d4 - d9 - d20 - d22 + 16.

Worry = d1 + d7 + d10 + d12 + d16 + d19 + d21 + d26.

Range of scores. Scores will range from 0-32.

Remaining items are candidate items for an improved worry scale.

Table 9: The Scoring table of DSSQ’s Pre and Post Task Questionnaire (provided by Dr. Gerry Matthews)

4.4 (e) How to Make This SCM More Actionable For Designers: Different Levels

This SCM is analyzed with all these questionnaires and tasks; nonetheless, it can and should ideally be more specific on design stress nuances. It is projected to try and solve the stress issue by fitting into any NPD process and checking for the psychological stress specifics. However, if certain aspects can be added to this base SCM structure, a more appropriate solution can be achieved. It should include the observational approach, which can be adapted during task questioning (i.e. being incorporated with the regular product task questionnaire). It can also be made more design element specific by having the ethnographic observation and interviews interspersed or at the end portion. These could focus mostly on the psychological stress dimensions.

4.4 (f) Observational / Ethnographic Approach at Two Stages

This Observational/ethnographic approach as mentioned above can be incorporated at two different stages in the SCM process. The 1st level is the base SCM, and the 2nd level is the one which is designed to be more actionable for the designer. In the 2nd level, as shown in the diagram, the observational approach can be put during the product task questionnaire portion and the more in-depth ethnographic and observational approach can be placed after the post task questionnaire (of the DSSQ). This would ideally help in getting the right responses as well as provide specific pointers that could make it easier for the designers to incorporate and hence come up with less stress inducing designs and products.
Figure 17: Visualization of expanded SCM which can prove to be more actionable for designers.

The Observational/Ethnographic approach is demonstrated here with the help of the Coffee mug example. This is the part where both mugs are put in real situations testing. The ‘watch-out’ is for stressful handling issues, task analysis as well psychological mood gauging, all for relevance to stress they cause etc. The pictorial representation of this example that follows is taken of a person using these two mugs in daily situations in the college.

It demonstrates how a designer/ethnographer from any company can invest their time in this process and after doing so, can provide some insights which might have been generally overlooked. It can prove because it can help in pinpointing certain stress triggers that may not be fully grasped with this base SCM. It can make it simpler for designers to know what and where to focus.
Observation / Ethnographic Pointers:
(with notes of how to better)

If looked carefully to see what is needed or what is missing or how a particular task is being carried out. Certain pointers noted:

- In usual coffee vending machine area, the stirrer used for mixing cream and sugar can be small.

- Can become messy and can spill out the creamer or sugar (in such situations) (Easy position locator in the bottom or in the vending places can be a help along with travel mugs made easy to refill)

- Sometimes finding a place to rest the coffee mugs on counter can be an issue, especially if they are at an angle. (If possible - make mugs easy to stand at different places as it can be very useful)

- Its either carried in hand (generally indoors if cold weather outside) or put in the side pouch of backpack while outdoors. (Different options for carrying made available: handle, narrow bottom for cars, slim enough for backpack side pockets etc.)

Figure 18: Task analysis and observation part1
Observation / Ethnographic pointers:

The ritual of cleaning can also provide certain cues etc. Certain pointers noted here:

- When cleaning, the top of the mug is given more importance since it touches one's mouth. *(Easy to clean surface would be better)*

- If the coffee or the hot beverage inside has been there for too long, it can start to give an unpleasant odor which sometimes cannot be done with just water washing. *(Odor control would be a different yet needful area)*

- If the need is to carry the mug after cleaning, then wiping is done so that the water droplets are not there. *(Easy drying outer surface would be a help)*
4.5) Final step for the SCM: the results and observations

4.5) (a) The DSSQ Part: Data Collection And Analysis:

Wal-Mart Coffee Mug

<table>
<thead>
<tr>
<th></th>
<th>PRE-TASK</th>
<th></th>
<th>POST-TASK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub1</td>
<td>Engagement</td>
<td>Distress</td>
<td>Worry</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Sub2</td>
<td>28</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>Sub3</td>
<td>18</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>Sub4</td>
<td>20</td>
<td>5</td>
<td>18</td>
</tr>
<tr>
<td>Sub5</td>
<td>4</td>
<td>13</td>
<td>24</td>
</tr>
<tr>
<td>Sub6</td>
<td>19</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>Sub7</td>
<td>26</td>
<td>9</td>
<td>21</td>
</tr>
<tr>
<td>Sub8</td>
<td>16</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Sub9</td>
<td>24</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Sub10</td>
<td>17</td>
<td>10</td>
<td>21</td>
</tr>
<tr>
<td>TOTAL</td>
<td>200</td>
<td>80</td>
<td>180</td>
</tr>
<tr>
<td>MEAN</td>
<td>20.0</td>
<td>8.0</td>
<td>18.0</td>
</tr>
</tbody>
</table>

OXO GOOD GRIPS

<table>
<thead>
<tr>
<th></th>
<th>PRE-TASK</th>
<th></th>
<th>POST-TASK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub1</td>
<td>Engagement</td>
<td>Distress</td>
<td>Worry</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Sub2</td>
<td>21</td>
<td>17</td>
<td>16</td>
</tr>
<tr>
<td>Sub3</td>
<td>18</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Sub4</td>
<td>15</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>Sub5</td>
<td>22</td>
<td>13</td>
<td>23</td>
</tr>
<tr>
<td>Sub6</td>
<td>19</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Sub7</td>
<td>10</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td>Sub8</td>
<td>16</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>Sub9</td>
<td>20</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Sub10</td>
<td>17</td>
<td>13</td>
<td>19</td>
</tr>
<tr>
<td>TOTAL</td>
<td>189</td>
<td>112</td>
<td>155</td>
</tr>
<tr>
<td>MEAN</td>
<td>18.9</td>
<td>11.2</td>
<td>12.5</td>
</tr>
</tbody>
</table>

\[
t-value(\text{calculated}) \quad \text{Alpha} = 0.05
\]

The comparison between pre-task and post-task engagement, distress and worry value and CI or Confidence interval of 95%.

