Chapter 1: Thesis Overview

Introduction / Abstract

The motivation of writing a thesis with the theme of elderly healthcare came from always coming across elderly members of the public not having proper care, out in the streets by themselves.

The objective of this project is to try to help these elderly members regain some of their dignity by giving them some independence and higher mobility.

This project went along with the help of many people including staff from institutions for the elderly as well as experts in gerontology from educational institutes.

The findings were a result of the various field studies as well as in depth studies of the aging process and life as an elder. My hope is that this project can achieve what it initially set out to do, that is to help the elderly live a more fulfilling life.

1.1) Issuing a challenge

This thesis project started when we were given the challenge of resolving a problem. We were to resolve this issue through design in a year long period. In the first week of the semester, we were told to come up with various issues that needed solutions. From amongst these would be our project proposal and preferred solutions.

1.1.2) An initial proposal
After the initial critique of problems and solutions, my theme of work was set at working on the specialization of gerontology, in particular, the mobility of the elderly in tandem to shopping. In order to understand more about the subject, information was to be gleaned from a few sources. The following statistics was obtained from various governmental sources.

1.2) Issues surrounding the study.

1.2.1 The Aging population.

An aging population is normally associated with developed or developing countries such as Singapore.

Statistics show one in every four persons will be 60 years or older by the year 2030 (Ministry of Home Affairs, 1989). There is also information that tells us that the increase in the number of elderly between 1985 and 2025 will be approximately 348 percent, the second highest of 31 countries surveyed. (U.S Bureau of Census)

The Ministry of Health has released statistics that reveal the fact that approximately five times the number of senior citizens is admitted to hospital than any other age group.

With such a huge portion of the population in the aging category, there is great commercial value for the product that will be developed in this thesis project. Besides introducing it into the local scene, it can also be adapted to fit countries with an aging population such as the United States.

More importantly it also shows how important a study on gerontology will affect a significant portion of the population.
1.2.2) Changing Health needs of the Population.

The Life expectancy of the average citizen has risen to 77.1 years as estimated by the Ministry of Health.

While cancer and heart disease remain the principal causes of death from the year 1998 to 2000, this is expected to change with the ageing population.

1.2.3) Increasing Health Costs amidst Inflation and Recession.

Although the Government has raised health expenditure from 7.2% to 8.2% over 3 years, Health costs are still steadily increasing.

A series of rising costs (transportation, insurance, etc) has brought inflation to the economy. This, coupled with an extremely serious recession has led to the restructuring of not only the economy, but also the domestic infrastructure.

A consequence of this is that the elderly have a smaller budget for other necessities than before. A direct result would be that the costs of manufacturing a mobility aid would probably have to be around an affordable price of $10.

However, as a result of the restructuring of the economy and a higher educational level, the future batches of the elderly will be more affluent. This allows them to have prepared for elderly life. Therefore it remains to be seen whether or not they are prepared to pay more for a mobility aid.

1.2.4) The case of institutionalization of the elderly.

Rapid Industrialization has resulted in the change in the source of caregivers for the elderly. The cultural tradition of looking after the elderly has been eroded with the increase in the number of women working. The female labor
participation rate increased from 8.8 percent in 1957 to 40 percent in 1990 for married women (Department of Statistics, 1970, 1990).

With the erosion of traditional values, the case of the institutionalized elderly has become even more obvious. The demand for residential care such as welfare homes is expected to increase four times to 17,290 beds in the year 2030. This demand will be made up hugely from the frail elderly, many of which are married or widowed (Ministry of Home Affairs, 1989).

1.2.5) The independent senior citizen.

With this change in the economic structure, more studio apartments have been built for the elderly citizen in mind. A total of 1000 plus units have been built and are already occupied. These units are built by the Housing Development Board and have facilities that are designed with the elderly in mind.

This represents the acknowledgement in the shift from traditional culture to a resettlement in which the elderly have longer working lives and live more independently than they used to.

(J.D. HARRISON. Housing Singapore’s Frail Elderly in the Next Millennium.)

My opinion is that with such a new mentality amongst the elderly, they are now more prepared to stay alone and move independently regardless of their immediate relatives. This movement is however limited to the strength and the bodily functions of the elderly person.
1.3) The Concept of Aging in Place.

1.3.1) The changing of the environment to suit the Elderly.

The Singaporean society is now approaching an age where institutionalization of the Elderly is no longer appreciated or enjoyed. This brings us to the Aging in Place concept. This concept gives the elderly the leisure of living within their own homes for the remainder of their lives. This is done through changing the environment of the elderly and giving them mobility to go wherever they wish to. This is idealistic, though it may not actually be one hundred percent achievable.

First of all let us look at achieving the changing of the environment. There are four critical components of the environment that we need to look at. (Ward, 1988) These are:

- Neighborhood; space containing neighbors and services.
- Interpersonal environment; social networks and systems.
- Social environment; norms and values within culture
- Supra personal environment; metropolitan spatial structure.

The first three environments would be exceptionally important to me in the design of my aid. The research generation would therefore tend towards the investigation of these environments.

However in the instance that such environments cannot be changed or have a limitation to change, then there can be equipment designed for the elderly to help them into that environment.

Aids such as walking canes have been around since time immemorial, and they are a good example of such aids that can help the elderly person.
1.4) Bringing Mobility to the Elderly (shopping.)

1.4.1) Present Mobility.

With the increase in the numbers of Senior Citizens in Singapore, we find that there is also an increasing number who are rendered immobile or less mobile. By giving them mobility through the use of aids, we give them more freedom to live independently and to live a life of more purpose.

“We encourage the elderly citizens to move about freely as much as possible. This not only keeps them physically fit, but also mentally keen.”

Madam Yip Moh Han, Director, Bethany Nursing Home.

This is actually being carried out, though in small steps. Field research in the studio apartments of the Tampines precinct have revealed easily accessible lifts on every floor, ramps, and hand bars on nearly every wall.

Studies were made at an elderly couple’s abode in one of these apartments to investigate further the problems they faced. This couple supported themselves with their private savings and a monthly allowance from their children. The male member was struck down by stroke and is only partially ambulant. His wife is the only member who cooks and cleans up this small apartment. The following are the findings from the visit. (Due to the wishes of the couple, their names were not reported in this report.)

- The couple is generally pleased with the facilities offered in the studio apartment. They feel secure living in an area that has fast and easy access to medical and health facilities.
- Due to a lack of mobility, they seldom move out of the apartment and the surroundings. However they exercise daily by taking short trips to the food centre at least once every day. Their daily groceries include 2 packets of cooked food for lunch. Their children often buy food weekly
for both their dinners and breakfast. They have indicated a desire for more variety and choice.

