

Personal Development Process and Tools (PDPT)

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So, what is in this PDPT?

1. What is Engineering Design – “Engineering Design \approx See + Play + Think + Be”
 - a. See the Opportunities
 - b. Play with Ideas
 - c. Play alongside Risks
 - d. Think using Models
 - e. By Myself
2. My Personal Design Process
 - a. Personal Design Process – Opportunity and Legitimacy
 - b. Personal Design Process – Diverging
 - c. Personal Design Process – Converging
 - d. Personal Design Process – Prototyping and Stakeholders
3. Reflection - on the courses and on myself...
 - a. Biggest Failure – What Happened
 - b. Biggest Failure – Focusing on the Future
 - c. Working with different Individuals
 - d. Taking ownership of my work – Live in Action
 - e. Taking ownership of my work – Pre-conditions

What is Engineering Design?

“Engineering Design \approx See + Play + Think + Be”

See the Opportunities

Whether it is in an industry setting, or on the sidewalk during a jog, seeing the opportunity first hand is pivotal. It allows the designer to take part in the user experience, thereby allowing the designer to recognize implications associated with the opportunity and understanding the root causes of the problem.

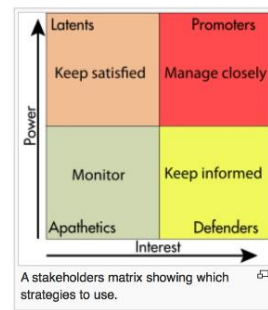
One of the key steps to seeing an opportunity is to engage with its stakeholders. Primary stakeholders, the users, for example, are excellent people to discuss and inquire about their first-hand experience. In addition, they could critique the existing design process, from legitimacy of the requirements model to the feasibility of the conceptual ideas. With the latter, as with my engagement with Spinal Cord Injury Ontario, stakeholders could even offer potential solutions to an opportunity which they are often much more familiar with than designers ourselves – the coordinator, after we presented our initial solution to her, disliked the idea of attaching the legs of the design to the arm-rest, and instead suggested to place them on the front legs so that the design would not interfere with user's wheelchair motion. Other stakeholders, such as the manufacturing company of a related product, could suggest alternative detailed design decisions and offer other insights. In the case of Praxis II, the C.E.O of a wheelchair manufacturer suggested that we could use a locking mechanism used in the bike industry, which we had not considered before. Nevertheless, as per Lecture 26, Slide 49, we, as designers, need to be aware of their context in the situation and their specific characteristics in regards to opportunity. By engaging potential stakeholders and incorporating them into the design process, it allows the designed product to be more effective in altering the lived experience of the user, and provide more feasibility were it ever to enter the market.

However, not all stakeholders are willing to engage, and not all will engage to the same depth. This difference in stakeholders, as per Lecture 18 Slide 11, means that when approaching different stakeholders, we may need to take up different strategies so that, for both parties, it is a win-win situation, and neither is upset over the interpersonal aspect of the engagement. In fact, it is always our responsibility as designers to make key design decisions, and while some stakeholders may not appreciate the decision, we should have confidence to uphold our judgement, whether it is through additional research, or through other stakeholder engagements

Methods of Stakeholder Mapping [\[edit \]](#)

The following list identifies some of the best known and most commonly used methods for stakeholder mapping:

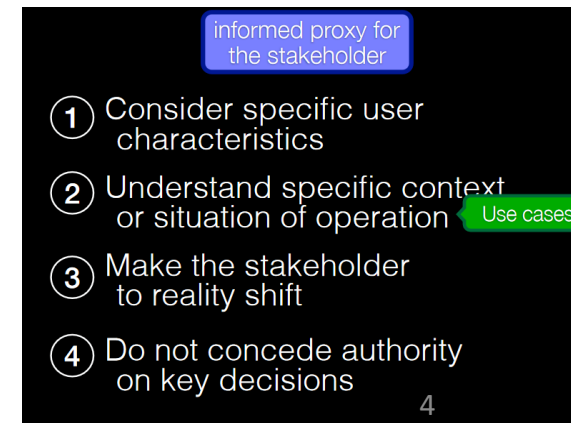
- (Mitchell, Agle et al. 1997) proposed a classification of stakeholders based on power to influence, the legitimacy of each stakeholder's relationship with the organization, and the urgency of the stakeholder's claim on the organization. The results of this classification may assess the fundamental question of "which groups are stakeholders deserving or requiring manager's attention, and which are not?" This is salience - "the degree to which managers give priority to competing stakeholder claims" (Mitchell, Agle et al., 1997, p. 953).



Sem 1; Lecture 18; Slide 11



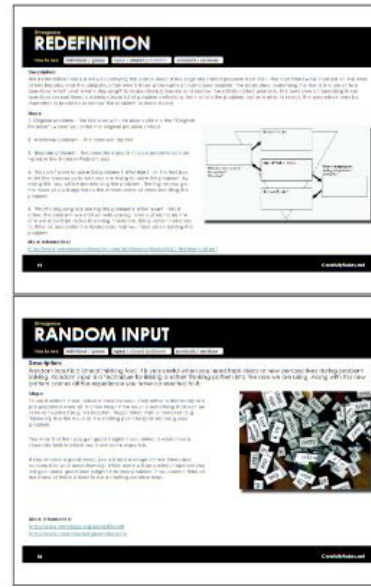
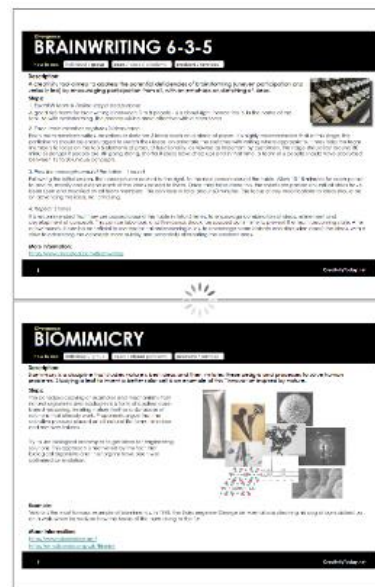
Sem 2; Lecture 26; Slide 49



Sem 2; Lecture 26; Slide 47

Play with ideas

Idea generation is a key part of engineering design. In Praxis, we were introduced to a wide variety of techniques to generate ideas. While some, such as wishing, failed to provide a satisfactory result, others, such as classical brainstorming, were very fruitful. Nevertheless, I found that the appropriateness of each technique would depend on the specific team dynamic as well as the context of the divergent process. For example, my praxis I team, which was more expressive and thinking out of the box type, had much better results with random input, which required the team to interact more closely, while my praxis II team was much more introvert in terms of thinking process, and classical brainstorming was much better. In addition, for both teams, we incorporated a strict timer limit for each diverging sessions so that the team can focused on the task at hand. Each of us, regardless of our personalities could have a chance to incorporate his/her values and vision into the design process.



