Hazard Planning Games Co-Designed with Youth using Player Motivation:
A Longitudinal Pilot in Westport, WA

Laura St Jarre

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Daniel Abramson
Marina Alberti

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Abstract

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Laura St Jarre

Chair of the Supervisory Committee:
Daniel Abramson
Department of Urban Design and Planning

This thesis serves as a longitudinal pilot for using observation of player motivations among community youth co-designing a localized coastal hazard planning game in Westport, WA. The benefits of this may include better youth engagement with lessons on local natural hazard risk reduction, deeper reflection on potential solutions, more positive associations with an inherently somber subject matter, and a stronger sense of personal connection with efforts to increase the adaptive capacity of their community. The project's design focused on drawing directly from local coastal hazard data, while also prioritizing the identification and satisfaction of participants' measurable gameplay motivations to enhance engagement-based learning and participation of youth in building adaptive capacity.

It follows years of substantial NSF-funded research done by the Cascadia Coastlines and Peoples Hazards Research Hub to assist coastal cities across the Cascadia region to "increase coastal community adaptive capacity, through community engagement and co-production" (Cascadia CoPes Hub). An NSF Large-Scale CoPe: The Cascadia Coastlines and People Hazards Research Hub grant (Award Abstract #2103713) supported the work of this thesis. Though the sample of participants was too small to gather any solid conclusions from the data, engagement with this approach to game-based learning was observed to be enhanced noticeably compared to earlier game-based research in Westport. This may be attributable to player motivations, which remained fairly consistent over six months, as well as the substantial increase in the participants' sense of ownership over the learning experience.

Acknowledgements

Let me first acknowledge the guidance and encouragement of my mentor, Prof. Dan Abramson, who first recognized potential in me to contribute to the field of urban planning. Working to build community resilience with Dan, in my small way, has truly been an honor and a privilege. His enthusiasm for finding and maintaining genuine partnerships with rural and tribal communities has been especially inspiring to me. Right from the beginning of my interest in attending the University of Washington he started connecting me with people who shared my research interests and passions.

One of these was Sarah Lukins (who graduated just before I started at UW), whose Minecraft related research contributed greatly to my knowledge and thinking about conducting hazard planning outreach with games. We only had the opportunity to chat on a couple of occasions, but both came with invaluable warnings and advice that served me well.

I'd also like to acknowledge the support of Prof. Marina Alberti, who encouraged my belief in the potential of game-based learning and fired my interest in using co-development and speculative fiction to advance more inclusive and sustainable societies.

Thanks to Ziyang Liu and Matias Korfmacher for the lifts to and from Westport. Both the journey and this thesis wouldn't have been possible for me otherwise, and the many five hour round trip drives went by fast (ish) thanks to your fascinating ideas, conversation, and podcasts.

Thank you to the Cascadia Coastlines and Peoples Hub, and everyone I got to know there, for its support and for giving me the chance to learn from such a wonderful gathering of academic minds from across multiple states and campuses.

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This includes Kevin Goodrich, Westport's Public Works Director, who helped introduce me to Westport and its efforts to build community resilience with an incredible depth of expertise and genuine interest in my feeling welcome.

It should also be noted that Andrea Mirante, the local afterschool program coordinator, may have worked harder and with more energy than just about anyone to ensure the success of my game-related research with youth. Both with my first informal outreach with youth and then with this co-design pilot, she tirelessly worked to support every possible need I had in Westport while also looking to the needs of the youth taking part. Along with Andrea, I also want to extend my thanks to Ben Velasco and Hannah Rigo for also helping with this work.

Finally, of course, I must thank the incredible teenagers who were willing to give my work their time and best effort (often on their days off) and who were always such a pleasure to work with over the last several months. Your group's signature combination of professionalism, creativity, and wit along with your obvious interest in helping Westport are a real credit to your generation. Thank you all so much!

Contents

PART I: Research Behind the Player Motivation Pilot

Building Community Adaptive Capacity in Westport

The work of this thesis extends from a core interest in building regional sustainability in western Washington by engaging with communities on potential approaches to integrating all their resources (social, technical, and environmental) using "innovative, localized strategies" (Idziorek, et al. 2021, pg.3-4). The greater objective is to contribute to the formation of a network of more self-reliant and resilient communities throughout the region.

Engagement needs to appeal to a wide range of personalities while addressing the inherent challenge of conceptualizing a holistic picture of local environmental change and hazards. The relatively gradual, but cumulative and inexorable nature of changes such as sea level rise can suppress response times to slower disasters, putting communities in the position of the proverbial frog in a pot of water coming very slowly to a boil. Conversely, there are also sudden, catastrophic, but rare and unpredictable changes such as earthquakes and tsunamis, which people tend to ignore because they are so infrequent and may be unlike anything they have experienced. An integrated response requires engagement that helps communities recognize these changes on a spectrum of interactions, how they may affect and amplify each other, and how locals might fashion an equally interwoven set of local adaptive solutions.

In June 2018, a team from the University of Washington's Department of Urban Design and Planning (UW Team) consisting of Katherine Idziorek, Daniel Abramson, Cynthia Chen, and John Scott extended the work of a project sponsored by the Bullitt Foundation from a single wealthy Seattle neighborhood to include both a lower-income urban neighborhood and one rural coastal community to address the adaptive capacities of each and to better understand their key differences with respect to resilience and identity (Idziorek, et al. 2021, pg.5-6). While adaptive capacity was defined as "the ability to absorb shocks or reconfigure and transform in response to or anticipation of change" (Idziorek, et al. 2021, pg.3), through a participatory engagement process the potential for self-transformation would only take place on each community's terms.

That the rural coastal community chosen was Westport, WA was no coincidence. Coastlines are scenes of some of the most powerful and dynamic changes witnessed on Earth, and yet Westport demonstrates the potential of communities to develop strong values which reach beyond individual limitations to defend their futures. The city's leaders recognized that options for response can be drawn together from a diverse array of useful sources. These might include indigenous written and oral histories (Lauer 2012, pg.1), the personal experiences of current residents, and Science being conducted and shared by research institutions to name a few.

One reason Westport is an exceptional choice for this work is that it chose to face the prospect of danger and isolation from a tsunami by building North America's first vertical evacuation structure (VES) into the Ocosta School District's new elementary school using their own tax dollars. This serves not only Westport, but also members of the South Beach community and students from the nearby Shoalwater Bay Tribe who attend the same school (Idziorek, et al. 2021, pg.26).

Over the course of this project Westport worked with determination to fully incorporate hazard mitigating priorities and strategies into their aspirational goals and values. Unlike many communities, which normally compartmentalize steps toward self-preservation from their plans for development, Westport clearly recognizes that a healthy synthesis is required to realize the best possible future (Idziorek, et al. 2021, pg.10).

To build off Westport's progress up to that point, the project leaders reached out to Kevin Goodrich, Westport's Public Works Director, and other local leaders in the summer of 2018 with a proposal to conduct public workshops and introduce a local community resilience survey. This partnership would not only assist in updating the city's Comprehensive Plan with measures from the Grays Harbor County's hazard mitigation plan, but also introduced a graduate-level urban planning studio course the

following autumn that would explore "as-yet-unvetted strategies for both short-term and long-term coastal resilience" in Westport and would offer several engagement opportunities. (Idziorek, et al. 2021, pg.26).

The Coastal Resilience Project

The Coastal Resilience studio in Westport began with a Memorandum of Understanding signed by Westport Mayor Robin Bearden and Prof. Abramson on behalf of the UW Team (Idziorek, et al. 2021, pg.6). The aim was to suggest ways for Westport to address its goals for development while also properly preparing itself for natural disasters. The studio would work to suggest hazard planning updates to Westport's comprehensive plan by engaging many local stakeholders and residents, while the students might learn from the city's experience in facing and acting to prepare for natural hazards. The results could then be shared with many other communities (Abramson, et al. 2018, pg.1).

Identifying versatile hazard mitigating strategies which integrate well with a community's local culture and everyday priorities can contribute to a lasting understanding and effectiveness in facing unpredictable danger (Abramson, et al. 2018, pg.6). In Westport's case, the community sits exposed to the Pacific on a relatively flat coastal peninsula where the connection between peoples' livelihoods and the ocean reaches back to long before white settler-colonization began. Destructive, and sometimes cyclical challenges (both natural and man-made) have been born in this relatively isolated area and forced the residents of Westport to develop a culture of self-reliance and respect for the power of nature (Idziorek, et al. 2021, pg.27-28).

Though the engagement manifested in a few ways, the two public resilience workshops may be the most directly related to the work of this thesis. They each offered the opportunity for the community to inform the project team directly of their perspectives, ideas, and experiences while gaining some more understanding of the possible impacts of local disasters (Idziorek, et al. 2021, pg.32).

The theme for both was "more meaningful" hazard mitigation which offered everyday usefulness to the community and began by engaging participants from a mindset of "appreciative inquiry" where everyone involved would look for positive potential from future change rather than focus on destruction (Abramson, et al. 2018, pg.1-2)(Freitag, et al. 2014, pg.324-325). Community members shared aspects of their community's character and values by highlighting local social and physical assets through discussions, participatory mapping, and through sharing stories (Abramson, et al. 2018, pg.49). Some participants recounted their memories of the 1964 Alaska Earthquake and tsunami, with one person sharing that the event's impact motivated her to prepare for the incredible power of nature (Abramson, et al. 2018, pg.37).

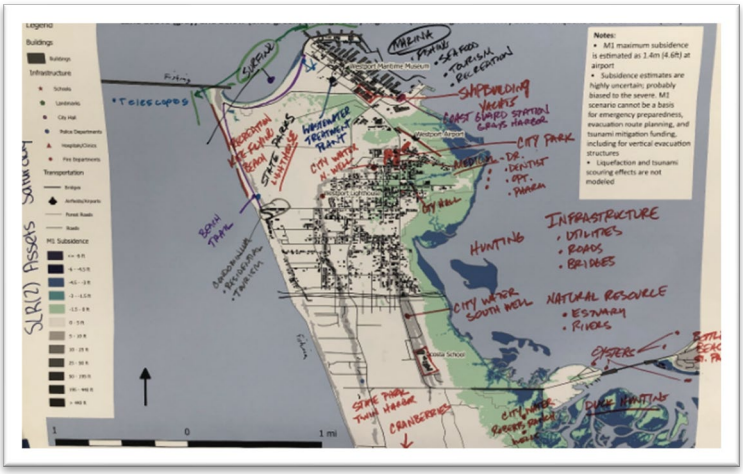

Figure 1 – Community Assets Identified by Saturday SLR Group 1

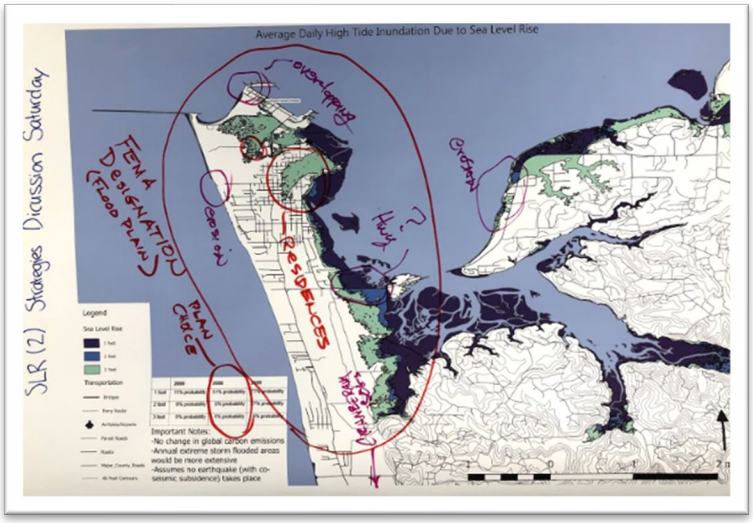

Figure 2 – Community Assets Identified by Saturday SLR Group 2

Figures 1 and 2 show maps of community assets created by two groups participating in the workshop drawn over high tides given different sea level rise scenarios (Abramson, et al. 2018, Fig. 29-30, pg.39-40). Residents drew on knowledge of the area to point out vulnerabilities they felt needed to be addressed given the disaster scenarios presented to them and emphasized that further outreach should attempt bring the community together around a common understanding of local hazard risks and planned responses to them in Westport (Idziorek, et al. 2021, pg.32).

This opened the possibility of offering new forms of engagement in Westport focused on broadening local natural hazard risk awareness and mitigation strategies in the community (Idziorek, et al. 2021, pg.33), including the formation of an after school "STEAM club" sponsored by the Center for Safety Equity in Transportation (CSET) based in UW's Civil Engineering department using drones for students to explore their local environment and Minecraft-related research conducted by Sarah Lukins which first inspired this thesis (Lukins 2022, pg.9).

This also conformed with the earlier aim of introducing more innovative and localized strategies for building adaptive capacity (especially at a critical community hubs like Ocosta Junior High School (Lukins 2022, pg.35)) out of existing social and technological resources, in this case by reaching out to local youth using a game which they already find fun and familiar.

Youth Hazard Planning Research using Minecraft

A few years after these workshops took place, UW graduate student Sarah Lukins (pursuing a joint Master of Urban Planning and Master of Landscape Architecture degree) joined the CSET sponsored drone program going on at the Ocosta school district. She worked with Kevin Goodrich, still Westport's Public Works Director and close partner in UW's natural hazard outreach work, to arrive at her decision to submit designs for two prospective parks on the Westport Peninsula as part of her thesis. Both park designs would be informed by engagement with local youth considering options given that these two areas are prone to coastal flooding under multiple scenarios of sea level rise and co-seismic (earthquake-generated) land subsidence. With NHERI Natural Hazards Reconnaissance (RAPID) Facility supported drone mapping and 3D digitization of the Westport peninsula already showing a lot of success at effective youth recruitment and engagement, the question she wanted to answer was what other technologies

might also "quickly recruit and deepen student engagement in adaptation conversations" (Lukins 2022, pg.9).

From her research, she was able to identify virtual space in Minecraft as a prospect for meeting local youth "where many of them already are" (Lukins 2022, pg.32-33) to facilitate the recruitment and engagement process. Though she had no experience with the game prior to this work, she found that many of the Ocosta students she worked with knew the game well and could navigate the control systems in ways she hadn't predicted (Lukins 2022, pg.65).

The figure to the right is a screenshot from one area of digitized Westport that students worked on (Lukins 2022, Fig. 21, pg.58).

Figure 3 - An aerial view of work done in Lukins' digitized Westport

Her intention was to work iteratively on park designs for Westport with the students by tapping into their capabilities and creativity with the game. Through this work she found the students were often preoccupied with expressing their sense of humor and interest in novelty, connecting with the "more than human", looking for opportunities to overcome challenges or risk (Lukins 2022, pg.51).

Observations of the way the students used their virtual world was of particular interest to me because I felt they might point to their motivations to engage with the technology. Lukins mentions in her thesis that the virtual landscape was used both to play out their creative sense of humor, as well as to "antagonize" each other by occasionally destroying each other's work (Lukins 2022, pg.63). References to youth preoccupation with antagonism came up a few times along with their testing boundaries set by authority, both in the final thesis and in a couple of personal conversations I was able to have with Lukins.

She mentions that students often became more "invested in their social life" in Minecraft than in attempting to devise creative strategies to hazard planning problems (Lukins 2022, pg.64). In other words, despite the opportunity to problem solve offered by the game's creative features, the students' apparent preoccupation with the more competitive and destructive gameplay features available appeared to conflict occasionally with the creative and cooperative problem-solving motives Lukins hoped to engage with.

Viewed from the perspective of the typical game developer, all these player motivations are equally valid given that the only real aim is to achieve a sense of satisfaction in the gamer from their engagement with the product. As Lukins points out the problem faced for her research came in the form of determining the right balance of ownership, both between the students over their creations and between the purpose of the research and the creative freedom of the participants (Lukins 2022, pg.64).

In her search for that balance, Lukins asked the students, who mostly did not choose to work cooperatively, if they would prefer to work in "separate parallel worlds". Every one of them said no, they wanted to play together. This offers strong evidence that their apparent antagonism was socially motivated and suggests they might have benefited from planning engagement by competition. Ultimately, getting the parks designs from the students involved having to activate "Classroom mode" and eliminate competitive destruction as an option in the game through changing the admin permissions (Lukins 2022, pg. 43, 65-66).

Lukins' speculation was that the destructive impulse may have derived from needing to cope with the reality of natural hazard risk to their community. This may have played a role, but Lukins herself suggests that if she were to do it over again, she would have "interrogated them about where the

impulse came from" (Lukins 2022, pg. 66). I believe this was the most important lesson to take from the Minecraft research on hazard planning engagement. Not only because understanding how youth participants are feeling in a disaster planning context is important for their support, but also because it points to the primary motivations for their most effective engagement.

Great expectations for how the students would become local advocates for hazard mitigation, may have contrasted with Lukins' actual experience of "open rebellion" against the guardrails she set on their use of Minecraft, but she pointedly states that the greatest successes were a direct result of meeting students "where they were" and allowing them to take more control of the creative process even when it "ran counter or parallel to my desires" (Lukins 2022, pg.65).

As I will show from my own early experiences doing similar outreach, it's incredibly easy to fall into the mistake of pursuing your own motivations at the expense of audience engagement with games. Having worked in game development for several years, and after reviewing Lukins work with her, my initial attempt at hazard planning outreach still managed to replicate (or even intensify) disconnect around engagement motivations. Both underscore the importance of developing an early understanding of primary player motivations when attempting to engage youth in hazard planning using games.

Cities: Skylines Outreach

The idea for studying player motivation during engagement with a longitudinal pilot emerged in response to the results of the earlier attempts at natural hazards outreach with games in Westport. As I was about to begin my graduate education at the University of Washington, Sarah Lukins was just finishing her work using Minecraft to invest youth in climate change adaptation in Westport.

I was able to have a couple of conversations remotely with Lukins as I got started and my work later benefited greatly from her advice. As I mentioned, I learned that despite the project's overall success there were drawbacks to using Minecraft such as her relative lack of starting familiarity with the game, and that students were occasionally distracted from contributing by other interests with the game. In particular, she noted that their ability to use the game's multiplayer functionality to affect and destroy each other's work rather than focusing on creative collaboration.

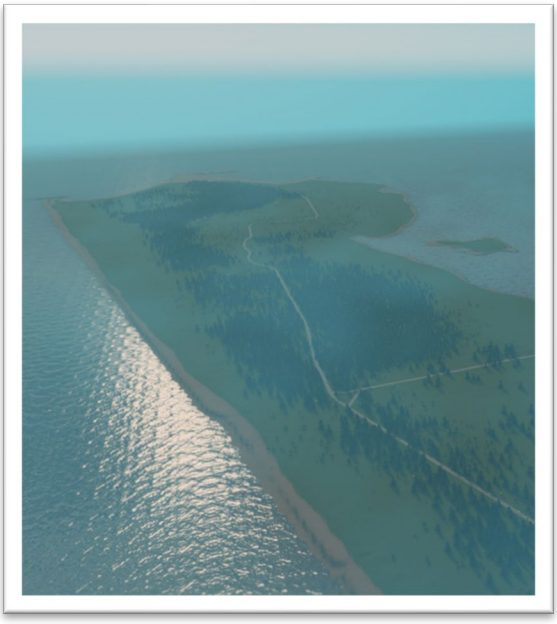

Figure 4 – Westport Peninsula in Cities: Skylines

Despite this, her success in submitting recommendations made using input from local youth with her park design proposals showed the potential of doing hazard planning outreach with games in Westport (Lukins 2022, pg.51). Wanting to build on Lukins' achievement and maintain the connections she made with Ocosta School District, I introduced local youth to the city building game Cities: Skylines. At this time, I wasn't so much considering the research potential of my work as just looking for ways to contribute from my years of experience with game development and develop my public engagement skills. However, I tried to draw lessons from Lukins research to avoid some of the early difficulties she experienced. I chose Cities: Skylines because I had extensive personal familiarity with the game and was very confident in its use. For one, I knew I could build an attractive digital recreation of the Westport peninsula using real geodata. I also knew I could include the Natural Disasters downloadable content which would enable players to play with local hazards (including earthquakes and tsunamis) on the Westport map. Additionally, with my

focus on the warnings of antagonism, the fact that Cities: Skylines was a single-player experience without the need to change permissions seemed like a strong starting advantage.

What I found, when I introduced the game to youth in Westport the fact that they had to split their contributions into five single-player experiences (there were five different computers at the school with the game installed) meant that any desire for social engagement had to come at the expense of attention on the game. The players would try the game for a while but turn to each other often to assess and (often) playfully deride each other's work. They were generally delighted at the different forms of destruction they could inflict and competed both in terms of their building and the scale of destruction they could produce. A couple of them were mostly interested in creating designs or mastering the building controls, but for the most part the learning curve for this city-builder was generally too steep. Few of them had ever played a city-builder before, and I found that my personal familiarity with the controls and the genre had obscured how unintuitive they can seem to others.

In attempting to avoid the personal inexperience that Lukins had experienced with Minecraft, I'd effectively inflicted an intense learning curve on youth instead. In purposefully disconnecting the youth from social expression in the game, I'd removed one of their primary motivations for engaging with the game I presented. The youth working with Lukins had even made it clear that they wanted to occupy a single game space despite (or because of) their mutual tendency to affect each other's work. All of this, but particularly the disconnect I observed between the game's features and youth motivations, served as valuable reminders of lessons I should have heeded better from Lukins' research. I recognized that the outcome was likely to be partly based on the biases of my own interests and motivations, and partly the chance configuration of a given group's collective motivations. This group of teenagers might have already been well acquainted with city building games and strongly motivated to engage with the learning opportunities it offered, but does game selection based on one person's assumptions of the engagement potential of a game pose an unnecessary risk of disconnect from its intended youth audience?

I was aware from my undergraduate education in game development that there was game design research which suggested player motivations might be measured and categorized in order to better systematize effective engagement with games as a product. I wondered if helping Westport youth discover and reflect on their own player motivations might serve as a first step to limit the risk of disrupting their engagement with adaptive capacity building, specifically by offering to co-develop a hazard planning game optimized around their engagement motivations. This co-production approach could maximize their sense of ownership and limit the restrictions placed on them to key objectives (e.g., a hazard planning game set in Westport founded on real risk data from the area) without dictating how youth designers were to pursue and engage those objectives.

Since expressing creativity might itself constitute a player motivation which youth may or may not exhibit strongly, my first concern with this idea was whether such a project would only be feasible for a group consisting primarily of design-oriented individuals. I reasoned that the solution to this problem might lie in the iterative nature of game development involving many playtests. Since the objective of the project would be to build a game around a group's player motivations, then even the least design-oriented participants might still be very engaged by taking on the role of a play tester and providing feedback on what their more design-oriented peers had most recently implemented.

An important assumption would be that anyone might be able to provide expertise on their own opinion of fun, and if individual player motivations could be measured (and remain mostly consistent over time), then anyone should be able to contribute effectively to a game design intended to appeal specifically to them simply by providing honest feedback on gameplay they've just been presented with. One might assess youth participant knowledge of local risks along with the character and consistency of their motivations before and after the development of a co-developed hazard planning game using a longitudinal pilot. The intent would be to suggest a potential methodology for maximizing engagement for learning while avoiding instances of deep disconnect seen using Cities: Skylines and Minecraft.

First, I needed research to show that a) youth participation in natural hazards outreach offers value to building local adaptative capacity, b) that the degree of engagement is important to learning, and c) that player motivation contributes to successful engagement with games.

Youth Motivation, Engagement, and Participation

Figure 5 – Research Question Sequence

The Value of Youth Participation in Adaptive Capacity Building

Building adaptive capacity, as mentioned, is about enhancing the ability of a community to absorb and reconfigure itself around change on its own terms. The priority is placed on the sustainability of the community rather than limiting resilience efforts to restoration of the built environment prior to disruption. After a major disruption, the original configuration of a community might not be possible or even preferable to locals given the new reality (Freitag, et al. 2014, pg.325).

The capacity of communities to adapt to major change is supportable by much more than understanding physical conditions and material assets. While they shape some of the circumstances of a disruption scenario, a lasting future for a community really depends on its accumulation of less visible social ties, common values, and access to well-organized resources (Freitag, et al. 2014, pg.325).

Prioritizing a community's focus on ways to reduce risk with these assets rather than on the potentially off-putting details of a disaster scenario, referred to as the "appreciative inquiry" approach, is why getting broad community participation is so vital to effective hazard planning (Freitag, et al. 2014, pg.325).

As mentioned, this was the approach demonstrated in the workshops in Westport and helps explain why there was a workshop focused on the wider community in addition to the one working with local specialists. While resident experts should certainly remain closely involved in local adaptation efforts, both as members of the community and for their specialized understanding of the local environment, it's at least as important for the wider community to participate as much as possible. Only the involvement of the wider community can provide everyone a meaningful window into understanding all the immaterial assets that are available to a community, and it's only when local plans which involve and enhance these assets are made broadly accessible that they are able to serve their intended role for lasting community sustainability. Part of establishing a clear holistic picture of a community necessarily includes involving local youth in these outreach efforts. It's not just that youth will inherit the future that the participation process envisions, but youth represent a distinct group with their own particular social resources and local values to share (Derr, et al. 2018, pg.8).

Despite assumptions that teens are generally uninterested in participation with others outside their cohort this has not been shown from past participatory work. Youth want to make positive contributions to society and when they feel they aren't given those opportunities this can be the source of any feelings of "exclusion, indifference, and antagonism" (Derr, et al. 2018, pg.8).

Despite young people being especially at risk intellectually, emotionally, and physically from disasters, they can still be easily overlooked in hazard planning efforts by assumptions that any support offered to adults is sufficient to cover all the needs of local youth as well (Peek 2008, pg.3-4). Disasters can set back development and affect the mental health of youth more so than adults who may benefit from years of relative stability as a frame of reference when confronting the effects of a major disruption. As the frequency of natural disruptions increases with changing local climates there will be an increasing need for preparation to support youth with engagement and ease their sense of vulnerability. Giving young people the chance to contribute meaningfully to their community's resilience can contribute greatly to this effort (Peek 2008, pg.2). Additionally, being part of a process of local planning and sustainability offers youth some hard evidence that leaders are willing to take their ideas seriously along with a definite sense of inclusion that contributes positively to adolescent development (Derr, et al. 2018, pg.8).

Research partnerships with communities are always improved when the expertise of all parties involved can be mutually recognized and respected as this ensures that a freer sharing of perspectives will be worthwhile (Christopher, et al. 2008, pg.1401). Acknowledging different kinds of expertise can be difficult if we're conditioned from personal experience to expect expertise to take certain forms (e.g., from years doing a one kind of job) (Christopher, et al. 2008, pg.1401), but we might include keeping an open mind to youth expertise as an important requirement to overcoming any age-related biases, and thereby improve the knowledge exchange between adults and youth.

Practically, efforts to extend awareness of sustainability plans and resources to the wider community are also enhanced by youth participation as they can assist in sharing and advocating for what they learn with family members and peers on social networks. This may help to include those who may not have had time to engage with local sustainability up to that point. This has the potential to build on and enhance existing social capital by inspiring people to get more involved with local community organizations or build informal connections with neighbors around the development of a shared response prior to a disruption (Derr, et al. 2018, pg.333). After a disruption, the informality of social capital (which usually takes a while to build up) serves as an indispensable safety net for a community if they are likely to experience losses in formalized access to services and institutions (Derr, et al. 2018, pg.333). The longer these efforts can take place in a community before a disruption, the more local adaptive capacity should be enhanced by any knowledge integrated into multiple generations of youth outreach. This widespread awareness and active involvement in addressing local natural hazard threats could contribute to development and elaborate on a lasting "culture of risk reduction" (Pfefferbaum et al. 2018, pg.3).

The Value of Engagement in Game Based Learning

The pursuit of research on engagement with games can be understood as one dimension of exploration in positive psychology. Positive psychological experiences can have profoundly beneficial impacts which stand in direct contrast to the traumas and anxieties that might otherwise overwhelm our capacities (Tingshu and Csikszentmihalyi 2020, pg.1). As has been discussed, this could be particularly useful for youth learning about local natural hazard risk, and some planning outreach in Westport has already involved educational or data gathering activities which were intended to be engaging and fun based on the idea that that these qualities can support learning objectives.

One study supporting Lukins' use of Minecraft for youth engagement observed that games can be very effective tools for positively motivating and engaging youth in urban planning topics (de Andrade, et al. 2020, pg.15). Games have also been found to be useful in supporting player engagement with new and complex concepts by stimulating player imagination, roleplay, or exposure to strategic thinking among other possibilities (Vervoort, et al. 2022, pg.214). Engagement through games also offers reflective opportunities which support interactive experiential learning, as games as a medium rely on players to think about their prior learning experiences with a game to advance beyond the next set of challenges (Shaheen et al. 2023, pg.3).