- Also highlighted were some issues related to shopping. The couple complained that although the surrounding area was built for their convenience in mind, they are still hampered by a lack of proper shopping equipment that helps them with shopping. The present trolleys are too cumbersome and do not provide much support.

1.4.2) Proposed Objectives of the Thesis Project.

With the infrastructure issues mainly solved by the Housing Development Board, we turn our attention to the issue of mobility in the outdoors. Of the Activities of Daily Living that have been surveyed, marketing ranks as one of the most problematic issues that the elderly face. *(Functional status of the Elderly in Singapore)*

My initial proposal that was accepted after discussion is to design a movement aid that helps the elderly cope with mobility while doing their shopping. However at this initial stage not many people are convinced of the need for such a product.

The end goal is to cultivate independent living for the elderly that wishes to do so, yet have limited means.

**Summary**

*In the first chapter, background studies have been the mainstay of discussion. This knowledge provides a rudimentary grasp of what the project process will need. References will be made and changed through the course of work.*

*In the following chapter, there will be a further look at the research and design methodology that the project will be carried out under.*
Design process adapted from Archer's three phase summary model and Pahl and Beitz's model of the design process.
Chapter 2: Research and Design Methodology.

The previous chapter focused on understanding the background of the issues of marketing and mobility at hand. In this chapter, the focus will be on the research and design methods. These are

- Field Research
- Literary reviews
- Expert opinion

2.1) Field Research.

Field research on the project was implemented with the help of Dr Vasoo, a Professor with the Arts and Social Sciences Faculty who specialized in Social Work. Visits to the following places to gain a first hand experience of the difficulties of the Elderly were also carried out.

2.1.1) Homes and Institutions.

- Bethany Methodist Home.
- Thye Hua Kwan Moral Society. (Henderson Moral Home)

We were entertained by Mdm Yip Moh Han, the Director of the Bethany Methodist Home and Mr Ardi S. Hardjoe from the Moral Society.

In these institutions, we were brought around to visit the semi ambulant elderly patients who frequented or visited the facilities. Many of them exhibited an enthusiasm to exercise despite their physical frailties.

Many of these elders moved about using metal frame walkers, wheelchairs and variations of walking sticks. They also worked on exercise machines ranging from light weights to stationary bicycles.
Feed back gathered from the wardens proved a few issues; not only did these aids have to be strong structurally, but they also had to be cleaned and disinfected easily for fear of infection. Most equipment have to be washed and left in the sun after heat.

2.1.2) Interviews and market observations.

This was done in a market in Haig Road, Aljunied. The aim of this activity was to conduct interviews regarding the present shopping habits of the elderly. Some of the results are reflected in the Appendix.

We also used the opportunity to observe and to analyze some of the present products on the market to get a grasp of the opportunities that were available. These studies are reflected in Chapter 4.

Most elderly people interviewed reflected the fact that many products used for shopping such as the supermarket trolley have a lot of problems. They are either too bulky, heavy or are simply not flexible enough to push around.

All these factors hinder what would otherwise have been an enjoyable shopping experience.
2.1.3) Living conditions observations.

To understand the new studio apartments available to the elderly, visits were made to the Golden Pines apartments in the Tampines precinct. We were given access to one of the apartments of an elderly couple. Some observations have already been recorded previously in chapter 1.3.1.

2.2) Literary reviews.

Information was then sieved from the various sources with regards to the design proposal.

**Brochures.**

Visits were made to the Ministry of Health and relevant information was sieved from the brochures that were given as well as information from researchers in the institution.

**Digital Journal.**

This would be the Singapore Medical Journal in a digitalized version available online. From this source, a series of articles relating to design for the elderly (dating a few years back) could be accessed for reference.

**Medical Journals.**

The annual local medical journal for elderly care was sourced from a local general practitioner. These allowed an in depth study of some of the problems that the local physicians faced in their practice as well as the norms of treating elderly patients.

**Newspaper Articles.**

Newspaper articles that were deemed useful for researching mental and emotional factors of gerontology were clipped for reference.

However, due to the inaccuracy of media reports, this category of information has to be deemed the least reliable.
2.3) Expert opinion.

Throughout the course of this project, various experts who are familiar with the subject matter were consulted over the feasibility of the project. They also gave invaluable feedback along the entirety of the project process. These are:

**Professor Vasoo.** Department of Social-Work, NUS.

**Mdm. Yip Moh Han.** Directory of Bethany Methodist Home.

**Alan Joey Chng.** Chief Medical Officer.

**Mr. Ardi S. Hardjoe.** Directory of Henderson Moral Home.

**Ms Bernadette.** Chief Physiologist.

Along with these are the selected guests who will be invited to critique the work with their expertise.

**Mr. Loke.** Society of Aid for the Paralyzed.

**Lawrence Wee.** Presbyterian Welfare Hospice.

**Col. Joseph Chong.** Lions Befrienders.

**Betty Wong.** Henderson Senior Women Home.

**Mrs. Maurice Pham.** Asian’s women Welfare.

**Summary**

The research further increased the knowledge that was required for the project, especially in the context of the local scene. Exposure to the elderly members who were isolated and weaker gave more motivation to the project. In the next chapter, there will be an investigation on various products on the market that demonstrate traits of assistive mobility and shopping. This would help give a better understanding of the competing market.
After Chapter 2, the project is now at the end stage of collecting data and will go on next to the analysis of the user.
Chapter 3: Competing Product Analysis.

After field investigation in the last chapter, this chapter takes a further look at the product market that competes with the project. This will enable not only new ideas but also help the project gain an understanding of its competitors.

3.1) Existing products on the market. (Shopping)

3.1.1) The market trolley.

This commonly seen market trolley is a foldable trolley that can be folded before use in the market (Fig 1). It is used most commonly in wet markets and places where no means of holding food can be found. It is the cheapest product for a portable trolley locally. After investigation, we have found out that it is not necessarily the best thing an elderly member can use for marketing. However the selling point of this trolley is that it is so highly collapsible that it makes for easy storage space. It is also not very heavy on its own weight. However there have been times when elderly citizens try to lean on it for support, as if using a walking stick.

Fig 1. Foldable Trolley

Advantages
- Cost efficient, each unit is sold at a market price of around $15.
- Easily folded flat (150mm) on its side. Space efficient.
- Allows for push or pull system.

Disadvantages
• Ergonomically not designed for optimal pushing or pulling. Variations have been found at a smaller size and at a lower cost. These seem to be not ergonomically sized.
• Hard to Maneuver. Low center of gravity makes this worse. Not easy to use when pulled.
• Hard to reach pocket region. Products often get tangled in it as well.
• Lack of a degree of height customization for both male and female elders.