Table 10: The calculated values of engagement, distress and worry for the Wal-Mart and OXO Liquiseal
4.5(b) The DSSQ Result Analyzed:

DSSQ Readings: t-values and significance (2 tailed -probability)

<table>
<thead>
<tr>
<th></th>
<th>ENGAGEMENT</th>
<th>DISTRESS</th>
<th>WORRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAL-MART (t-values)</td>
<td>-0.313</td>
<td>0.761</td>
<td>-1.049</td>
</tr>
<tr>
<td>OXO LIQUISEAL® (t-values)</td>
<td>-1.171</td>
<td>0.272</td>
<td>2.405</td>
</tr>
</tbody>
</table>

Table 11: The T-test values of the 2 mugs through SPSS paired sample t-tests.

For analyzing the DSSQ readings, a paired sample t-test is done on a product to judge the pre and post task differences between the scores of the three dimensionalities of stress. In this particular case, the engagement, distress and worry aspect of stress of both the company’s products have been analyzed to see the difference between the 2 mugs here. (This is so because it is a real world example of already manufactured and existing products and it’s a small sample size. The answers cannot be used in the real world based on the data set. This is more so for directional purposes.)

These Are The Following Observations:

- For DISTRESS, the data suggest that the OXO mug lowers distress but the Wal-Mart mug does not.

There is again a difference in the pre-task levels, but not so large, so this is evidence in favor of greater usability of the OXO mug.

- For WORRY, there is a significant decrease for the Wal-Mart mug, but no significant change for the OXO mug. So, on the face of it looks like the Wal-Mart mug may produce more peace of mind than the OXO mug. However, the pre-task worry scores are different for the two mugs (18 vs. 12.5), so the conclusion is not justified. The post-task scores (10.6 vs. 11.1) suggest it is safest to assume there is no real difference.

- There aren’t any meaningful differences in task ENGAGEMENT - the mugs are neither tiring nor energizing to use. In this example, the product task-design specific questions were put in between pre and post DSSQ to have some quantifiable numbers for not just the stress state dimensions scoring of
DSSQ but also understanding of the stress causing elements in the basic design. That was to help in deciphering which are the areas in the design that if changed can lead to a less stressful situation. It gives designers actionable insights to take this information and work around it accordingly.

**DSSQ RESULTS : BASED ON QUESTIONNAIRES AND OBSERVATIONS (FROM FULL SCM)**

**WORRY**

The worry aspect of the Wal-Mart remains the same. (However on the face it appears to produce more peace of mind.)

The worry aspect of the OXO mug does not have any significant change from pre to post task.

For e.g. as found and noticed through product task questionnaire and ethnography, The mug’s inability to close properly or not being secure accounts for WORRY. The other one is carrying it around and Worrying it might spill etc.

**DISTRESS**

The Wal-Mart mug does not lower distress

The OXO mugs lowers distress significantly

For e.g. as found, distress is reduced when OXO mug is used. It can be due to fact that it doesn’t have the issue of security or spilling. Since these are important in travel mugs. However the wal-mart mug can’t vouch for that and hence distress remains

**ENGAGEMENT**

The wal-mart mugs is neither tiring nor energizing to use.

The OXO mug is neither tiring nor energizing to use.

For e.g. The mug’s are very basic to use and do not have extra contraptions etc. in an attempt to engage the consumer. Since the mugs are standard they do not help in increasing or reducing the engagement. It makes sense here since its a everyday use product and therefore engagement need not be of crucial importance.

**Figure 20:** Diagram representing correlation between design issues and stress dimensions of example
4.5(c) The Product Task Questionnaire and Observational / Ethnographic Method

As mentioned above, the product task questionnaire is interspersed with the DSSQ. This questionnaire can be specific to the company and the product they want tested. It needs to be guided primarily by the results of the t-tests. There are two significant effects, for worry with the Wal-Mart mug, and for distress with the OXO mug. Here the two coffee mugs have been analyzed, and the results from the questionnaire point towards some areas of difficulty that people might be facing and which can be worked upon. The recurring ones include the following:

<table>
<thead>
<tr>
<th>WAL-MART</th>
<th>OXO LIQUISEAL ©</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guessing the volume it can hold and knowing if the mug was securely closed.</td>
<td>Closing the mug and deciding how much it can hold</td>
</tr>
<tr>
<td>Issues of drinking while travelling and being apprehensive of spills.</td>
<td>Carrying and storing it while traveling</td>
</tr>
<tr>
<td>Cleanliness of opening and stranding it over a counter.</td>
<td>Cleanliness of opening</td>
</tr>
</tbody>
</table>

*The observational approach and the pointers have been mentioned in pages --- and ---

Table 12: Areas where appropriate action can improve the design/usability of the respective mugs.

4.6 Final Analysis: Gist of the results and observations of this SCM in totality:

The main purpose of using the SCM is to be able to help in producing less stress inducing products by incorporating it in the NPD or design process. In this case the SCM needs to present the analyzed result in reports and suggestions generated for business aspect of the industry as well as by providing design actionable suggestions for the designers to able to work on.