Play alongside Risks

Managing risks is a key component in Engineering Design. Whenever one engages in a project, there exist potential for criticisms and utter disapproval. Nevertheless, it is the responsibility of an engineer and a designer to embrace that factor of uncertainty and mitigate, as much as possible, its consequences.

In order to manage risk, one first need to identify sources of this feeling of uncertainty and thus resolve the issue from its root. One of the biggest one we as students face is procrastination. From homework to finals, we can procrastinate on anything – through an unconscious uncertainty due to new problem sets and nerve-wracking exams, we become more reluctant to begin the task given. This would inevitably lead to a decision between indulging into desires and shun away from the daunting task, and forcefully delving into the assignments. While both decisions would lead to consequences, such as missing a deadline for submission or getting a low mark due to lack of understanding, the latter option mitigates a certain level of uncertainty by lowing the level of abstraction, making the task seem more concrete. Just like Newton's First Law of motion: an object at rest stays at rest and an object moving stay moving, we need a change of momentum to alter our state of being, and in our case, to do homework.

In addition to understanding procrastination, other concepts such as the sunk cost fallacy, the cargo cult phenomenon, and truthiness could also create risks. The sunk cost fallacy enroots from a notion of fearing to be wrong and to squander away valuable resources already invested. By refusing to acknowledge the issue macroscopically, one would continue investing resources, hoping that it would lead to a miraculous outcome. Whenever a designer is engaged in a project, sunk cost could lead the design astray by making the designer focus on a single design regardless of the negative user feedback, wasting valuable resources as a result. Cargo cult, similarly, could also lead design cycles astray. Sprouting from a compulsion to follow specific guidelines in fear of neglecting key elements, the designer, under cargo cult thinking, would try to use design/engineering models under unsuitable situations. As I will discuss next in the next section, models should only be used with a full understanding of its purpose.

our previous work (Liberman, Trope, McCrea, & Sherman, 2007), but also actual completion times. As in our prior study, the effects we observed were not mediated by the perceived importance, attractiveness, or difficulty of the task. Rather, we think that the effect of construal level on completion times reflected an association between concrete construal and sooner times.

The results are consistent with other theoretical perspectives suggesting that goal pursuit is more successful when individuals represent the task at a more concrete level. For example, according to action-identification theory (Vallacher & Wegner, 1987), individuals are likely to respond to difficulties encountered in executing a task by thinking about the task at an even more specific level. Furthermore, performance on a difficult task is improved when the task is represented more concretely (Vallacher et al., 1989). Setting more specific subgoals increases the utility of action by reducing the delay of rewards (Steel & König, 2006). Forming implementation intentions has also been shown to facilitate goal pursuit by allowing the individual to delegate action control to the situation (Gollwitzer, 1999). As a result, individuals are quicker to identify opportunities to act (Parks-Stamm, Gollwitzer, & Oettingen, 2007; Webb & Sheeran, 2004), to initiate responses (Orbell & Sheeran, 2000; Parks-Stamm et al., 2007), and to complete assigned tasks prior to a deadline (Bamberg, 2002; Gollwitzer & Brandstätter, 1997) when they have formed an implementation intention.

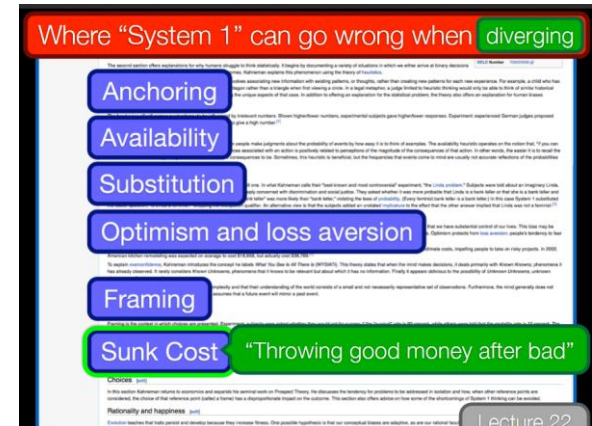
appropriate for completing it. Future research should examine the role of possible moderators of construal-level effects on procrastination, such as the evaluative effects of high- versus low-level construals. Thus, in our example of writing a review, a concrete representation may lead to less procrastination than an abstract representation does, as long as "writing a page of comments" is not viewed as aversive. In contrast, to the extent that writing comments is perceived negatively, being reminded of the importance of feedback to the scientific process (the abstract framing) may reduce procrastination.

Researchers should also extend these findings to individual differences in chronic procrastination (see Ferrari, Driscoll, & Diaz-Morales, 2007; McGown & Johnson, 1991). Our results suggest that chronic procrastinators are more likely than other people to represent tasks abstractly. Dewitte and Lens (2000) found, however, that chronic procrastinators represent tasks less abstractly than do nonprocrastinators. They argued that chronic procrastinators focus on task details to such an extent that they feel overwhelmed. Alternatively, the tendency to represent tasks concretely may increase the salience of task delay and thus elicit self-reports of procrastination. Future research should examine these issues, as well as the possibility that the value of high- versus low-level construals moderates the relationship between chronic procrastination and construal level.

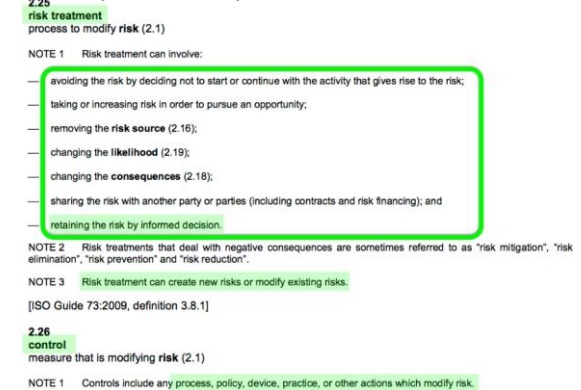
Acknowledgments—The authors thank Caroline David, Mir-

If uncertainty tends to cause procrastination, what is one tool (and there are many) you can use to reduce uncertainty?

