Prospectus

Designing and Manufacturing a Human Powered Vehicle

(Technical Report)

Effects of Contemplative Collaboration on Group Dynamics

(STS Research Paper)

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Introduction

Most people at some point in their lives will be required to work in a group in which conflict will arise between group members. Conflict can arise not only from different opinions but different interests as well. If left unresolved, such conflict can negatively impact the group's work as well as an individual's mental health. Group dynamics can be solved by listening to the opinion of each individual in the group and considering the work objectively rather than personally. Other ways in which stress and listening can be improved are through mindfulness and contemplative techniques that more people use each day to improve their well-being.

Working in a team of 14 students that contains sub-teams; the technical portion of the prospectus looks on the design and manufacturing of a Human Powered Vehicle (HPV) and the impact it has on the world around it. Students will take into account safety measures stated by the American Society of Mechanical Engineers (ASME) as well as previous designs to build a successful vehicle for competition next semester. Working in a team as well as being part of a sub-team people will often have contrasting opinions regarding the design of the HPV, which can cause tension within in the group. Methods which consider the resolution to such tensions will be conveyed in the sociotechnical topic.

The sociotechnical topic will look at the impact of contemplative collaboration and its effects on a person's mental wellbeing as well as group relationships. The focus will be on the differences of contemplative collaboration to other forms of collaboration, its impact on group dynamics, and what forms of contemplative practices can impact collaboration to be taken into consideration for the design of the new Contemplative Commons being built by UVA.

Technical Topic: Designing and Manufacturing a Human Powered Vehicle

With more concerns each day regarding carbon footprint and damages to the environment alternatives to fuel-powered vehicles are being assessed. The powering of such vehicles either comes from electricity or human power. Our technical topic aims at designing and manufacturing a human powered vehicle that has the same comfortability and accessibility of normal gas-powered cars. The human powered vehicle must meet all specifications given by ASME as to compete in a Human Powered Vehicle Competition (HPVC) next semester consisting of speed and endurance events. As mentioned in the intro, some of the most important specifications given by ASME concern safety which is increasingly important as many human powered vehicles such as bicycles and tricycles must share the road with cars which have caused many accidents. ASME requires that the human powered vehicles have a rollover protection system (RPS) to prevent the rider in case of an accident; its goal is to absorb energy from impact, prevent body contact with the ground in case of a fall or rollover, provide resistance to abrasion, and ensure that the rider is not ejected from the vehicle in the event of a crash.

The team is aiming to exemplify the qualities of speed, safety, sustainability, durability, accessibility, and user-friendliness. As such we are interested in and have conducted market research to determine which qualities, including comfort, speed, sustainability, cost, or safety, consumers rate most highly so that we can not only design a vehicle for the HPVC but also one that can be used by consumers as an alternative to cars or buses.

After creating and presenting initial designs, the group will build a tadpole tricycle (two front wheels, one rear wheel) with a full fairing. A tricycle design will provide our vehicle with more stability as it will not tip over when the vehicle comes to a stop. The full fairing will be designed to reduce drag to increase our aerodynamics. Frame designs have been iterated through and tested to confirm if the vehicle meets ASME's specifications using finite element analysis (FEA) and computational fluid mechanics (CFD). After coming to a final frame design, the fairing sub-team will work on their design to create better aerodynamics for the vehicle by building around the frame schematics.

For innovation, we will look into the carbon emissions of the human powered vehicle's life cycle; including the mining of materials, shipping of parts, and manufacturing of the vehicle. We will use existing data to determine how much carbon is emitted during mining and will estimate the emissions due to shipping. The most emission of carbon will occur during the manufacturing phase as we will be required to weld metal that results in flux. To reduce emissions throughout the process, we will use recycled parts if possible, have multiple parts ship from the same place at once, and looking at welding techniques that could lead to the reduction or elimination of flux. We are also planning to incorporate some sort form of fan and air flow system as a way to reduce the heat within the vehicle to make it comparable to the A/C found in cars.

To increase accessibility, we are designing the vehicle to accommodate riders from 5'4" to 6'3" (the range of heights of the riders who will be competing next semester). We are also conducting biomechanics research to determine which seat angle and position will give us the greatest power output so that we can perform well during the speed and endurance events.

For the rest of this semester the frame sub-team will finalize their design to allow for designing the fairing. The drivetrain and steering sub-teams will look at incorporating their designs into the frame. At the end of this semester we will order parts and manufacture some part of the vehicle before winter break. Next semester we will continue the manufacturing process and conduct test rides to allow riders to become accustomed to the vehicle before the competition.