Hamari et al., investigated the impact of player engagement on learning outcomes and showed that when the challenge of a game maintains player effort just at the edge of player ability this tends to

increase levels of engagement, and that this engagement tends to increase learning (Hamari, et al. 2016, pg.175). This is supported by other research showing serious games which are more "personalized and adaptive" to player expertise tend to increase motivation to engage with a learning experience (Streicher and Smeddinck 2016, pg. pp.332). Interestingly, the Hamari et al. study found that a sense of immersion in a game experience does not necessarily increase learning. However, it did suggest that players developing new skills to overcome new challenges tends to lead to both greater engagement and immersion. This point, and what exactly is meant by immersion, will be covered in the section on whether player motivations support engagement.

The more important takeaway is that learning outcomes may be strongly predicted by player engagement, defined here as a combination of "concentration, interest, and enjoyment" in an educational gaming experience (Hamari, et al. 2016, pg.175), and that this kind of engagement may depend partly on designers achieving and maintaining a balance between challenge and increasing player ability (Hamari, et al. 2016, pg.170).

> *"The results specifically showed that engagement in the game had a positive effect on learning."* (Hamari, et al. 2016, pg.175)

Personalized engagement may also offer improved player acceptance and identification "within and outside" the experience of the game (Streicher and Smeddinck 2016, pg. pp.333), which would be important for building lasting and positive memories of the lessons on building local adaptive capacity. Streicher and Smeddinck also make the point that personalization of game experiences can enable heterogenous groups of players (with different kinds of abilities) to progress in a "motivating and rewarding manner" (Streicher and Smeddinck 2016, pg. pp.333), which would also be very useful in offering more inclusive access to involvement in hazard planning.

Another study done by Kafai and Burke specifically supports the idea of co-developing gameplay to support learning through engagement. They contrast the educational outcomes of "constructionist" and "instructionist" activity in games, with the former specifically promoting active learning through creation and the latter being passive reception of lessons (Kafai and Burke 2015, pg.325). The study points to the use of student-lead game development for improved learning outcomes. Providing a sense of ownership over a serious game's development builds improved confidence in the learner while prompting them to think about the multilayered complexity of a game's "mechanics, interactions, and content" (Kafai and Burke 2015, pg.325). The inherent complexity involved points to another use of co-development of games in promoting learning about hazard mitigation and adaptive capacity because it demands some level of "systems thinking" to achieve good game design (Kafai and Burke 2015, pg.325).

The design of player progression in games often resembles the adaptive cycle in that the sustainability of an engaging experience proceeds through phases of growth, conservation, release, and reorganization analogous to communities responding to real world challenges. This isn't very surprising, since the adaptive cycle applies to most systems where decisions are made "iteratively based on prior experience" (Streicher and Smeddinck 2016, pg. pp.343).

Finally, in line with the participatory approach to building adaptive capacity, Kafai and Burke also claim a need exists to broaden access and participation in co-development of serious games not only to improve the educational value of these games, but to allow students to make the games which best align with what they want to play (Kafai and Burke 2015, pg.327). This supports the idea that co-designing a game with its intended audience should support the kind of engagement which supports learning.

The Value of Player Motivation in Engagement

A review of 91 papers providing empirical evidence on the impact of Game Based Learning showed that engagement is tied to players "cognitive and emotional involvement in gameplay", development of skills, and researchers can observe which aspects of a game produce enjoyment and motivation to identify the causes of engagement with learning (Jabbar et al. 2015, pg.767). Another

literature review, which looked at studies of students (mostly in high school and college) learning chemistry with games, showed that educators have used game-based learning to increase interest and enhance understanding of Science, but that using this approach is still underutilized by educators and the use of games to address curriculum requirements still needs exploring (Byusa et al. 2022, pgs. 8-9).

When considering whether to try a new game, players tend to use personal identification with what a game seems to offer (Williams et al. 2008, pg.1009), and their motivation to continue playing once they've started is likely to be maintained through a combination of that identification potential and an experience generally referred to in game design theory as "Flow". The positive psychology researcher Mihaly Csikszentmihalyi developed the concept as he took note of a specific state of mind that people might enter playing games where all their focus seems to be taken up by the enjoyability of the activity. Csikszentmihalyi's Flow "describes a highly enjoyable condition which allows individuals to operate at their full capacity" by finding a sustainable balance between a state of mental arousal and player control over an experience. Too much of the former and the player becomes anxious, too much of the latter and the player becomes bored (Tingshu and Csikszentmihalyi 2020, pg.1).

This supports the idea encountered in results by Hamari et al. that educational game design should set up a carefully escalating series of challenges which keep the player operating at the very edge of their developing capacities. In other words, Flow is achieved when a game effectively holds the interest of players by its capacity to maintain a state of perpetual learning.

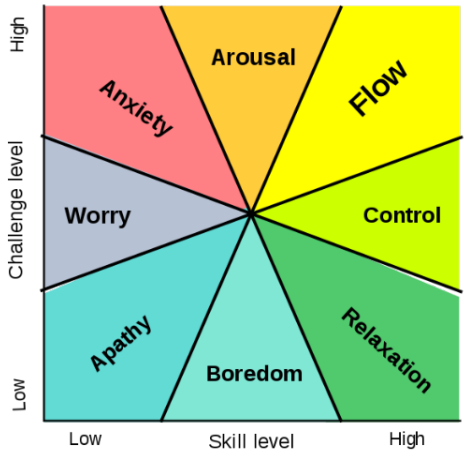

Figure 6 – Arousal versus Control

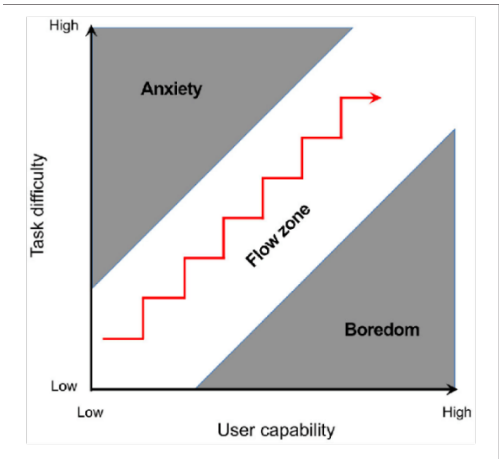

Figure 7 – Anxiety versus Boredom

Players tend to engage, and continue to learn from a game, when they are seeing their own growth take place in the pursuit of their own motivations. A more detailed enumeration of the qualities of "Flow" which contribute strongly to engagement-based learning goes beyond the balance of challenge and skill to include factors which contribute to its maintenance, including "action-awareness merging, clear goals, unambiguous feedback, concentration, sense of control, loss of self-consciousness, transformation of time, and autotelic experience" (Oliveira, et al. 2021, pg. 1). These qualities of Flow help us to recognize that enabling optimal engagement for learning must involve clearing the smoothest possible path for players to direct all their attention on their attempt to progress. Any negative impacts on clarity, concentration, feedback, and so on may be thought of as a kind of turbulence which is disruptive to optimal learning.

Flow may be the basis of sustaining motivation to engage with learning, but we know from Williams et al. that motivations also likely impact players decision to engage challenges due to identification. How motivations seem to affect and sustain engagement with difficult work is an area of focus for game analytics researchers such as Nick Yee, who has points out that players will sometimes spend many hours of effort on laborious activity such that even they sometimes admit the games they choose to play sometimes feel like an extra day job (Yee 2006, pg.69). Game studios find that they can engage diverse personalities with difficult and complex work if these products offer appeal to specific player motivations. Contrary to common bias about gamers only seeking escape, these motivations are

most often about aligning and expressing one's personal goals or self-concept with the activity at hand (Williams et al. 2008, pg.1009).

> *"One possibility is game use as personality maintenance. If a player is highly achievement oriented, she may seek games that fulfill this when she has a lack of achievement in her nongame ("real") life."* (Williams et al. 2008, pg.1009)

Since we all have preferences and motivations we can identify with, then presumably there are ways to develop any game in such a way as to give it the best chance to engage even the most ardent non-gamer with an important learning topic. Nick Yee co-founded a game analytics company called Quantic Foundry which developed a Gamer Motivation framework for the purpose of better understanding who players are and why they play the games they play without relying on misleading player stereotypes. This framework was built with "Intuition/Observational models (e.g. Bartle's Player Types), Theory-driven models (e.g. PENS based on Self-Determination Theory), and Factor analytic models (e.g. Sherry's Uses and Gratifications Model)" (Yee 2021), each of which are reviewed briefly below.

A study by Park, et al. specifically considers learning motivation among Bartle's Player types. It shows sustainable learning can be created through the engagement of each "player type's" preferences for certain game experiences (Park, et al. 2021, pg.8). The study suggests a focus on satisfying player type preferences during development should take precedence to see the benefits from gamification. It warns that disengagement, of the kind observed in earlier Westport outreach with games, may stem directly from mismatching the preferences of player types with overly assertive academic motivations (Park, et al. 2021, pg.8). The lesson here is not to sacrifice academic *objectives*, but rather to set aside preconceived assumptions of how best to engage students with lessons.

If learning follows from engagement which follows from player motivation, then academic objectives should be made more achievable (not less) by a clearer understanding of players motivations and with a sufficiently adept application of that understanding on game design. Bartle's Player Types were more limited (Achiever, Socializer, Explorer, and Killer) (Park, et al. 2021, pg.6)., than the Gamer Motivation Model ultimately produced by Nick Yee. A study considering the role of Self-Determination Theory based motivations such as sense of autonomy, relatedness, and competence in a game's design has shown these to contribute to players easing into the "Flow" state-of-mind (which seems to support learning engagement) and serves as another lens in evaluating a game project's success with each participant (Rogers 2017, pg.449).

> "...when a game positively impacted feelings of competence and relatedness, those feelings led to greater enjoyment of the game." "only competence and relatedness impacted enjoyment." (Rogers 2017, pg.449)

My sense from this study was that this lens shows promise, and I suspect that the finding relating to autonomy failing to impact enjoyment was likely tied to the fact that providing the right amount of feedback to the player is an extremely difficult balance to strike. However, this further supports the idea that player motivations support the kind of enhanced engagement which facilitates learning. Another study involving Self-Determination Theory in Game Based Learning suggests that sufficient player experience of autonomy, relatedness, and competence are required for players to achieve a sense of growth (Proulx et al. 2017, pg. 85).

The last model Yee refers to directly in building his Gamer Motivation Model, the Uses and Gratifications model, involves seven constructs of convenience, entertainment, socializing, status seeking, information seeking, sharing experience, and continuance intention. A study by Gallego, et al. considered online learning motivation using this model and found that "Convenience, Entertainment, and Sharing Experience have a direct influence on user Continuation Intention", but that we don't know enough about how personal motivations affect engagement with online learning (Gallego, et al. 2016, pg.81).

In addition to these earlier models, Yee's Gamer Motivation Model also draws on player data from over 1.65 million gamers. This provides invaluable empirical data to game studio clients, so it seemed to present the best means of assessing youth motivations for this research (Yee 2021).

Yee's model features twelve distinct player motivations that drive engagement. Certain pairs of motivations have appeared to correlate regularly so they are further organized by Yee under one of six headings which try to describe what players are identifying with and pursuing in a more general sense (Yee 2021).

Figure 8 - Player Motivations of the Gamer Motivation Model (Yee 2021)

For researchers interested in gameplay motivation, it's worth recognizing that these nuances and patterns are shown to exist in the data gathered from players, but this probably will not be as useful for youth co-developers to consider if they are to optimize gameplay around their own motivations.

In practice, such project guidelines shared with youth should probably be limited to introducing these 12 primary motivations and their respective qualities. The Gamer Motivation Model shown here should serve as a solid basis for a longitudinal pilot project exploring learning engagement potential around hazard planning through a co-development process informed by player motivations. It appears to be based in multiple well-regarded player motivation models which support learning and offers twelve very distinct sets of qualities to track in each co-designer's player profiles.

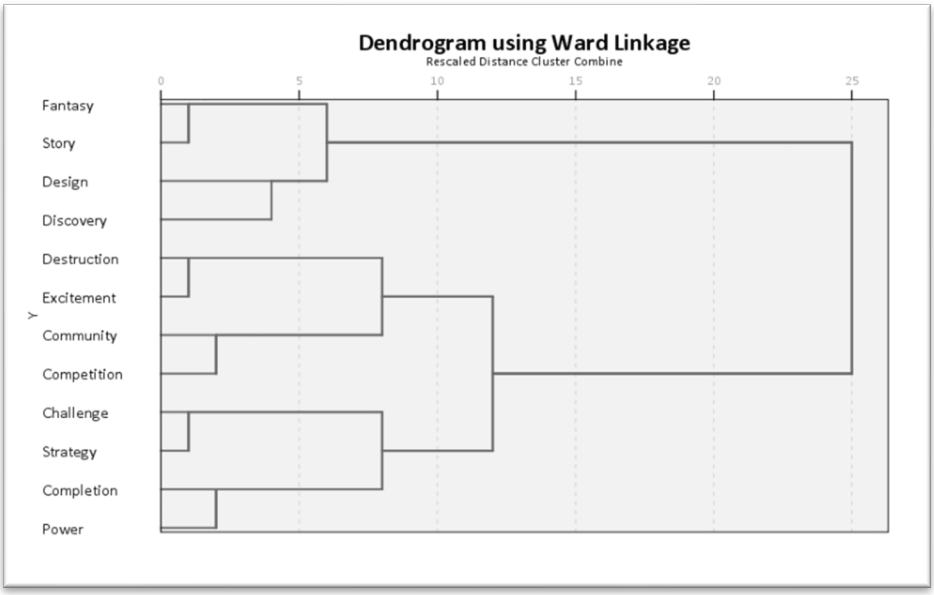

Figure 9 - Dendrogram of Player Motivations (Yee 2021)

Envisioning the Application of Player Motivation for Hazard Planning

Understanding player motivations to engage with the problem of simulated local hazard risk in a gaming environment may also prove analogous to broader community engagement discussions of real hazard risks in their community.

If, for example, a group engages strongly with a hazard planning game in response to a Story-driven focus, then it may be that the same group would be similarly engaged with a real-world hazard planning which also draws on storytelling. Below is a short list of ideas for similar engagement outside of gaming with potential to draw on player motivations as described in the Gamer Motivation Model:

- **Destruction:** Engagement potential might exist here by allowing Destruction-motivated participants to personally embody or direct simulated natural hazards against simulated targets and witness their most destructive consequences.

- **Excitement**: Dynamic, difficult-to-predict events with potentially dramatic consequences could be tapped for engagement by including timed races to some hazard planning accomplishment or including a repeating element of chance into activities (dice rolls, or card/name draws).

- **Competition**: Setting up teams or individuals to compete over the best design solutions for a local hazard planning problem.

- **Community**: Encouraging a cooperative approach to hazard planning by sharing different priorities or helping to strengthen local networks of relationships.

- **Strategy:** Asking for the best solutions for local resource management and most effective deployment of resources to improve community resources.

- **Challenge:** Purposefully presenting problems which are very difficult to solve, but with the tools and timely-and-effective feedback necessary to learn.

- **Achievement**: Offering a very long checklist of needs or requirements to completely satisfy, presented as a collection to complete, in order to best serve local adaptive capacity.

- **Power**: Maximizing a sense of individual or collective empowerment of the community by continuously and visibly building on their prior capabilities.

- **Design**: More directly involving locals in the design process to realize a more resilient community that they feel best expresses their identity.

- **Discovery**: Presenting the largest possible range of areas of exploration without overly micromanaging topics or responses and focusing more on facilitating self-guided interest and innovation.

- **Fantasy**: Allowing participants to indulge their roleplaying abilities, allow extensive speculation on the future, or simply to indulge highly improbable concerns on the topic of local hazard mitigation (with real local data following in parallel).

If there is a systematic way for leaders of outreach activities to quickly discover the primary player motivations for participants in local hazard planning setting, then they might adjust a set of approaches

to potential outreach activities to optimize them for the best outcomes. The results for hazard planning might be both more appealing, and easier for locals to access.

If, for instance, an individual is motivated by strategic thinking, and they usually apply this outside the context of hazard planning, they will likely find it easier to draw on this approach in a hazard planning meeting. Strategic minds in Westport might be more willing to contemplate some form of planned relocation from low-lying coastal areas if they think strategically about *both* sea level rise *and* co-seismic subsidence — both of which increase the hazard of coastal flooding in the same spatial areas but with different speeds of onset and on different time scales. The need to balance multiple considerations and interactions could be a source of effective engagement for these individuals. Contrast this with an approach which considers motivation by Fantasy. Perhaps a walk upland to an area Westport might expand into could involve engaging local imaginations by having them visualize being present in this addition to the community. They might describe what this hypothetical part of the community looks like and how environmental change would be adapted to through roleplay.

Similarly, if the same individuals have interests which seem in conflict with local hazard planning, they're more likely to see the value of finding a solution or compromise if it's pursued along a line of thinking they're most familiar and engaged with.

It would be just as impactful to use insight into engagement motivation to *avoid* the least engaging or even disengaging activities. None of the player motivations are necessarily mutually exclusive, so there would likely be individuals for whom both above examples work, but lacking any motivation to engage with the only outreach activities provided could set back progress on building local adaptive capacity.

Even if the applications of understanding player motivation are, in fact, limited to co-production of high-quality educational games, there would be value in observing both the development and game testing results of participants for hazard planning research.

For instance, how participants choose to represent their community in the game-space can tell researchers something about how locals perceive space and the identity of an area. The aspects of the community which they may regard as more essential might be expressed by their casual inclusion in a game. Similarly, what co-designers *exclude* about local hazard mitigation might identify an important opportunity for learning or signify a generally less interesting topic which might benefit from extra consideration in outreach preparation.

As the process of co-producing a game should be done iteratively, this provides an opportunity for locals and planners to run knowledge and ideas through a feedback loop to better clarify collective understanding of an area as the game's development progresses. Geospatial analysis run on locally perceived spaces might, for instance, encourage the implementation of more locally informed design decisions while progressively improving the quality of the game's simulation.

Part II: Methodology of the Player Motivation Pilot

Research Design

Overview of Research Design and Methodology

Participant behavior (contributions to development and responses to facets of the final game design) will be observed and referenced against their respective profiles over the course of the study. If there are repeated patterns of correlation, even within the quite small sample population, this could support the potential of the Gamer Motivational Model for youth engagement on local hazard mitigation.

For instance, a high Competition score might correlate with a participant who seems motivated to suggest or test new competitive game mechanics or to contribute more than their peers.

Additionally, the assessments themselves may be supported by signs of this kind of correlation, and their consistency will be checked by repeating the assessments at the end of the study.

Variables and Operationalization

Motivations (for Engagement):

Discerning potentially useful motivational profiles for youth engagement will be done with the Gamer Motivation Model assessment. The twelve distinct motivations in the model cover a broad range of potential reasons to engage with an activity, and each motivation can be matched with many preexisting gaming experiences which demonstrate mechanics useful for appealing to specific motivations.

The assessments are accessible online, straightforward to navigate, and can be completed in roughly ten minutes without the need to register with the site which provides them.

I will be physically present to walk the participants through the process of filling out these assessments and immediately recording their results (in an anonymized table which will correspond to a code key of names and participant identification numbers).

The results of the motivational assessments will then be presented back to the group in the form of an aggregated profile. This will enable the group to understand the motivations they need to appeal to, and to what extent they need to be addressed, over the course of the development process.

The consistency of the individual results of the profile will be checked at the end of the project by reassigning the same gamer motivation assessment. This will also be weighed against observations of the participants behavior in terms of their contributions to the project, and their responses to different aspects of the game.

Personality Traits:

Nick Yee has suggested that the Five Factor model (O.C.E.A.N. model) of personality traits shows correlations with certain Gamer Motivation Model profiles. It would not only be useful to recognize if this is the case (since it might suggest avenues for outreach simply by measuring personality traits), but also if there are outcomes which are unexplained by the GMM having a well-established alternative psychometric model might illuminate factors which are responsible.

If there are indeed some correlations between the Five Factor model and the Gamer Motivation Model this might lend some additional credibility to the wider utility of the latter.

As with the Gamer Motivation assessment, the Five Factor assessment is freely available online without the need for registering with a third-party site. I will be physically present for this assessment and will record the results in the same way as the GMM. Likewise, only the aggregated results of the group's personalities will be reviewed with the group.

The consistency of the individual results will also be checked for the Five Factor personality traits by simply retaking the assessment at the end of the study as with the GMM.

Local Hazard Fluency:

A custom-made survey will be provided (through Google Forms) along with the two assessments which will establish a) participant familiarity with local hazards, and b) familiarity with games of any sort. This will serve as a baseline from which to measure the impact of exposure to the process of co-developing a game around the group's motivations.

The survey will be retaken at the end of the study and compared against the baseline.

Participant Behavior (Contributions and Responses):

Notes will be taken observing each participant's elective contributions and responses during the development process. The course of development will be, as much as possible, the result of participant behavior. The role of the researcher will be simply to enable the realization of the participants' intentions by drawing on game design experience.

How individuals interact with each other should correlate with social motivations (cooperation and competition) as well as personality traits (extraversion or agreeableness). How much they contribute directly to design innovations or prefer testing an innovation's limits should correlate with their creative motivations (design and discovery) and potentially personality traits (like openness). Even resistance to effective contribution might be expected to correlate closely with specific profiles.

Sampling and Data Collection

The sample participants will be a single group of volunteer students (ages 14-17) from Ocosta Junior High in Westport, WA. It's unlikely the group will surpass 20 individuals, and the minimum group size would need to be about 10 students.

The advantages of this population are that they have some exposure to the relevance of local hazards (particularly earthquakes and tsunamis) to their own community. This is useful in that they will more easily recognize the importance of the research and perhaps feel more committed to the project as a result.

As the game is intended to be set in a real community with local hazard data for the project's development to build from, Westport (the site of years of hazard research) is an ideal setting.

Structure of Observation-based Data Collection

After the initial assessments and surveys are taken, most of the time spent with participants over the course of the study will center on game development by the participating students. Materials and some brief game design theory presentations will be offered, but for the most part the role of the researcher will be to empower the participants to realize the game which they wish to make according to what they will learn about the composition of motivations in their group.

There will be a separate, tightly controlled, code key which matches names to participant ID numbers. These ID numbers will be referenced as the researcher takes notes on the following:

- Which participant, that session, is initiating (or refocusing) work on the design process itself.
- What ideas are being proposed (even if they don't make it into the game) and from which participant is this idea coming from.
- Which participants seem least inclined to contribute to design specifically but might be engaged with the process in other ways (for example, providing positive or negative feedback on the ideas of others).
- What activities are participants who are not designing mechanics engaging in during this process (for example, sketching imagery related to the game).
- Which participants are actively disengaged with the development of the game, including reacting to the work of others, and what they are doing or talking about. (This is still useful data in that there might be a pattern of correlation between this behavior certain personality traits or game motivations,)
- Which participants appear to prefer to work as individuals, and which are working with one or more partners.
- Which participants appear calm or less reactive, or excited or highly reactive.
- Which participants are inclined to compete (for example, showing a pattern of reflexive preference for their own ideas or balancing decisions over others, especially as a reaction to another participant's stated position.)
- Which participants are inclined to cooperate (for example, showing a pattern of reflexive preference for the ideas of others, especially after another participant presents a challenge or resistance to their own stated position.)
- Which participants appear motivated to learn or master all there is to know about the game development process, without reference to the mastery of other participants (this could suggest motivation toward edifying achievement and might be expected to correlate with Power).
- Which participants seem the most inclined to test or find strengths and weaknesses in the systems being proposed (this could suggest an inclination toward Discovery).

In general, the intention is to record as much behavior taking place during the development process as possible, even if it's pointedly dissociated with the development process to identify patterns of behavior which might correlate with the personality and motivational factors which are recorded for the group.

Conceptual Framework

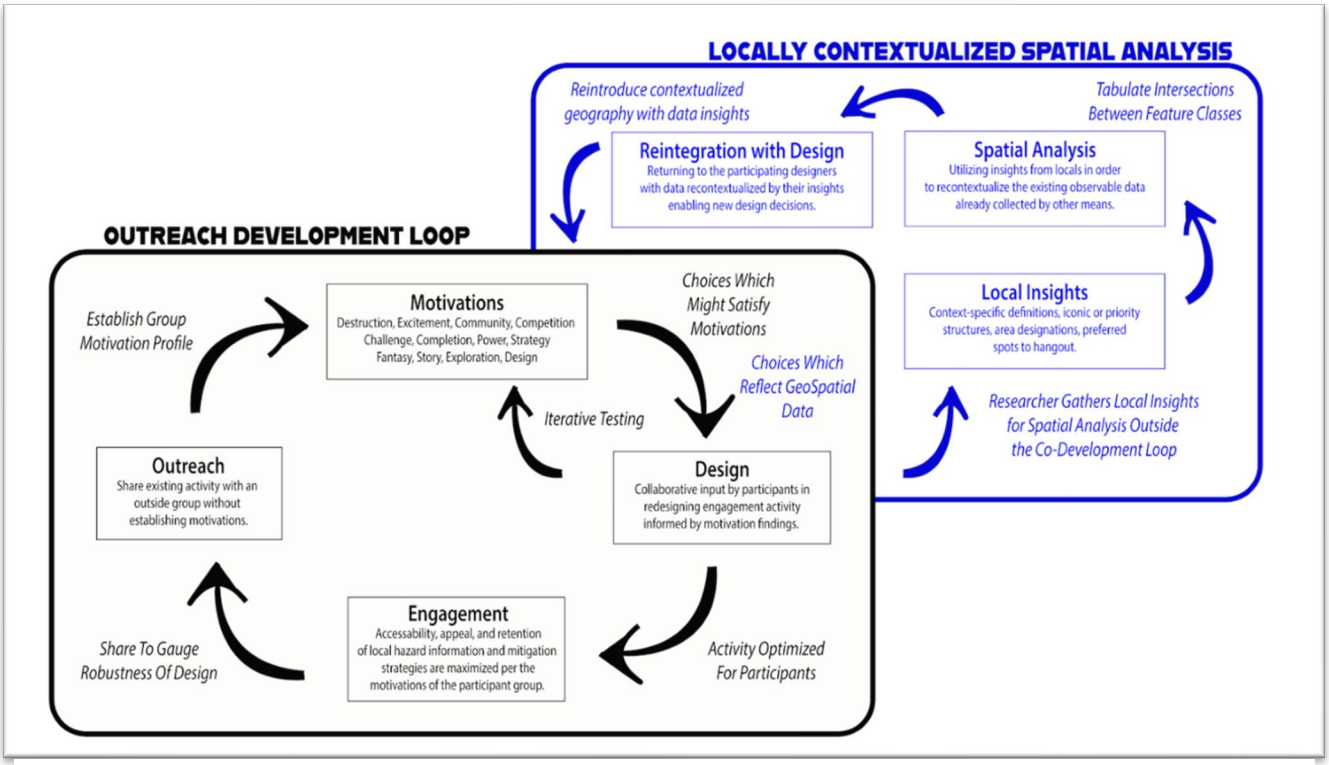

Figure 10 – Diagram of Phases of the Control Framework

The image above illustrates the longitudinal pilot project's development loop (in black), which would include all the work the youth participants are doing, and the spatial analysis loop (in blue), which is work just for or coming from the researcher. I break down what each of the pieces of conceptual model shown are about below.

Phase 1: Outreach

The first and final phase of the development loop is outreach. The initial *Cities: Skylines* experience was an example of outreach with gaming without any way of accurately predicting or adapting to the motivations of the youth involved.

Groups with unknown player motivations are commonly part of outreach with games. In this case, a control group of individuals of co-developers with unknown motivations aren't available for this research, but ideally the larger scale version of this pilot would include at least one group outside the design process entirely and at least one other which would create a game without assessing their own motivations. Both control groups would then be asked to try games produced by other participants who knew their own motivations. This would best illustrate the more typical untailored approach to outreach activities, and the relative impact of assessing player motivation for co-development of games.

In this case, Outreach will take place with just one group of youth with anonymized results on their player motivations, their personalities according to the Five Factor Model (a.k.a. the FFM, O.C.E.A.N., or Big Five) psychological assessment, and baseline knowledge established in a custom survey. The participants who take part in the design process are expected to experience more enjoyment of a game which functions according to their own specifications.

It's worth noting that co-designers might also be unfair (positively or negatively) in their assessment of a project which they contributed to depending on their personalities. For instance, high levels of Neuroticism (one of the O.C.E.A.N traits) could correlate with more lasting negative feelings when faced with setbacks. Another possibility is that high levels of Extraversion and Agreeableness could correlate with a more positive impression of the collaborative process of design.