The second product used locally is the collapsible trolley shown in Fig 2. This is less widely used due to its complexity in usage and its price tag. In a normal marketing day, I could only see three sets being used out of a sample of about 100 shoppers. However, it seems to be more useful due to its degree of collapsibility and size. As compared with the first instrument, this is more hand held than pulled when it is closed. This seems to be a flaw, as it seems to have been designed for collapsibility rather than mobility.

**Fig 2: Collapsible trolley**

**Advantages**
- Highly compressive, able to carry it easily when not in use.
- Plastic-like material makes it lightweight.
- Small degree of height customization with its pull out handle.

**Disadvantages**
- Hard to maneuver. A lack of revolving wheels.
- Hard to reach pocket region.
- Not easy to collapse. Some degree of strength and neurological ability is needed to
close the trolley up properly. Not built for the physically weaker elderly members who shop.

- Lack of a degree of height customization for both male and female elders.

3.1.2) The Supermarket trolley.

The Supermarket trolley comes in a variety of designs; most commonly seen the metal-framed behemoth that moves on a series of four castor wheels on its bottom. It normally comes with a collapsible side frame that is meant for carrying kids or to separate different goods. To save space when not in use, it can be slid into each other from the back to form a short queue of trolleys. Its large size gives highly desired carrying space, yet through this it also creates less maneuverability. A huge problem is the weight, with most of the elderly unable to cope with the metal structure.

The latest designs come in easily manufactured plastic frames that are not only light, but also cheap. (Fig 3) However, in the context of the movement aid for the elderly, it is still not as feasible due to its inability to collapse (and thus give more mobility). The advantages it has over its predecessors are that it is much lighter and has a smaller carrying size that can relate better to the elderly citizen who has been found to purchase less amounts of food.

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**Fig 3: Supermarket Trolley**

**Advantages**

- Light and durable makes it easy to use and profitable to manufacture.
- Retractable basket allows for modular use.
- Highly maneuverable.
- Portrays a classy and sporty image.

**Disadvantages**
• Still a little too much pocket space for the amount of food that the elderly would buy.
• Too bulky for the elderly.
• No sense of customization at all.
• Unable to collapse into a smaller area.
• Lack of a degree of height customization for both male and female elders.

3.1.3) The Airport trolley.

The area of the airport trolley is important as well because it provides some avenues into solving some issues of the mobility aid particularly maneuverability. In referring to the airport trolley, I am looking at some of the latest trolleys that are shown in the figures below. A particular model I am looking at is the Schiphol Shopper. (Fig 4)

This trolley was designed originally for small spaces. It is highly maneuverable and carries a portion that looks a good fit for the smaller portions of purchases the elderly citizen makes. This trolley is situated in airport terminals where transits are made and the amount of luggage one carries is comparatively less than usual.

However, like all other supermarket trolleys, its failure to be totally collapsible means that it can only work for the elderly within the premises of the shopping experience. Movement from home to market vice versa thus becomes a potential hotbed of difficulties.

**Fig 4: Schiphol Shopper**  
**Advantages.**
• Highly Maneuverable. Four casted wheels enable it to turn on its base 360 degrees.
- Good reach and easy access to pocket space. Pocket space is also a nice size for carrying small and light items.
- Not as bulky as others in the base region, but can be improved.
- Classy image.
- Good enough to hold around 3-5 kg.

**Disadvantages.**
- Unable to collapse into a smaller area.
- Is definitely very expensive to produce, definitely much more than what the elderly person can afford.
- Too heavy to lift when circumstances demand it to be carried.
- Lack of a degree of height customization for both male and female elders.
3.2) Existing products on the market (Mobility).

3.2.1) Walking Cane.

The walking cane is one of the most commonly seen instruments of aid. The cane provides support up to 25% of the body and helps the body maintain its posture. (Pang, 1997)

However, in various interviews conducted with local elderly men, I found that elderly men did not perceive the use of the walking cane as necessary even though they were frail in body. Most young people however, have an impression of the walking cane as a sign of prestige and power that comes with age.

This is perceived to be an egoistic issue as these men felt the walking stick (or other walking aids) portrayed them as being weak and poor in health. Therefore I have to address the image of the shopping aid in the minds of these particular men as well. Not only does the aid have to provide a dual functional purpose, it also has to provide a visual stimulus. (C.Y. LIM. Social Activities in Late Life)

This visual presentation should not just give the elderly self-confidence; it should also be highly presentable to the immediate family of the elderly. This category would most likely be the young and impressionable.

Variations of the walking cane have been found with impressions of seating modules and four legged ends.

The latest in recuperative aids involve the **swan neck design** that reduces the stress on the wrist. This is definitely worth investigating if the walking cane is used as a platform of design.
Advantages.
- The walking cane is extremely lightweight and easy to store. As many elderly citizens have commented, it is the easiest of aids to use. Its share of the market for elderly use is 75%.
- Its use is mentally still accepted as a sign of ageing and prestige but not as a sign of weakness. This is why it is still so popular all over the world.
- Some models allow for height customization.
- An ideal platform for further design.

Disadvantages.
- Only variations with four legs allow the aid to be suspended on its own when not in use.
- Legs often get stuck in drainage grills and cause the elderly patient to fall.
- Heavy stress on the wrist and nerves in the palm.

3.2.2) Walking frames.

Walking frames allow support of the body weight up to 50%. The observations at homes and institutions show that many of the elderly who use these products are in their seventies and need lots of support while moving about in their daily routines. These can be due to a variety of reasons ranging from osteoporosis to cardiac problems. (Pang, 1997)

Most of these frames are made of light materials such as aluminum. This allows for easier carrying and also better maintenance. When not in use, the frame is designed for folding into itself. This allows it to be kept easily.

Movement on these frames however, is extremely slow. The user has to lift the frame up and shift it forward first. This allows the user to move a little by a little.
Advantages.
- Frames can be collapsed easily and stored when not in use. Easy to collapse, these frames can be kept even by the elderly members who are weaker physically.
- Light weight allows the user to move about with less burden.
- This support allows for the use of both hands. There is less stress on one hand and allows for much of the body weight to be supported by the frame.

Disadvantages.
- The frame is cumbersome when fully open and in use. Not easy to maneuver when it is in use.
- Takes a while for the elderly patient to get used to it. This is because of the 3 step movement sequence of lifting, moving forward and pushing downwards.
- Imagery of such an aid is that of weakness. Not many are willing to use this even if they need it badly.