**Final Business and Marketing Suggestions:**

**For Wal-Mart Mug:**

- The SCM pointed out that distress aspect in this case is the one to be focused on as more important of the 3 dimensions of stress being tested against. It with the help of the DSSQ in the SCM. This could provide a potential unique selling point (USP) to the marketing and distribution division of the company.
- The aesthetic appeal needs to be worked on. Some resource allocation for redesigning certain portions of the mug to remove any negative association with the product – for e.g. being top-heavy makes it look less safe etc.

- However minimizing costs is essential as it’s a Wal-Mart in-house product. However, in-store advertising is essential to show the care for the customers that Wal-Mart is adapting to.

For OXO Mug:

- Focus: Since they are travel mugs, they should be easy to carry as a priority. The need is to make the travel coffee mugs more easy to carry and more funds and resources should be allocated in achieving that.

- People like the design of opening and closing and think it is secure after testing. The company needs to leverage on that as a USP.

- SCM as a tool or standard can be used to aid in promoting the OXO mugs, especially since OXO is in the segment of making products which care about the customer. The POP in this case however would be increasing their adjacencies and target market and caring for the younger population as well.

Final In-depth Design Suggestions: Elaborating on information from tables 4(e) and 4(f), including observational pointers, the following are the design suggestions for the OXO and the WAL-MART mug respectively. This can prove to be the actionable insights any design group would need to deliver a better end result.
Figure 21: Design Direction from SCM created from test results of the Wal-Mart travel mug.
Figure 22: Design Direction from SCM created from test results of the OXO Liquiseal® travel mug.

(OXO mug pictures source: www.oxo.com / www.amazon.com)
4.7) Takeaways:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>A Stress Check Mechanism is needed to help in reducing the making of stress inducing products coming out in the market.</strong></td>
</tr>
<tr>
<td>2</td>
<td><strong>Real world examples can demonstrate how such a mechanism can work out in real life.</strong></td>
</tr>
<tr>
<td>3</td>
<td><strong>The Data Collection and Analysis associated with such a mechanism helps in showing the direction where it can be of help. Concrete results can't be proven because of the small sample size here, but it shows the potential.</strong></td>
</tr>
<tr>
<td>4</td>
<td><strong>The next step would be to show how the SCM can fit in any particular NPD process and prove its worth in the full scope of things.</strong></td>
</tr>
</tbody>
</table>

**Table 13:** Main takeaway pointers for chapter 4: Introducing the mechanism
5.1) The Full Scope: Putting in context for maximizing potential

When suggesting this kind of Stress Check Mechanism is fully developed and can become universal (after following the directional path this thesis has set and real world testing and data collection), it is important to note where it could be incorporated in the New Product Development cycle (NPD). The figure below shows the Cagan and Vogel model of the user-centered iNPD process (‘A comprehensive approach to User-Centered, Integrated New Product Development.’) (Cagan & Vogel, 2002).

![Diagram showing the suggested phase in the NPD process for placing the SCM](image)

**Figure 23:** Diagram showing the suggested phase in the NPD process for placing the SCM
As is depicted by the diagram, the 3rd phase would be the better time for placing the SCM in the process due to the following reasons:

- The involved team in an NPD /Design process, generally becomes expert by the end of this phase.
- The dealings with consumer feedbacks and focus groups etc. make the team have the important understanding of the stakeholders, aesthetics, features, and the material.
- This phase involves quick and rapid prototyping and iterations of the design’s form and function.
- Possibilities of user testing and usability issues are judged by many companies, but to focus on the stress causing aspect of a product is a novel idea.
- The process of reverse engineering is also part of this phase and helps the product be at the cutting edge of technology and more evolved than the competitor’s product if in the same category. The stress check mechanism will also help in giving the companies that extra edge.
- The R&D division can take it upon themselves for furthering their own product specific research and be able to, in the future, even be able to make a clinical claim of being stress-less.

5.2) SCM Incorporated: Putting it in the Broader Perspective

Besides showing the SCM fitting into the NPD environment, it should also be seen in the whole context. An SCM can have the potential to be incorporated in the real world and not just the NPD arena, but in other respects as well. This could be the product upgrade arena, where the SCM can be useful for creating a point of difference with the other similar products. It could also be in the case of benchmarking, if it’s done with enough data sampling and methodical approach the SCM can provide a claimable approach for business profitability as well.

The following diagram shows, where in the NPD cycle are the Benchmarking and Product upgrades mostly generated and worked on and where to place the SCM so as to get less stress induction. This depends on what category or where in the process a particular product fits. For e.g. for any product upgrade, placing the SCM in the understanding phase would be more apt than the conceptualization
phase as the product is already out there. It just needs to be upgraded through the use of the SCM.

Figure 24: Placing the SCM for maximizing potential for different product areas in the market

As shown in the following table, the example of the travel coffee mug has been visualized to illustrate the SCM’s relevance. Where they fit in the overall sense and where the opportunities lie for these kinds of products and services to incorporate the Stress check mechanism or the SCM.
5.3) Argument for Business

The SCM methodology provides for a unique business enhancing opportunity for companies as well.

Adaptability: For all practical business purposes, the product task questionnaire and the ethnographic aspects of the SCM are adapted according to the product or service industry it is placed in.

Distinctness: It can be adaptable by incorporating the factors of psychological and physiological stress combined with product specificity and have a point of difference to stand out in the marketplace.