Understanding what has changed about the participants' expertise with the subject matter, and looking qualitatively at the manner in which they contributed to the project will provide context around their own assessment of the final product.

This approach may also address a problem with how activities are selected for outreach. Outreach leader's unconscious bias toward satisfying their own motivations could cause overestimation of the inherent engagement potential of a chosen activity (e.g. an urban planning student choosing a city building game for outreach). Student-centered pedagogy works around the potential for this bias.

Along the same line of thinking, the motivations of individuals to lead outreach activities would likely impact the direction of a game's design. Personalities most likely to lead outreach on local hazard awareness are likely to be skewed with respect to certain player motivations and Five Factor personality traits, this would underscore the importance of a very student-centered approach to activity design.

In other words, the same reasons which caused me to choose a city building game for the purpose of outreach would likely drive me to influence a game's design toward something similar to a city builder. To give Outreach its best chance using this player motivation methodology, the guiding hand of the researcher during co-development would need to be exceptionally passive. In practice, the approach I used was to avoid leading suggestions, and offer a minimum help to realize the intentions specified by the youth participants.

An example of this would be, when the youth co-developers had added a lot already, I might then ask a very broad question like, "How do we use this?" or "What happens next?" If an incomplete suggestion was made, I might ask for clarification to help them elaborate on it or examine any potential risks or roadblocks.

Phase 2a: Motivations

The second phase of the conceptual model's development loop is where the assessments and surveys are given. These were Nick Yee's Gamer Motivation Profile, mentioned previously and the Five Factor Model.

The point of including the Five Factor Model (also known as the "O.C.E.A.N." model) was to look for potential correlations between player personalities and their motivations. The FFM is also better known and if there seemed to be some relation between it and the results of the player motivations, that might lend some added support to its use (Widiger 2017, pg.3).

The youth participants' results are anonymized, averaged, and a group profile is formed for reporting back to the youth participants. While they were free to share their individual results with each other, I kept the focus on the group profile for the sake of unifying their development priorities.

Self-perception will factor strongly into this process. The profiles are likely to conform closely enough with self-perceptions that each participant will recognize their potential in making design decisions based on them, but emphasis will be on satisfying the whole group's motivations in the design process.

Certain motivations are expected to correlate with certain needs and role preferences during the design process. For example, the "Design" motivation could correlate strongly with high enthusiasm for (and investment in) their contributions to game development (personality factors might then predict whether collaboration in this context is perceived as enjoyable or resented).

On the other hand, the "Excitement" motivation could correlate with low enthusiasm for (and disinvestment in) their contributions to design. The engagement of individuals predisposed to disinterest in the design process might require greater emphasis on their feedback through hands-on iterative testing. In other words, the design-oriented participants might attempt to appeal to the excitement motivation of their partners through design, and excitement motivated individuals can help them by providing their insight into what is (and is not) exciting. Illustrating this kind of dynamic to the participants will hopefully help them to understand how they need each other to produce a successful game.

Phase 2b: Iterative Design

Iteration is key to a successful design process. The initial decisions of designers never result in a perfectly balanced experience which maximizes enjoyment for a broad audience. Playtesting prototypes can reveal features which one assumed would feel appropriate to the experience turn out to be no fun at all, while accidental innovations turn out to be the heart of the fun.

One of the key considerations will be balancing broad and individually optimized appeal. While the iterative design process can be used to refer back to the gamer motivations of the group, the question of what the correct balance of appeal is will ultimately come down to participant compromises.

For instance, if the group is collectively motivated by Competition, and uninterested in Fantasy they would be right to make their own interest in Competition a priority. However, if a single participant is motivated by Fantasy, the group should be encouraged to find creative ways to integrate some design choices which satisfy this motive as well. Gamer motivations are not mutually exclusive, even if some motivations synergize more readily.

The FFM trait Conscientiousness is likely to correlate strongly with a participant's level of interest in others' needs during the design process. While high levels of Openness are likely to correlate with acceptance of new ideas being incorporated into the project. If these traits are low across most of the group, more reminders to consider every motivation and to embrace iteration are likely to be necessary.

Design around any unrepresented motivations in the group in pursuit of broader utility is less likely to be successful than simply focusing on design around the motivations present in the participants due to the fact that verifying which choices better satisfy certain motivations during iteration can best be done by those who actually express those motivations. Therefore attempting to design a game which satisfies every motivation, which is difficult anyway, will be discouraged unless this reflects the collective motivation profile of the group.

Co-production of knowledge is also an important dimension of this phase. The participants' own concerns and priorities in their community will define what assets are the subject of attention in this game about local hazard mitigation. The preference for the forms which in-game solutions will take, while based in real Science, will also be a result of whatever the participants find most appealing. This all lends more credibility to local civic engagement as a democratic process.

Finally, let's consider the Researcher Role within the Iterative Cycle. This is represented by the blue section of the conceptual model. During the Iterative Design process, the researcher would be gathering observations of the choices and perceptions of the participants. Some of these perceptions could be perceived space or places of perceived value. Spatial insights into the personal assessments of the co-design participants might then be taken into Geospatial Analysis software for a researcher to gather in-depth metrics or attributes specific to those areas.

The researcher can then take the results and share these details back to the participants on their own perceived spaces during consideration of further design choices. For example, if a game mechanic depended on the amount of wetland within spatial zones or clusters in a community as defined by participants. The participants, not having the benefit of usable geospatial software, might understand

these places exist in a way that an outside researcher might not notice, but it's the researcher's use of GIS that might be able to provide the young designers with the precise difference in wetland area between each zone. This might enable a more realistic simulation of the community within the game, while respecting the perceived reality and intentions of the local youth designers.

Phase 3: Engagement

Success in engagement will be defined both by self-reported experiences of "fun" or "enjoyment", as well as by comparing the amount of learning and original ideas related to the learning objective from the initial survey and those after the game is complete. Noting the availability of "Flow", where the mind is both focused and involved in a task perceived as enjoyable will also be a point of focus.

The reliability of the personality and motivational assessments will also be gauged by noting the manner of contribution by each participant, and by comparing the consistency of the results of their retaking the assessments when the project is finished. Engagement in the design process itself is expected to correlate with how well each participant's motivations are satisfied by both their role in development and their experience of testing the game.

Finally, how the participants feel about both the survey and the assessments will be noted, and if they feel they can be improved on. If the process of assessment and survey taking can be improved, this will also facilitate engagement in the future.

Summary of Expectations

The participants who take part in the design process could be expected to experience more enjoyment of a game which functions according to their own specifications. This expectation derives from the assumption that the better the design of a game satisfies the designers' player motivations, the more these players will be engaged with the activity. Further, from prior work relating to the impact of engagement on learning, the more engaged these players are with an activity the more they are expected to learn.

Further, as previously mentioned, the more a participant contributes to the game's development, the more their sense of ownership is expected to support their learning engagement along with their design's satisfaction of their motivations. There is an expectation that the less involved in development, and the less a person's particular motivations are considered during game development, the weaker their relative level of engagement is expected to be. While there won't be a dedicated control group, the participants might share their game with others and so an anecdotal contrast between the participants' reactions to their own game and people outside the study should be possible.

Recruitment of Youth Volunteers in Westport

While I had done the game related outreach with Westport youth using Cities: Skylines that did not involve any data collection. It was simply an informal outreach activity with Ocosta Junior High's after school program.

For the longitudinal pilot co-developing a hazard planning game I wanted to do for my thesis I had to get IRB approval and recruit youth volunteers willing to take part in long term anonymized data collection.

Westport resident Andrea Mirante, who managed the after-school program during that initial outreach work, also helped with setting up and running this longitudinal pilot.

During the initial recruitment phase, she gauged student interest at the school. I was also eventually able to create a volunteer recruitment poster which was hung up around the school and at the local supermarket to get more youth volunteer involvement. We were able to gather nine youth volunteers to the introductory session where I simply introduced myself and explained the project concept in greater detail.

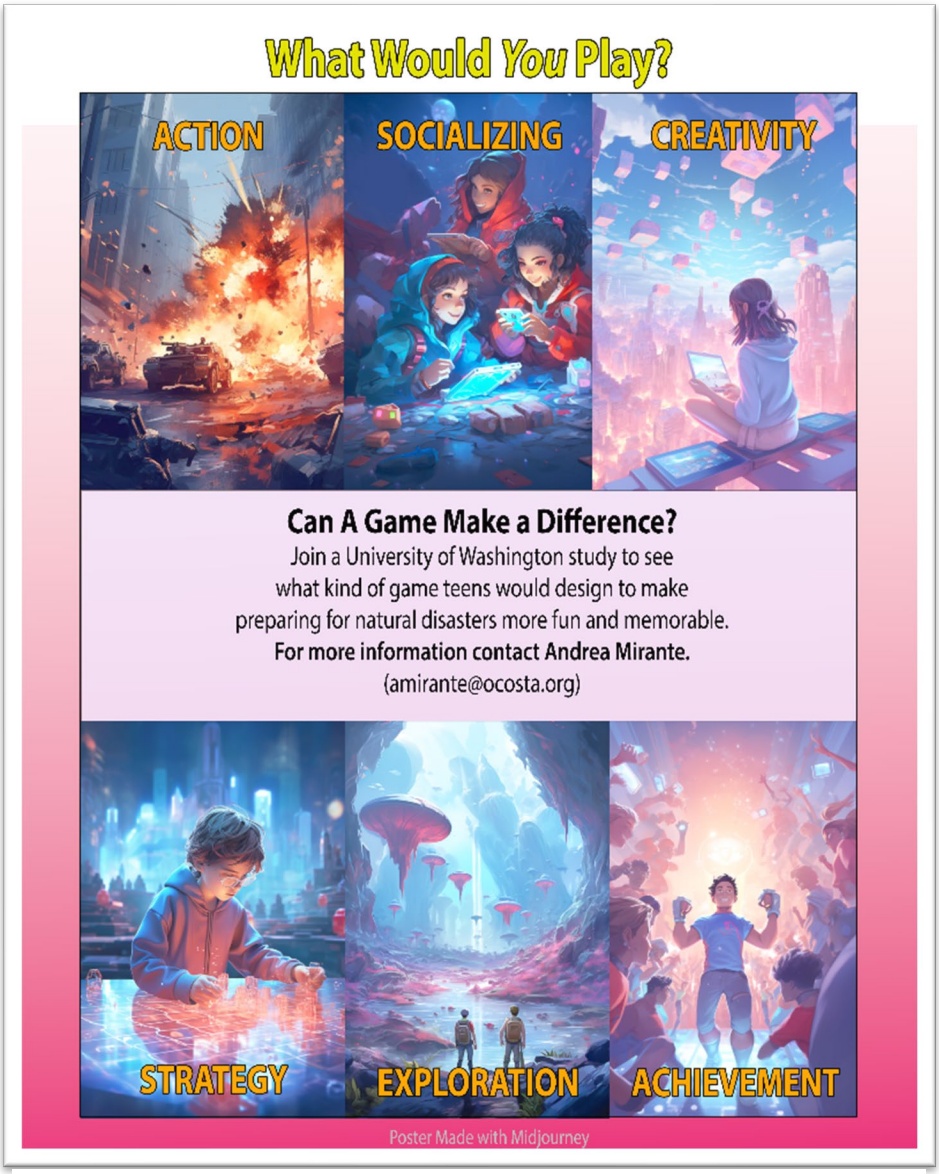

Figure 11 - A Recruitment Poster for the Longitudinal Pilot (made with Midjourney)

In addition to my own project, another UW graduate student was offering involvement in drone related thesis work, and we would be splitting most in-person sessions between the two projects. We hoped that the attraction of both games and drones would garner a lot of interest from local youth.

The group of youth that we ultimately collected also started their own local student news organization and used their participation and coverage of their involvement in our research projects for a capstone project. The mutual beneficial relationship probably contributed to the lasting commitment of most of the participants through all six months of data collection.

Data Gathering Materials and Development Timeline

Figure 12 – Project Development Timeline

After initial recruitment and an introductory session to the intended work and objective of thesis were completed in October, initial data collection began in November. This included "Gamer Motivation Profile" developed at Quantic Foundry by games analytic researcher Nick Yee, and the "O.C.E.A.N." personality assessment (a.k.a. the Five Factor or "Big Five"). These were both accessed online and given in person. There were nine youth participants that took these initial assessments, but two of them would not go on to finish work with the pilot project.

Along with the individual player and personality profiles the participants were given a custom-made survey in an effort to gauge their baseline knowledge of natural hazards and of games. It also asked them a few questions on how they felt about the assessments.

In December, with the initial results anonymized and player motivation results averaged together to create group player motivation profile participants discussed ideas for a game which might best appeal to the group.

More concrete design sessions took place in February, and March where details of the game were developed and refined. Also, in March we spent one session playing a couple of different board games (1666: The Great Fire of London, and Cascadia) to practice critiquing a game and identifying things to maybe include or avoid.

Running in parallel to the design process I was taking notes on their design decisions, providing very minimal suggestions (such pointing them to which questions they might next need to answer, like how to structure game progression), and I also began a geospatial project to gather real-world metrics for the spatial features they were creating in the game (specifically for the zones of Westport which they defined themselves).

In April, the game was considered fully playable and ready for dedicated playtesting. While testing of ideas had been done in a much more compartmentalized fashion up to this point, the April session was the first time the group was able to simply sit down and play the first "complete" iteration of the game. Only two rounds of dedicated playtesting were ultimately performed before the pilot ran out of time, so unfortunately there are still many imbalances left with the game (generally, this is to be expected in game development without a significant amount of dedicated time for playtesting) but observations of the gameplay were still able to take place. Most of the observational data from these sessions were taken down as written notes (with the participants' identities concealed), but the final playtesting was recorded through video recordings that will not be shared publicly because the dynamism of gameplay made notetaking more difficult. The results of the video were transcribed in notes and anonymized after the fact.

One data gathering resource that was found to be ineffective was a shared living "game document" that the participants had to share any new design ideas with each other between sessions. In practice, work on the game was found to be almost impossible outside of in person sessions. This underscores a need, referenced later under limitations, for more frequent sessions if this work is to be repeated in the future.

Finally, in May the final data collection from the participants took place. The seven remaining participants created new player motivation and O.C.E.A.N. profiles in person, and the final survey was sent out for them to complete when they had time. Originally, it was intended that the final surveys be done in person as well, as they had been in the initial data collection, but the in-person session ran out of time because they had a very long and informal play session of their game which did not involve observational data collection.

Access to these profiles with the following links: Gamer Motivation Profile and O.C.E.A.N. assessment.

PART III: Results of the Player Motivation Pilot

Initial Player Motivation Assessment Used in Project Design

This section covers the results gathered at the beginning of the longitudinal pilot for player motivation. The complete results of the initial survey and assessments can be found in **Appendix A** below.

The figure on the left shows the average group results of the youth co-designers player motivations including the two participants that later dropped out. This was the figure presented as the profile the co-designers should reference while making game design decisions.

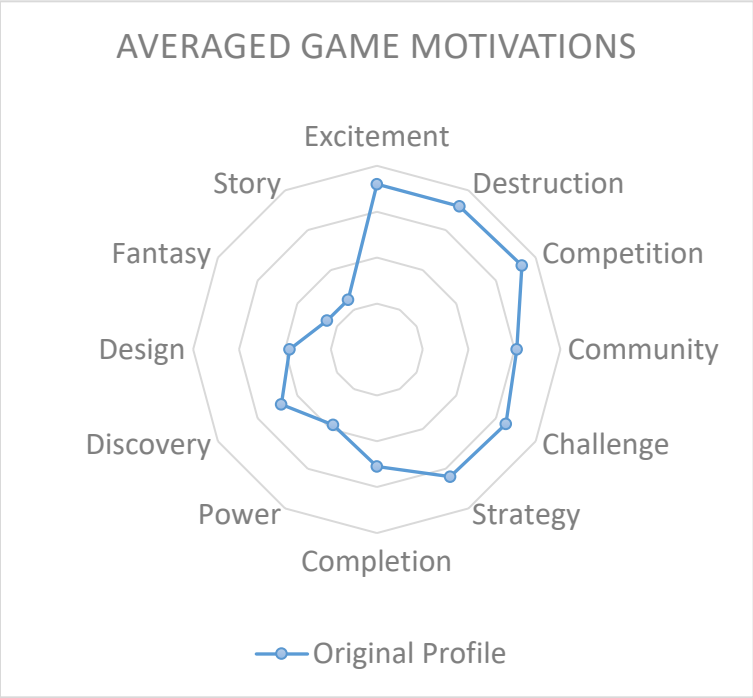

Figure 13 – Initial Average of Game Motivations

The primary takeaway for the co-designers was that they should attempt to design and implement features which might best appeal to their own engagement, with the focus primarily on the motivations Excitement, Destruction, Competition, Community, Challenge, and Strategy.

Conversely, the original group profile suggested Fantasy and Story appeal were unnecessary or might even be detrimental to successful engagement for this group, and the intermediate scores for the other motivations were approached as "nice-to-have" but less important to address.

As mentioned, two of the original nine participants who took part in the initial assessment dropped out before the end, but game design progressed with this profile as the reference. Most of the initial individual player profiles suggested, due to their overall similarities, that the average would hold close to this shape even excluding the two individuals that were unable to continue with the pilot.

The question of whether these initial profiles could be relied on to suggest the group's player motivations six months later would be answered by the exit assessments.

Unlike player motivation, the initial O.C.E.A.N assessment scores and the survey were not referenced for designed purposes. The anonymous averaged O.C.E.A.N. scores were shared once simply as a point of interest, but they weren't relevant to the design process.

Summaries of Observations by Session Date

For the complete set notes referenced for these summaries, see **Appendix D**.

October 28th, 2023

This session introduced the idea of the longitudinal pilot project with a presentation which introduced the idea of using player motivations to co-design a fun hazard planning game for the participants. In addition to introducing myself in the traditional manner (name, my university, what I'm studying, etc.), I also introduced my player motivation and O.C.E.A.N. results to the youth as way to help them get to know me and understand what kind of information I would be collecting for the pilot.

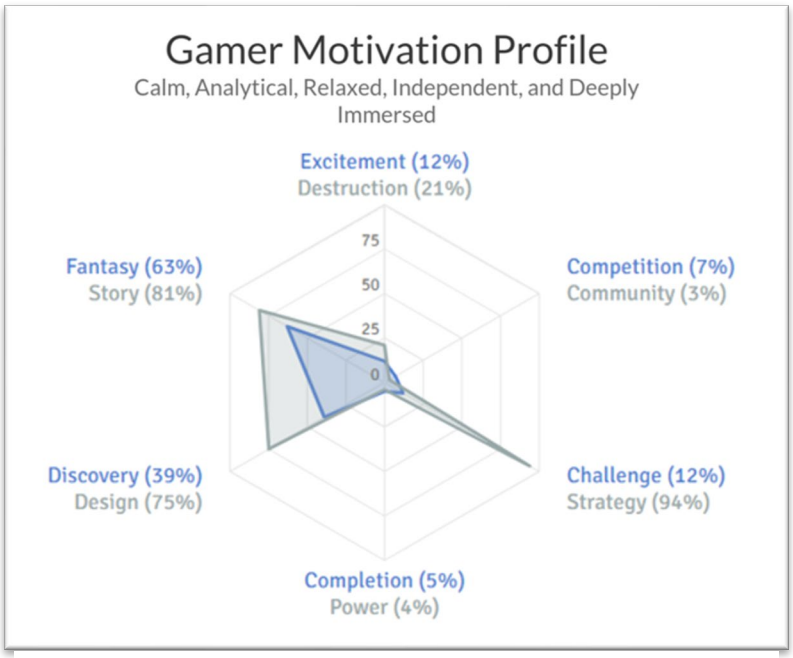

Figure 14 – Example of Individual Game Motivation Profile

The figure on the left (which I showed during the introductory presentation) demonstrates my player motivation profile and helps to illustrate why a game like Cities: Skylines (which strongly appeals to Strategy and Design motivations) might appeal very well to me.

If one compares these scores to the one derived from the group's player motivation profile, there's a clear potential for disconnect over our understanding of "fun" in a game.

When I presented this, I didn't know for certain what the participants' group profile would look like, and it may have aligned well with my own by chance. If this had happened, it would have been reflective of a hazard planning presenting an activity which is wildly successful with players. However, rather than leaving it to chance, I explained that this pilot project was meant to explore a method of tailoring a co-productive activity around youth's measurable player motivations. The youth responded positively to the idea.

I addition to the assessments, I also explained that there would be a custom survey to fill out at the beginning and end to look for evidence of learning based on the activity.

Finally, I explained that even though we would be "co-designers", the usefulness of the approach really was proportionate to how much ownership they were taking over the decisions for the game. My role was to introduce them to their own motivations for consideration during development, help them if they got stuck or needed clarity, facilitate their access to the risk data, and to set the few ground rules for the project (that it be set in Westport, about natural hazard planning, and reflect real Science local to Westport).

With the last rule, about the game being grounded in real hazard Science, I emphasized that this didn't mean they couldn't add fantastical metaphors, humor, or fictional storytelling. Since, as far as I knew at the time, this group could have been almost exclusively driven by Fantasy or Story in gameplay I needed to be particularly careful to give them permission to express their fun however it made sense for them without worrying about the game being "serious" enough. From the pilot project perspective, success would be measured in engagement with natural hazard information.

November 18th, 2023

Almost the entirety of this session involved the first round of assessment taking and filling out of the initial survey. The youth were given (and gave their own) consent to participate and were reminded of the guidelines of the project and were thanked for their involvement. Then they were directed, on smartphones, to the online location of each assessment. The player motivation profile was taken first. As the first of these were finished individuals were direct to the O.C.E.A.N. assessment. Finally, they were directed to the custom survey on Google Forms.

The participants were informed their personal data would be anonymized in any work produced for this thesis, and that for the purposes of design decisions we'd mostly consider the collective player motivation profile. I didn't prevent them from sharing their assessment results with each other if they wanted to, as long as they understood that we wouldn't be identifying anyone.

December 9th, 2023

This session reviewed the player motivation results for the group (averaged from individual scores) and gave participants in attendance the ability to start thinking about how they might meet the criteria of the project while best appealing the motivations of the group. They were also provided with an ample supply of art and crafting materials and a map of Westport.

Some of the highlights from this design session were participants coming up with two teams each leading a different Westport on their own board, as well as raising-and-launching kaiju (Godzilla-like monsters) as metaphors for natural destruction at their opponents while each team considered investments for sustaining their own Westport. Participant 6 (who scored notably high in design), notably chose to contribute mostly through art (which would be an ongoing pattern) and conceptualized the first of five kaiju. They also began the preliminary thoughts for how the town might be divided, how investments would be made, and what would or would not be simulated on the board.

Figure 15 – These are four of the final 'kaiju' youth designed.

February 3rd, 2024

The design session in December illustrated a need for detailed spatial mapping on the part of the co-designers. They had a vague idea of five "zones" they wanted presented on the Westport peninsula (along with nearby uninhabited Grass Island), but they hadn't settled on what these zones looked like or where their borders met. In order to design the game space for the project I had a copy of the Westport

Walk Time Evacuation Map provided by the WA Department of Natural Resources made into a large dry-erase poster which I brought in for the participants to develop ideas on.

Besides suggesting they try to agree on zone boundaries, I also encouraged them to draw on the map or on sketch paper whatever else they were working out about the game. Apart from some doodles on the map, they mostly used it for drawing and naming zone boundaries. The other important addition to this mapping exercise was the placement of structures the group agreed were iconic of the zone. These positions would be the focal points proposed for interventions within the game. The results of the dry erase mapping exercise are shown on the next page.

The red plastic loop highlights the place the co-designer intended to invest in growing their kaiju to launch natural disasters at the other team. Each of the five kaiju would have a natural territory in one of the five zones, which they wanted protected from both too much human development or attack from enemy kaiju (natural disasters). This underscores an interesting pattern of identification with nature, even if it is destruction at the expense of urban development.

Figure 16 - A Map Drawn by Westport Co-Designers on Dry Erase Map

February 10th, 2024

This design session took the development of a testable prototype a little further. The participants started working on very basic red and blue proxies for the two Westport boards, but rather than focus on the game space as much as the last session they largely focused on developing the other mechanics in more detail. Namely, they came up with the phases the gameplay would progress through (including kaiju battles/disasters), how investments would work, and how events during turns would take place and what some of these might look like.

The event and investment would enable further localization of the game to Westport by involving real industries and natural cycles specific to the area. These were usually exaggerated a bit for humor and to fit with the involvement of kaiju in the game. For instance, the real fishing industry in Westport would be scaled up to support feeding tame kaiju and the real tourism of the beach town would expand to include "kaiju watching" as an exaggeration of reality on the ground which the youth found engaging.

Figure 17 - Westport Co-Designers Building Prototype Game Boards for Testing Game Mechanics

March 17th, 2024

This design session took earlier designs towards further refinement. The major highlights were the decision to represent the passage of time in the two versions of Westport seasonally by having a different set of potential events that could happen (good and bad, at varying levels of intensity) depending on the season. Each team would have a turn per season. There also would also be a reference sheet for potential investments with their associated costs.

At the end of this session, there were enough solid decisions to begin work on a less theoretical playable prototype and integrate real world spatial analysis that was taking place in parallel to the co-designers work to fully realize the first complete iteration of their game as they envisioned it.

March 24th, 2024

With most of game's initial rules worked out, this co-development session was meant to provide some practice in critiquing other games' designs to inform the dedicated play session that would follow. We looked at a hazard response game called The Great Fire of London 1666 and a simpler nature-oriented game centered on ecology called Cascadia. This presented two very different experiences for the participants to consider and gave them the opportunity to draw inspiration or determine things they might want to avoid.

Their primary takeaways for the participants were that they wanted a short setup time, and to avoid the game feeling overly repetitive (appreciating elements of chance being included). They also appreciated access to in-game explosives in the first game, and strategic decision making.

These responses aligned with what one would expect to see given their player motivation profiles as players highly motivated by Excitement (hating long setup and "repetitiveness"), Destruction (explosives), and Strategy (strategy may be seen noted by multiple participants in the notes of Appendix D).

April 13th, 2024

This was the session where the participants were able to focus on playing their prototype in a dedicated way and limit themselves to critiquing what was and was not working for them with their game. The participants split themselves into two teams, and were able to setup their game quickly.

There wasn't time to produce four decks of seasonal event cards, so a reference sheet with a list of 20 possible events per season was used along with rolling a 20-sided dice. This was such an effective substitute that the participants actually determined they preferred this approach to the idea of actually having four separate decks of cards. They also liked the similar sheet used as a "menu" for selecting potential investments. The former provided the element of chance and risk they needed to keep play fresh and exciting, while the later played into their interest in strategic decision making.

There also wasn't time to create a custom currency, so poker chips were substituted for the time being. One of the major unpolished elements to the prototype was an apparently unbalanced economy. The scale of costs and rewards were extreme, and it was possible to get deep into debt from natural disasters very quickly. The upside is that it was relatively easy to break any fatal feedback loops with a little luck, but the economy would certainly need repeated instances of playtesting to get it just right. It's telling that even with the broken economy the participants generally seemed to really enjoy themselves (it was observed that they reveled in both the misfortune of their opponents and were sensitive to the apparent success or failure rate of their teammate's rolls). There was a lot of laughing and jokes about not letting their teammates roll anymore (so the event system in particular definitely seemed like a good foundation for success).

The other major change needed was to the combat system between the kaiju. The original idea was to have a fairly simplistic rock-paper-scissor system of advantages depending on who was facing who and on what territory. In practice, the co-designers found this system overly simplistic and unsatisfying. So during the playtest they implemented a system whereby players would give each kaiju 100 health points to start with and each team would roll a D10 for damage in addition to factoring in any modifiers. They arrived at gameplay alternatives like this impressively quickly, probably as a function of their extensive experience with gaming, and the co-designers seemed pretty satisfied with the reworked system. The modifier system itself likely needs more fine tuning, but it's already successfully fun.

From a hazard planning perspective, one of the most interesting things from my perspective were the way team's playstyle responded to their experience. In this case, the Red Team had some unfortunate rolls that resulted in early devastation from sea level rise and environmental degradation followed by being deep in debt for several turns. They responded as a group by making more long term

and less risky decisions, like investing in natural buffers to further sea level rise and migrating their investments to safe areas. In contrast to this, the Blue Team, which apparently felt they had luck on their side decided to try to double down on their success by investing in ambitious development which would leave them with less protection from disaster for the sake of more immediate gains in profit.