3.2.3) Limb straps.

These are straps that are attached to limbs that have mobility problems such as osteoporosis. Such attachments are not only for rehabilitation; they also help the limb in extended movement.

Advantages.
- These aids are used for specific medical problems and they work well to relieve the elderly patient.

Disadvantages
- These aids can only be used for limited mobility uses such as extending the limbs.
- Some of these are also too heavy and impede the user instead of aiding them in movement.
3.2.4) Rollators.

These are the mobile aids that come closest to the aim of providing movement for the purpose of shopping. These are seldom used or even purchased locally due to the high cost of such equipment. Their weights range from 4 kg to 8 kg. This can surely be improved with current materials.

Most of this equipment is a nice blend of support and shopping elements. However I find that they are cumbersome and portray too much of a medical aid image which is uncalled for.

**Advantages.**

- Good support element of the walker system, often with a collapsible feature that allows easy storage.
- Allows the elderly user to move much further as it relieves the user of much more stress then other aids.
- Shopping element incorporated is a bonus feature.

**Disadvantages**

- The aid is too cumbersome and portrays weakness.
- Wheels can only be controlled by brakes that may not be handled properly by frail hands and limbs.
The **product characteristics matrix** shown above depicts the analysis of the competing product comparison.

- The walking canes, frames and movement aids portray more functional use as a support aid than rolaters and carts.
- However, a lack of shopping elements make them less desirable then the rolaters and carts.
- The walking cane has the highest image rating amongst the aids, and is a very probable platform for use just for this reason.
- The desired characteristics spectrum falls in between the three different product categories.
- A platform could thus be chosen for further work on how a mixture could be achieved somewhere within the red region as shown in the matrix above.
Summary
This chapter gave a strong indication of the advantages and disadvantages of the competing products in the gerontology industry. It also helped gain an understanding of what is required to create a product that is safe and desirable for the elderly citizen.
The resulting product characteristics matrix helped pinpoint some vital characteristics that will be useful when listing down the design brief.

The next chapter shall focus on the user and analysis of the issues surrounding the elders’ daily routines.
Chapter 4: User Analysis

4.1) Field Studies/Research.

After some studies and analysis, I have come up with my problem statement and potential beneficiaries.

**The Problem:** The elderly have restricted mobility due to physiological / mental deficiencies. As a result, many of them tend to spend the golden ages of their lives starved of purpose and recreation. They have to rely on others and will develop a mental image that they are no longer useful and are a burden to others.

**Potential beneficiaries:** The aim is to create a shopping aid for the elderly who are ambulant or semi ambulant and wish to lead a more independent and purposeful life. Not only can this aid help in shopping, it can also increase the movement rate and capabilities of the elderly person.
4.2) User Profile Analysis.

The user profile analysis plots the user against his roles in developing the product. This helps to decide on the various design implications when coming to the planning of the design formulation.

The *stakeholder* represents the different categories that can contribute to the feedback leading ultimately to the design. The *senior citizens* group is a direct user while the *caretakers* and *housewives* groups are indirect users and contributors to feedback.
The table above was a direct result of information that was sieved from the first two chapters. This table allows me to take into account the needs of the elderly and the design implications for the shopping aid that will be designed.

The ‘actions needed’ column is an indication of what might be required in the design process later.
4.3) User Schematics.

The user schematics graph shown in the appendix. is an analysis of a couple of case studies of elderly shoppers. The relevant findings are listed below.

1. The independent elder goes to the market to shop for food not only for oneself but also for the family. Where he lives alone or with a companion, the amount of food bought each day amounts to 3 – 5 kg.
2. He encounters infrastructural obstacles that he overcomes with the help of the mobility aid.
3. The distance that one travels is less than 1000m. The aid also helps him board public transportation easily.
4. However, the aid is needed to help increase mobility, speed and strength.
5. Upon reaching the market, the aid becomes a tool that helps the elder in his shopping, whether it is a basket, walking aid or support.
6. A single action mechanism lets the conversion of the aid into its various functions be easy and clear.
7. With the aid of the shopping aid, he traverses through the huge crowd with relative ease then before.
8. Food is packed into the collapsible storage unit that is placed at the top of the cart for easy access.
9. Due to the huge difference in the amounts of food one can buy, different bags can be mounted even before one travels out of home.
10. On the way home, fatigue starts to kick in as a result of the time spent in the open. The seat unit is used for a short rest when there are no proper seating amenities available in the vicinity.
11. Upon reaching home, the bags are taken out and the aid becomes a walking device once more.
4.4) Summary of findings.

The summary of findings consists of three sections.

- **Scenario painting**: This illustrates the various situations of the elderly in the process of marketing. By investigating the different scenarios, we find different problems and issues that hinder the marketing process.

- **Issues of contention**: These issues address the various problems that the elderly have to contend with in the marketing and movement process.

- **Outcome visualization**: This represents the probable/possible design solutions that can be undertaken to resolve the issues of contention that have been stated.
Summary

In this chapter, there has been a focus on gathering and compacting the information that has been sieved from field and literary research. From these findings, there have been several possible outcomes that have been visualized.

More importantly, there have emerged some more issues of contention relating to the shopping and movement process.

In the next chapter, there will be more issues emerging with an in-depth study of the ergonomic issues relating to the ageing process.
Chapter 5: Ergonomic Issues.

5.1) Physiology of Aging.

5.1.1) Outward signs of Aging.

- When one ages, the most telling features of the process of aging will show on one's skin, hair and nails. With increased time and age, one's skin loses the underlying fat layers and oil glands, causing wrinkles and reduced elasticity.

- The skin develops "age spots" due to deposits of melanin pigment. The hair loses its black pigmentation and turns white gray.

Implications: The design implication here is the issue of image. With age, one becomes more conscious. The Shopping aid should therefore not just increase the independence of the elder; it should also increase one's self-confidence. It would therefore be quite a fashion statement to be seen using the shopping aid.

5.1.2) Changes in the cardiovascular system.

- The most important change is a reduction in the blood flow to the body. This reduced blood flow results in reduced stamina since less oxygen is being exchanged.

- As a consequence, the individual has a slower rate of healing and a reduced response to stress. Other consequences of these cardiovascular changes are hypertension with an increased risk of cardiac related diseases such as heart attack.
Implications: The design implication here is whether or not there should be another storage unit that holds medication for the elderly. Perhaps there could be also a tag that provides information of the users medical history as well as data relating to his next of kin should he suffer a relapse of an illness.