Sem 1; Lecture 10; Slide 11



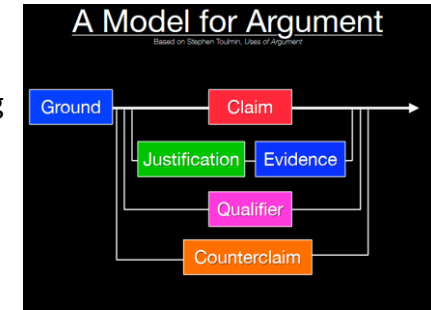
Sem 2; Lecture 8; Slide 11



Sem 2; Lecture 8; Slide 11

Think using models

One of the first models we were introduced to is the Toulmin's Model for Argument, and in it contains the fundamental elements of which, whether we consciously or unconsciously aware of it, ran throughout the Praxis journey, from writing the Praxis I Midterm, to the Showcase. This model gave us a framework to develop from. Nevertheless, as with all models, we must not fall into the compulsion that models are fill in the blanks. A model is only something we develop upon, and to use it properly, we must understand its process first. For Toulmin's Model, it is composed of a series of introspection, with each element an end result of "what, when, where, who, why, and how", thereby strengthening the argument as a whole.



Sem 1; Lecture 2; Slide 41

The Toulmin's Model also emphasized the importance of evidence and justification necessary for a successful claim. In order to acquire information to strengthen our arguments, we should have both verification and validation of the design.

Verification is the evaluation of the design based upon the requirements model, and specifically the objectives, metrics, constraints and criteria. While intuition/system 1 thinking may require less effort from the designer, it ultimately does not serve as legitimate reasoning due to the lack of rigor and lack of knowledge. In order to justify the design against the requirements, we were introduced to, in the Library Studio in Praxis II, a wide variety of sources that could provide us the ethos. In particular, I found that Handbooks and DFX are great for establishing a legitimacy for the design while codes and standards serve more as necessary constraints to the design space. In addition to library sources, we could also consult experts, and especially we are in a world-class university with renowned professors, we could have the involved in the project as well. At last, we should also have a healthy amount of confidence in our own individual abilities and the knowledge we obtained from our undergraduate courses. For instance, in Praxis II, we wanted to investigate if the device would remain rigid under a certain range of frequency. Recalling the damped vibrations we learned in Civ102 in the fall semester, we were able to devise a simple mathematic model for the vibrations, and from it, determine the effectiveness of our design. We then took our calculations and confirmed it with a university professor in a related field, thereby completing our verification process.



Sem 2; Lecture 15; Slide 51

Do the **stakeholders** accept the design?

- "Validation. The assurance that a product, service, or system meets the needs of the customer and other identified stakeholders. It often involves acceptance and suitability with external customers. Contrast with verification."
- "Verification. The evaluation of whether or not a product, service, or system complies with a regulation, requirement, specification, or imposed condition. It is often an internal process. Contrast with validation."

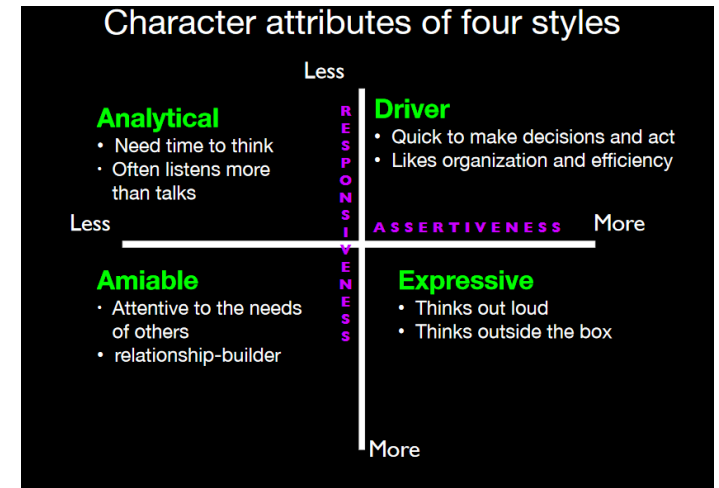
Does the **design** meet the requirements?

Validation, on the other hand, is the evaluation of the design based upon the feedback from its stakeholders. As mentioned earlier in the "See the Opportunity", stakeholders can provide valuable feedbacks and suggest ingenious ideas due to their pre-established familiarity with their opportunity. While verification requires less community engagement and can be simpler, we, as designers, must remember that we are designing for the client, and while an idea may seem satisfying to us the designers, if it does not address the needs and the values of the client, the design is rendered useless.

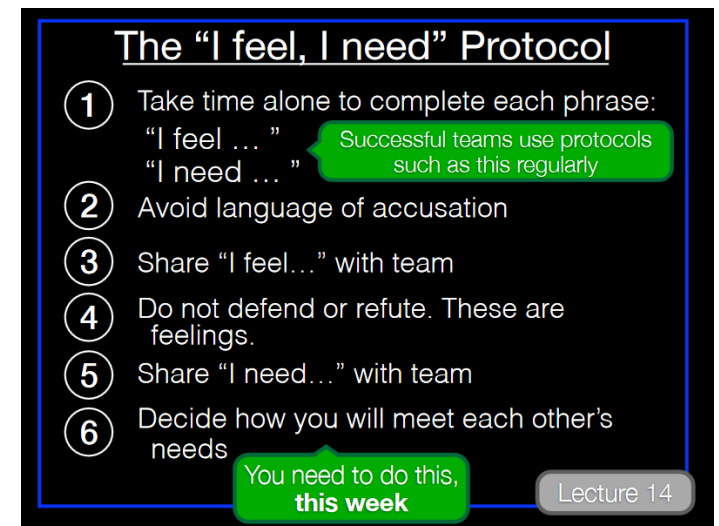
Sem 2; Lecture 15; Slide 52

Be myself

From Bolton and Bolton work styles and Health's Professional Inventory and Learning to the Duckworth Grit scores and Learning & Study Strategies, Praxis introduced us to various techniques and methodologies of self-awareness. It gave us a scientific methodology to understand, our strength and weaknesses, and acknowledge the difference between each other. For instance, people labeled as "more expressive" on Bolton & Bolton should sometimes reserve themselves for the "less expressive" ones to articulate their ideas. Personally, being labeled and a self-confessed "converger", I appreciated the fact that, in a team environment, some stepped aside so that others like me could convey my ideas as well. Nevertheless, through Praxis, I also understood that labels are essentially labels and nothing more than that. The four major work styles for Bolton & Bolton are not black and white – indeed it is four quadrants of space. Some "drivers", for instance, might lean more towards a "converger" than "expressive". In addition, people can change. Given certain circumstances, such as a lack of someone setting deadlines, someone less assertive might step outside of their zones to fulfill that role so that the team is better well-oriented. In fact, these models of distinguishing working styles, including Bolton & Bolton, and the Health's Professional Inventory and Learning, serves more as a guide towards forming a more effective team than to just categorize each person. By treating the team as a comprehensive entity, it establishes an ideal team dynamic so that in the real, imperfect and perhaps more diversified world, each team member can expand themselves to fill each other's needs, thereby amplifying the team's strength, and diminishes its weakness. In fact, this strategy to compromise resonates with the principles of Macroeconomics (comparative advantage vs absolute advantage), stating that "as long as the relative opportunity costs of producing goods differs among countries, there are potential gains from trade", the only difference being instead of countries, we are maximizing the skills of each member so that collectively we can do better than we can achieve individually.