This combined with their careful attention to the placement of their best investments, attempting to reduce risk overall for the least cost by strategically placing their man-made hazard mitigation structures, were some of the most useful outcomes from the hazard planning perspective. They could, for instance, see for themselves that the next best place for Westport to build their second vertical evacuation structure was around the marina or the "Docks zone" as the participants named it.

"What do you like about this game?":

- Participant 4: It's simple. It's not super complicated (like the Great Fire of London game we played). "It's easy and it's fun to understand." And there's a lot of "back and forth" between the teams. It's fun to listen in on the other team's plans.
- Participant 6: Communication with the other team.
- Participant 8: Cooperation and Communication are both important.

Is the game fun?

- All: "Yes" "Yup"

Did you learn anything from the game? Gain any insights about disasters?

- Participant 8: Protecting and expanding wetlands can be used as a way to be safe (from certain water related hazards).
- Participant 4: Having not just more evacuation structures, but good coverage helps reduce the risk from natural hazards.

Figure 18 - Westport Co-Designers Performing Dedicated Playtesting of Latest Prototype

May 4th, 2024

This was the session where the assessments were retaken in person, and the end of project survey was sent out (this was to be done in person, but time for it ran out). There was a long running informal play session of the game which delayed participants getting to the survey in person (this likely contributed to three of the seven surveys not coming in for this thesis). It's worth noting that, again, the co-designers appeared to enjoy themselves, but I'll refer to the May 4th session in more detail in the Discussion section below. A comparison of the initial and retaken player motivations will be covered in the next section.

Comparing Initial and Retaken Player Motivation Assessments

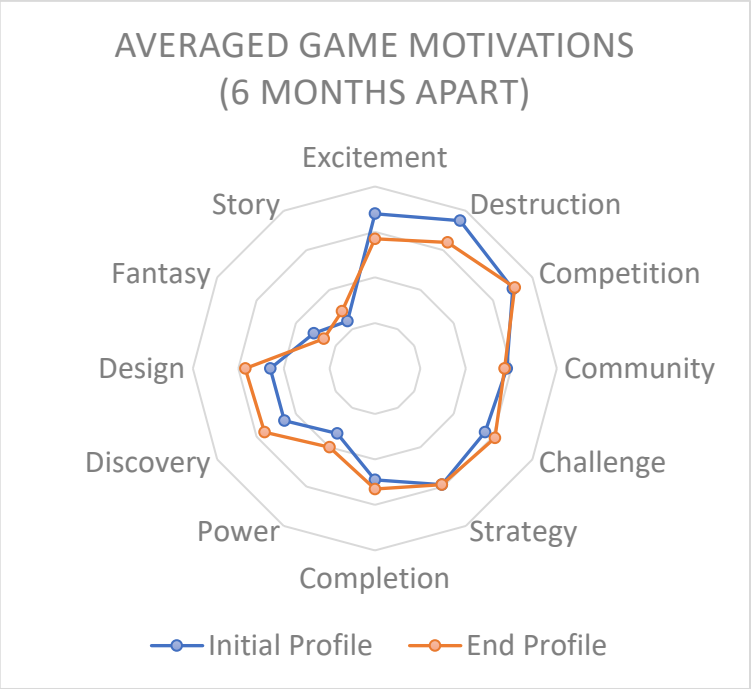

Figure 19 – Comparing Averaged Game Motivations Over 6 Months

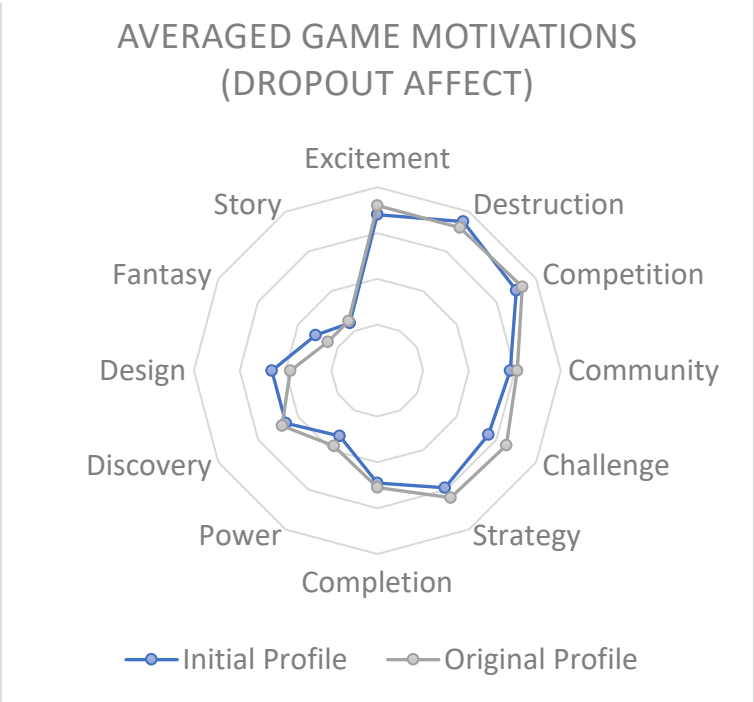

Figure 20 – Comparing Motivations After Drop Out Data Removed

This section will briefly describe the results for player motivations gathered at the end of the longitudinal pilot and compare them to the initial results covered above. The complete results of the assessments can be found in **appendix A** below.

Figure 18 shows the initial player motivation group profile (in blue) but excludes the initial scores of the two participants who dropped out of the pilot over the six-month period and compares it to the average of final player profile scores from the group.

The impact on the overall shape of the group profile is apparently minimal (see figure 19), but the effect of six months seems to have had a more substantial impact.

Specifically, it seems there is an overall increase in interest in Design and Discovery. This is matched by a similar decrease in interest in Excitement and Destruction. This seems to support Yee's findings that correlate Excitement with Destruction, and Design with Discovery.

The overall shape of the group's player profile appears to hold close enough over a six month period to support a long-term co-design project with youth focused around their player motivations. The emphasis remains largely on the right side of the graph, with the least interest in the Fantasy and Story (which are referred to by Yee as the Immersion pair of motivations).

Based on these very limited results it may be worth investigating whether co-design process itself encouraged more interest by the participants in Design and Discovery at the expense of Excitement and Destruction.

Comparing Initial and Retaken O.C.E.A.N. Assessments

This section will briefly describe the results for O.C.E.A.N. (or Five Factor) personality traits gathered at the end of the longitudinal pilot and compare them to the initial results covered above. The complete results of the assessments can be found in **Appendix C**.

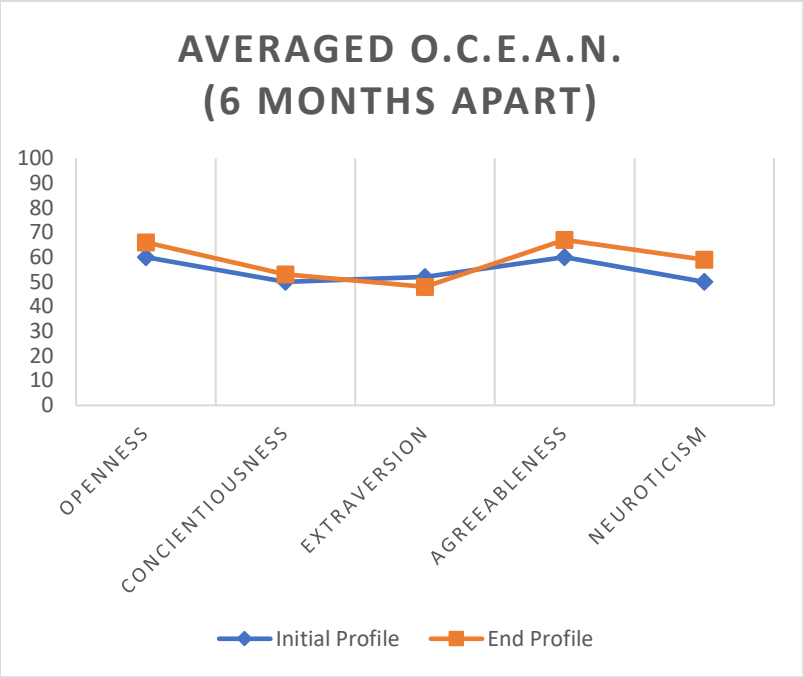

Figure 21 – Comparing Averaged O.C.E.A.N. (or Five Factor Model) Results

The O.C.E.A.N. (or Five Factor) personality assessment was not used by the participants for any of their co-design work. The intention was to look for any obvious correlations between the scores on this assessment with those of the player motivation profile.

The sample size prevents any conclusive analysis, but there didn't seem to be as much of a correlation as one might have expected.

The other thing I felt might be useful would be looking at the level of consistency across the six months for this assessment and comparing it to the consistency of the player profiles over the same period.

The O.C.E.A.N. profiles were expected to be consistent over a long period of time, so they were largely intended to serve as a frame of reference for what consistency in results might look like for the player profile. However, if they turned out not to be entirely consistent, and that lack of consistency aligned with some similar major change in the player profiles, which might have suggested a correlation.

As expected, the O.C.E.A.N. results were very consistent over six months, more so than the player profiles. The averaged scores for the group before and after the pilot are above. The individual results located in Appendix B also show pretty high consistency overall.

The notable changes in player profiles (both group and individual) do not appear to correspond strongly with the relatively stable O.C.E.A.N. profiles from this limited sample.

Interestingly, as will be shown in the next section on the survey results, participant opinions of their O.C.E.A.N. results were that they seemed less accurate than the less stable results from the player profile. A clear majority agreed with their player profile, while they were split between agreement and being "somewhat" in agreement with their O.C.E.A.N. profiles both before and after the pilot. This may be more to do with their feelings about what was being measured, or perhaps they simply felt they understood the player profile better despite receiving explanations of the O.C.E.A.N. traits.

A larger sample size is sorely needed as there was one hint of a potential correlation between the assessments in the fact that only Participant 6 shows extreme dissimilarity from the group results, for *both* the other O.C.E.A.N. and player profile results. Participant 8 also showed the least consistency for *both* the O.C.E.A.N. and individual player profile.

Comparing Initial and Retaken Survey Results

This section will describe the results for the custom survey gathered at the end of the longitudinal pilot and compare them to the initial results covered above. For the end survey results (shown in orange), only four surveys were returned of the seven participants that otherwise took part in the assessments and game development. The complete results of the assessments can be found in **Appendix B**.

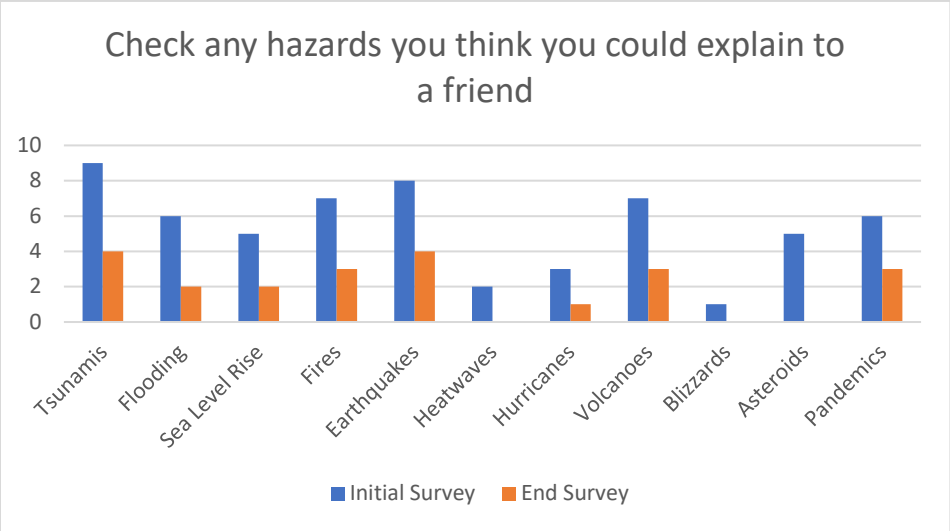

Figure 22 – Comparing Survey Results on sense of Hazard Competency

These results show the relative confidence the participants had in explaining specific natural hazards. It seems to illustrate their prior familiarity with hazards which were most relevant to their community's risks or to which they've had personal experience (i.e., pandemics).

The exception is asteroids, from the initial response, which might simply reflect the relative simplicity of the risk asteroids pose, or relatively recent exposure to asteroid natural hazard risk in media. Though there were less survey responses at the end of the pilot, the relative proportion of familiarity remains largely unchanged. This group of youth are most familiar with tsunamis and earthquakes because of the attention paid to these risks in their local education system.

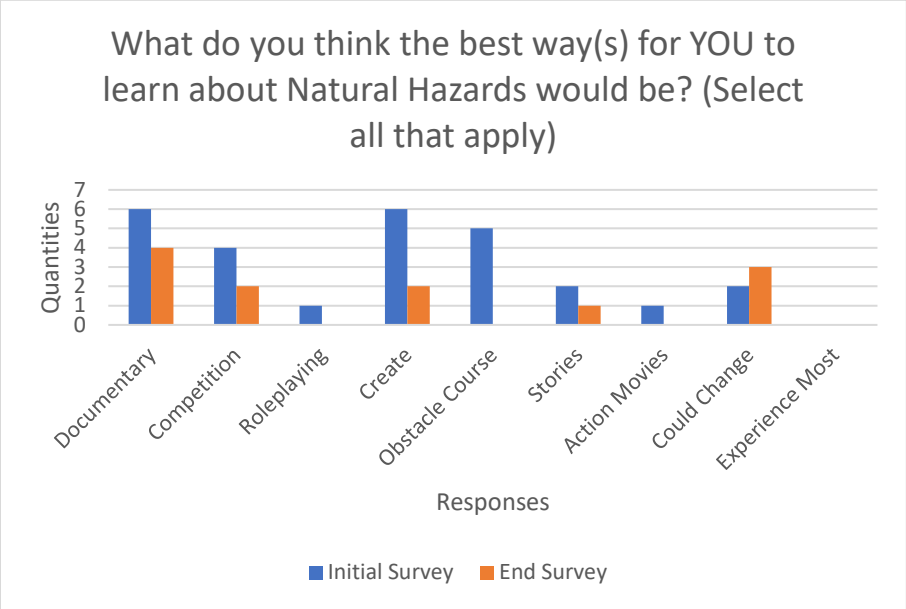

Figure 23 – Comparing Survey Results on preferred approaches to learning

The intention of the next question was to present a list of learning options which might align more with certain motivations than others (see Appendix B for full description of the options provided).

The most popular options were a documentary meant to appeal to Discovery, a creative model city-building project meant to Design and Strategy, an outdoor obstacle course meant to appeal to Challenge and Excitement, and a competitive design

project meant to appeal to Competition and Design.

The least popular were roleplaying, stories, and watching disaster movies. Some said their preferences were flexible, but no one said they'd like to experience most of these. While there are variables which can't be accounted for in this question the pattern aligns somewhat with what the player profiles would suggest. Immersion related activities are generally not of interest, while Action, Mastery, and Creativity related activities tend to be more appealing. The limited responses to the end survey show some parallels with the original answers, with the exception of depressed interest in an obstacle course.

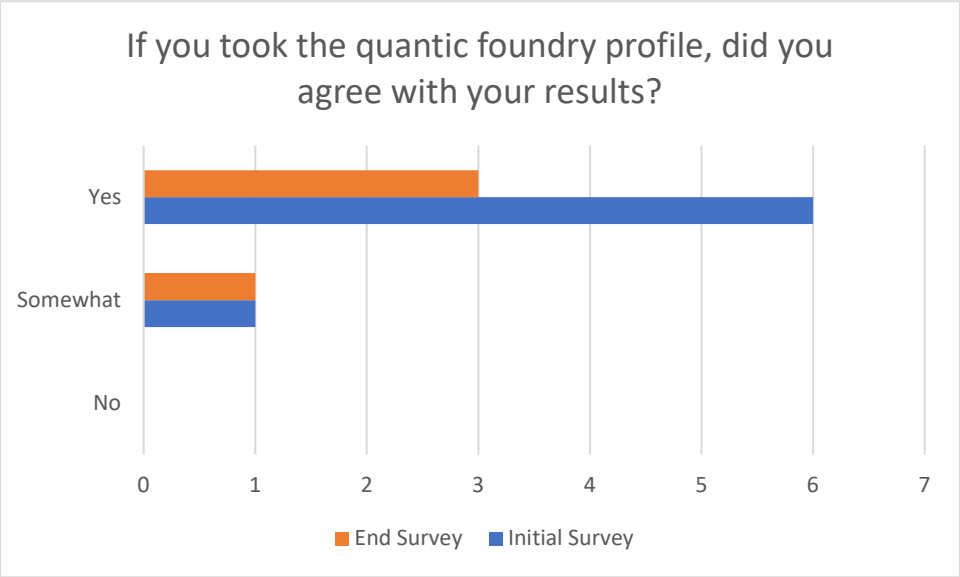

Figure 24 – Comparing Survey Results of Agreement with Player Motivation Profiles

As discussed briefly in the previous section there was far more participant agreement with the results of their player profiles.

This may have been due to differences in feeling or understanding of what was being measured.

The nature of the player motivation questions might feel easier to agree with since they rely more on the simple facts of what people remember they have enjoyed while playing a game, rather than asking them to introspect deeply on their feelings or overall behavior.

It was observed that multiple youth participants seemed to need to follow up with questions if they scored high on Neuroticism. This could be a function of simply not knowing the word, any learned negative impressions of the word, and/or reflective of the behavior expected scoring high in Neuroticism.

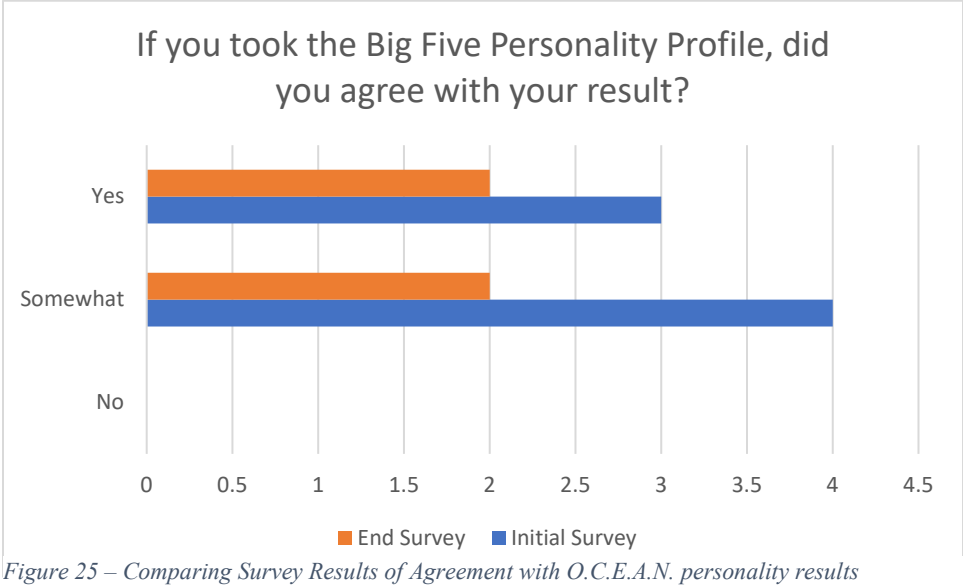

Figure 25 – Comparing Survey Results of Agreement with O.C.E.A.N. personality results

Overall, most of the O.C.E.A.N. profiles scores were similarly moderate with one exception as mentioned previously.

If this work could be redone with a larger sample size, it would probably be worth keeping the O.C.E.A.N. assessment since this sample size is too small for any conclusions.

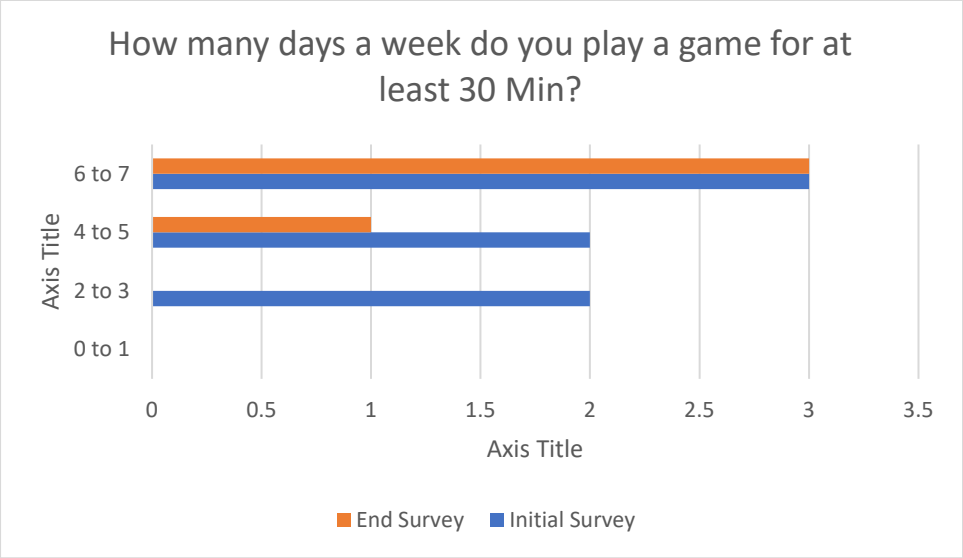

Figure 26 – Comparing Survey Results on Frequency of Gameplay in Days per Week

This question was meant to establish whether the participants who would be taking a player motivation assessment played games with any regularity.

In theory, I feel a player motivation profile can still be established for non-gamers given that the questions about what sounds fun or appealing could be treated as hypothetical. My working assumption was that someone who has never played a video game would still be able to answer whether interacting socially in a digital environment sounds appealing rather than slaying a bunch of monsters or attaining a series of collection items. In this case, the participants appeared to be quite familiar with games. Many play a game almost every day, so the results of the player profiles rest on first hand gaming experience and little to know speculation on their part.

The survey asked about a range of types of play (sports, phones, board games, consoles, and computers). Computer gaming scored the highest by far with this group.

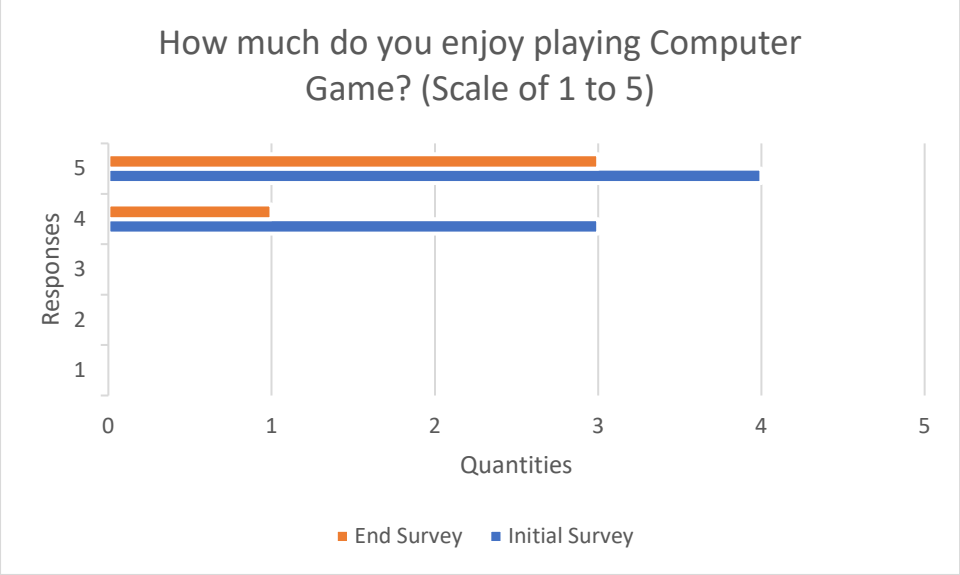

Figure 27 – Comparing Survey Results on preference for Computer Games

If the pilot were able to take place over a longer period or with more frequent sessions it would have been my preference to approach game co-development using computers so that they could be even more engaged with the final product. Given the distance to travel, the limited timeframe for development, and the uneven experience with computer game development we went with a video game prototype built to resemble and play like a board game which was still fairly popular with the group overall.

Geospatial Analysis Run in Parallel to Pilot Project

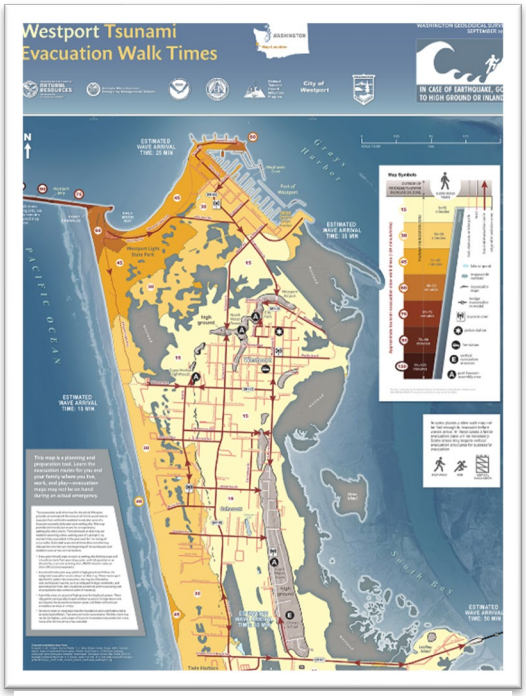

Figure 28 – Eungard, et al. 2018 Walktime Evacuation Map of Westport

Figure 29 – Map of Game's Zone Features Created in ArcGIS

This section covers the geospatial analysis work that was performed outside of the co-design sessions using spatial data from the natural hazards game set in Westport created by local youth participants. Namely they defined the boundaries of five "zones", or distinctive areas which they perceived as making up their community, along with identifying a location in each zone which they viewed as "iconic" to the area, and which served as focal points for activity in the zone.

The resource drawn on for the analysis was provided by Daniel Eungard at the WA Department of Natural Resources and his GIS data for the Westport Tsunami Evacuation Walk Times map seen here on the left (Eungard, et al., 2018).

First, the zones defined by the game's co-designers were recreated in ArcGIS, so that attributes could be added to them using the real-world ground data available from DNR. These included, but were not limited to (wetland area, area of elevation ranges, area considered safe from tsunamis, and areas for different walk times to the VES at the elementary school).

The wetland data for each zone would go on to be integrated with the latest rules for the prototype by serving as potential buffers to disaster (both in the form of sea level rise specifically and more generalized ecological disaster in the form of local "kaiju" becoming enraged).

The attribute with the strongest potential use for the game (and for real life hazard planning) was showing the relative impact on access to evacuation points. The co-designers identified five locations they felt were vital to that zone's identity and treated them as focal points for hazard defenses. These were also marked in ArcGIS Pro.

The routes provided along with the walk time map data were fragmented in places, so I connected them together to build pathways useful for network analysis to each of the focal positions identified in each zone.

The resulting maps can be found in Appendix F, but an example of that network analysis is shown here for the Docks and its focal point for defense at the Maritime Museum.

Figure 30 – Network Analysis of Access to Hypothetical Defensive Structure from the game

Figure 31 – Zone metrics of risk based on the same Hypothetical Defensive Structure

The Maritime Museum is should as a blue circle, and each of the different colored areas shows walk times to it in roughly 15-minute intervals.

In the present iteration of the game, this data becomes relevant to gameplay by allowing for a more accurate adjustment of risk to different areas depending on where players choose to prioritize their defenses.

By default, the game begins with defense set up at the school (which reflects the present reality), and the risk on the board roughly mirrors what's shown on the real world walk time evacuation map. However, when players invest in defenses for an area (like the Docks) the costs associated with disaster a reduced where access to safety at the Docks is more advantageous than what was already provided by defenses at the school.

In practice, this is done with cards showing the amount of cost (proportionate to the local risk) given the nearest safe evacuation point.

The map on the bottom left shows, in bar graph form, the level of accessibility to safety that defenses at the docks would provide. These bars were used directly in the development of the cards which change the risk on the board.

In this case, the cards for the Docks (yellow), the Forest (purple), and Residential 1 (red) might be applied while the School (green) and Residential 2 (blue) might keep their cards if the defenses at the school are still in place.

In this way, players can see the relative impact of hypothetical placement of defenses in the places which they identified.

Often, the result has been that defenses are prioritized at the Docks (where most of the risk and income exists for Westport), but wetland is either developed (for a riskier increase in profits), or more wetland is added (to reduce some disaster risk through adaptation) in the other areas.

Research Strengths and Limitations

Sample Size

By far the greatest limitation of this pilot was the limited number of participants. It began with nine young participants, between the ages of 14 and 17, and ultimately reduced to seven. Five of the seven participants were more active in contributing, but it was interesting to see the survey and assessment results of less frequent contributors as well.

Ideally, this kind of research would have benefited from having at least four groups of about fifteen young participants each (for a total of about 60). Any more than fifteen youth participants per project would have been unwieldy to manage and harder to allow for substantial contributions from every individual.