Brand Identity: SCM can prove to be a standard to reckon with down the road and become synonymous with people trying to have a healthier existence.
Like in this case, the brand Identity here of the rectangular logo can be altered in color and material signifying the difference according to the industry that the SCM caters to. For e.g.- For industrial products-machineries, equipment in lines etc., colors like blue and black can be used, whereas in case of lifestyle products like accessories etc, the pastel colors of green and pink can be the right fit. In this way the brand identity can have a common base (logo) yet provide an individualistic appeal for the different segments.

**Social Benefits:** At a certain level, it can be adjudged that the SCM methodology could be a proposed mechanism with which designers can have a say in doing their bit for society by reducing stress. This could tie in with the whole Corporate Social Responsibility concept which companies consider for the showing their interest in society and for taking responsibility for the bearing of their actions on consumers etc. This tie in with the SCM would help them not only in the traditional business returns but also provide for many adjacencies that can arise from this idea and help them in moving forward. The bigger picture is basically about different companies with different products, questions and agendas, all working towards the same cause of stress check and reduction.

**5.4) Takeaways:**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A solution is plausible that deals with the issue of stress in the product and service design environment.</td>
</tr>
<tr>
<td>2</td>
<td>The solution in form of a tool or mechanism makes more sense when placed in real world NPD process to see the effectiveness in a broader context. The mechanism created can have the ability to fit in with the industry settings easily.</td>
</tr>
<tr>
<td>3</td>
<td>The favorable arguments of the tool being a good business decision makes it a feasible option for future adaptations in the industry as well as in the lives of the consumer.</td>
</tr>
</tbody>
</table>

*Table 14: Main takeaway pointers for chapter 5: Part of the iNPD process*
CHAPTER 6

CONCLUSIONS

6.1) Summarization of the stress issue and its design solution:

Background: Stress is an identified social problem. Research suggests that design sometimes forgets to account for the stress that they can cause for the end user. To reduce or alleviate this issue, products and services need to be designed in such a way that they reduce stress or at least not induce it.

Discussion: The Psychological (mental state and emotional responses) and Physiological (physical changes/discomfort levels) are the two aspects of stress to consider for design of less stress inducing products. Many existing stress measuring tools are analyzed to check out the viability of usage in design processes, people and feasibility or adaptability in industry/real life settings. Consequently the psychological aspect is taken to further the research due to factors of industry validation, ROI and holistic theory.

Future Recommendation: A checking standard for stress which can be incorporated in any New Product development process and helps in the following:

- Having products or services not only be tested for usability but also the psychological aspect that is common in any interaction of the user with a product.
- Depending on the context of use, setting product tasks in regular situations (the variable being either controlled, normal or combined condition) for checking the stress aspect.
- Taking into account the aspect of stress holistically. Look into the different dimensions of moods and personalities as they all make up the psychological stress factors in an individual.
- The return of Investment (ROI) opportunity depends on the kind of testing done for the design of the product.
This results in the possibility of creating the Stress Check Mechanism (SCM), a tool or methodology that fits in any NPD process and includes all the above needed points. Here (for the purposes of this thesis paper) it is made of 2 parts: The Dundee Stress State Questionnaire (a dynamic Psychological Stress measuring tool tackling 3 states of stress—engagement, distress and worry) and the Product task questionnaire (tasks which are more usability and design centered which gives actionable insight to designers.) The SCM has the option of expanding with a third part of Ethnographic approach that can be incorporated depending on the willingness of the company or design team of how much more in-depth they want to go.

**Figure 26:** A condensed view of the SCM as standalone and the SCM as placed in the full scope of NPD.

**Final Analysis:** Using the SCM to focus on its work as a tool that helps in keeping designers from adding unnecessary stress to their designed products is the approach to take for the future. This is how a SCM can fit in the whole New Product Development process in the industry and always have the unique ability to be more and more expandable over the years.
### 6.2) Final Takeaways:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A Stress check is needed to stop the influx of stress causing bad designed products in the market today for the unassuming and unprepared consumer.</td>
</tr>
<tr>
<td>2</td>
<td>A person’s psyche is one of the most important elements to be considered when discussing the issue of stress.</td>
</tr>
<tr>
<td>3</td>
<td>The ability to transfer that into real life situation testing and having a validation for that makes for designing an apt tool that takes care of the issue of stress in the real world and industrial context</td>
</tr>
<tr>
<td>4</td>
<td>This tool could help in doing its bit from the design side to deal with the issue of stress in society.</td>
</tr>
<tr>
<td></td>
<td>This is one of the ways to show how there can be ‘Design Against Stress’.</td>
</tr>
</tbody>
</table>

**Table 15:** Few Main takeaway pointers for thesis summarization
7) APPENDIX:

## A) Biofeedback Device Table

<table>
<thead>
<tr>
<th><strong>TEMPERATURE DEVICES:</strong> They give feedback based on the difference in bodily temperatures. How temperature Relates to Stress under stress muscles tense and blood flow is restricted to the main body and shut down from the hands and feet</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biodots or stress points and stress squares.</strong> (Warm hands are relaxed, cold hands are tense)</td>
</tr>
<tr>
<td><strong>Heart rate and Pulse rates devices:</strong> They measure the changes and abnormalities in the heart and pulse rates.</td>
</tr>
<tr>
<td><strong>GSR 2:</strong> Single channel Galvanic Skin Resistance monitor. Measures minute changes in skin pore size and sweat gland activity as it relates to tension. Ideal for personal use.</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td><strong>EMG/MUSCLE DEVICES:</strong> <em>Electromyography</em> measures the electrical response of the muscles when contracting. This can recorded on an <em>electromyogram</em>.</td>
</tr>
<tr>
<td><strong>MyoTrac EMG Monitor:</strong> This portable stand alone or PC-linked two-channel monitor is designed for clinical assessment and training for stress, urge or fecal incontinence.</td>
</tr>
<tr>
<td><strong>EEG NEUROFEEDBACK:</strong> is a therapy technique that presents the user with real-time feedback on brainwave activity, as measured by sensors on the scalp etc. The aim is to provide real-time information to the Central Nervous System (CNS) as to its current activity.</td>
</tr>
<tr>
<td><strong>Pocket Neurobics A3</strong> Pocket Neurobics A-3 2 Channel EEG System. Stand alone device that can be connected to a computer. This system can measure 2 channels of EEG, 2 Channel HEG nIR or 1 channel pIR.</td>
</tr>
</tbody>
</table>
MULTI-MODALITY: Since humans are complex beings, it is useful to receive feedback in many modalities at once.