STS Research: Impact of Contemplative Collaboration on Group Dynamics

Introduction

Conflict can easily occur within a group setting due to our own assumptions, ideals, and the current situation of the project. While the first two reasons for conflict can be an outcome of either an individual or the group as a whole, the situation of the projects comes from the individual's perception alone (Mekelburg, 2000). Often times when left unresolved, such conflict can cause an increase in mental stress felt by the individual as well as the group from the pressures of working in such an environment. Last year, for example, even after discussing with a teammate their lack of attendance in group meetings that teammate still refused to show causing my other teammate and I to take on the bulk of the work, which made us very stressed. Stress causes a negative impact on people's lives; a news article reported that in recent years there has been an increase in people seeking counseling and other mental health services; at the University of Virginia (UVA) alone, the number of students making appointments at the Counseling and Psychological Services increased by 25% in 2016 (Quizon, 2016). In her

analysis of solutions to conflict, Mekelburg analyzes five different resolutions; competing, avoiding, accommodating, compromising, and collaboration, in terms of assertiveness and cooperativeness. Of all the resolutions collaboration stands out as bringing out both assertiveness and cooperativeness within the group, making it the best solution to the problem (Mekelburg, 2000). Mekelburg does not consider contemplation within her analysis, but it is important to do so as more and more people are incorporating contemplation in to the classroom.

Literature Review

In group settings, as previously mentioned, conflict arises due to reasons within the group and the individual. Contemplative practices allow the individual to concentrate on the world around them (time, space, and people), which can reduce anxiety and distraction resulting in an alleviation of mental stress ("The Contemplative Commons"). Furthermore, incorporating contemplative practices can bring out underlying conflicts within the group which leads to thinking about possible solutions to that conflict. By remediating this conflict and focusing on the impact, such practices can foster a sense of trust and create collaboration that would not have been possible had underlying tensions persisted (Duerr, 2004).

In an effort to promote collaboration many companies have created open work environments as opposed to cubicles with high walls, giving off a feeling of always being connected to one another. The overwhelming issue with such collaboration space in the US is the need for privacy. Collaboration does not only refer to working in a group and being able to see each other at all times, but rather there needs to be time for the individual to reflect upon their own thoughts and ideas as well (Congdon, Flynn, & Redman, 2014). In fact, many industries are found to have more of a focus on the third-person rather than one's self; medicine and science are some of the predominant industries with this issue (Britton et al., 2013).

To create a balance between the group and the individual as well as a remediation technique for conflict people have turned to contemplative practices. Studies have found that the integration of contemplative practices can make students more engaged and critical thinkers (Sable, 2014). When contemplative practices are incorporated within the classroom it has been found that such practices made the students more present which allowed them to experience more engagement with those around them as well as with the material they were learning and gave them more self-confidence (Sable, 2014). Such changes in how students interact not only with one another but with the faculty as well is a result of the innovative and engaging environments that contemplative practices provide. In small group settings, by staying in more of a small space the deeper the experience can be ("Contemplative Commons"). Through such examples and case studies I hope to showcase the benefits of contemplative collaboration.

Framework

UVA is following trends of incorporating contemplative practices into education with its plan for a Contemplative Commons in hopes of fostering more collaboration. In my STS topic I seek to answer: What is contemplative collaboration? How is it different from other forms of collaboration and to what extent does it increase group dynamics? What types of contemplative practices can impact collaboration? Using these questions as guides I will assist in the design for

the Contemplative Commons. I will utilize social construction of technology (SCOT) to analyze stakeholders; faculty, students, and potentially community members to determine what they will need in a new contemplative collaboration space and what modes of contemplation work best for them to improve collaboration. As the Contemplative Commons is being built by UVA, students are the biggest stakeholders as they will be the ones using the space.

Methods

I plan to focus on modes of collaboration, gathering information from current collaborative spaces across UVA, looking at different forms of contemplation, and focusing on how to make the space inclusive of all, while also alleviating tolls taken on mental health. I have and will continue to interview students and faculty to determine the issues with current collaborative spaces, group dynamics, and mental health. I will also use my capstone group as a case study for what sorts of conflicts can arise in groups and what remediation techniques work better than others. This data will allow me to gain more knowledge regarding the needs of students within a new contemplative collaboration space.

Discussion and Next Steps

Taking data from surveys, observations, and interviews in the beginning of next semester I will determine what students would like in the Contemplative Commons and what forms of contemplation can help in the alleviation of their stress and improve collaboration. With the possibility of varying needs, multi-use spaces and designs can be evaluated as well to fulfill the needs of various stakeholders.

Conclusion

My technical and sociotechnical topics fall under a large umbrella of group dynamics. In my technical portion, my team will focus on finalizing our designs for the HPV this semester to put ourselves in a good place to manufacture the vehicle next semester to compete in one of ASME's E-Fests. For my sociotechnical topic I will use my capstone group and other groups to further research the benefits of contemplative collaboration and what types of contemplative practices work more than others.

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