One of the groups would be pure control, and simply take a survey to measure their baseline understanding of natural hazards without any assessment of their motivations or personalities. They would then play a natural hazard game untailored to their motivations, and a researcher would take notes on how they played (paying attention to how well engaged the group seemed). Then they would retake the survey to gauge its effectiveness as a learning tool.

Another ("client") group would have their motivations and personality tested as well as take the survey, their motivations would be included in the design considerations of another group ("co-designers") which would build the game. The latter would also take the survey, but not measure their own motivations or personalities as they are designing a game for someone else. Both groups would then play the finished game, and their respective levels of engagement would be observed. The client group, whose profiles were initially established, would then retake the assessments to check their consistency, and both groups would retake the survey. This would help to establish the degree to which taking ownership of a game through contributing to its creation trumps playing a game tailored to one's motivations or personality.

The last group would mirror what was done for this pilot, but with roughly twice the number of participants involved. They would take both the starting assessments and the survey before then creating a game with a focus on appealing to their collective primary player motivations. Researchers would observe how they contributed to the game, and their level of engagement while playing it. Then the group would retake the assessments to check their consistency and retake the survey to gauge how much they learned.

This approach with the four groups would be repeated many times with different youth from different backgrounds to measure results with significance. The group used for this pilot has received a lot of hazard education (particularly around earthquakes and tsunamis), which wasn't necessarily ideal for showing the educational impact of this pilot.

Prior Familiarity with Hazards

One potential disadvantage might have been that since the population involved already had some familiarity with local natural hazards there might be less room for improvement based on any learning that took place over the course of the project. While it's safe to say these students already know more about natural hazards than the average member of their age group, there is plenty left for them to learn. Additionally, having a solid foundation of hazard knowledge contributed favorably to the early phase of project development.

Research Period

The six-month research period may have been substantial enough for this pilot, but a future iteration of this project should aim for at least a couple of years (more typical of the game development cycle). It's very possible that even averages of larger sample sizes will show substantial shifts in group motivation profiles over longer periods of time. At this point, given the small sample size, it's difficult to say how much time was a factor in the shift in interest away from Action and toward Creativity shown by the results.

Infrequent Sessions

More problematic than time was the relatively infrequent co-design sessions which took place over the six0month period. In total, excluding the introductory session and data collection sessions, there were about six meetings that directly contributed to the game's development. This was mostly due to the distance between the researchers and the participants. Ideally, meetings would take place on a regular weekly or at least a bi-weekly basis.

The amount of time between meeting sessions meant having to briefly catch-up youth that attended last time, and an even greater level of catch up for youth that may have missed the last session. This was somewhat made up for by the fact that each session devoted three or four hours to game development, which was a pretty substantial block of time for youth (especially since most of these took place on their Saturday).

Future iterations of this project would do better to involve researchers who live near to the participants they're working with. Building relationships with youth over game development is relatively straightforward, but more regular meetings would be helpful in maintaining these connections between sessions.

Sense of Ownership

It's difficult to say to what extent the co-designers' seeming preference for the game was directly attributable only to its focus on appealing to their player motivations. One of the big factors which may be biasing them in favor of the final product is a sense of personal ownership over the game given how many of their own work was invested into it. While this only serves as another point in favor of co-producing hazard planning games with youth, it limits understanding the role it played versus player motivation. One thing which offsets this somewhat is the fact that some of the participants in the longitudinal pilot did not contribute much, and in at least one case took both the initial and exit assessments without participating in any of the co-design sessions. Those who contributed little directly to the game's design seemed to engage well despite having contributed little or nothing themselves.

Were this approach to be repeated with larger and multiple groups, at least one of those groups should repeat the experience of the one participant that took all the assessments but contributed nothing to the design themselves in order to parse ownership from potential players' preference for a game designed with their player motivations in mind.

Discussion

Potential Future Iterations of, or alternatives to, 'Disaster Attack: Westport'

As a product of local co-designer's effort, and given its setting and purpose, this game ultimately retains a lot of value for youth outreach in Westport. The prototype will certainly need refining before it can be considered a finished game, or perhaps the game will never really be finished as it may be adapted by new youth in the area at some point.

I've provided the rules and list of materials in Appendix E primarily to assist people in creating their own improved version of the prototype, or in inspiring some new version of the game set in a different location.

Other groups of young people, while likely to show patterns of identification with certain motivations from qualities they have in common (e.g., developmental stage), could very well show the inverse player motivation profile of the one that was worked with here. A future iteration of Disaster Attack: Westport, being co-designed by youth who are motivated primarily by Story and Fantasy and unmotivated (or even demotivated) by Destruction or Strategy would have to come with a completely different ruleset to optimize engagement within the guardrails of a Westport game using real hazard risk data.

This might look like developing a large set of local character profiles for Westport (probably entirely fictitious, but based on real roles), each with their own background, portrait, and personal objectives. These could be characters the game's players choose to roleplay as during the game. There might be a story guide role (like a tabletop role-playing game "game master") who leads players through an adventure in preparing for and adapting to a disaster. Gameplay might also proceed by providing chance story events (before, during, and after disasters) which each of the players respond to fully in character. With its deemphasis on Strategy, such gameplay wouldn't require following personal stats or tracking other numbers so much as focusing on player performance and immersion in the setting. As a group the players would effectively construct an emergent story of pulling together for shared survival and recovery.

Another thing to consider, with more time and resources, would be to offer digitized versions of the game and the co-development experience. While we didn't have the means to pursue that with this study, the surveys showed that this particular group (while generally enjoying board games) were avid computer gamers. If a future version of the Westport game was accessible via a computer, perhaps it could integrate the RAPID 3D model developed with local drone mapping and even make the game accessible over the internet.

To expand the use of this kind of work to other public outreach working with less time or fewer sessions and having less expertise in game development, an ideal solution would be to develop a single robust hazard planning game with modular sets of interchangeable rules and assets in order to optimize gameplay to virtually any group's particular composition of motivations. This would skip past the co-development process, but for a group with no interest in design this may be valuable anyway.

I discuss this more in the section below, but if this game were digitized then perhaps the co-development process could also move online and include more people. I would caution that as convenient as this sounds, it might be best to expect online co-development to work best with certain adults and may not be very inclusive of different groups. I have found even going partially remote during outreach with youth makes engagement substantially more difficult to the point that I wouldn't recommend it generally. Youth would likely enjoy engaging with a final product located online, but co-development with youth really should take place in person in my opinion.

Another thing future research along these lines should investigate is the role of content selection versus the way it's presented. To some extent both are likely influenced by the player motivations of co-

designers (e.g., using tamable kaiju to embody destruction), but how important is the "what" versus the "way" of a game to engagement? To what extent were youth more engaged simply because they were performing destructive acts (along with defending against them) versus the fact that they had the opportunity to control more-than-realistic destructive force through their kaiju? Perhaps, after finishing a version of the game, researchers could then selectively remove aspects (like the kaiju) for experimental playthroughs which might provide more answers. My guess is that both the "what" and the "way" need to be aligned with player motivation to achieve optimal engagement. Simply launching the most realistic destruction on realistically represented timescales, would have likely been less engaging, but just having gigantic animals to tame and raise would also likely have been far less engaging with this group. This is why the co-development process is so useful, because the participating designers intuitively pursue what would be the most fulfilling of their own motivation.

Modular Rulesets for Optimized Engagement

Overall impressions of youth to their game were very positive, and engagement with the hazard planning topics seemed strong during playtests. With a larger data sample, it might be possible to establish how much of this is due to effective appeal to player motivation, and to what extent learning is actually taking place. Assuming there was value in matching player motivation to hazard planning outreach activities, more modularity could be offered if there isn't time for hazard planners to co-design a whole new game with participants.

Having participants take the player motivation profile takes very little time, and so it would be relatively easy to poll a group's primary motivations quickly. If scores for these motivations could then be matched with a corresponding set of rules, written out on a game's cards or in a booklet, then perhaps a single game could adapt itself to the engagement needs of the audience. These could be matched by a range of ruleset-specific customizable assets (dry erase maps and cards, lots of different dice, different kinds of tokens, etc.) and even different titles for the game ("Disaster Attack" was meant to reflect the present gameplay). In effect, the game would offer many different potential play experiences existing on a gradient. This would likely be a major draw for individuals who identify strongly with the Design motivation, but there should also be preset assets which can be set up quickly if full customization is undesired. One of the major realizations during playtesting by our group was that fast setup time was an important feature for them to have a good time overall.

Sharing the Game Outside the Co-Design Group

The May 4th session was the only one which took place outside of Westport. Instead, the co-designers came to Seattle to share the work they'd been doing with youth in the Laurelhurst neighborhood. Among the work they shared was this game, which they played informally with the Laurelhurst youth so that the latter could get a sense of what was possible if they wanted to work on a similar project over the summer. The Laurelhurst youth that participated seemed to enjoy playing the game created by the Westport co-designers. The Laurelhurst youth seemed excited at the prospect of doing something similar to address community resilience in their own neighborhood in a couple of months.

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List of References for Figures

Figure 1 - Abramson, et al. 2018, Fig. 29-30, pg.39

Figure 2 - Abramson, et al. 2018, Fig. 29-30, pg.40

Figure 3 - Lukins 2022, Fig. 21, pg.58

Figure 4 - (Created by author using Cities: Skylines)

Figure 5 - (Created by the author using Photoshop)

Figure 6 – First Flow diagram via https://commons.wikimedia.org/wiki/File:Challenge_vs_skill.svg

Figure 7 - Second Flow diagram via https://www.researchgate.net/profile/Ying-Yang-67

Figure 8 – 12 Player Motivation by Yee 2021: https://quanticfoundry.com/

Figure 9 – Dendrogram by Yee 2021: https://quanticfoundry.com/

Figure 10 - (Created by the author using Photoshop)

Figure 11 - (Created by the author using Photoshop and AI generator Midjourney)

Figure 12 - (Created by the author using Photoshop)

Figure 13 - (Created by the author using Excel and Yee's Gamer Motivation Profile: https://quanticfoundry.com/)

Figure 14 - (Created with Yee's Gamer Motivation Profile: https://quanticfoundry.com/)

Figure 15 - (Photo taken by the author)

Figure 16 - (Photo taken by the author)

Figure 17 - (Photo taken by the author)

Figure 18 - (Photo taken by the author)

Figure 19 - (Created by the author using Excel and Yee's Gamer Motivation Profile: https://quanticfoundry.com/)

Figure 20 - (Created by the author using Excel and Yee's Gamer Motivation Profile: https://quanticfoundry.com/)

Figure 21 - (Created by the author using Excel and O.C.E.A.N. (Five Factor) assessment: https://www.truity.com/)

Figure 22 - (Created using a custom Google Forms survey and Excel)

Figure 23 - (Created using a custom Google Forms survey and Excel)

Figure 24 - (Created using a custom Google Forms survey and Excel)

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Figure 26 - (Created using a custom Google Forms survey and Excel)

Figure 27 - (Created using a custom Google Forms survey and Excel)

Figure 28 - Eungard, et al., 2018

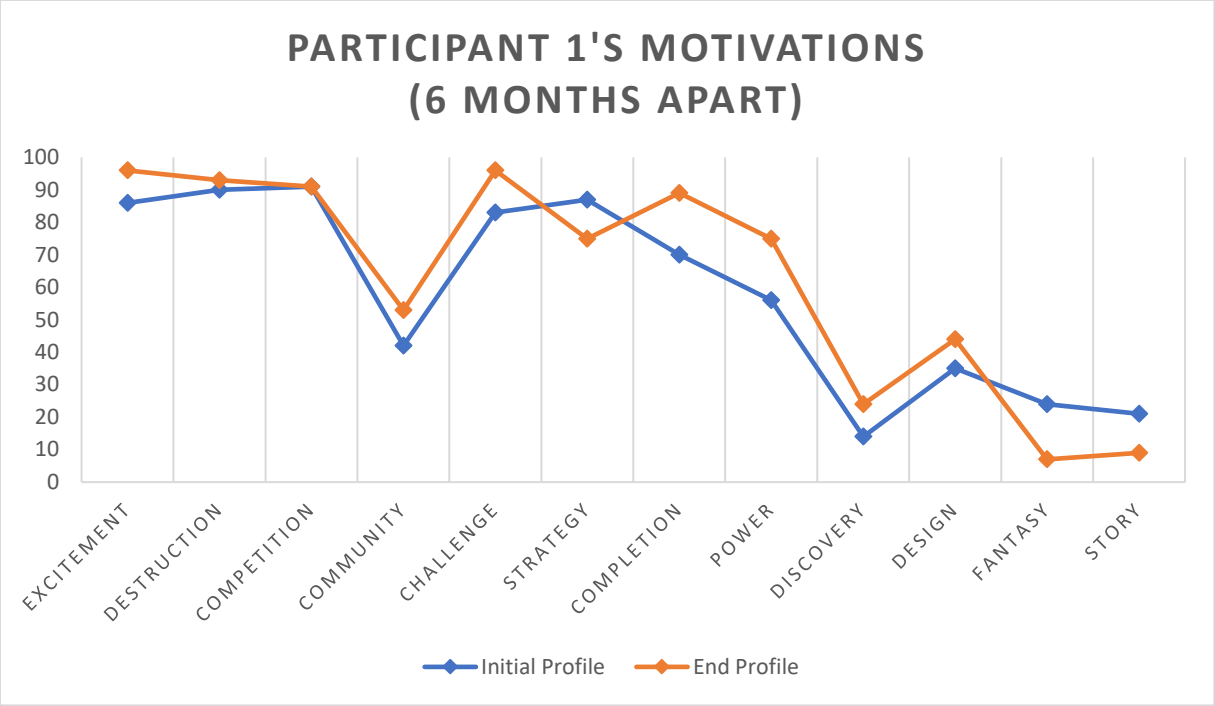
Figure 29 - (Created using ArcGIS, thesis data, and data from Eungard, et al., 2018)

Figure 30 - (Created using ArcGIS, thesis data, and data from Eungard, et al., 2018)

Figure 31 - (Created using ArcGIS, thesis data, and data from Eungard, et al., 2018)

Appendix A: Player Motivation Profile Assessment Results

This Appendix describes the results of individual player profiles.



This participant's player motivations remained fairly consistent over six months, especially in terms of holding their shape. The greatest differences shown seem to align with Yee's findings which pair Completion with Power and Fantasy with Story, but the diversion of Challenge from Strategy undermines this pattern slightly.

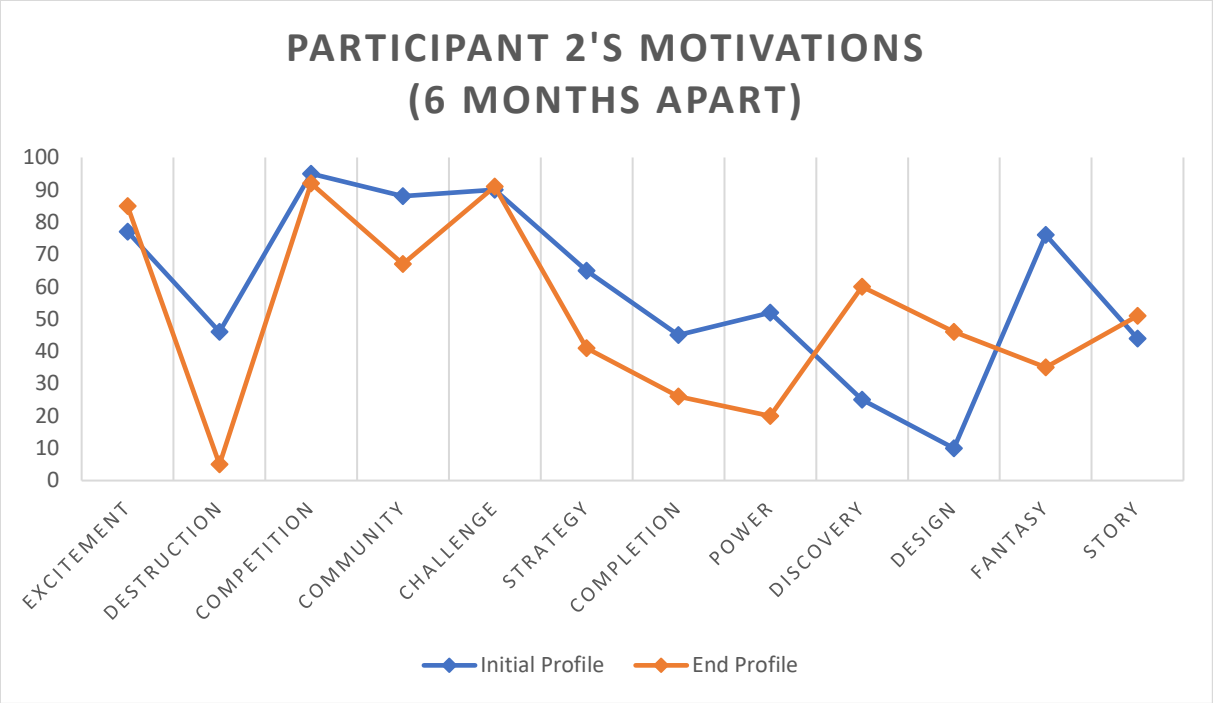
They participated on Oct. 28th (Intro), Nov. 18th (Initial Data Collection), Feb. 10th, Mar. 24th, Apr. 13th (mostly non-verbal, but engaged with playtest), and May 4th (Final Data Collection).

February 10th, 2024: Co-Design Contribution Highlights

- Positive and negative events, when they take place, should do so with immediate effect.
- Kaiju should have advantages/disadvantages and different preferred areas.

March 24th, 2024: Game Criticism Contribution Highlights

- Cascadia:
    - Pro: The reroll system (paying a small cost for a reroll)
    - Con: A little too repetitive (at the easiest difficulty level)
- Great Fire of London 1666:
    - Pro: Once I understood it after a little while it was interesting. Destruction and could blow stuff up.
    - Con: Super long setup. Too many things / aspects to setup and adds more rules as it progresses.



There are quite a few substantial changes to this player profile. A pretty steep decrease in scores for Destruction, Community, Strategy, Completion, Power, and Fantasy are shown. Equally steep increased interest in Discovery and Design are seen as well. While the changes to Completion and Power and Discovery and Design might align with Yee's findings which support the pairing of certain motivations, the rest of the major changes do not.

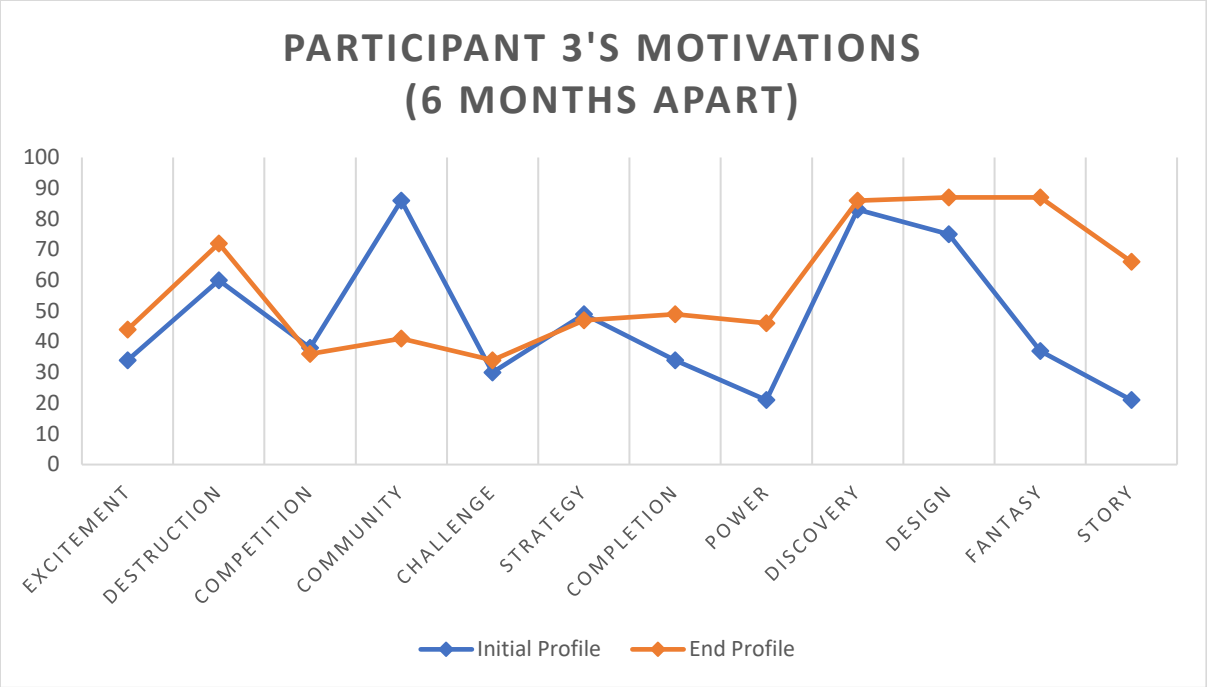
They participated on Oct. 28th (Intro), Nov. 18th (Initial Data Collection), Feb. 10th, Mar. 24th, and May 4th (Final Data Collection).

This individual attended for one design session (on February 10th).

February 10th, 2024: Co-Design Contribution Highlights

- The group decided that there should be "phases" to gameplay, including a battle phase, and Participant 2 pointed out that this phase should be optional.
- Suggested there could be a menu of upgrades or investments for players to reference (Participant 4 agreed). This made it into the latest prototype.
- Supported the spending of game money to make upgrades and investments.
- Suggested delineating local versus tourist population areas (this didn't make it into implementation for the latest iteration, but is probably a good idea for a future update)
- Crab fishing/hotels both suggested as business to represent in the game.
- Suggests using rolling of dice for initiative during other parts of gameplay (other than simply which team should go first at the start).

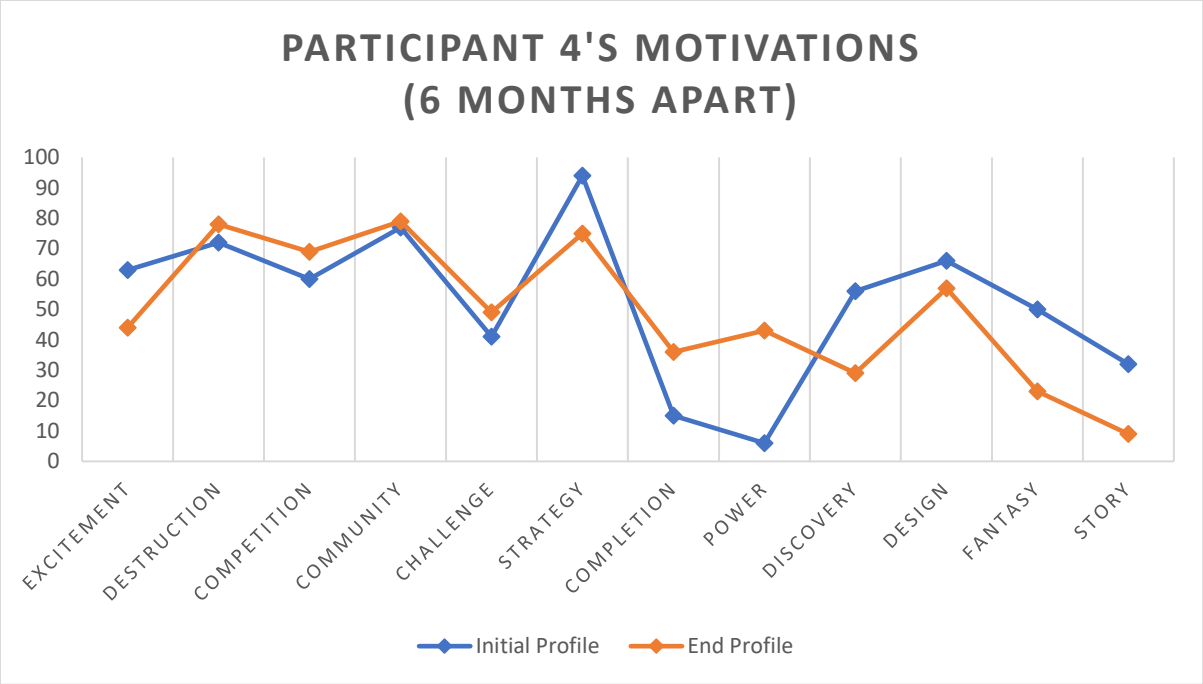
It's difficult to draw any connections between this player profile and major contributions to the game. Interest in Social and Mastery motivations and Excitement remained high, so some of the mechanics suggested my align with problem solving during co-development and supporting fairness.



There are notable changes to this motivation profile, namely a major decrease in interest in Community and major increases for Fantasy and Story. There's a more minor, but still notable increase in Completion and Power as well. The pairing of Completion with Power, and Fantasy and Story align with Yee's findings, but the way Community fell drastically without any change to Competition does not.

Participated on Oct. 28th, Nov. 18th, Feb. 3rd, and May 4th.

These dates of participation reflect that this person did not choose to contribute much directly to the game design activity but did participate in both the initial and end of project assessments and survey. This doesn't align with the expectation that individuals who consistently score well on design would be more likely to engage with the activity, but there may be other factors which interfered given the small sample size. The one design session this participant attended, however, they spent most of the time doing concept drawings for defensive structures and disaster/monsters in the game. This aligns well with their scores in Design.



A substantial increase in interest in Completion and Power and decreases to Discovery, Fantasy, and Story is seen in this profile. A correlation between Completion and Power, and Fantasy and Story appear to be supported here, Design also fell somewhat along with Discovery, but the more minor changes to Strategy and Excitement go against their pairing with Destruction and Challenge.

They attended every session. This means they participated on Oct. 28th (Intro), Nov. 18th (Initial Data Collection), Dec. 9th, Feb 3rd, Feb. 10th, Mar. 17th, Mar. 24th, Apr. 13th, and May 4th (Final Data Collection).

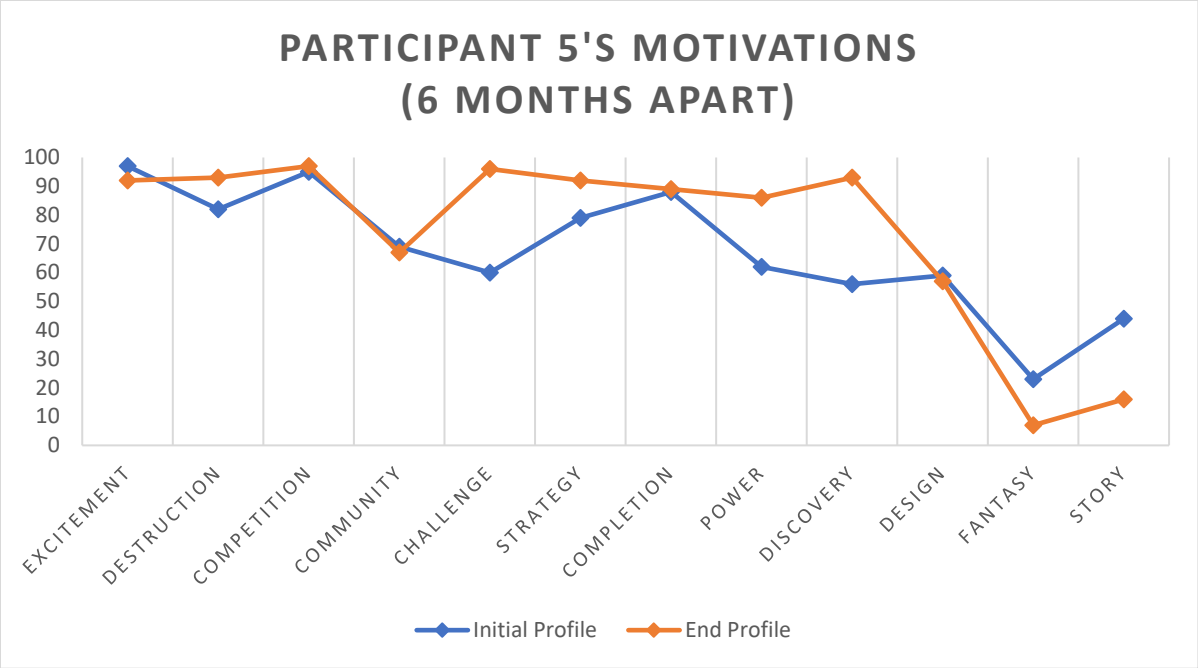
This participant, as can be seen in the complete notes section, contributed the most to the project's development. They suggested a lot of ideas and did a lot of refining of existing mechanics. Their tireless enthusiasm for working out solutions through game mechanics aligns well with their high scores in strategy. In general, it also meant that there was very little need for me to prompt more design decisions in general. Instead, I was able to focus mostly on working to involve the opinions and perspectives of the other participants. The only exceptions to this were helping establish the basic structure of the game's loop. The more moderate scores from this individual in Design may also align with their substantial number of creative contributions.