<table>
<thead>
<tr>
<th>Capnocheck II Capnograph with Pulse Oximeter</th>
<th>Nonin 9843 Pulse Oximeter &amp; CO2 Monitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>The 8400 hand-held capnograph / oximeter is a full-featured monitor providing ETCO2, Inspired CO2, Respiration Rate, SpO2, and Heart Rate measurements.</td>
<td>The Nonin 9843 combines proven pulse oximetry technology with reliable CO2 detection, making it an ideal monitor for patient transport and emergency use.</td>
</tr>
</tbody>
</table>

Table (i): Source* (Bio-Medical Instruments, Inc.) (biofeedback products and resources for practitioners and home users, 2001)

B) PAIRED SAMPLE T TESTS: Explained (Oleson, Kathy; Steckler, Maureen)

Paired-Samples T-test (a.k.a. T-test for Dependent Means)

When to use T-test?

A t-test evaluates two groups that are related to each other. For e.g., data from a group of participants who are tested before and after a procedure would be analyzed using a paired sample T-test.

Running the test

This t-test evaluates two groups that are related to each other. For e.g. data from a group of participants who are tested before and after a procedure would be analyzed using a paired sample t-test.

Checking the assumptions

1) Normality: Assumes that the population distribution is normal. The t-test is quite robust over moderate violations of this assumption. Check for normality by creating a histogram.

2) Independent observations: The observations within each treatment must be independent.
C) T-STATISTICS TABLE CALCULATIONS 1) WALMART AND 2) OXO RESPECTIVELY

### Paired Samples Statistics

<table>
<thead>
<tr>
<th>Pair</th>
<th>distress_pre</th>
<th>N</th>
<th>Std Deviation</th>
<th>Std Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>60000</td>
<td>10</td>
<td>2.94444</td>
<td>.78831</td>
</tr>
<tr>
<td></td>
<td>distress_post</td>
<td>10</td>
<td>5.59786</td>
<td>1.75784</td>
</tr>
</tbody>
</table>

### Paired Samples Correlations

<table>
<thead>
<tr>
<th>Pair</th>
<th>Correlation</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>.765</td>
<td>.007</td>
</tr>
</tbody>
</table>

### Paired Samples Test

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Std Error Mean</th>
<th>65% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 distress_pre - distress_post</td>
<td>-1.30000</td>
<td>3.91720</td>
<td>1.23873</td>
<td>-4.16220 - 1.56220</td>
<td>-1.849</td>
<td>9</td>
<td>.021</td>
</tr>
</tbody>
</table>

### T-Test

### Paired Samples Statistics

<table>
<thead>
<tr>
<th>Pair</th>
<th>engagement_pre</th>
<th>N</th>
<th>Std Deviation</th>
<th>Std Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>20.0000</td>
<td>10</td>
<td>7.15938</td>
<td>2.27547</td>
</tr>
<tr>
<td></td>
<td>engagement_post</td>
<td>20.0000</td>
<td>9.16802</td>
<td>1.95050</td>
</tr>
</tbody>
</table>

### Paired Samples Correlations

<table>
<thead>
<tr>
<th>Pair</th>
<th>Correlation</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>.988</td>
<td>.009</td>
</tr>
</tbody>
</table>

### Paired Samples Test

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Std Error Mean</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 engagement_pre - engagement_post</td>
<td>-6.0000</td>
<td>9.06937</td>
<td>1.91801</td>
<td>-9.2433 - 1.2433</td>
<td>-3.132</td>
<td>9</td>
<td>.003</td>
</tr>
</tbody>
</table>

### Paired Samples Statistics

<table>
<thead>
<tr>
<th>Pair</th>
<th>worry_pre</th>
<th>N</th>
<th>Std Deviation</th>
<th>Std Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>10.0000</td>
<td>10</td>
<td>4.19964</td>
<td>1.32497</td>
</tr>
<tr>
<td></td>
<td>worry_post</td>
<td>10</td>
<td>6.59828</td>
<td>2.07739</td>
</tr>
</tbody>
</table>

### Paired Samples Correlations

<table>
<thead>
<tr>
<th>Pair</th>
<th>Correlation</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>.464</td>
<td>.177</td>
</tr>
</tbody>
</table>

### Paired Samples Test

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Std Error Mean</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 worry_pre - worry_post</td>
<td>2.4000</td>
<td>5.92821</td>
<td>1.87498</td>
<td>-3.59950 - 8.40490</td>
<td>3.947</td>
<td>8</td>
<td>.003</td>
</tr>
</tbody>
</table>
### Paired Samples Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>N</th>
<th>Std Deviation</th>
<th>Std Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 emo_dle_pre</td>
<td>12.2000</td>
<td>10</td>
<td>3.95444</td>
<td>1.26345</td>
</tr>
<tr>
<td>emo_dle_post</td>
<td>9.3000</td>
<td>10</td>
<td>4.37373</td>
<td>1.69337</td>
</tr>
</tbody>
</table>