5.1.3) Changes in the Respiratory System

- As with the cardio-vascular system, there is also a reduction in the efficiency of the respiratory system in later life. There is generally decreased oxygen uptake and exchange.

- The muscles of the rib cage also degenerate, decreasing the ability to breathe deeply, exhale and expel waste carbon dioxide. The result is decreased stamina, which in turn impairs one’s ability to perform activities of daily living.

Implications: This implies that the elderly citizen requires lots of time to travel from place to place. A possible intervention is the addition of a seat unit that allows rest.

Could there also be a medical unit that monitors the health of the elderly citizen? This could be an optional accessory and not a compulsory module as not everyone can afford to pay for technology.
5.1.4) Changes in Musculature

- A general degeneration of all muscles is normal when one gets older. This is accompanied by a replacement of muscle tissue by fatty deposits. Hand strength is reduced by 16%, arm and leg strength by 50%.

*(The measure of Man and Woman, Human factors in Design.)*

- The loss of motor units means there is a decrease in metabolism, endurance and strength.

**Implications:** Maximum walking speed as a whole drops by up to 90%. Fatigue and weariness also kicks in much earlier. However, with the huge number of seating amenities in local housing estates, the need for a conversion to a seating unit is questionable. The degeneration of strength means mechanisms such as brakes cannot be effectively handled as before. There should be minimum steps required for any use of the aid.

5.1.5) Changes in the Skeletal System

- At around age 35, osteoporosis starts to set into the bones of men and women. This decreases the weight carrying ability of bones. There becomes a change in the posture due to the hardening of the vertebrae.

- The joints also undergo degenerative changes. Arthritis, the degenerative inflammation of the joints, is the most common chronic condition amongst the elderly. These conditions can impair mobility and the performance of ADL.

**Implications:** The body is less able to support heavier structures due to the weakening of the bones. The shopping aid should therefore support most of the users weight and his shopping items.
The walking speed also decreases by 10-20%. The elder also feels tired more easily.

The ergonomic considerations must take into account the change in height and posture after such a condition. The most probable course of action would be in the design an aid that is height adjustable.

5.1.6) Reduction in neuropsychological process.

- After the age of 25, humans start to lose nerve cells. This result in the elderly being slow to comprehend, execute or remember complex, unfamiliar or uninteresting tasks.

- A reduction in reaction time to the surroundings can also be seen.

Implications: In order for the elderly citizen to be able to remember how to operate the shopping aid, it should provide a single movement in response to a single stimulus.

It must also be clear in instructional use and easy to remember. Colour coding could be used to help facilitate medication if there is an medical kit incorporated into the aid. Prof Vasoo has also recommended using colour and instructions to devise a scheme or plans to help the elderly user make his way home if ever he loses his way.

5.1.7) Sensory changes with age.
• Three times the amount of light is needed for the elderly to see as well as a young adult. There is increased sensitivity to glare and it becomes difficult to distinguish pastel colors.

• Skin sensitivity decreases and becomes less sensitive to sensations such as heat, cold and injury. This makes it extremely dangerous to the elderly who has apparently lost his sense of touch.

**Implications:** The shopping aid should provide a cognitive system that allows one to remember where he is going, what he is shopping for. Again the use of colours could help, although a recorded voice mail system would be a more direct approach for help.

As far as possible, the shopping aid should be wrapped in material that enhances the grip or sensations that the elder can feel. This increases the security he or she feels when griping it.
5.2.1) Balance

This can also be known as postural stability.

- The first kind of balance we are interested in is the vertical maintenance of stability in a stationary position.

- The second kind is balance known as dynamic balance, which is essentially the maintenance of stability during locomotion and other movements.

It is known that elderly adults fall when they lose control over their postural stability, be it static or dynamic balance. The risk of such an occurrence increases with age, as there is increased degeneration in musculature and general health.

To make up for this, the human body adapts by:

- Reducing walking speed by 10-20% per decade.
- Decreasing stride length.
- Increasing time needed to monitor the environment.
- Using aids such as walking canes to prevent postural sway.

**Implications:** To prevent falls and to maintain balance, it seems necessary to have the use of a movement aid such as a cane or a walking frame.
Perhaps a system could be designed to support the body internally as a form of clothing or strap on.

5.2.2) Falls and coordination

The effects of falls can be disastrous even if one does not even actually suffer such an accident.

- 36% of those over 75 years of age have a fear of falling so strong that it affects their mobility and independence.

- Falls have a higher occurrence rate in females than in males. This is due to a higher compromise in diseases such as osteoporosis.

- Of those who are 70 and above and fracture a hip from a fall, 50-70% die within one year of the fall, usually due to secondary complications.

- Due to nerve cell degeneration, older adults have a reduced ability to accurately time their actions and co-ordinations. There has been an overall downgrade in neuropsychological process.

**Implications:** It is imperative therefore, that the shopping aid not only helps in shopping, it also gives support to the user, thus preventing him from falling, or gives him an assurance that the aid will prevent him from falling and suffer serious injuries.

Due to the slowdown in neuropsychological process, I should also look into how this delayed reaction will affect the user in the way he uses the aid.
Summary

The process of aging brings many physical and mental changes to the human body. Most of these changes are detrimental and often bring to an end the usefulness and purpose which one might serve society with. This include Changes in the cardiovascular system, Respiratory System and Musculature Skeletal System

Such aging processes have helped in bringing across many design implications and clues as to how the shopping aid could be visualized.

In the next chapter, a comprehensive design brief of the shopping aid will be devised. This will help keep the project focused on its requirements and objectives.
After reaching the stages shown in the graph, a design brief is ready to be written for the project.
Chapter 6: Project Brief.

In the previous chapter, the focus was on the process of aging and the detrimental effects of aging on the human body and mind. In this chapter, the emphasis will be on the compilation of a list of requirements focusing on the user and his needs. This will result in the formation of the design brief of the design aid.

6.1) Problem Definition

Many of the elderly would like to live independently and with purpose. However ageing prevents them from having such a lifestyle. They have restricted mobility due to physiological / mental deficiencies. They have problems even in basic essential activities of daily life such as marketing.

6.1) Target Market

The target market for such a product is the elderly who are ambulant and wish to lead an independent life. This estimate puts the number of people who would use the product to at least 50,000 of the population.

6.2) User considerations

Physiological considerations

- User is physically much weaker than he used to be. Limb strength is estimated at 50% less. Walking speed has decreased by 10 – 20% and time needed to travel increased.
• Neurological degeneration makes the user less agile and more susceptible to falls.
• Tasks that are difficult to remember and execute are often cast away and forgotten.
• User is more susceptible to glare.