December 9th, 2023: Initial Design Session Highlight

- Eager to design. Came up with the idea of two Westports.
    - Attempting to address the need for competition, cooperation, and destruction while meeting the need for the players to consider hazard resilience suggests each Westport launches monster attacks at its opponent Westport.

February 10th, 2024: Design Session Highlights

- Gameplay should start with Spring (each team gets 3 turns or "rounds" per season, but this was reduced to 1 per season.)
- Seasonal impacts on Income, and board effects. The balance should skew favorable to the players.



There are some notable changes to this player profile, despite some similar scores. Challenge, Power, and Discovery scores all appear to increase substantially, and Story fell quite a bit. More modest increases were measured for Destruction and Strategy, and a more modest decrease for Fantasy. The pairing of changes to Challenge with Strategy and Fantasy with Story appears to support Yee's findings, but the way Power increased substantially without any measurable change to Completion does not.

They participated on Oct. 28th (Intro), Nov. 18th (Initial Data Collection), Dec. 9th, Apr. 13th, and May 4th (Final Data Collection).

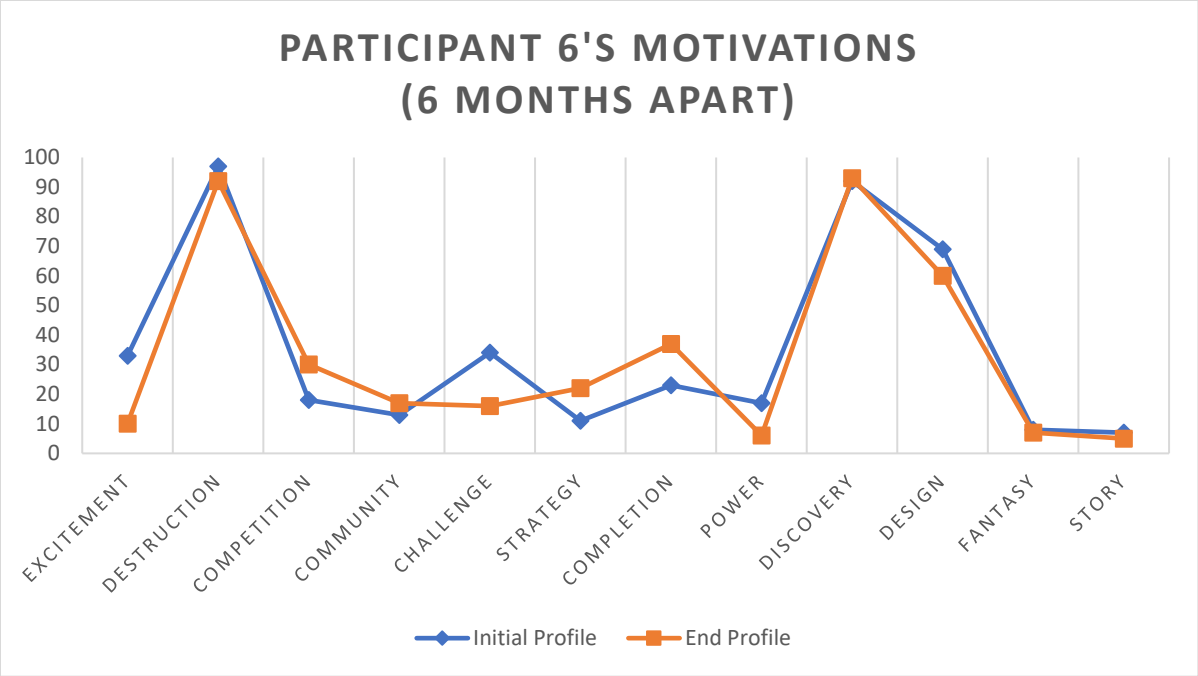
This participant was one of a few at the initial game idea session in December so they were able to have some major influence on the initial trajectory of the co-development project, but they otherwise missed the other design sessions before the first proper playtest session. They contributed somewhat less during the prototype testing than they did during the initial idea session.

December 9th, 2023: Initial Design Session Highlights:

- Suggested Westport should be divided into 4 zones, with a single large residential-oriented zone. (Ultimately, 5 zones were settled on with two residential zones.)
- Maybe boats can be used in the game for shipping, crab and clam fishing. Also tourism could be an important industry.
- There should be smaller disasters to experience as well. (This was an important early decision for the rest of the game.)

April 13th, 2024: Prototype Playtesting Highlights:

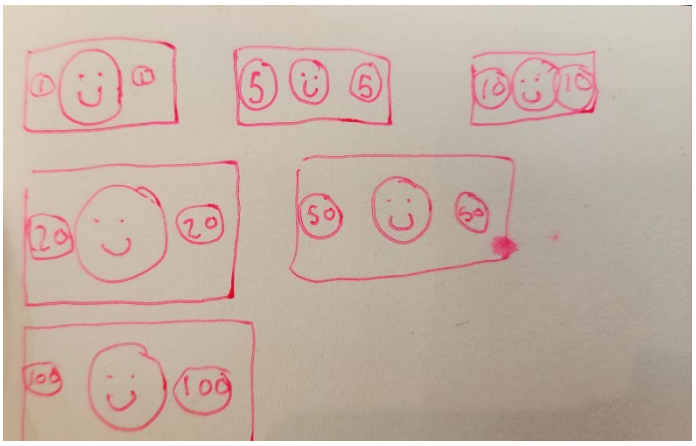
- Prefers spending on new investments to paying down debt during playtest.
- Chose to expand the wetland again. To buffer against disaster.
- Appreciates the reworked combat system.

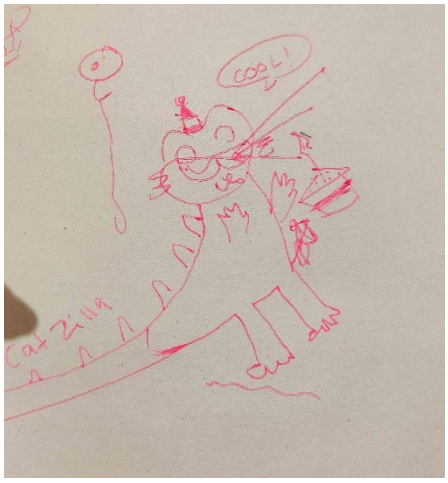


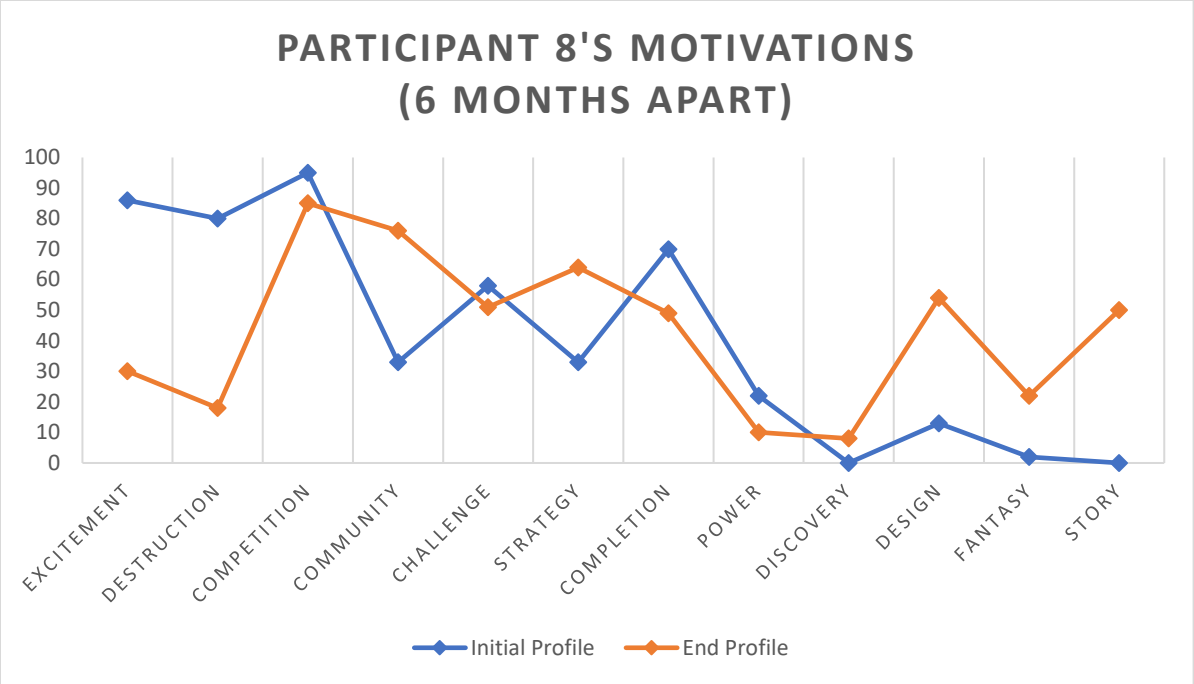
This profile is notable in that it defies the group's overall trend of scoring high with Action and Social and scoring lower toward Creative and Immersion motivations. It's also notable in that the overall shape remains fairly similar to the initial profile with extreme preferences for Destruction, Discovery, and Design, and very little interest in most of the other motivations. The greatest shift that takes place is slightly more interest in Competition, Strategy, and Completion with somewhat less interest in Excitement and Challenge. They don't support Yee's pairings very well, but they're also minor and reflect the results of a single profile.

They attended every session by participating on Oct. 28th (Intro), Nov. 18th (Initial Data Collection), Dec. 9th, Feb 3rd, Feb. 10th, Mar. 17th, Mar. 24th, Apr. 13th, and May 4th (Final Data Collection).

This participant attended every session, but mostly contributed by drawing concepts for different aspects of the game. They were the first to develop the kaiju metaphor. They also gave feedback during playtesting, but generally were less interested in game mechanics. This all aligns strongly with the scores in their player profile (especially Design).







The results of this profile changed substantially from the initial results. Notably scores for Excitement and Destruction decreased around 60 points, while Community, Strategy, Design, Fantasy, and Story rose very noticeably. The correlation Yee's findings show between Excitement with Destruction and Fantasy with Story are supported by these results, but the changes seen with Community, Strategy, and Design fail to align with the results for Competition, Challenge, and Discovery respectively.

They participated on Oct. 28th (Intro), Nov. 18th (Initial Data Collection), Feb. 10th, Mar. 24th, Apr. 13th, and May 4th (Final Data Collection).

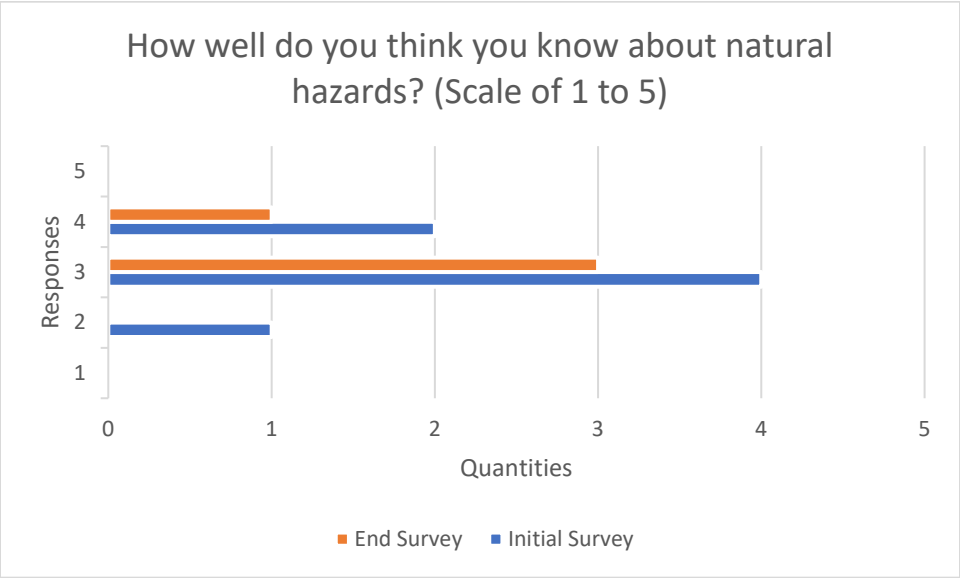
February 10th, 2024: Design Contribution Highlights

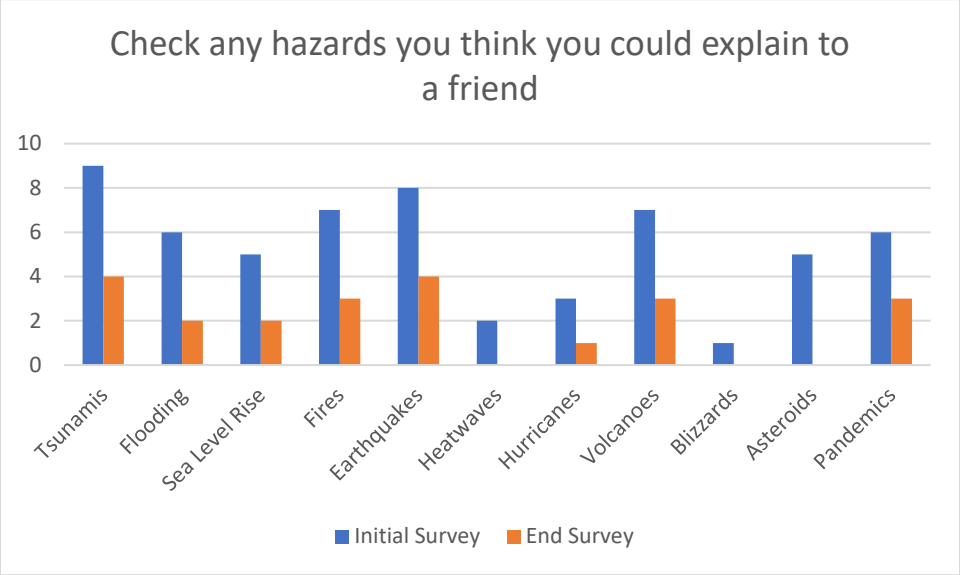
- The Vertical Evacuation Structure should be located at the School by default.
- There should be physical currency to track income effects.
- Suggested the opposing Westport's arrival could mean the destruction of north beach.
- The teams should be able to go into debt.
- Going fishing for extra money could be an option (baby kraken fishing for instance)
- Possible event card examples:
    - Raid from nearby city of Aberdeen causing infrastructure damage, loss of money
    - Pirates attack fishermen at sea
    - Invasive species make fish die, depressing fishers and tourist activity
- Kaiju rock-paper-scissors mechanic

The relative inconsistency of this player profile makes it difficult to draw connections between the substantial contributions to the game this participant made and their motivations. It's interesting to note that the disparity over time with Participant 8's O.C.E.A.N. results was also greater than with other participants (though not nearly so much as with their player motivations). It may suggest that something particular to this individual resulted in their showing more variable outcomes for both rounds of assessments. A larger sample size would help to address cases like this.

Appendix B: Initial and Exit Survey Results

Natural Hazards Education Related Questions and Responses





If you know a hazard, please briefly explain how it can be dangerous.

Initial Responses:

• Tsunamis and floods could damage and wipe out entire cities
• Mass destruction and exposure to dangerous elements.
• A fire can be dangerous because they can spread very rapidly causing massive amounts of destruction and loss of life. Fires can be also be hard to control and maintain.

• Tsunamis because they destroy everything
• Tsunamis can destroy lots of things.
• They can cause damage to civilization
• Volcanoes have a built up a ton of pressure and police is all at once to leave releasing a bunch of magma from the Earth's mantle which can kill people

End Responses:

• Because it can hurt people or damage an environment.
• tsunamis, they are caused by earthquakes and destroy many towns.
• People and infrastructure get hurt.
• Sea level rise can be dangerous to where humans settle, an example being land loss.

If you know a hazard, please briefly explain what can be done to protect people or towns from them.

Initial Responses:

• People can build Tsunami towers or go to higher grounds to escape and stay safe out of tsunamis and floods.
• Immediate evacuation and precautionary standards.
• Tsunamis are large amounts of water that commonly caused by earthquakes that can cause massive amounts of destruction to coastline communities, ripping up houses. Tsunamis also have very little warning before striking and hit land very soon.
• Build vertical evacuation towers
• Build Tsunami towers so that people can be safe.
• [No response given.]
• Volcanoes can be defended against by by rerouting the magma flow to a different side preferably to the water side cool down or just let it run out

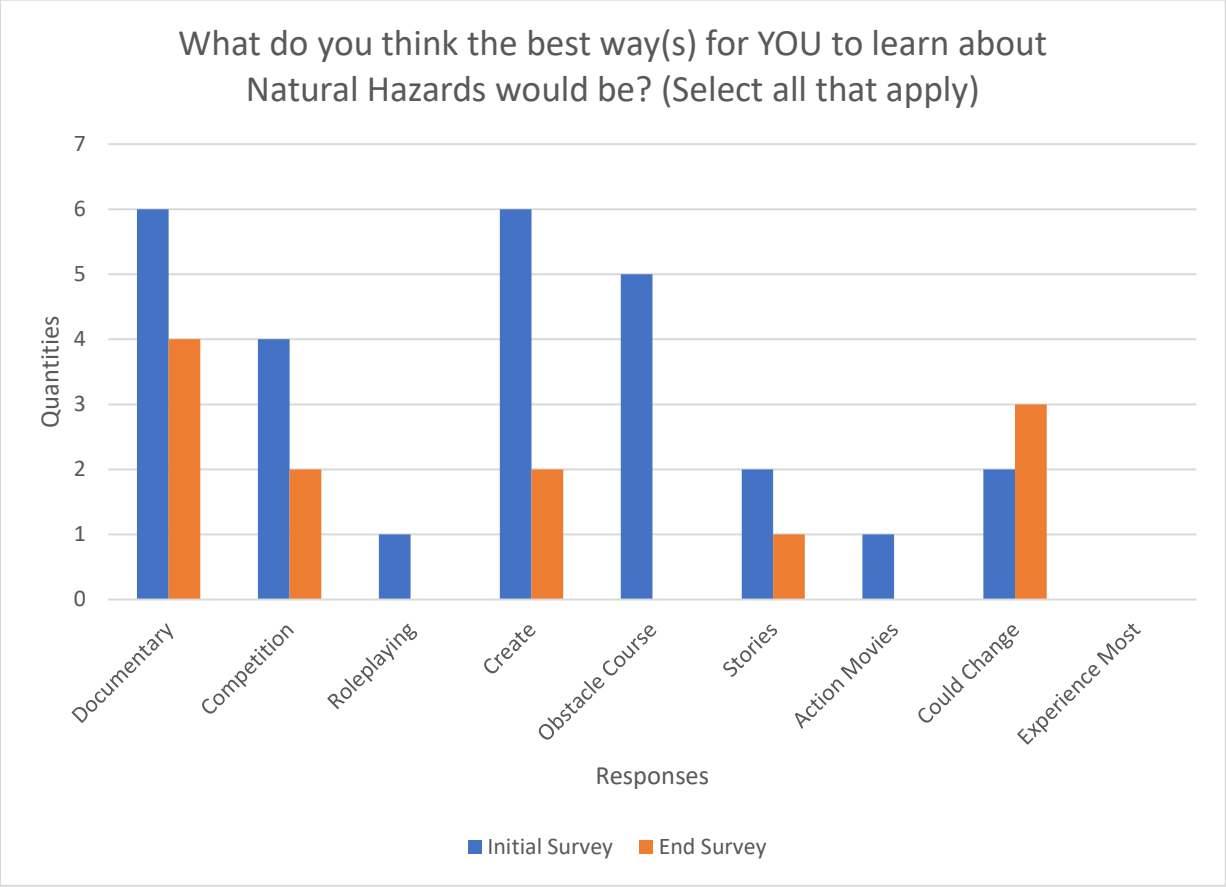
End Responses:

• Evacuate people or create precautions to avoid destruction.
• (more about tsunamis) you can put in vertical evacuation towers or have high-ground places set so townspeople can go to them.
• Evac and preparations for future hazards.
• A measure to protect from sea level rise can be building seawalls.

What do you think the best way(s) for YOU to learn about Natural Hazards would be? (Select all that apply)

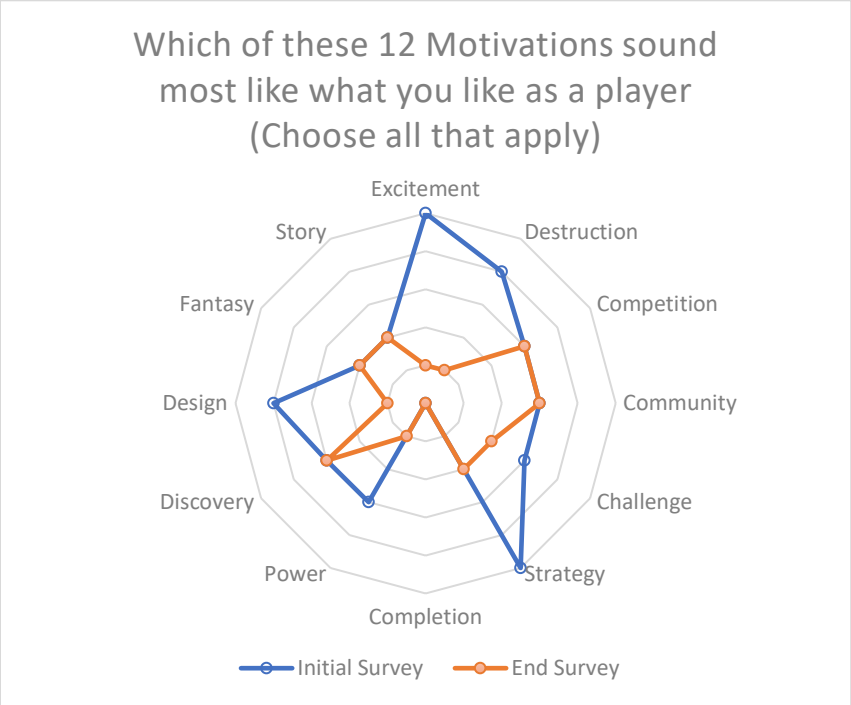
Options Provided (Emphasis specifically for reference in this document)

• A **documentary** showing many different places and potential hazards
• A **competition** to make the best plan for defending against natural hazards
• **Roleplaying** as adults who have to work together to save a town
• **Create** your own city (on paper or computer) and explain how your city is protected
• Run an outdoor **obstacle course** meant to simulate different natural dangers
• Hear **stories** or read books or comics about people dealing with natural hazards
• Watch **action movies** that are still pretty realistic, with some discussion after
• I feel my preferences **could change** a lot from day to day
• I would prefer to **experience most** of these (if not all) at least



Player Motivation, Game, and Personality Related Questions and Answers

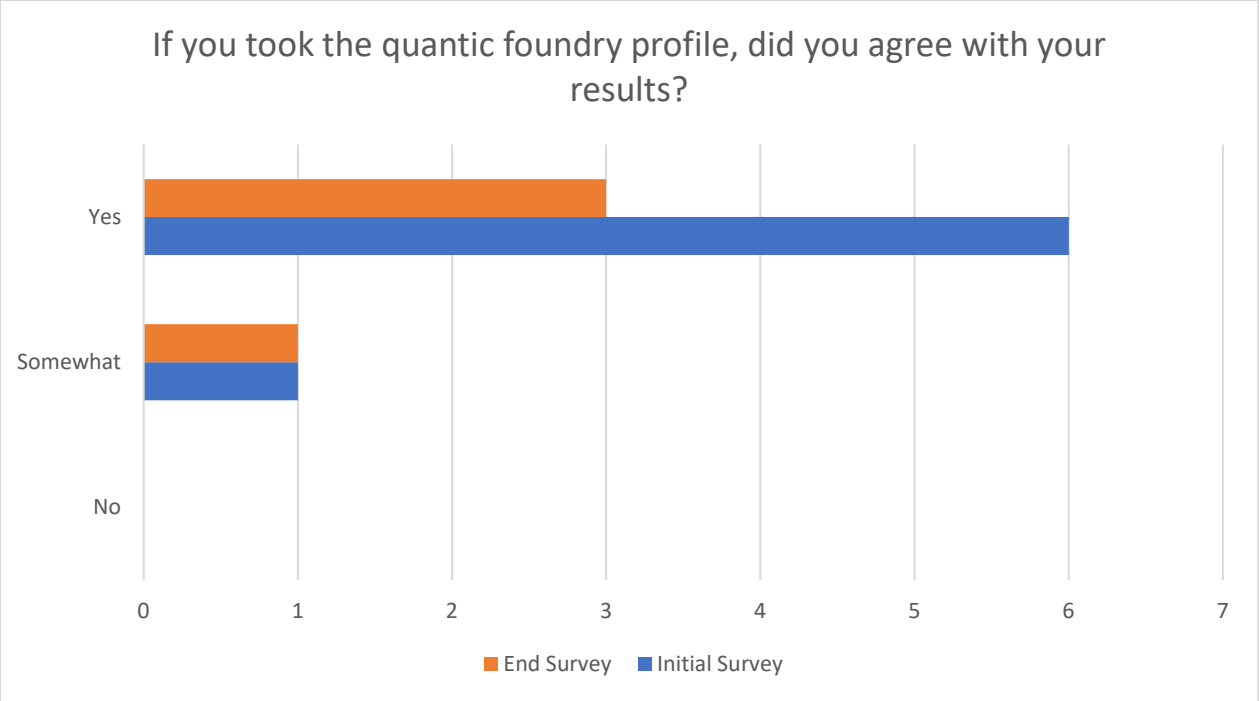
Which of these 12 Motivations sound most like what you like as a player (Choose all that apply)

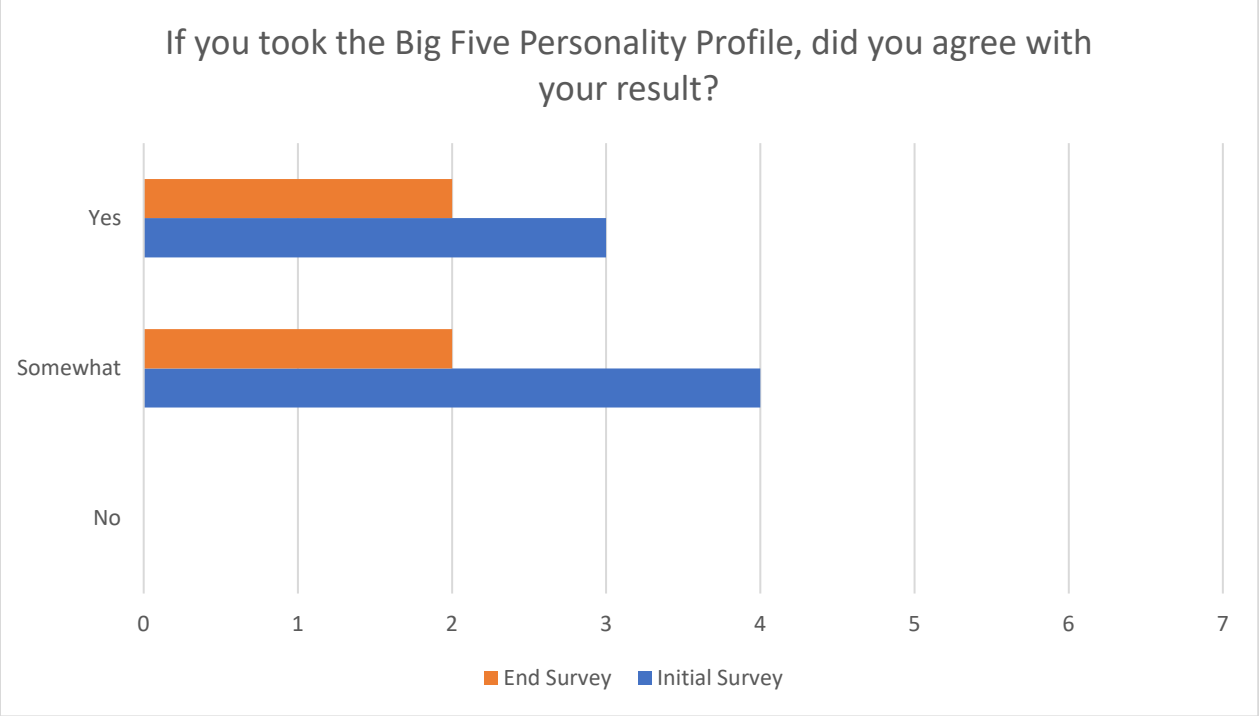


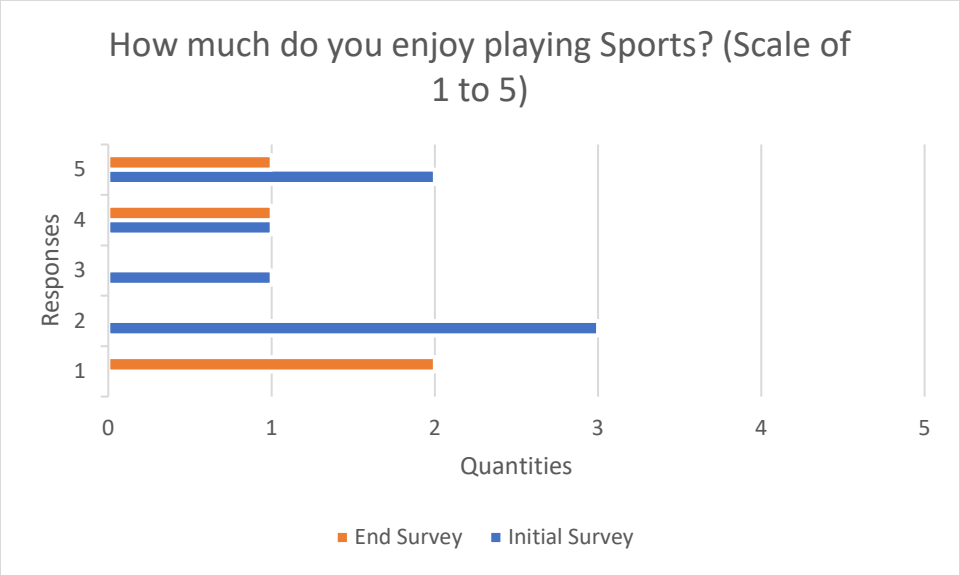
Options Provided

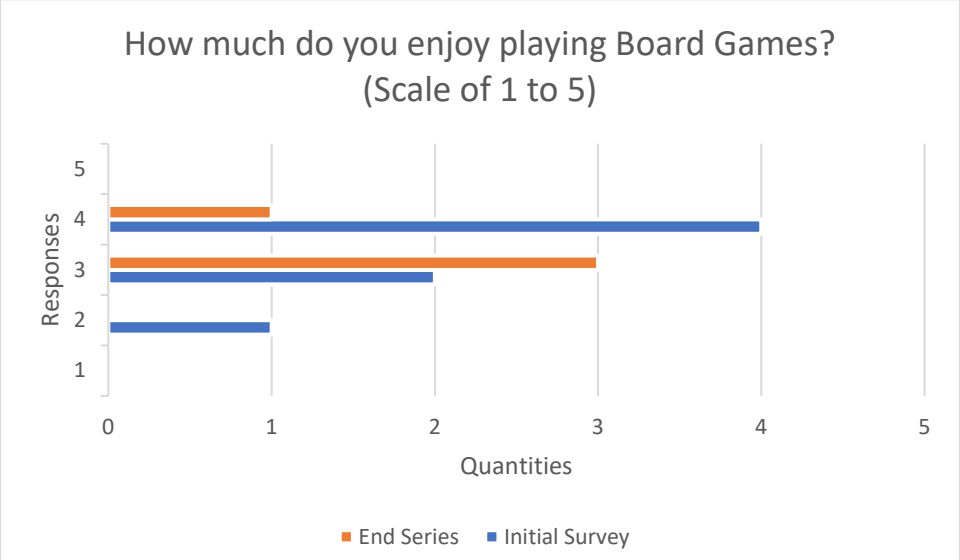
• **Destruction** (Explosive. Chaos. Mayhem)
• **Excitement** (Fast-paced. Surprises. Thrills)
• **Competition** (Duels. Matches. High rankings.)
• **Community** (Being on Team. Chatting. Interacting.)
• **Challenge** (Practice. High Difficulty. Overcoming.)
• **Strategy** (Thinking ahead. Making decisions. Careful planning.)
• **Power** (Powerful Character. Powerful Equipment.)
• **Fantasy** (Being Someone Else, Somewhere Else)
• **Story** (Elaborate plots. Interesting characters.)