### Paired Samples Correlations

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Correlation</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 emo_dle_pre &amp; emo_dle_post</td>
<td>10</td>
<td>.683</td>
<td>.036</td>
</tr>
</tbody>
</table>

### Paired Samples Test

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Std Error Mean</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 distress_pre - distress_post</td>
<td>-1.3000</td>
<td>3.81726</td>
<td>1.23673</td>
<td>-4.10220 - 1.50220</td>
<td>-1.049</td>
<td>9</td>
<td>.321</td>
</tr>
</tbody>
</table>

### Paired Samples Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>N</th>
<th>Std Deviation</th>
<th>Std Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 emo_eng_pre</td>
<td>17.6000</td>
<td>10</td>
<td>3.60501</td>
<td>1.13909</td>
</tr>
<tr>
<td>emo_eng_post</td>
<td>20.1000</td>
<td>10</td>
<td>6.65484</td>
<td>2.19785</td>
</tr>
</tbody>
</table>

### Paired Samples Correlations

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Correlation</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 emo_eng_pre &amp; emo_eng_post</td>
<td>10</td>
<td>.590</td>
<td>.141</td>
</tr>
</tbody>
</table>

### Paired Samples Test

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Std Error Mean</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 emo_eng_pre - emo_eng_post</td>
<td>-2.2000</td>
<td>5.94345</td>
<td>1.87853</td>
<td>-6.44954 - 2.04954</td>
<td>-1.171</td>
<td>9</td>
<td>.272</td>
</tr>
</tbody>
</table>

### Paired Samples Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>N</th>
<th>Std Deviation</th>
<th>Std Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 ass_wory_pre</td>
<td>12.6000</td>
<td>10</td>
<td>3.31769</td>
<td>1.96163</td>
</tr>
<tr>
<td>ass_wory_post</td>
<td>11.1000</td>
<td>10</td>
<td>7.76903</td>
<td>2.43766</td>
</tr>
</tbody>
</table>

### Paired Samples Correlations

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Correlation</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 ass_wory_pre &amp; ass_wory_post</td>
<td>10</td>
<td>.261</td>
<td>.432</td>
</tr>
</tbody>
</table>

### Paired Samples Test

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Std Error Mean</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 ass_wory_pre - ass_wory_post</td>
<td>4.6000</td>
<td>8.04152</td>
<td>2.54684</td>
<td>-1.35456 - 10.55456</td>
<td>1.730</td>
<td>8</td>
<td>.118</td>
</tr>
</tbody>
</table>
D) Case In Point: Working Through the Present NPD Process with a design example (for Chapter 3)

The above point tries to suggest the fact that if stress was accounted for or kept in mind throughout the process, probably the designs wouldn’t have been so stressful or problematic. To see the validity of this statement, an example should needs to be shown that goes through the entire process keeping stress as a criterion in mind and see the outcome.

The need here is to design a product or service following the NPD process while keeping stress under consideration and then analyzing the end result.

A phase by phase approach of the NPD process is taken and used for designing such a product. For the purposes of this paper, the term stress point in consideration is called out in the steps.

Identifying Phase:

- Observing Trends: Social Relevance/Stress

Although the dynamics change and the variables alter, the underlying foundation of simpler, uncluttered living that helps in improving quality of life and stress free existence always remains. People want ‘things’ to seamlessly fit into their daily lives. A very recent trend that can tie into this issue is the trend of ‘NichetrIBUTES’. As per Trendwatching.com, ‘it is about the power of making products and services relevant by incorporating ‘attributes’ and features that cater to distinct (if not niche) consumer lifestyles and situations.’ An example is the Dot Gloves which are knit gloves with metal dots on the fingertips that won’t scratch iPhones, iPods or other touch-screen phones or devices and thus preventing the user from exposing their hands in the harsh climate. (Consumer trends for 2009, 2008). The other rising trend that can help in negating the stress of this over mechanized society is that of human powered systems. The energy generated by the human body as a means to power small devices. Human power is rapidly gaining in popularity worldwide as businesses seek ‘greener’ methods of operating. It can also ride in the ever popular sustainability wagon.
- **Trends As Inspiration For The New Product Ideas:**

The opportunity has been statistically analyzed to affirm that there is value in making stress reducing solutions. (e.g.- statistic inference diagram pg.-----). The trends inspiring this new product development process here would be those of wellness, human powered systems and about certain niche attributes in the economy. Wellness signifies the want to do something for their personal well being and not shying away from trying new things. By human powered, the sustainability issue also comes into play and if the new ideas are sustainable, they would help to draw in more people. The ideas (of wellness/nichetributes/human power) can inspire new designs and lead to a very interesting dynamic of trend/counter-trend here. For example electronics are becoming cheaper, smaller, and more ubiquitous. People tend to carry their devices around with them but sometimes are not able to access an electric outlet, especially on the go. Consequently it could make sense to use the human body as a power source. Combining the ubiquitous nature of the devices, with the trend for wearable technology and the want for wellness benefits, provide possibilities that can be worked on. (Tech Republic, 2007) (CS Scout)

Leveraging on these facts and trends, there is a need that can incorporate these trends and create a stress reducing product that would connect with the user.

- **Problem Statement**

A product for the workplace needs to be designed that is either an entirely new category or a new product. Would it try encompassing existing technology and positioning itself differently?