Ergonomic considerations
• The figures for elderly men and women are as follows on page 43.
• Walking strides are smaller due to the maintenance of postural sway.
• Cumbersome and complicated mechanisms cannot be handled with ease by the user.

Mental considerations
• A paranoia fear of falling prevents many elderly members from moving about.
• Imagery of weakness causes many elderly members not to use walking aids even when they need to. The walking stick remains the favourite and most used walking aid.
• Loss of memory is often a common problem amongst the target market.

Costs considerations
• Due to the improvement in economic infrastructure over the years, the elderly can afford to spend more in relation to health care products.
• However, there are still many who cannot afford even basic necessities.
• Therefore, it is still imperative to produce the product at a relatively cheap cost and launched with a governmental subsidy.

Environmental considerations
• The urban setting has been increasingly redeveloped to suit users who have disabilities or are physically weaker. Steps have been replaced by gentle slopes and there are lifts on every floor in housing units.

• Public seats are also readily available for members of the public in housing estates. Public education has seen to it that elderly members of the public are offered seats on public transportation.
6.3 Design Brief

Area of work: Healthcare system.
Potential Beneficiaries: Senior Citizens.

To design a:

- Shopping aid that enables the elderly to lead an independent life by giving them access to public facilities.
- To integrate the walking stick / walking frame / rollator with an element of marketing.
- Aid that does not remind them of their weaknesses and age, yet allowing them to feel wanted and useful again.
- Trolley that is designed ergonomically for the elderly yet works better than present products.
- Aid must be extremely easy to use. Interface must be designed with a weaker anatomy in mind.
- Product must have brand value that distinguishes itself from other would be imitations through either exclusive manufacturing processes or materials.
Summary

The design brief has compiled a list of requirements that will help in directing and focusing the design of the shopping aid.

The next chapter shall be on concept categories. This is aimed at brainstorming for platforms from which the shopping element of the aid can be launched.

A selection of the platform will be done at the end of the chapter, with further detailed constructions to follow in the following chapter.
Chapter 7: Concept Categories

7.1) Cane concept.

The design brief that was written in the last chapter enabled us to gain a rough idea of what would be required of a shopping aid.

This chapter looks at the rough concept categories of how a shopping element could be integrated into a platform that has been used as a mobility aid. This aid could also be modified and changed where it is not ideal for use. The three main concept categories are:

- Walking cane
- Baby walker
- Walking frame

7.1.1) Basic unit of cane.

- We first build from a basic unit of support. Statistics suggest that the cane is one of the most popular and acceptable aids.

- By using the cane as the basic unit, we avoid many issues of infrastructure obstruction.
As mobility analysis has shown, the need for support is inherent for the elderly.

Using this as a platform, we started incorporating the elements of marketing and mobility together.

The underlying motive is to convert the cane into a shopping aid.

7.1) Cane concept. (Continued…)

7.1.2) The conversion.

This conversion allows us to give the frail elderly added mobility to public areas.

The aid has hidden wheels which are revealed when the bottom half is bent back to form the supporting legs.

In this form, the cane becomes a shopping trolley almost like a pram unfolded.
7.1) Cane concept. (Continued...)

7.1.3) The Marketing aspect.

- A collapsible bag that can be activated via spring mechanism is used for the marketing space that has been pushed up.

- This is based on the single stimulus concept and for easy memorization.

- A series of different bags can be mounted for the varied needs.

- Next we come to the issue of customization. By using a retractable handle, we allow for adjustment.

- In trolley mode, the handle retracts or slides out to allow for height and posture customization, an issue we mentioned earlier.
Expert Opinion: Prof Vasoo

- Concept could be much better if a seating platform could be mounted within the module.

- The image of the aid must also be more attractive to make the elderly want to use it.

- Materials to be used should be given serious thought. A suggested material for the frame is Aluminum.

- Overall quite a good concept, think it will work quite well….

7.2) Baby walker concept.

7.2.1) Driving the trolley

- This concept is based on the survey findings that state that most people want a more maneuverable trolley than the ones they presently have.

- Its basic unit is actually a walking cane with a three-legged bottom.

- Castor wheels are used so that there is maximum rotation.
7.2.2) Push or Pull

- The trolley is designed such that it can be used to push or pull depending on the preference of the user.

- The high location of the bag space allows for easier reach and accessibility.

- By driving the trolley around on its highly rotating wheels, the trolley becomes more maneuverable.

**Expert Opinion: Prof Vasoo**

- Concept looks strange. Not really appealing for an elderly person.

- Maneuvering seems to be much easier though

- Materials to be used should be given serious thought. A suggested material for the frame is Aluminum.
7.3) Walker concept.

7.3.1) Step by step.

- The walker concept is created by assimilating a walking frame with a shopping module similar to the one in concept one.

- The concept works in a similar direction, with the shopping module able to retract before use.

- This gives support to the elderly before it is used as a trolley.

7.3.2) Modularity and Customization.

- The shopping module also consists of different sizes and shapes for different activities.

- It has a high customization value as it has a long retractable handle and back legs which can be adjusted according to the height of the user in question.
Summary

After a series of discussions with tutors and advisers to the project, it was decided that the platform that would help launch the marketing element would be the walking cane.

However it was also decided that the present walking canes have many flaws as well. Therefore it is imperative that these design issues are resolved as well.

The next chapter will concentrate on concepts that have been derived from using the walking cane as a platform. Some of these are individual unique ideas, the others are processes of previous concepts. The main idea is to keep working towards a better solution to the problem at hand.
A platform for further exploration has now been derived from the concepts category evaluation. The next step will be to bring in concepts with more details and elements of shopping.
Chapter 8: Concept Process and Development.

After deciding on the walking cane as the platform for developing the walking aid, more concepts have to be found before an ideal can be achieved. After conceptualizing and evaluation, final concepts will be derived and the main functions of the shopping aid will be finalized.

concept 1

Advantages

- Concept 1 is the very initial model of a simple walking stick that has abilities such as the collapsible seat and an adjustability in height.
- This concept seems technically sound and stable.
- It looks relatively easy to operate.

Disadvantages

- It seriously lacks storage space.
- However there are safety issues when the seating unit closes up.
- Looks heavy because of the size and number of parts. Could be costly because of this factor too.
- Aesthetically not pleasing, image does not portray a very fashionable trait.
Advantages

- Concept 2 shows a modified swan neck at work. It clearly shows the stress being reduced at the wrist due to the extension.
- This model works on an angular concept, that of the walking stick at 90 degrees and after conversion, the wheeled stick at 30 / 45 degrees.