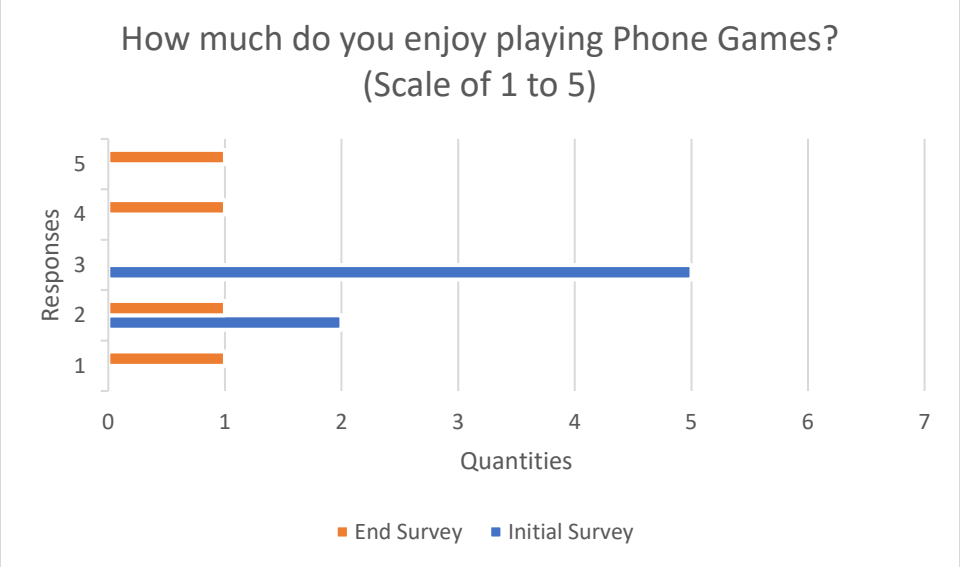
The initial self-assessment of player motivation seemed to roughly resemble the initial group player motivation profile. Unfortunately, since the latter self-assessment only includes four of the seven participants that made it to the end of the pilot, the results can't be compared as easily to their final player motivation profile.

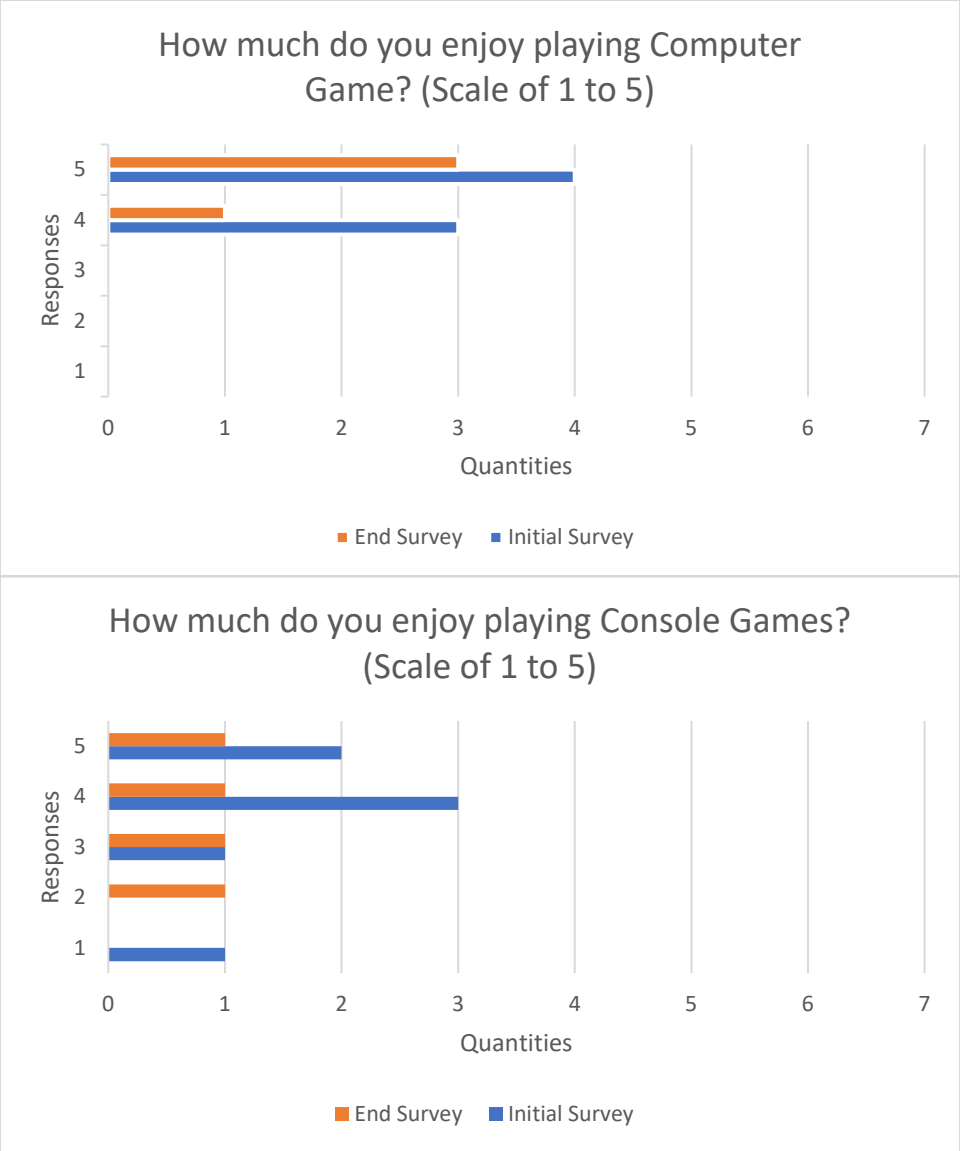

If you took the quantic foundry profile, did you agree with your results?
Yes
Somewhat
No
0
1
2
3
4
5
6
7
End Survey
Initial Survey

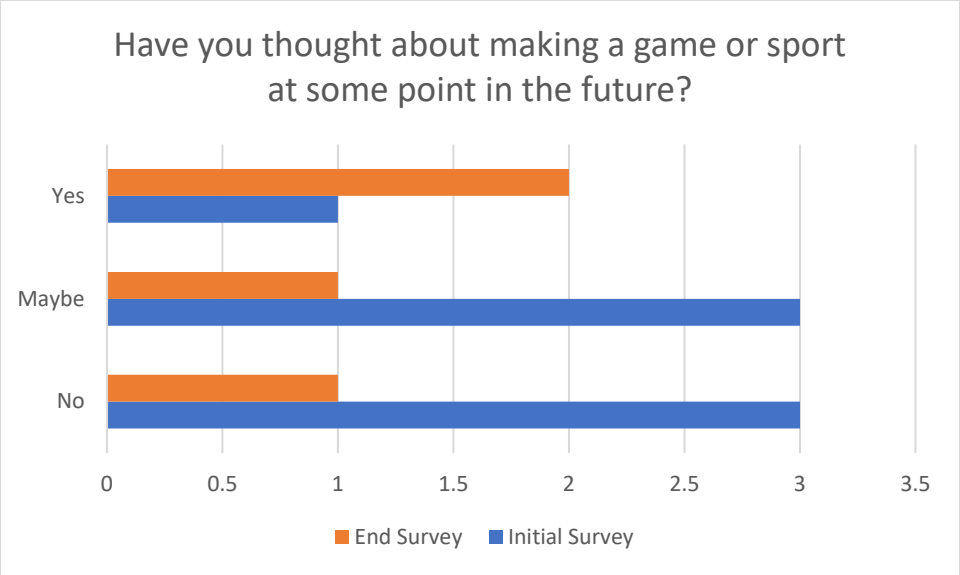

If you took the Big Five Personality Profile, did you agree with your result?
Yes
Somewhat
No
0
1
2
3
4
5
6
7
End Survey
Initial Survey

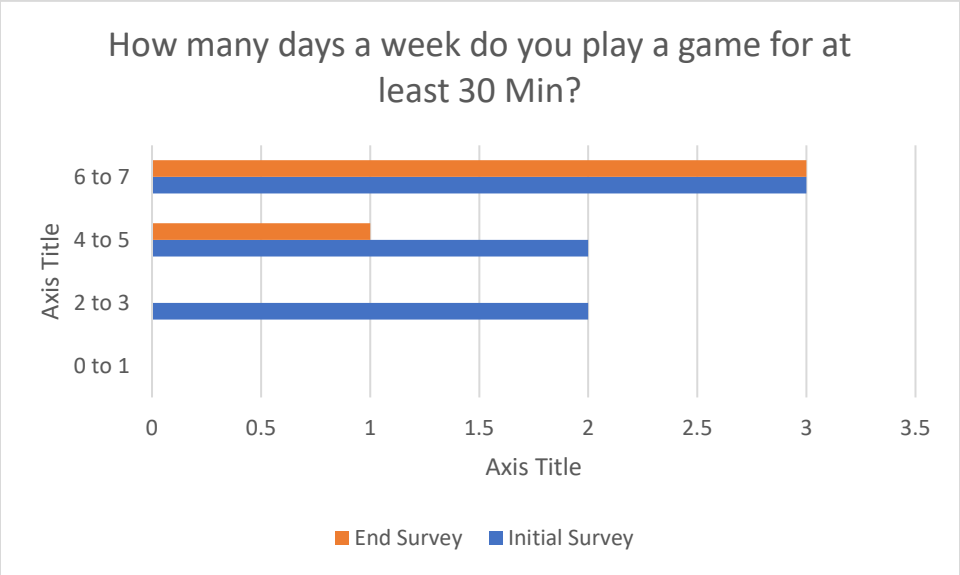

How much do you enjoy playing Sports? (Scale of 1 to 5)
Responses
5
4
3
2
1
0
1
2
3
4
5
Quantities
End Survey
Initial Survey


How much do you enjoy playing Board Games? (Scale of 1 to 5)
Responses
5
4
3
2
1
0
1
2
3
4
5
Quantities
End Series
Initial Survey


How much do you enjoy playing Phone Games? (Scale of 1 to 5)
Responses
5
4
3
2
1
0
1
2
3
4
5
6
7
Quantities
End Survey
Initial Survey


How much do you enjoy playing Computer Game? (Scale of 1 to 5)
Responses
5
4
3
2
1
0
1
2
3
4
5
6
7
Quantities
End Survey
Initial Survey
How much do you enjoy playing Console Games? (Scale of 1 to 5)
Responses
5
4
3
2
1
0
1
2
3
4
5
6
7
Quantities
End Survey
Initial Survey





If you enjoy playing any games, please share one or more examples of a game you like (And can you explain what you like about them?)

Initial Responses:

• Minecraft because of the creative abilities to it
• Competition and sociability.
• Cities: Skylines, I enjoy this game because I love strategizing about building and designing my perfect city.
• Fortnite because I can connect with people from school easily
• Papa's games (papa's burgeria, freezeria etc.)

• I like valorant and Minecraft and fortnite
• Rust and cod I love them

End Responses:

• I like Barotrauma. Its unique.
• minecraft is pretty cool. i like that i'm able to build stuff and destroy it.
• I really like Barotrauma because its unique
• A game I enjoy is Bloons TD 6 because I like the increasing difficulty of the waves of the balloons.

Have you ever made a game or sport before? (Whether alone or in a group) If so, please briefly describe.

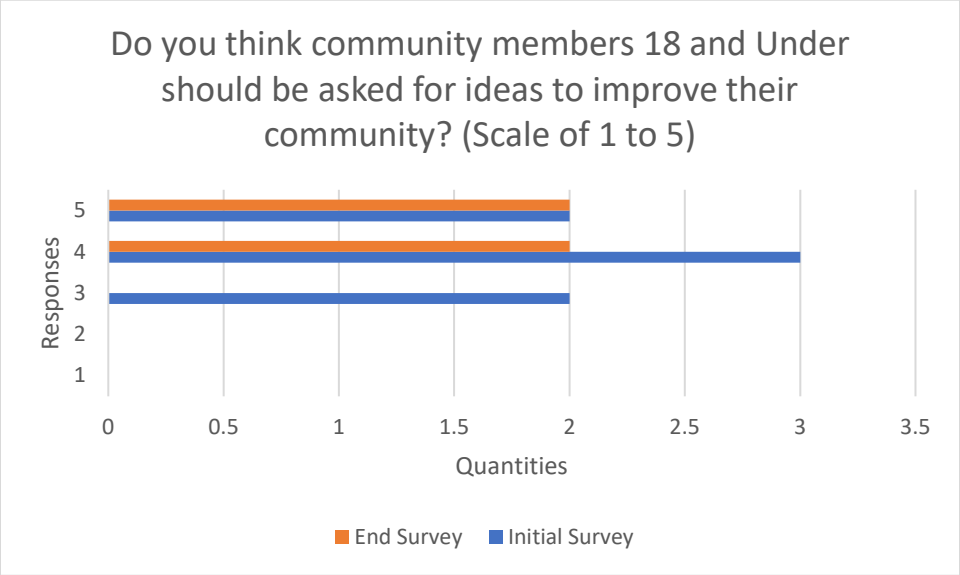
Initial Responses:

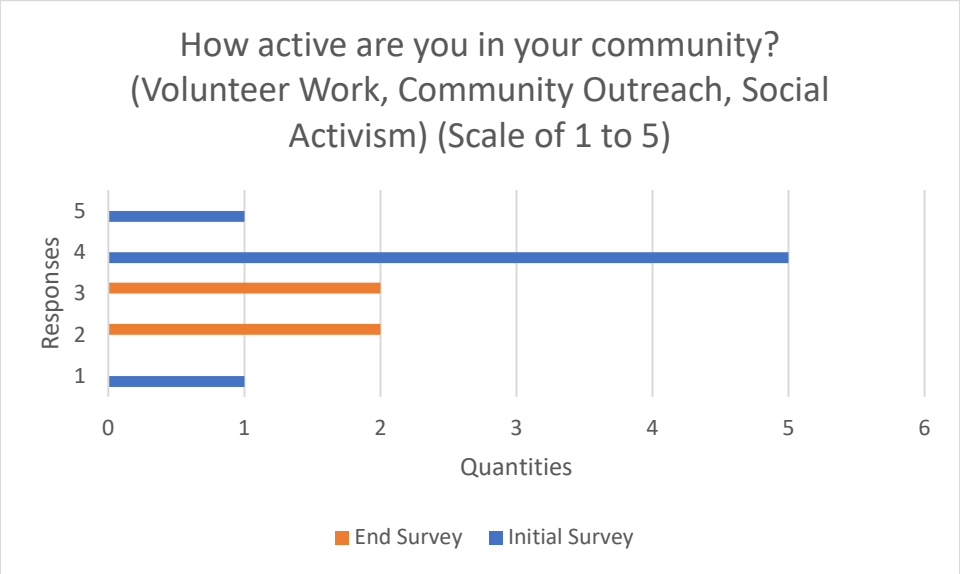
• I run in cross country, as well as track and field. I also briefly played volleyball, and I did soccer from 1st to about 5th grade.
• No.
• I've designed a couple games that we played in P.E. in elementary school a long time ago. I've also made some basic games in Scratch and more recently have done think like recreate a Wheel of Fortune clone in C++.
• no
• [No Response] • [No Response]
• No I havent
• No

End Responses:

• No.
• n/a
• No
• No

Civic Engagement Related Questions and Responses





Can you think of any ideas that might improve your community? (Just your opinion. No one else has to agree.)

Initial Responses:

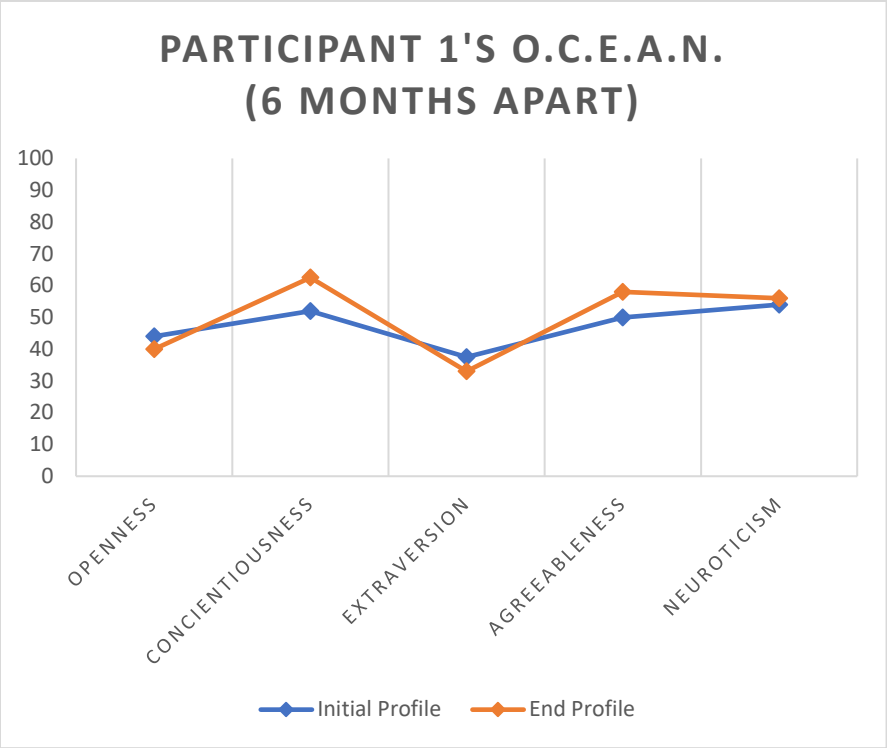
• Better communication throughout the town
• Youth drug and violence prevention.
• A ferry from Westport to Ocean Shores and a golf course.

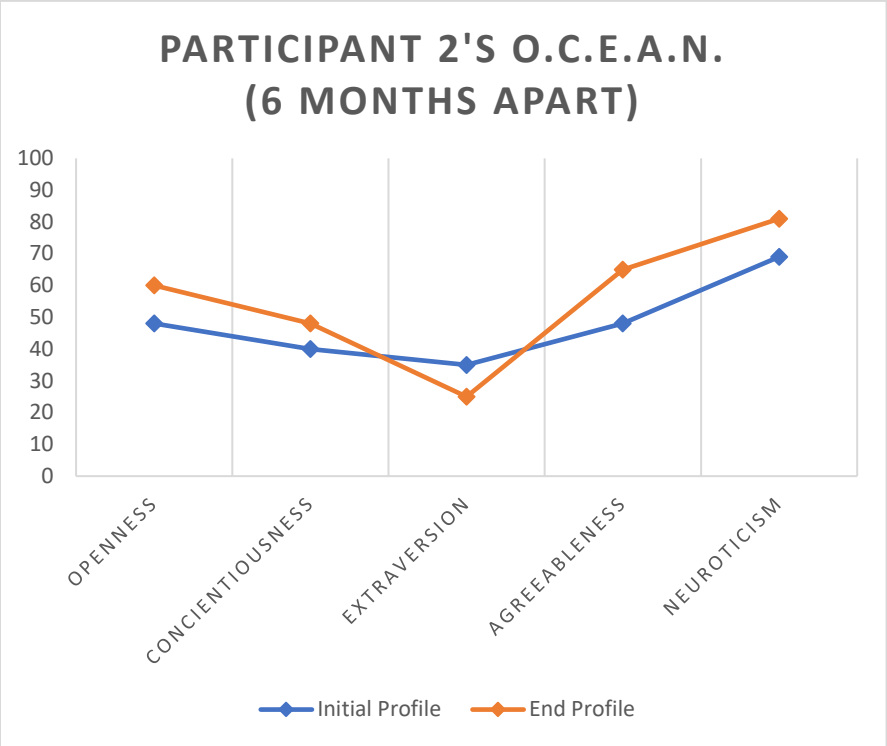
• Involving the youth in things more. And stop drugs.
• [No Response]
• More options for places where kids can hangout.
• No

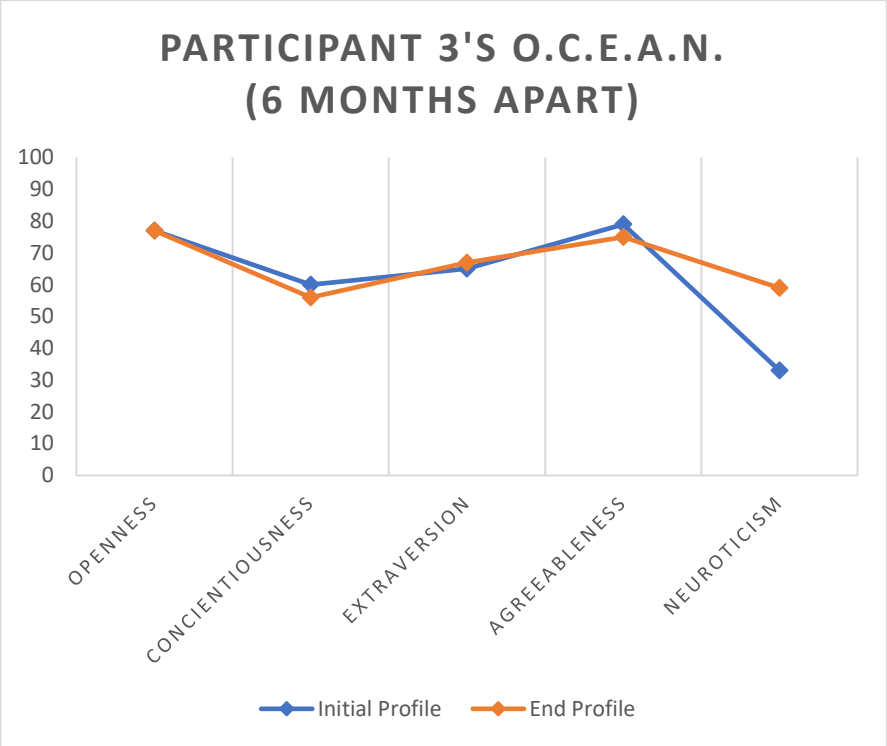
End Responses:

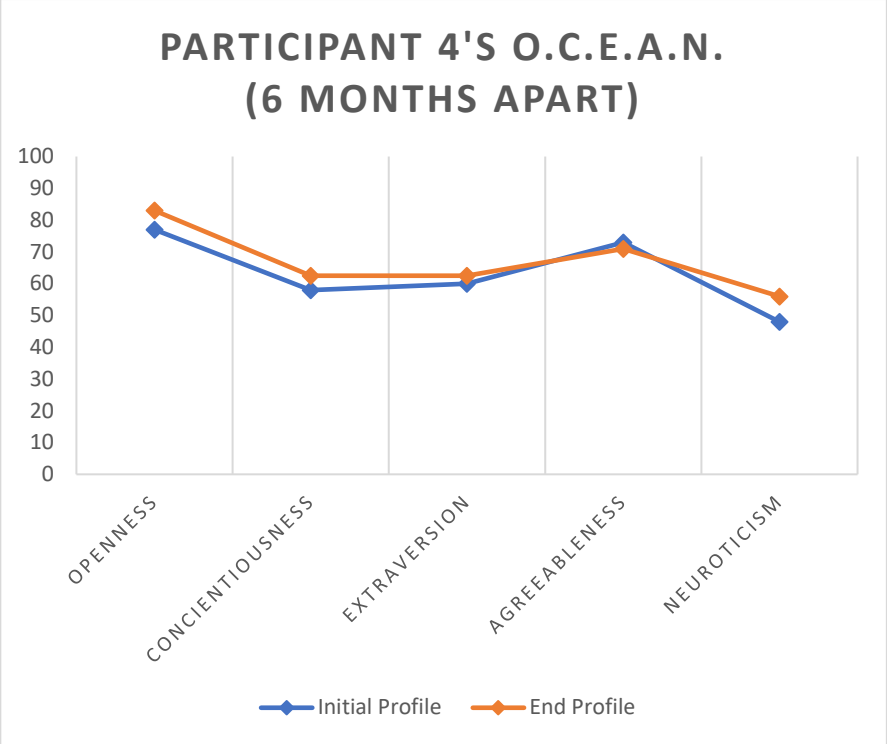
• More opportunities for the unfortunate youth
• i think we should have a point set other than the school for people to go to.
• More opportunities for youth
• Make more sidewalks