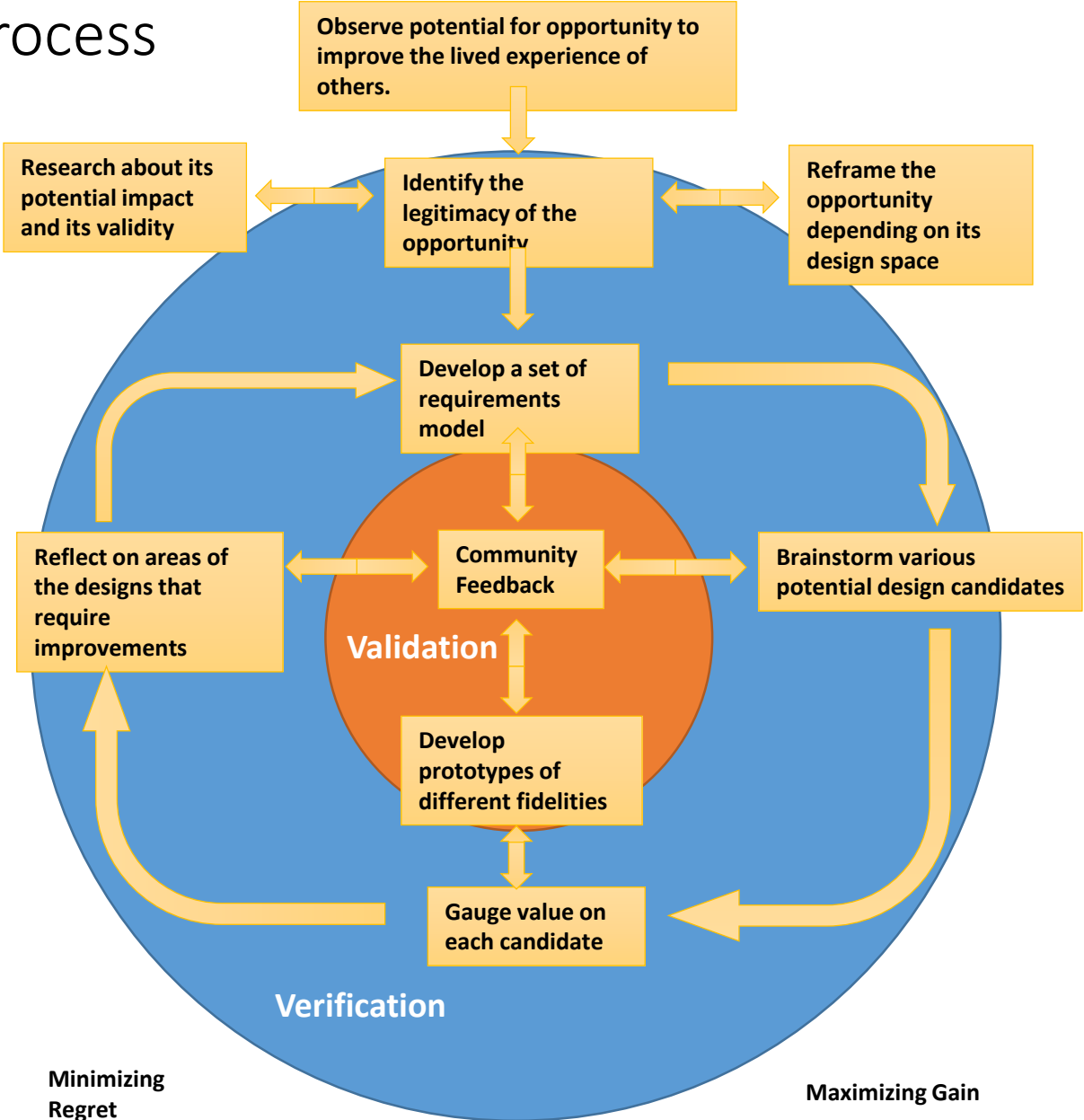


Sem 1; Lecture 16; Slide 17



Sem 2; Lecture 17; Slide 30

My Personal Design Process



Personal Design Model – Opportunity and Legitimacy

First part to my design process model is to identify an opportunity. Whether it is on a casual walk along the lakeshore, or during lunch hours eating at the cafeteria, finding an opportunity that would impact people's lives is always the start point of any design process.

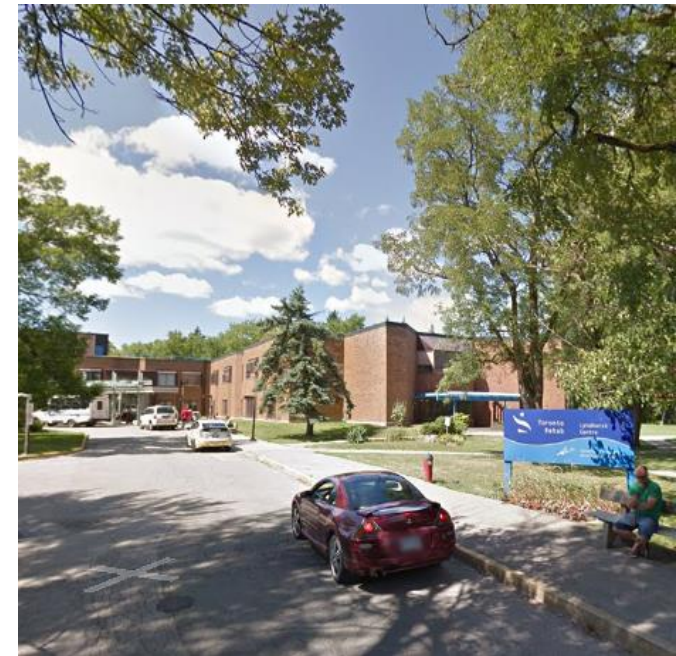
In addition, the obtainment of an opportunity should be a natural process, and not be forced. By doing so, because we each have our intrinsic values and interests, this would ensure our interest in the opportunity. The fact that the opportunity is realized means that the individual has an interest or would like to care for the community. For example, in Praxis II, before the RFPs were selected, my group decided to focus on an opportunity to enhance sushi-shop vegetable slicers because sushi was something all members liked to eat. As a result, we were all very involved and engaged in developing the RFP.