Disadvantages

- Overly simplistic. No storage ability.
- User could be led to slip forward if wheel lets up. Very dangerous.
- No stability at all. Walking stick skips from side to side when in use. Not technically sound.
Advantages

- This development begins to show the integration of the shopping element with the modified walking stick. As shown in the sketch, the storage element is joined by snapping on its side.
- Aesthetically pleasing though, satisfies the notion that an aid need not look dull or medical in nature. Looks to be the best looking in terms of image so far. Even the storage element looks sleek and beautiful.

Disadvantages

- Could be highly unstable, have to be tested. Might have to add more wheels to compound its stability.
- Handle is too close for comfort to the shopping element. Too big, sharp and angular for ergonomic comfort.
- Too heavy backwards? Centre of gravity of storage pocket does not lie in the centre of the aid, instead it leans towards the user. Tendency for aid to fall backwards.
- Cannot stand on its own. Need to be stable on its own when user is seated.
Advantages

- The next step brings in a collapsible storage cart that is held through the centre of the walking stick, this allows for flexibility for shopping.
- The base has additional depth and strength with the added length along its base. Technically more stable.
- Aesthetically still not too bad, although it has lost some of its simplicity. More can be done to make it look less engineered.
- Cart looks overtly technical, perhaps it can be stylized.

Disadvantages

- However, this extra length can trip the user if he/she is not careful. Basis is that base support has intruded into the private space of the user. Caution to be exercised when in use.
- Single stimulus action is not exercised when the collapsible storage cart is held through the centre of the walking stick. Not easy for the elderly person to fix it on properly.
- Centre of gravity is also not centralized through the main stem of support. Tendency for aid to lean backwards.
Advantages

- Concept 5 has additional support limbs beside the walking stick. This provides extra strength to the walking element.

Disadvantages

- However it takes up a lot of space and could interfere with the users immediate movement and take up the private space of the user.
- Could be costly to produce. It gives one the feeling that it can be produced for similar effect with a simpler design.
- No shopping element as yet. Bags could be hung on the handle but this would leave them dangling. The intricate balance of the walking aid would thus be affected.
- Angle is too steep, have to recalculate the exact angles for the design to work.
- Center of gravity still too far back. Weight causes aid to lean back and fall.
Advantages

- This scheme is an integration between holding the cart by the side and from its back. It is highly stable and works almost like a supermarket shopping trolley.
- A positive point is the collapsibility of the shopping cart to fit the varying needs of the user.

Disadvantages

- This design however is very cumbersome to the user and it is not easy to maneuver around the aisle of wet markets or supermarkets.
- This model is also not easy to use. Collapsible cart may not work as well as it should.
- The walking aid looks too complicated to use. Coupled with the cart it does not look like something easy to use for the elderly.
Advantages

- The sketch on the left shows a more organic walking stick that holds plastic / paper bags instead of the collapsible cart. This is done because of the reason that the elderly may not wish to bring a cart about.
- The sketches on the left show different possible leg formations such as an organic looking tripod and a mine detector look alike.
- The base designs look much more classy and sleek compared to before.

Disadvantages

- The mechanism that allows the wheels to spring out look too flimsy to be used. Objects could be stuck in the groves beneath them.
Concept 8

Advantages

- Concept 8 works on the premise of stability and offers it as a table top multi speaker would. Observed closely, it looks like a speaker from a familiar brand.
- The storage unit is fiber glass molded and is jointed to the walking stick as seen in the side view. Its base is flat and offers high stability.

Disadvantages

- However, as with the previous concepts, the extended leg tend to get in the way of the user.
- Weight could be an issue here judging from the amount of material used.
Advantages

- One of the final concepts before developing a final three, this trolley-like aid folds downwards to become a chair by itself.
- It has very straight clean lines that give it a sophisticated and contemporary style.
- One new element to this shopping aid is the addition of an air or spring suspension at the top of the aid. This helps to absorb much of the stress that the wrist brings onto the aid.
- It also gives the user additional bounce when he moves on and off the aid.

Disadvantages

- Too boxy. It takes up too much room during movement.
This final variation shows the basic unit of the cart on the walking stick.

The first picture shows the design in its walking aid mode. In this mode, the storage unit is stored directly below the swan neck handle. This height is a suitable one for elderly members to reach in and out of.

The second photo shows the aid in shopping trolley mode. A secondary leg extends out of the first leg. When the front leg is raised onto the first, the aid is able to move.

After testing, this model was found to be highly unstable, however it satisfied its requirements as a walking stick.
• This second variation is of a more aesthetically pleasing walking stick design.
• The first photo shows the model in its dormant mode, the walking stick, as before, the storage unit is situated at a position whereby it can be reached easily.
• The second photo shows the active mode whereby the wheels and legs of the trolley slide down to form a stable tripod. This allows the model to travel with relative ease.
• As an arrangement to deal with the fatigue of the elderly members, a seating platform is designed into the top frame of the aid. This seat is actually the handle of the walking stick. It can be opened to form the seat.
This third variation is a more organic design compared to the first two. The storage unit is located at the same place again.

The photos show that the legs can be folded upwards as like the previous variation. This would give us the walking stick again.

This model has a higher accuracy in the angle stipulated then the other variations.
• This last variation is the closest technical model that I have made and tested.

• In the first model, one can see the air suspension that has been created for absorbing the stress that is exerted on the wrist. We can also see the stick raised at 90 degrees to satisfy the walking stick mode.

• In the second photo, one can see the shopping trolley mode. In this mode, one can leave the aid standing on its own. It can also be raised at an angle of 20 degrees and used as a trolley on its wheels.

• After testing, it is found that the suspension works well. However, it has been found that the base of the model is too big and interferes with movement.

• A much simpler design is required to resolve the issue of the big bottom and yet maintain stability.
Revision of requirements

- First prerogative is the safety of the elderly user, therefore it is important that whichever mode the aid is in, there must be a huge amount of support and stability.
- The finalized variations show too much technicalities. There should be greater attention to aesthetical value. A brand value must be developed in order to differentiate would be imitations. This brand value can be in the manufacturing or materials segment.
- The aid must be much easier to use than the previous variations. As much as possible, there should be no or little transformation of the aid in physical form. This will ensure that the interface is relatively easy to operate.
- Base level legs are still too wide and cumbersome. Perhaps the stability of the trolley can be sacrificed for the user to move properly.
- Storage unit to be mobile; while not in use it is situated high up, while it is in use, it is right at the bottom. This gives much more weight to the base and therefore more stability.
After a final revision of the specifications, the project is finally ready to go onto a preliminary model of the final product.
Chapter 10: Final Design Outcome.