**Stress point considered:** Looking specifically into solutions that can fit seamlessly into people’s lifestyle.

**Research and Opportunity Identification**

As discussed in the previous chapter, work related stress is a major happening and has a big scope for designing in it. As the epidemiologists point out, time, pressure and physical effort are the common stressors across a wide range of occupation. These prove to be the take off point for any such design and innovation. Besides stress management programs, not much thought has gone into stress reduction
technology for employers and employees at core personal or physiological level. This opportunity gap presents a good potential to take it further.

**Stress point considered:** This new product should make them feel less stressed out and enable self monitoring due to the lack of time that people deal with.

**Area to be designed for:** Workplace

- **Objectivity Of Measures For Job Stress**

  ![Inference Diagram](image)

  **Figure (i):** Snippet from the full inference diagram on page 11

  The opportunity here lies in designing something that can be present at people’s workplace, fit seamlessly in their day to day lives and is human powered to reduce the complexities of technology and alleviate stress. This way they tie into the trends discussed above. This could be in the realm of garments, apparels or accessories. In view of the fact that garments/clothes are a necessity and people will always buy them. The apparel design aspect doesn’t push the limits to such an extent that is becomes difficult to adapt or causes unnecessary stress.

  **Stress Point in consideration:** They should not be so complex, such that the stress alleviation product presents a different kind of stress itself for using them.

- **Target Market**

  It should be the generation Y demographic. This particular target market comprises of the young professionals, (age range 20-35) especially women. They would show more probability of being
interested in the compatibility of this new age garment to fit any normal garments they currently use, along with having the possible added benefit of stress monitoring or stress reduction.

**Stress Point in consideration:** This generation of consumer is more tech-savvy and not much boggled by complexity and hence would not feel stressed using any such product designed.

**Understanding Phase:**

**Design Ideation** – Area of design: Apparels/accessories, Target market: Young professional working women. Thus the ideation process is approached in the following way:

- **Incorporating the aspects of fit and fabric** along with accessories which can serve different purposes. The latest technology available in these seemingly disconnected areas of fabric/apparel and software technology is analyzed. The self-monitoring stress reduction attributes are prioritized.

- **Leveraging on the technical research** in various areas done before and considering certain areas that would be requiring further research. It is more feasible and plausible than to just come up with something relatively more disruptive and probably unheard of.

- **Following the trends,** mostly classic styles and incorporate those aspects to further the products ability in being more marketable. The classic cuts would help it letting it not get redundant soon and buy time for them to be accepted at a normal and not rushed pace.

**Stress point in consideration:** To integrate the research of trends/fit/technology in such a way that the adaptation process isn’t too steep and blends with target market’s lifestyle easily.

**Research After Design Ideation:**

A full scoping of the present available technology for stress reduction in lieu of technological innovation in areas of apparels and accessories is done through books, websites, journal papers, patented technologies, consumer reports and trend-watching articles etc. They are analyzed keeping the stress point in consideration. This can be called the attribute selection process in this case.
**Secondary Research:** About choosing the latest designs and the take-away in terms of technical attributes relevant to the purposes of stress reducing garment design for furthering this design process.

High tech textiles (Science News: Smart Suit Doesn’t Miss A Beat, 2007) | Luminative Textile Garments
| Biosensor integrated smart fabrics (Science Daily, 2006) | Heart rate monitoring suit | Chainmail fabric

**Figure (ii):** Attribute Selection Diagram: Presents an overall view of the attributes selected to go further along with the designs.
**Primary Research**: As a step to know more about new age technology (for fabrics/accessories) regarding future directions, getting in contact with the company Smartex™, the forerunners of smart fabric technology provided with first hand information of the company and it further research interest areas. Certain points discussed with the HR – Mr. Rod give a gist of the basic idea:

- The intention here in particular is to look for wearable designs made of such fabric that can overcome the short-comings in design and look specifically to monitor the state of the user and determine and alleviate their level of stress etc.

- He stated that an interesting point raised here is that there will be a time in future when textiles will play an active (rather than passive) role in various products. The complexity in technology being looked for in this case is only just emerging at the moment.

- The fabric is available, but the software it not. Inherently the ‘fabric can only ever be a reactionary medium’ to provide feedback & deliver the required prescription to the patient.

- Software is the real break-through in this field. When a device requires no human intervention to process the data & then deliver the prescription or the relevant stress reducing procedure.

**Stress point in consideration**: The fabric technology has to be fully thought through before launching in the market as the next big tech advance.

**Gist Of The Attributes For Designing Further Based On Above In-Depth Analysis**:

Less cumbersome | Therapy backed by scientific research | Convenience | Re-usability factor | Self diagnosing capability | integrating the electronic elements into conventional fabrics | Incorporating more design elements | Auto dynamic nature | Less complicated mechanism | Interactive electronic or biochemical devices | less disruptive | Re-Define traditional body adornment | Aesthetically pleasing |

Fabric is reactionary medium: Software needs to integrate. | Stress Less.
Conceptualizing Phase:

In the context of the paper/project here, this phase deals with drawing out the concepts of stress reducing product design. **The stress point in consideration:** While keeping in mind their need to be stress reducing, the design attributes chosen should be easily adaptable not only to the market but also the potential consumers. A good way is to approach those stress reducing elements that have been safer, tried and tested before in some way.

- **BRAINSTORMING IN THE DIRECTION OF FUTURISTIC STRESS REDUCTION**

The following themes give the general idea of the conceptual thinking that can go behind these designs and for the future adapted variations. (Sources for further in-depth explanations of some of the above are provided in the bibliography)

![Diagram representing different technologies presently being worked on in the industry.](image)

**Figure (iii):** Diagram representing different technologies presently being worked on in the industry.
The Other Essential Elements of the Designs:

In this particular process of apparel design the following are the design decisions made and presented, the whole time keeping in mind that the issue of stress is addressed appropriately as much as possible.