In Praxis II, when we switched to the Super 8 Opportunity and reframed, we encountered the problem of legitimizing our objectives. However, upon researching blogs of wheelchair users and engaging with several members of SCI-Ontario, we learned that there does exist a community who are paraplegics and would like to film / record videos.



Design Brief Opportunity – Sushi Shaver

Observe potential for opportunity to improve the lived experience of others.



Super 8 – Stakeholder Engagement at SCI-Ontario and Toronto Rehab

Research about its potential impact and its validity

Identify the legitimacy of the opportunity

Reframe the opportunity depending on its design space

Personal Design Model – Diverging

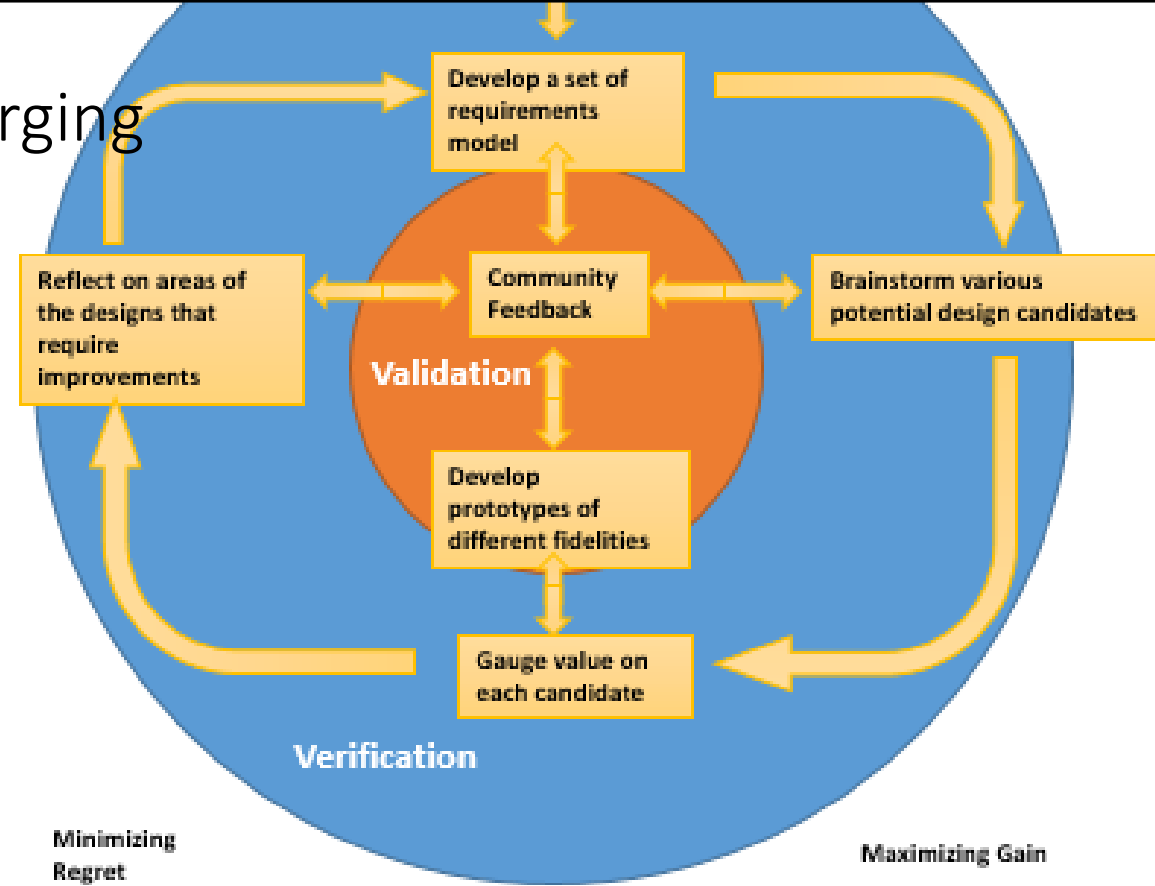
Having identified a legitimate opportunity, I would then proceed to develop a requirement model, which includes well-defined high and low level objectives, evidence-backed metrics and criteria, and a set of constraining factors.

Then, I would brainstorm a variety of ideas using ideation tools such as:

- Classical Brainstorming,
- Random Input,
- Bio-mimicry.

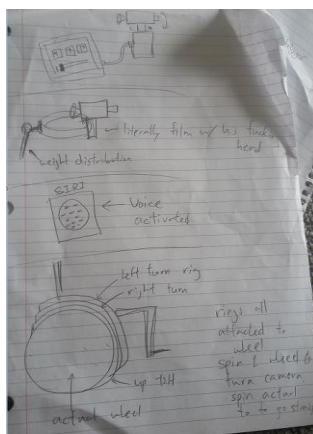
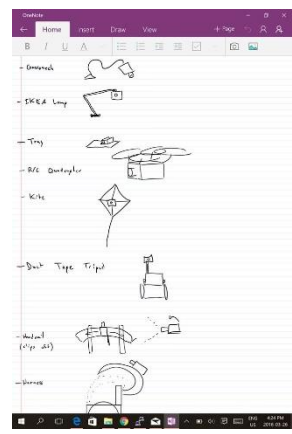
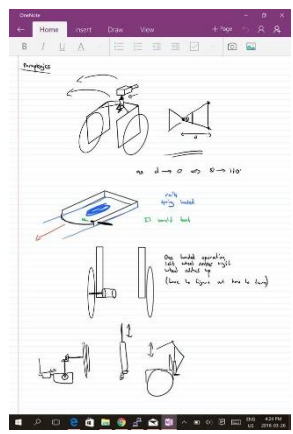
The first two techniques I have tried in both Praxis I and II, and both of them lead to fruitful results. In a team setting, I found Classical Brainstorming easier to diverge with when each member performs in parallel at first, before presenting the ideas to each others together; Random Input works more efficiently when the entire team is working together, thereby enabling the “bouncing ideas off of each other” process.