After two rounds of concept generations and revisions of specifications, I have now reached a time where the functional needs of the shopping aid can be addressed in its physical form.

- functional description
- technical speciation
- operational

10.1) Final Design Evaluation
Chapter 11: Market Implementation strategies.


My two main strategic approaches in outperforming other firms in a common industry are listed below. (Kotler, 1999)

- Overall Cost Leadership.
- Differentiation.

11.1.1) Overall Cost Leadership

The first factor that helps in competing against other firms is cost. By producing the designed product at a lower cost as a result of:

- Producing lesser parts
- The use of assembly effective processes such as snap fit joints. This reduces assembly time, assembly costs and material costs.

As a result, the selling cost of the product is also naturally lower than other competing products. By virtue of a lower price, it is already more attractive than other competing products.

11.1.2) Differentiation

Another factor that helps in selling the product is the differentiation of the design. There has so far not been any product sold with the purpose of the shopping aid in mind. Most competing products have been half hearted attempts at creating such a product. An example is the rollater that is a walking frame on wheels holding a netted basket.
11.2) SWOT Analysis

- Strengths
- Weaknesses
- Opportunities
- Threats

11.2.1) Strengths

- The strength of the product lies in its specialized ability to provide an aid to shopping yet increasing the mobility of the elderly.
- Its image is comparatively much more modern and fashionable than other products in the market.
- Products that have been already introduced into the market have so far failed to make an impact as very few elderly members are seen using them.
- As related above, the costs differentials make it more desirable than other competing products.
- The relatively young gerontology market makes it easier for a new product to penetrate the market and gain a foot hold.
- The product is an essential item that the elderly must some time or another use in their lives.
- The elderly have now been educated in better living by exercising regularly by walking or jogging. This aid helps them move along better than they used to.

11.2.2) Weaknesses

- Infrastructure of present day societies such as charities help the elderly cope with daily meals by bringing the meals to them. This makes the elderly not really willing to move around.
• Many elderly citizens are still not economically well off even to make ends meet. They would rather spend the money on basic necessities then on the shopping aid.

• Many of the elderly who are living with their families are often accompanied by members of the family or at least a maid. This makes the aid redundant except for elders who are staying alone or like to venture into the outdoors.

11.2.3) Opportunities

As the shopping aid was designed especially for the benefit of the elderly, it will be introduced to two main categories.

1. The shopping aid will be introduced to the government as an instrument that not only aids the elderly in movement but also an aid that helps in building up the strength and fitness. Government subsidies are necessary to ensure that the price of the aid is kept at a minimum for the members of the target market who cannot afford basic necessities. It has incentives both for the user as well as the sponsor.

2. The product will be launched for the elderly who stay in homes or institutions as part of a healthy lifestyle exercise. This encourages them to take part in outdoor activities such as excursions or walks in the neighborhood. This plan is currently seeking endorsement from various homes and institutions.

11.2.4) Threats

• The main threat to the successful marketing of the product is the cost factor. As many elderly citizens face economic problems they would probably not spend on such an item.

• Although the image of the product seems to be fashionable and acceptable to the young, the elderly might not be inclined to use it.
11.3) Product Lifecycle

- Introduction stage
- Growth stage
- Maturity stage
- Decline stage

**Introduction stage**
In the Introduction stage, sales of the product are bound to be slow. However with the aid of health and exercise campaigns by the government, the sales of the aid will slowly improve as a result of increased awareness.

**Growth stage**
In the growth stage, sales of the product start to pick up and this is the period when awareness of the product is at a peak and the product at its most popular.

**Maturity stage**
In this third stage of the products life cycle, sales start to stagnant or slow down as the market has become saturated with the product. It is time therefore for new variants of the shopping aid to be designed.

**Decline stage**
In this final stage of the product life cycle, the product should have already been stopped in production. New variants will either be produced or the product line could be stopped.
Financial Productions.

Main Sponsor / Customer:

As written in the marketing strategy, the shopping aid will be produced using governmental funding as well as funds from privately owned homes for the aged.

Each finished piece would ideally cost around $10 and could retail for $20. This would make it on a comparable standard with competitive products in a similar range.

The reason why it will go for so cheap is because this project is one that is made for social reasons, and profit was never a main concern of the project.
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Book Chapter


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Appendix A. Observation / Random Sampling.

Behavioral setting; Wet market in Aljunied, Haig Road.
Wednesday morning 1000-1100
Random sample of 200 +

Social Episode; Movement within the wet market.

Script; these shows the sole female or male in the family who cooks and buys groceries from the supermarket roughly three times a week.

Analytical studies; I will investigate the issues of
- Problems while marketing.
- Needs of the consumer.
- Behavioral patterns.

Scenario Painting 1

a.) Madam Lim (about 60 years of age) travels about a hundred metres from her house to the nearest market when her groceries have just about run out. To facilitate the carrying of her groceries, she brings with her a portable trolley.

b.) She brings cash of about $20, an amount that buys enough groceries to last her family of five for a few days.

c.) The market is crowded with shoppers just like her even though it is a normal Wednesday morning. She starts her marketing by picking the freshest seafood. She dumps the fish she buys into the trolley.
d.) As her marketing trolley starts to get full with products, she also finds it more difficult to move about in the packed market. She starts to move her lighter groceries to the top of the pack to avoid damaging delicate items such as her seafood.

e.) In an unfortunate incident, her foot gets run over by a fellow shopper’s trolley.

f.) When she finishes her marketing, she has a trolley that threatens to fall over on its side when she tries to move past the crowd. Maneuverability is at an all time low. When she encounters a small drain, she has a lot of trouble getting past it and has to make a big detour.

g.) The weight of her groceries on an average day of marketing ranges from 5 to 10 kilograms.

**Scenario Painting 2**

a.) Mr. Tan (about 70 years of age) travels about five hundred metres to the wet market. This allows him to save money as he is living alone with his wife who is bedridden.

b.) His monthly allowance of a few hundred dollars coupled with his personal savings allows him to lead a sparse but comfortable lifestyle.

c.) He pushes a similar trolley to buy his groceries. He spends about $5 – 10 each time he goes marketing. With this amount, he buys about 3-5 kilograms worth of food each time.
d.) As he suffers from mild arthritis, he finds it uncomfortable pushing the cart at his height. His slouch makes it even more difficult for him to handle the trolley.

e.) Maneuvering is a problem for him in the crowded market as he tires easily and tries to make his purchases as fast as possible. He also tries to buy as much as he can so he will not need to make more trips.

f.) Going home becomes a big problem as he tries to push the overloaded trolley little by little. He pauses from time to time for a break on his way home.