Color /Fabric and Silhouettes:

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>DESIGN DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>COLOR</td>
<td>Blacks, Blues, Grays and matte Browns would go well with corporate wear norms and fabric choices. With bright colored trimmings when required in the design.</td>
</tr>
<tr>
<td>SILHOUETTE</td>
<td>A classic style for office wear. One that provides excess fabric for maneuvering space required to include technology (e.g. -like a motherboard monitoring in the vests). Similarly one texture over another and one fabric over the other can provide the stylish layering effect. For e.g. Matte against shiny surface and/or dull against a shimmering black.</td>
</tr>
<tr>
<td>FABRIC</td>
<td>Sand silks, denims, woven suit fabrics: for the heavy outer look. Georgette, nets and crepes for classic fall and drape. Layering would be an essential part of these designs and these fabrics have to be easily compatible to the electronic textiles etc for the designs to work well.</td>
</tr>
<tr>
<td>STYLE</td>
<td>Layering, High waist pants and skirts, pencil skirts, denims, coats and skirt suits :They can provide excess fabric for maneuvering space required to include technology (e.g. -like a motherboard monitoring in the vests). Similarly one texture over another and one fabric over the other can give the stylish layering effect as well</td>
</tr>
<tr>
<td>ACCESSORIES</td>
<td>Metallic elements added which range from trims like buttons, belts, appliqués, jewelry etc. Bright colors (fabrics or trims) interspersed with the darker, more somber tones chosen for the office.</td>
</tr>
</tbody>
</table>

Table (ii): Enlisting basic elements of design directions to be incorporated the apparel design solutions.

Figure (iv): Real World inspirations for design directions
Detailed Design Garment Sketches:

Theme Based Concept (a):

**Figure (v):** Detailed Concept Design Sketch1
Theme Based Concept (b)

Figure (vi): Detailed Concept Design Sketch2
Theme Based Concept (c):

INTRICATELY DETAILED ENSEMBLE OF FULL SLEEVED TOP AND A HIGH WAISTED SKIRT

- Stretch lace silk fabric

- Stitched on wired corset (inlined with biosensors)

High waisted straight skirt with front pockets

Button Encasing on front Panel (sewed on metallic versions)

Figure (vii): Detailed Concept Design Sketch 3
Theme Based Concept (d):

CLASSIC SLEEVELESS SHIRT AND STRAIGHT SKIRT WITH FLORAL APPLIQUE

Floral Applique/Patch on for control device (i.e.-restructuring bulk into an aesthetic element)

Eleksen's textile pressure sensor, can be rolled or crumpled-used in mobile electronics here can be used in inner vests for monitoring with outside top flower applique acting as the control point.

Yarn made from strands of conductive steel spun with cotton or polyester fibers e.g.- To deal with fitting issues, a research team (De Rossi) developed software algorithms to clean up the data, along with code to reconstruct the wearer's movements.

Figure (viii): Detailed Concept Design Sketch 4
Theme Based Concept (e):

Fitted hip-length Jacket with fitted pants

Smart Fabric: Chainmail Fabric (nanotechnology)-underlying layer with biosensors

Stylish Top stitching to add effect (stitching piezoelectric or organic fabric with regular twill fabric for fitted jacket.)

Skinny fit black denim of Auto Snug Material

Figure (ix): Detailed Concept Design Sketch 5
(iv) Realizing Phase

- Evaluation

The next step once designing is accomplished is to evaluate them as sellable products and checking their feasibility in different areas which pertain to performance, aesthetics and consumer satisfaction.

The stress point in consideration here is that the ergonomic standard in terms of usability can be checked, and the task analysis of a consumer wearing the product throughout the day is possible. However there is nothing quantifiable when it comes to saying whether the designed product is stress inducing or not. This seems to be the missing link here:

- How does one know whether or not keeping stress in consideration for all parts of the process, the designs were able to make the products less stress inducing? There needs to be a way to check that and to see whether it is affective or not.

ACKNOWLEDGING STRESS TO BE ACCOUNTABLE IN THE PROCESS:

In spite of the fact that at each step of this design product process, the issue of stress had been taken into consideration, the assurance that the product is stress inducing or not cannot be quantified or justified for the market and consumers. When the above steps of new product development process is followed, and the concept phase realizes the product, it is at that time that the most amount of care is needed to look into the products as they get transformed for real world use. They can be in terms of real world models, large or small scale manufacturing decisions and distribution and roll out strategies etc. However since in this context, prior to any big term roll out, the companies should try and make sure that their products are not going to add to the stress of the very consumer they claim to be designing for. The question is how can that be realized and be validated enough to give confidence in saying that the product is stress free or less stress inducing. In concept generation and the testing phase, ergonomic and aesthetic issues are dealt with, but stress is not really called out. As pointed out, in this example through the process cycle, stress played a part in the choosing and designing of the apparels because of
the design feature being one of stress reducing garments, even then no such test or standard is there which can state or validate the level of stress they induce or don’t induce.

**Solution to this Issue:**

All this can be solved with the help of a mechanism or tool that is discussed and created in the later chapters (4/5/6) that can help in solving the above problem in its own particular way/method way that has never been thought of before.
8) BIBLIOGRAPHY


35. program home. (2008).


47. web, a. w. Patent No. 5381558. United States.