Biomimicry is a technique I would love to try in the future, given a topic that requires innovation. It blends nature into our everyday life, and transform the power of evolution to facilitate the experience of a community.



Minimizing
Regret

Maximizing Gain



Notes from Brainstorming

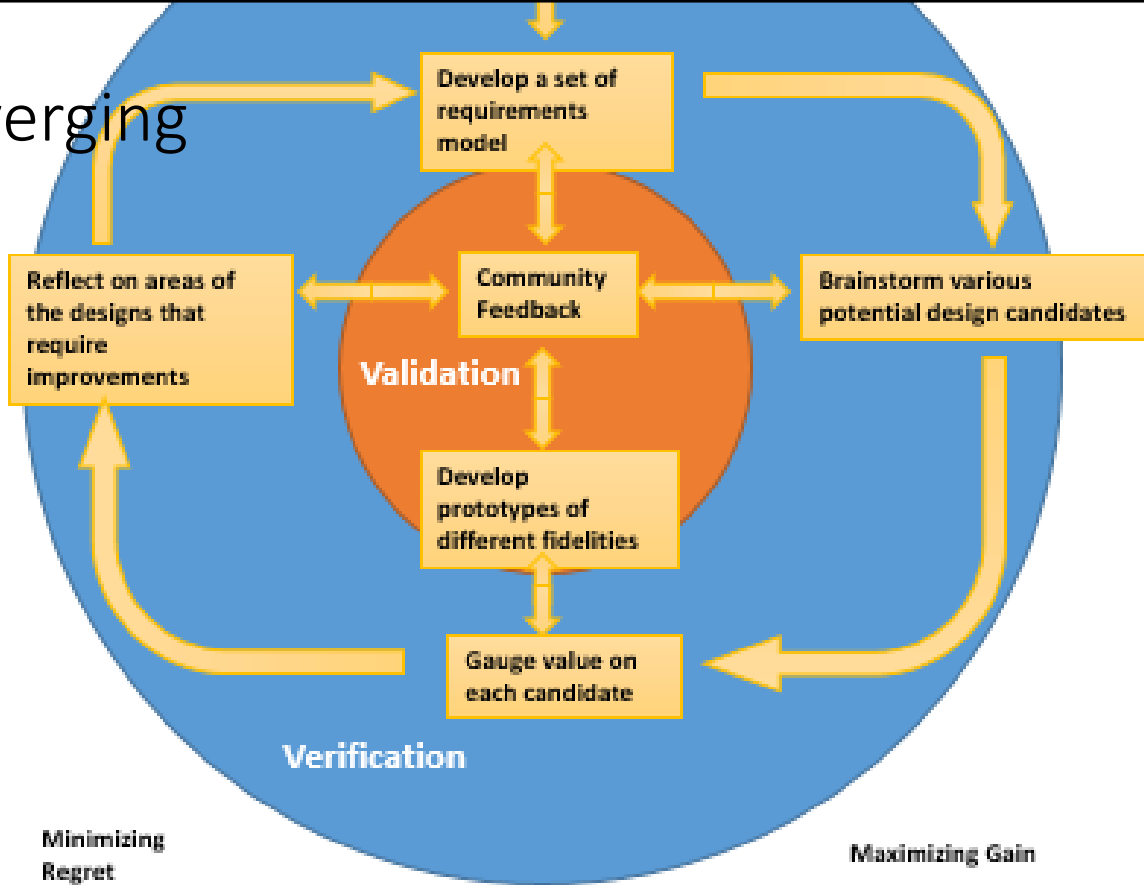
Personal Design Model – Converging

While having a wide range of ideas is great, they serve no purpose if none of them has the potential to resolve the RFP or the reframe in my case.

Praxis introduced several techniques to converge onto fewer, but better designs. The one I prefer the most is the Pugh Chart. I found that the Pugh Chart presents its information in a clear manner and does not take a long time to make. It is intuitive in that each candidate design is ranked relative to an existing design against the pre-established set of requirements. In addition, I enjoy the employment of both system 1 and system 2 in creating a pugh chart. While it requires system 2 to rank each candidate design, it also requires system 1 to pick out which design can have the greatest impact on the lived experience. This embracement of the grey area between intuition and rigor allows me to make a decision that is more holistic and meaningful.

Then, I would reflect upon my overall process and progress. I would decide whether the iteration might require some fundamental changes, especially if one of the stages did not

work as it is intended. I would also try to reflect on the design itself, and whether it requires additional detailed design decisions. I would also try and step back to see whether the design has any potential to be verified using research and other models.



Pugh Chart

	Baseline (ref)	Design A	Design B	Design C	Design D
Easy to Detachability	0	+	-	-	-
from chair	0	+	-	-	-
from camera	0	+	-	-	-
Durable for 5 Days	0	+	-	-	0
durability (1-5)	0	+	-	-	0
Safety	0	0	-	+	+
Variability of Direction Field	0	0/4	-	-	-
Distance from user hand	0	0	-	+	+
Proximity of user when sitting	0	0	+	+	+
App to other wheelchair design	0	+	+	+	+

Handwritten notes: "Research! = use of field", "Research! = use of field", "Research! = use of field"

Pugh Chart for converging

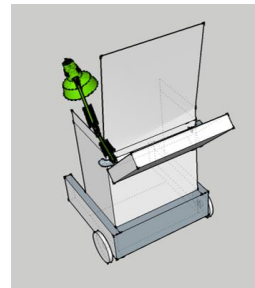
Personal Design Model – Prototyping and Stakeholders

As an aspiring engineer/designer, the happiness of my client/user is always my number one priority.

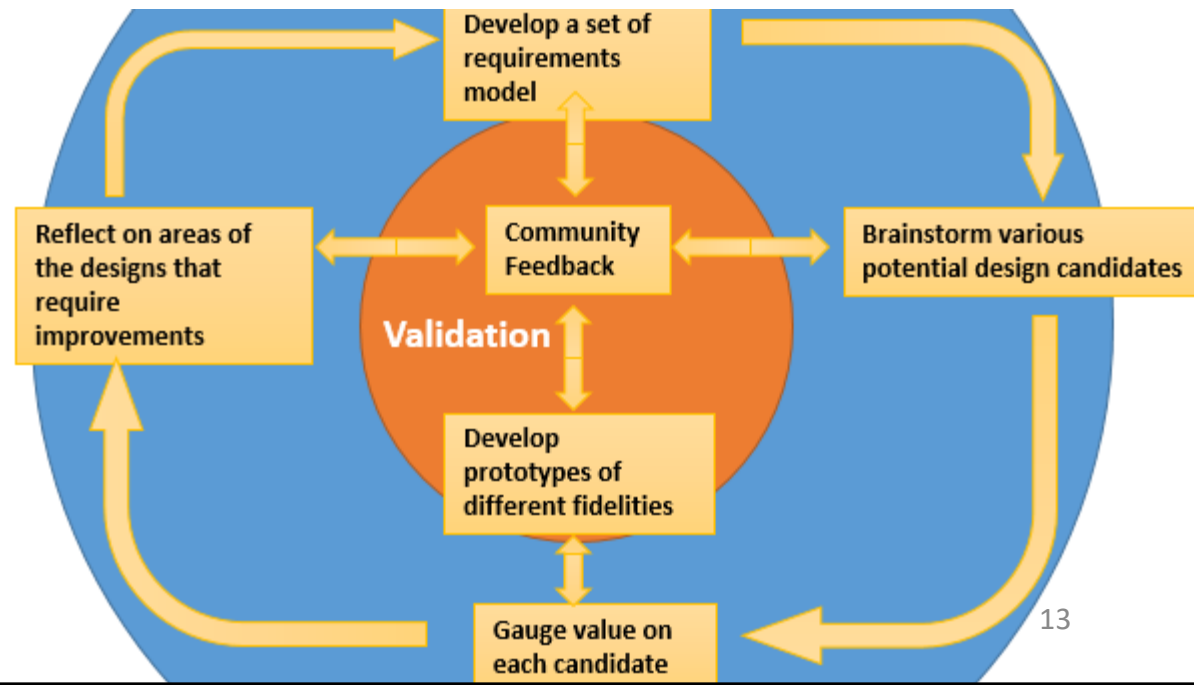
As a result, whenever I engage in any forms of designing, validation from the primary stakeholders is always a core objective for me. In each of every design stage, I would always try to reflect upon whether the stakeholders would want to have this decision or not. I would try to step into their shoes and take part in their experience, or if they are willing, I would visit the community in person or via video calling to present my ideas and share my thoughts on the opportunity. I would also look for them to respond to my designs, and to critique them for both their strength and weaknesses. If they are willing, I would also try to incorporate them into the design process, especially if I am not familiar with the community.

In Praxis II, through community engagement, we were able to transform a deficient design to a feasible one. Originally, we wanted to have the legs of the design on the hand-rest of the wheelchair. However, upon consultation with SCI Ontario, we learned that such as design decision would impair user's operation of the wheelchair. However, all efforts are for nought if the stakeholders does not understand the design in

the first place. That is where prototypes come in. From low fidelity to high fidelity, prototypes can serve as a mean to ensure the design decisions are conveyed clearly through to the person looking at it. In addition, it can serve as a way to gauge the feasibility of the design and whether it can actually address the issue.



*Super 8 –
Prototypes:
3D modeling
(left);
physical
representatio
n (right)*



Reflection

On the courses and on myself...

Biggest Failure – What Happened

This freshman year, both in Praxis and in other courses, has had its share of challenges and failures, yet is also comprised of many lessons learned. Through the obstacles overcome, not only did I acquire a greater amount of knowledge, I also gained a deeper understanding of myself, and of others. From working in teams with different personnel, and engaging with people from different backgrounds, I was able to evolve both as an individual, and as a student engineer.

One of the first failures I experienced in U of T was the CIV 102 Matboard Bridge. At the beginning of the project, everyone on the team was filled with excitement. While none of us knew whether our final design would work, we eagerly arranged team meetings, and had numerous cycles of converging and diverging. We did our calculations with care, and built the bridge with diligence. And finally, when our excitement ran over the roof on the day of the testing, our bridge, which had an estimate of over 2300N of carrying capacity, failed under a simple 400N train test. All of the time and effort spent on the project snapped just as our bridge broke.



Me standing on top of my bridge after it failed the train test.



Calculations to verify our design

Looking back to that project, our calculations made sense, and the bridge was constructed well; however, we neglected a major aspect of the design – we designed the bridge so that it can sustain the most amount of weight at the given points, and did not give considerations to the extra moment generated by the train. This one mistake led to the collapse of the bridge.

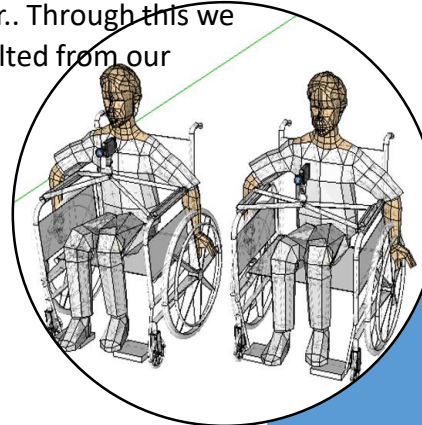
Nevertheless, this mistake helped me become more diligent in reading instructions. While I might have understood the detailed objectives, I need to be able to scope up and reflect upon the big picture. I should always make design decisions in respect to project as a whole, because by doing so, I can avoid neglecting key elements that could ultimately cause a disastrous failure and make the design more comprehensive.

Biggest Failure – Focusing on the Future

In Praxis II, there were plenty of room for failures due to negligence, and in order to create a design that would ultimately benefit the users and their community, we had to try and consider as many aspects of our design as possible.

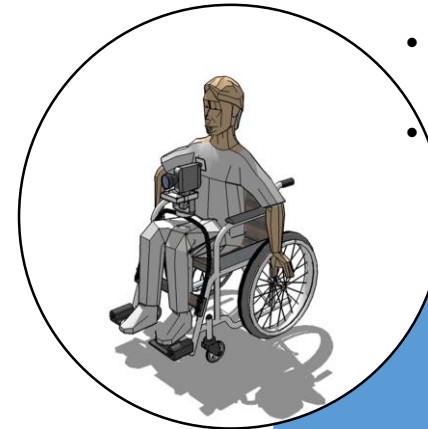
The Usability of the Praxis II design when the wheelchair moves

In Praxis II, my team and I was designing a device that would help a paraplegic film or/and record videos while he or she is moving in the wheelchair. Originally, our solution, as seen on the right, involved attaching the device's legs onto the hand rests of the wheelchair. While we selected this out of our many ideas, I was not sure whether this design would impair the user's pushing action on the wheels. Not wanting to neglect the effectiveness of a key feature of the design, my team and I proceeded to engaging with several stakeholders, most of who are wheelchair-users. Through conversing with them, we learned that this would indeed hinder the user in moving the wheels, and that this issue could be resolved if the legs were to be attached to the bottom frame of the wheelchair.. Through this we avoided making a less usable design which could have resulted from our negligence.



3D Model of the old design

- Interfered with user motion when moving the wheelchair
- More complex to detach from wheelchair



3D Model of the new design

- Does not interfere with user motion.
- More easily detachable from the wheelchair

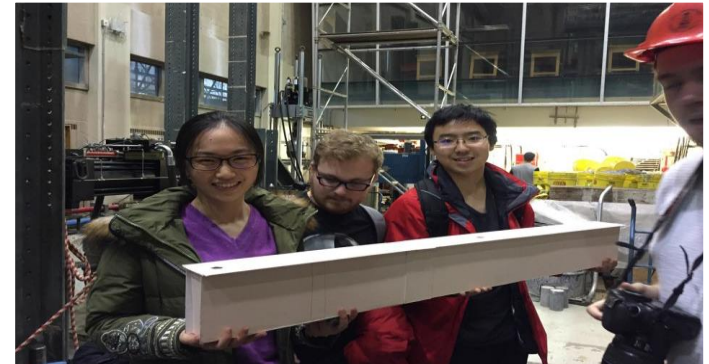
Working with different Individuals

The wisdom of the masses exceeds that of the wisest individual, and this is especially true for engineers, even for a student engineer like me.

Through Praxis I to Praxis II, good teamwork is the foundation to good outcomes. A good teamwork enables clearer communication between team members, even if they are from different cultural backgrounds, and allows a greater breadth of ideas available.

However, achieving good teamwork is not always easy, especially with a lack of understanding between one another and changing team cultures. In Praxis I, I was very fortunate to have a group of individuals who had similar working habits. We tended to focus for a longer period of time to work and brainstorm, and everyone was just as engaged in the project as I was. But in Praxis II, due to different members, my team's dynamics was the polar opposite – we tended to get distracted onto other topics easily and enjoyed more breaks than I did in the team in Praxis I.

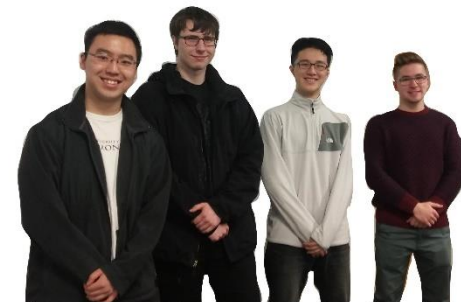
At first, I did not adjust very well. Being a converger myself, I became easily agitated and could not stand the frequent hiatuses during meetings. However, through further reflection, and stumbling upon the psychometrics, I began to, instead of focusing on the negative elements of the new team environment, concentrate on finding out each other's strengths. I soon learned that one of the member was great at making synthesizing different ideas, while another had a talent for developing mathematic models. In addition, I acknowledged the fact that I was overly focused on past successes and was trying to work with a different team using a model not suited towards it. By appreciating each other's differences, I opened my heart towards other and as a result, we established a solution that could have far greater impact than the design in Praxis I.



Civ 102 Matboard Bridge



Praxis I Team W27



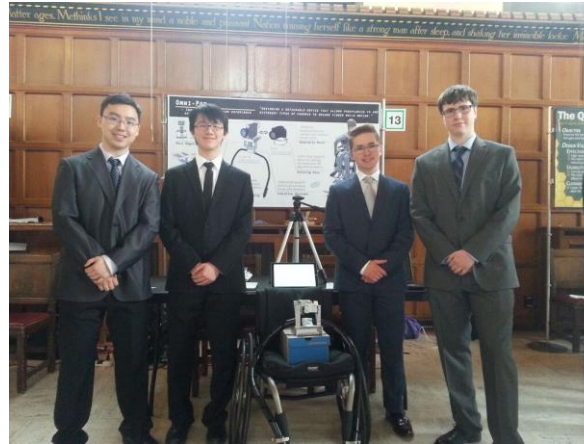
Praxis II Team T21

Taking ownership of my work – Live in Action

“Own it!”

– Professor Foster in numerous Praxis Lectures

Taking responsibility over an underdeveloped design decision is never easy, especially when it is being criticized by others. Nevertheless, this was a situation my team had to deal with in many situations during the showcase.



Team picture and final prototype at Showcase Presentation

Reframe and Adam

In Praxis II, the original RFP presented an opportunity to empower people with disability in LIFT such as Adam, a quadriplegic, the ability to film. We, however, as a design team, after discussing with stakeholders LIFT and SCI-Ontario, decided to reframe our opportunity to focus on the filming experience of paraplegics.

However, during the showcase, when Adam, who was unaware of our reframe, saw our design, he was noticeably upset over the fact that the design did not center around his situation. While I understood that there was a gap between Adam's understanding of Praxis, and ours, I decided to take responsibility of our reframe by admitting the obvious shift in our primary stakeholders, and sympathize with his situation, instead of expounding on the course itself, which would only exacerbate the situation.

By taking ownership of my work, I was able to avoid any escalation and minimize the consequences of the situation.

Showcase Critiques

Adam was not the only one critiquing our design; in the Q & A session with the project evaluators, we also had to own design decisions.

One of the key trade-offs we made was to sacrifice user's independence in operating the design for universality in being able to attach to different wheelchairs. While both elements had its respective value in the design, after consulting with wheelchair users and a wheelchair manufacturer, we decided to pursue universality due to the increased user values, and the fact that the user can still remove one leg from one side of the frame relatively easily. With these justifications in mind, owning the design decision to the evaluators was much easier because of the validation and the verification done prior to showcase.

Taking ownership of my work – Summary of Tools

Often times, I found that I am reluctant to take ownership of when I did not give a concerted effort towards that piece of work. In other words, owning my work requires a methodical process of verifications and validations, some of which are listed to the right:



Library Resource

Toulmin's Model for Argument



Mathematic Models

Stakeholder Critique



Stakeholder Input

- Acquire DFX knowledge from handbooks and textbooks.
- Provide necessary constraints from codes and standards.
- Ensure all elements necessary for successful arguments are present.
- Allow self-reflection of the validity and the justification of presented arguments.
- Using acquired knowledge from courses taken in U of T to develop models for the design.
- Present prototypes of various levels to ensure better understanding.
- Have physical models to test the feasibility of the solution.
- Allow the stakeholders, if they wish, to give input to the design process.
- Suggest other elements of the opportunity the design has not accounted for.

“The wisdom of the masses exceeds that of the wisest individual, and this is especially true for engineers, not to mention a student engineer like me. “