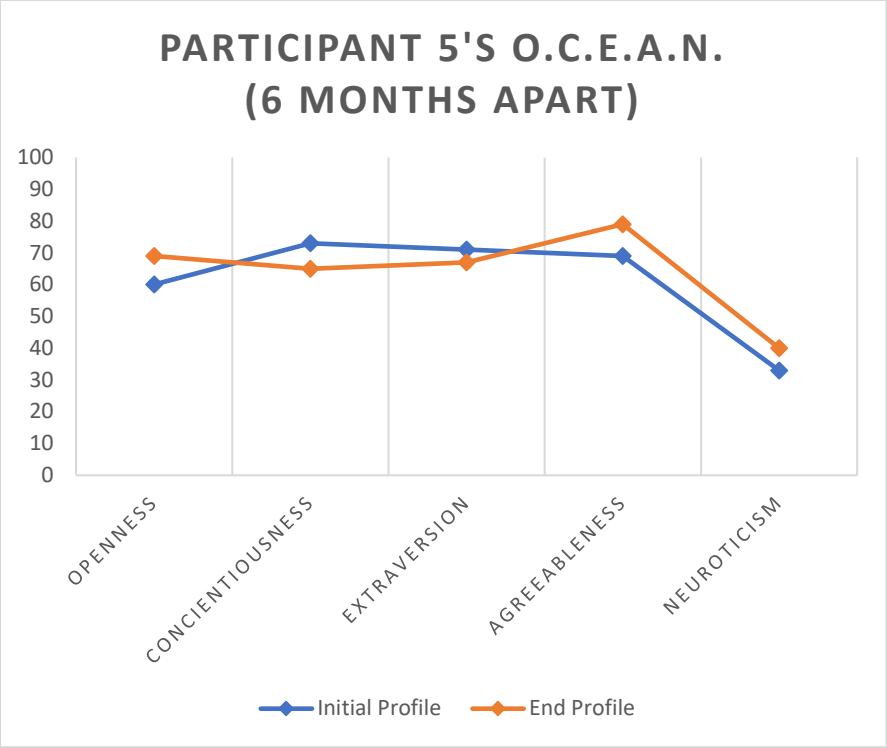
Appendix C: Initial and Exit O.C.E.A.N. Results

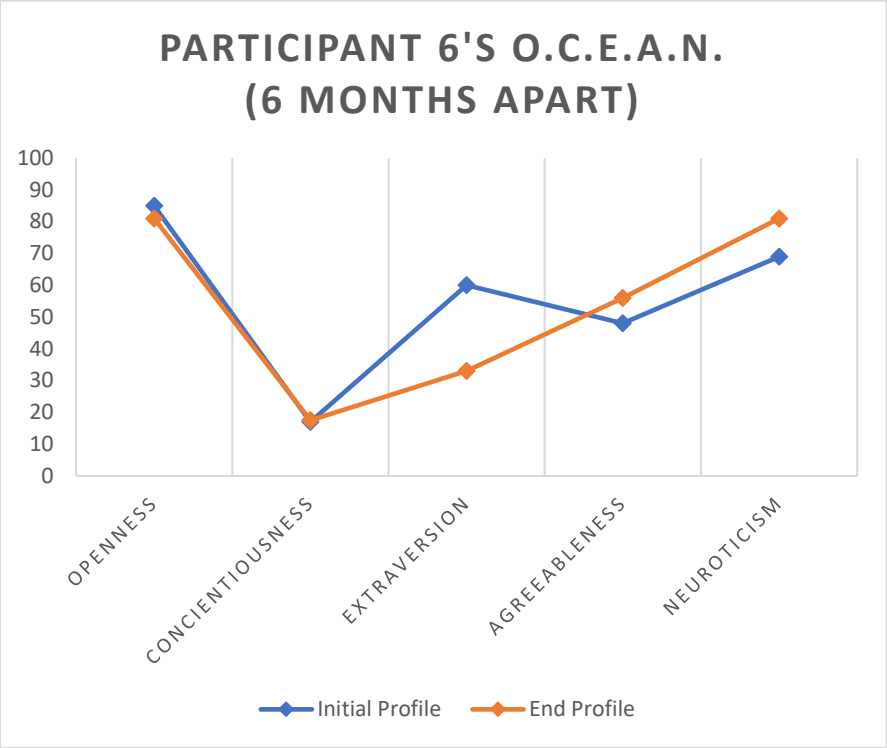


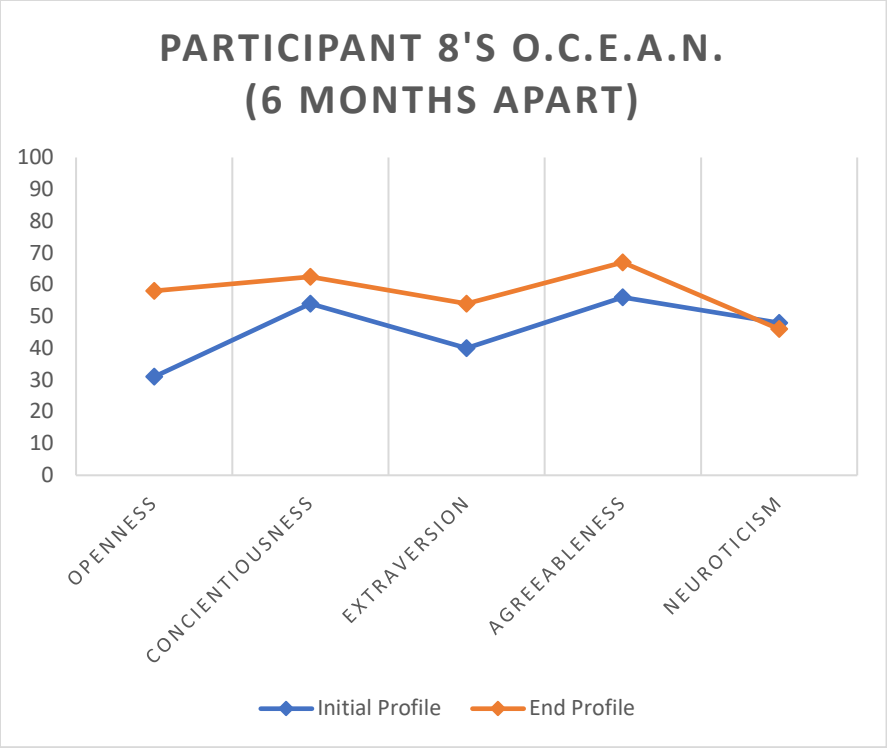



PARTICIPANT 3'S O.C.E.A.N.
(6 MONTHS APART)
100
90
80
70
60
50
40
30
20
10
0
OPENNESS
CONCIENTIOUSNESS
EXTRAVERSION
AGREEABLENESS
NEUROTICISM
Initial Profile
End Profile


PARTICIPANT 4'S O.C.E.A.N.
(6 MONTHS APART)
100
90
80
70
60
50
40
30
20
10
0
OPENNESS
CONCIENTIOUSNESS
EXTRAVERSION
AGREEABLENESS
NEUROTICISM
Initial Profile
End Profile


PARTICIPANT 5'S O.C.E.A.N.
(6 MONTHS APART)
100
90
80
70
60
50
40
30
20
10
0
OPENNESS
CONCIENTIOUSNESS
EXTRAVERSION
AGREEABLENESS
NEUROTICISM
Initial Profile
End Profile


PARTICIPANT 6'S O.C.E.A.N.
(6 MONTHS APART)
100
90
80
70
60
50
40
30
20
10
0
OPENNESS
CONCIENTIOUSNESS
EXTRAVERSION
AGREEABLENESS
NEUROTICISM
Initial Profile
End Profile


PARTICIPANT 8'S O.C.E.A.N.
(6 MONTHS APART)
100
90
80
70
60
50
40
30
20
10
0
OPENNESS
CONCIENTIOUSNESS
EXTRAVERSION
AGREEABLENESS
NEUROTICISM
Initial Profile
End Profile

Appendix D: Meeting Session Notes

October 28th, 2023

- "Kickoff" recruitment meeting. Explained concept. Gave a presentation on gamer motivations.

November 18th, 2023

- Initial assessments and survey given. Nine recruited participants in total.

December 9th, 2023

- First review of initial results.
- Initial game ideation.
- Participants 4, 5, and 6.
    - Participant 4:
        - Eager to design. Came up with the idea of two Westports.
            - Attempting to address the need for competition, cooperation, and destruction while meeting the need for the players to consider hazard resilience suggests each Westport launches monster attacks at its opponent Westport.
        - Chose to use godzilla-like "kaiju" as metaphors for disasters.
        - Suggested there should be 5 zones in Westport (discussed with participant 5, who suggested it should be 4 zones).
        - Suggested that there should be two residential sections.
        - Considering potential materials to use:
            - Coin flips. Game cards. 3D printed kaiju which you have to assemble to build. Population tokens.
        - Time should be a consideration in this game (as in the turning of seasons, rather than a real-world timer). There could be a turn per season or per month. (Settled on season)
            - There should be seasonal modifiers or varying kinds of experience depending on the season.
        - You should have to keep kaiju happy or risk destruction.
            - You could, for instance, expand the fishing industry at the expense of the local environment but this would risk the kaiju getting mad.
        - Somehow local industries should be integrated into the game.
        - There should be key buildings which are the focus of kaiju attacks in a specific zone.
        - There could be a reference sheet showing specific strengths and weaknesses of each kaiju.
        - You can choose to sacrifice your in-progress investment in a kaiju in order to defend against an imminent attack.
        - The game should progress from realistic to more and more extreme.
        - There should be specific defenses per kaiju.
    - Participant 5:
        - Suggested Westport should be divided into 4 zones, with a single large residential-oriented zone.
        - The large jetty would have appeal to offer the game.

        - Maybe boats can be used in the game for shipping, crab and clam fishing. Also tourism could be an important industry.
        - There should be smaller disasters to experience as well.
    - Participant 6:
        - Suggests the game's economy should resemble *Monopoly*
        - Does drawings for the game. (Draws currency, concept art for kaiju)
        - Invents the idea of "Catzilla", the first of the kaiju. Described as a godzilla-sized cat with sunglasses and a party hat, a large reptilian tail with spines like Godzilla.
        - Considers "Grass Island" a valuable feature for the game. Suggests the Westports ship stuff (food) to kaiju nests on Grass Island.
        - Suggests "Kaiju-watching" tours as an industry along with extreme kaiju-supportive fishing industries.
        - Suggests specific Kaiju should attack specific areas.
        - You can only grow or build up on kaiju at a time.
        - There should be landmarks in each zone.

Group Ideas:
IDs 4,5,6) Working titles of (5) sections for Westport *(with their associated landmark locations)*:

- Docks *(Maritime Museum)*
- Forested/State Park *(Lighthouse)*
- Residential 1 *(Shop n Kart)*
- Residential 2 *(School)*
- School *(Chateau)*
- *Grass Island *(not properly thought of as a sector, this is might be where giant monsters are raised or launched from at the other Westport)*

IDs 4,5,6) Giant monster (kaiju) options.

- School > Catzilla
- Docks > King Crab
- Forest > Really Big Foot
- Residential 2 > Kraken
- Residential 1 > "Dorothy" (the giant puppy)

IDs 4,5,6) Defenses specific to address specific kaiju (work in progress)

- Seawall > Kraken
- Vertical Evacuation Structure > Catzilla
- NA > Really Big Foot
- NA > King Crab
- NA > Dorothy (the puppy of doom)

February 3rd, 2024

- The dry erase mapping exercise clarified how places are locally perceived in Westport by participants.
- Participants 3, 4, 6, 7
    - This was primarily done through drawing, both on sketch paper and on the dry erase board.

February 10th, 2024

- Initial drawing on boards. Red versus Blue teams.
- Participants 1, 2, 4, 6, 7, 8
    - Participant 1:
        - Positive and negative events, when they take place, should do so with immediate effect. (Participant 4 and 8 agree).
        - Kaiju have advantages and different preferred areas (Participant 2 agrees)
    - Participant 2:
        - The group agreed that there should be “phases” to gameplay, including a battle phase. Participant 2 pointed out that this phase should be optional.
        - There could be a menu of upgrades or investments for players to reference (participant 4 agreed).
        - Spending money to upgrade/invest
        - Settlements/tourism areas
        - Crab fishing/hotels
        - Depending based on who got initiative roll, one going first.
    - Participant 4:
        - 500k (currency) per team at start of game.
        - At start, rolls to see who goes first. (Participant 8 agrees)
        - Gameplay should start with Spring (each team gets 3 turns or “rounds” per season, but this was reduced to 1 per season.)
        - Seasonal impacts on Income, and board effects. The balance should skew favorable to the players.
        - When events occur, players can roll to show the severity of the event.
    - Participant 6:
        - (This participant focused on drawing examples of structures, defenses, and kaiju.)
    - Participant 7:
        - Players could roll to see which zone is impacted by a given event.
        - There could be a “character sheet” describing each zone and its attributes
    - Participant 8:
        - The Vertical Evacuation Structure should be located at the School by default
        - There should be physical currency to track income effects
        - Suggested the opposing Westport’s arrival could mean the destruction of north beach.
        - The teams should be able to go into debt.
        - Go fishing for extra money (baby kraken fishing for instance)
        - Possible event card examples:
            - Raid from nearby city of Aberdeen causing infrastructure damage, loss of money
            - Pirates attack fishermen at sea
            - Invasive species make fish die, depressing fishers and tourist activity
        - Kaiju rock-paper-scissors mechanic
    - Group Ideas:
        - Event Phase. w/ immediate distribution of income.
        - Upgrade/Investment phase: self-determined
        - Optional battle phase

March 17th, 2024

- Refined design plans during this session.
- (section 2 of digital notes)
- Participants 3, 4, 6, 7
    - ID7: Giant Crab Pot for upgrades against King Crab
    - General: The nature of the damage by the kaiju matches the level of destruction.
        - The School VES -> space elevator
        - Lighthouse - super laser
        - Chateau - massive sea wall (with a castle theme)
        - Shop N Kart - mech made of shopping carts.
        - (The whale bone/necromancy was mine) Necromancy Powered Whale Bone Museum launches giant crab pots.
    - ID4: We can use a bank.

CARD IDEAS:

- ID4: Four Seasonal Cards (a different deck for each season)
- ID4: The decks are full of Event Cards (From really good to really bad)
- ID4: Reference Sheet/Card (kind of like a menu), use this to spend money collected.
- ID7: Reference Sheet/Card could show them upgrading over time.

WIN CONDITION:

- General: Destroy the other Westport

Westport Zones:

- ID4: Zones have HP. They can be 'totalled' by enough kaiju damage because you lose the faith of locals and tourists for protecting/restoring an area.

Num of Players:

- ID4: 2-10 players?

ID7: Borrow the Play Phases from MTG?

- Investments via the menu

Art Contributions:

ID3: Drew several concept sketches for key elements of the game. (Crab Pot Trap, Lighthouse Laser, a basic 'kraken', a Catzilla.) Also experimented with creating a paper-clay tail for Catzilla figure.
ID6: Also did some sketching. (Catzilla)
ID7: Sketched a space needle themed space elevator, shopping cart mech and a kraken.
ID4: Space needle themed elevator, and a shopping cart mech

March 24th, 2024

- The outside gaming session (Cascadia and Great Fire of London for ideas)
- Participants 1, 2, 4, 6.
    - Participant 1:

        - Cascadia:
            - Pro: The reroll system (paying a small cost for a reroll)
            - Con: A little too repetitive (at the easiest difficulty level)
        - Great Fire of London 1666:
            - Pro: Once I understood it after a little it was interesting. Destruction and could blow stuff up.
            - Con: Super long setup. Too many things / aspects to set up and adds more rules as it progresses.
    - Participant 2:
        - Cascadia:
            - Con: Not very stimulating. I prefer a large build up or setup to win a game.
    - Participant 4:
        - Cascadia:
            - Pro: Simple to play and to setup. The strategy to it is engaging.
            - Con: Gets repetitive. Not enough acorn tokens (currency).
        - Great Fire of London 1666:
            - Pro: I liked strategizing against it for myself. Good concept and once started was fun.
            - Con: Very long setup time. Can be confusing.
    - Participant 6:
        - Cascadia:
            - Pro: It's fun to use animal tokens and use strategy.
        - Great Fire of London 1666:
            - The game takes too long to set up.
            - Pro: Spreading fire is a fun concept.
- Realized they wanted a short setup.

April 13th, 2024

- The first prototype playtesting.
- "Important Date! Everyone who has come to any of these UW events MUST attend."
- Participants
    - Participant 1:
        - Joins midway through the playtest on the Red Team.
    - Participant 4:
        - Red Team: Chose to expand wetland strategy (for Res2), to buffer against disaster.
        - (Laughing) "It's like Monopoly, it'll ruin friendships."
        - "Do we want to go into debt to…?" Examples of inter-team cooperative strategizing.
        - Battle Phase: Originally HP was tame points, once it's reduced to zero tame points (from four) it goes to its home territory as a wild kaiju again. This was reworked and improved on the spot by this participant.
            - Roll to see who goes first (using D6)
            - HP is set to 100 instead.
            - D10 rolls are then used to calculate attack damage given.
            - The buff/debuff system changes -/+# to -/+#0 damage. (if the same kaiju is on each side)
        - Some seasons should be weighted to be more negative (in terms of events) than others.

        - Red Team: Starts to build an iconic structure (other than the school), right after Blue Team does this. They chose defenses at the Docks' iconic structure (Maritime Museum).
        - Realized there should be a marker for tracking the season.
        - **What really works about the game right now?:**
            - "The game loop"
            - The seasonal event list (which results in unpredictable positive or negative outcomes based on D20 rolls).
            - The reworked combat system. "The advantages and disadvantages mean something…" but chance is involved enough now that you can still potentially win even with a disadvantage. Also, you can't just "one-tap" or defeat an opponent immediately. There's more activity to it now.
        - **What does not work at all right now?:**
            - "The economy!"
    - Participant 5:
        - Prefers spending on new investments to paying down debt (as long as that is possible).
        - Red Team: Chose to expand the wetland again. To buffer against disaster.
        - Explains the reworked battle system to Participant 1, seems to show appreciation of how it works.
    - Participant 6:
        - Suggested using beads for taming markers on kaiju.
        - "Should we buy another thing?" (Make another investment?) Examples of inter-team cooperative strategizing.
        - The "menu" of investment options should actually look like a fancy menu or catalog. The restaurant theme specifically would be funny.
        - **What really works about the game right now?:**
            - The seasonal event list (which results in unpredictable positive or negative outcomes based on D20 rolls).
        - **What does not work at all right now?:**
            - "The economy!"
    - Participant 8:
        - Blue Team: Initially considered B-lining for taming kaiju, but then focused primarily on building a financial base for their Westport.
        - Chose to develop wetland (remove nature buffer) for greater income.
        - Played investment in a Tourism Campaign (so that any positive tourism event roll, you get bonus income, but you have to invest in it before you roll the tourism event)
        - Blue Team: Tames the first Kaiju. Took about 30 minutes into the game (probably could have done it in half the time, but it wasn't a priority - surprisingly).
            - Blue Team's King Crab sent against Red Team's Kraken.
        - Blue Team launches another Kaiju attack.
        - Blue Team: Starts to build an iconic structure (other than the school) before the other team, Red Team follows suit immediately after. They chose defenses at the Docks' iconic structure (Maritime Museum).
        - **What really works about the game right now?**
            - "The reference sheet" for possible investment options (kind of a menu of actions to take by paying money)
    - Researcher Thoughts:

        - Wildly broken economy (Red team is massively in debt, favors spending despite being in debt).
        - Costs are too costly (easy to get into debt, extreme swings possible though, so at least it's possible to get out of debt if you're lucky)
        - I wonder if we should come up with a rule for paying down debt, but this would require potential for deep debt to be reduced.
        - We're on the edge of a positive feedback look, but the chance is just strong enough that breaking out of the spirals is possible
        - One thing that's working is all those chance elements. The event rolls are both fun, and help resolve some of the balance issues.
        - We don't know how quickly the game can end.
    - All:
        - Setup time is considered good (in that it is brief enough).
        - (All laughing) When people have an unlucky roll, triggering a disastrous event. In general, these D20 rolled events are incredibly popular with the testers.
        - People also really enjoy the positive events they roll.
        - Should fires be permanent disasters? No. It's temporary, but hurts more than it would have as an accumulating cost. (Similarly, should things like wetland changes be permanent. We settled on yes, they should be.)
        - When sea level rises, it removes expanded wetland (without cost).
        - The Red Team had more misfortune from disaster (and therefore were deeper debt), and this resulted in them investing more in prudent long term measures (expanding wetland). Blue Team was luckier (made money early), and this resulted in them looking to expand into risky ventures (develop wetland) to make more money.
        - In addition to reducing potential costs, there should probably be slightly more positive events added relative to the negative events.
        - A lot of laughter and competitiveness from the group. Good sign for the game's fun, even with the broken economy.
        - Time seemed to pass quickly. Another good sign for the early prototype.
        - **"What do you like about this game?":**
            - Participant 4: It's simple. It's not super complicated (like the Great Fire of London game we played). "It's easy and it's fun to understand." And there's a lot of "back and forth" between the teams. It's fun to listen in on the other team's plans.
            - Participant 6: Communication with the other team.
            - Participant 8: Cooperation and Communication are both important.
        - **Is the game fun?:**
            - All: "Yes" "Yup"
        - **Did you learn anything from the game? Gain any insights about disasters?:**
            - Participant 8: Protecting and expanding wetlands can be used as a way to be safe. (From certain water related hazards)
            - Participant 4: Having not just more evacuation structures, but good coverage helps reduce the risk from natural hazards.

May 4th, 2024

- Assessments were retaken.
- Survey sent out again. Participants 1-6, and 8.

Appendix E: Co-Designed Game Prototype

Latest Game Prototype Guide

Disaster Attack: Westport
The Crazy Premise

For reasons beyond comprehension the fabric of reality has yawned open near the small coastal city of Westport and released five titan-sized creatures (called "kaiju") which are settling into new territories on Westport's peninsula. The potentially greater threat may be that the damage to reality has apparently split the city (and everything in it) in two.

Initial attempts to establish peaceful relations between the identical communities have completely broken down as the best panic-driven "Science" in town concludes reality will undoubtedly shake itself completely apart unless one of the two Westports is utterly destroyed.

To achieve this, the two Westports wonder if they could tame the newly arrived Kaiju enough to launch them at their (presumably) evil doppelgangers or if their resources are better spent elsewhere.

Setup

- 2-6 players should divide into two teams.
- Lay down the **two maps** of Westport (red and blue) facing opposite ends of a table.
- Place the **Zone Cards** for each board marked with the school bus on their respective zone (yellow on Docks, purple on Forest, red on Res 1, blue on Res 2, green on School). This shows the defense coverage for each zone's land area with a single Iconic Defense Structure at the school.
- There are four decks of seasonal **Event Cards** for each board (eight decks total), these would need to be shuffled and arranged Spring, Summer, Autumn, and Winter. ((For now there's a reference sheet with each deck and 20 numbered Events. These will be "drawn" by rolling a D20.))
- There's also a sheet with a list of potential investments that can be paid for using city resource credits (marked as 'k'). Some of these have corresponding **Choice Cards** to help mark their use on the board.
- Each team will keep track of their money ((in lieu of physical currency, keep track on a piece of paper)).
- Each team will also have five **Kaiju Cards** each. Each of the wild kaiju have a home territory where they hangout without taking any direction.
- Flip a coin (or use some other system) to determine which team goes first.

A turn in a game consists of five phases, in this order:

- Beginning phase ((Draw seasonal Event Card (start with Spring) / effects board))
- Pre-combat main phase ((incomes/costs/investment decisions))
- Kaiju/Combat phase ((if possible, optionally initiate disaster))
- Post-combat main phase ((immediate recovery decisions / kaiju aftermath))
- Ending phase ((other team's turn begins))

Beginning phase:

- Seasonal Event Card (Beginning with Spring) may:

- Directly impacts (positive/negative) the board conditions
  - Impact grass island/wetland (disaster/buffer building)
    - Provides boost to disaster/buffer building
    - Reduces buffers
    - Sets back disaster building
  - Structures and human industry (incomes/costs)
    - Industry activity being reduced costs income from each zone (for a turn - as an event)
    - Industry activity being advanced adds income from each zone (for a turn - as an event)
- Pre-combat main phase (player team's first decisions / incomes or costs)
  - Without an attack or disaster, incomes are proportionate to functional land area. (So, all things being equal, +50k to a team's credit total.)
  - If a disaster of any kind impacts a zone, the different colored bars indicate the costs associated with different evacuation times from each zone.
    - 'Green' (15 minutes to safety) = x0 costs
    - 'Yellow' (30 minutes to safety) = x1 costs
    - 'Orange' (45 minutes to safety) = x2 costs
    - 'Red-Orange' (60 minutes to safety) = x3 costs
    - 'Red' (75 minutes to safety) = x4 costs
  - Players can begin building disaster investments (creature) through grass island.
    - First decision is to Lure a kaiju to grass island, then Tame it, and finally - during combat - they'll be able to launch it at a random zone in the enemy Westport. Or, once tamed, they can move a kaiju defensively to a zone of their team's choice.
  - Players can also add to income earned per turn on a permanent basis
    - Best way to do this long term is to invest in special defensive buildings in an area - access level determines income/cost associated. Type of building built counters a specific monster's direct damage *better*, and another monster *worse.*
  - If Wetland is reduced to 0 in any zone, the corresponding wild kaiju will behave as a major disaster and the income from that zone will be costs in proportion to the evacuation outlook.
- Kaiju/Combat Phase
  - Any fully tamed Kaiju can be launched randomly at the enemy kaiju
    - When launching roll a D6, to determine where it lands
      - 1=Docks
      - 2=Forest
      - 3=Res1
      - 4=Res2
      - 5=School
      - 6=reroll
    - When an enemy kaiju lands in a zone, any wild kaiju in the area will avoid it, but a tame allied kaiju present will attempt to fight the invader.
      - Each Kaiju has a number of 'tame' points. Once these are reduced to zero, it will return home as a wild kaiju.
      - Both teams roll a D6 to determine which kaiju lands a hit
        - Higher roll hits.
        - A tie also counts as a hit on both kaiju simultaneously.
      - The amount of damage will be -1 Tame, but also will need to factor in adjustments based on which kaiju are fighting and whether there are home-zone advantages.

        - If the invader kaiju wins the fight, both kaiju return home (the enemy kaiju goes back to Grass Island) and all defensive structures in the target zone are cleared (iconic or minor).
        - If the invader kaiju loses the fight, the allied kaiju remains in place (Tame is only restored at Grass Island), the enemy kaiju goes to its home territory as a wild kaiju, and all minor defensive structures are cleared but iconic defensive structures remain in place.
        - More than one tame kaiju can join a fight against an invader, but again, invaders can only arrive at a zone at random.
    - After the Kaiju/Combat phase is over Tame is not restored automatically. It needs to be restored by the Tame action at Grass Island. (Only one Kaiju can fit on Grass Island at a time.)
- Post Combat Phase
    - If an iconic structure was destroyed, no income can be made for the next turn (apart from the invincible +3 safe areas), but a team can purchase (and should prioritize) an iconic structure in order to earn income next turn.
    - **If an iconic structure can't be afforded to protect Westport for two consecutive turns, the city can't recover and all confidence in the city's future will be lost.**
- Other Team's Turn begins (they draw an Event Card, beginning with Spring)

Seasonal Event List

The numbers which follow each event represent an income or a cost which hits the team rolling a number between 1-20 on a D20 dice. The 'z#' is referring to a permanent change in a zone (determined by rolling a D6, with the number identifying the target Docks (1), Forest (2), Res1 (3), Res2 (4), School(5), or if a 6 is rolled – then reroll the D6. These were originally going to be Event Cards, but the youth co-designers found they preferred this list format to reference.

Spring

1. Good Surfing (+10)
2. Storm(-20)
3. MermaidFestival(+20
4. NatureFestival(+10)
5. Sea Level Rise (cut 1 wetland zone)
6. EarthDayFair(+10)
7. FestivalColors(+10)
8. Fire (perm -2 z#)
9. Beach Tourists (+10)
10. EmergencyPrep(+10)
11. KaijuTourism(+60)
12. HungryKaiju(-60)
13. GrouchyKaiju(-80)
14. SleepyKaiju(frozen)
15. Develop(perm +1 z#)
16. ShorebirdLoss(-10)
17. ShrebrdRecover+10
18. LazyDay(nothing)
19. NewResidents(+10)
20. PollutionSpill(-80)

Summer

1. Beach Tourists (+20)
2. Storm(-20)
3. SchoolsOut(+10)
4. KiteFestival(+10)
5. Sea Level Rise (cut 1 wetland zone)
6. SPLASHFestival(+10
7. Fire (perm -2 z#)
8. EmergencyPrep(+10)
9. KaijuTourism(+60)
10. HungryKaiju(-60)
11. GrouchyKaiju(-80)
12. SleepyKaiju(frozen)
13. Develop(perm +1 z#)
14. ShorebirdLoss(-10)
15. ShrebrdRecover+10
16. LazyDay(nothing)
17. NewResidents(+10)
18. PollutionSpill(-80)
19. Researcher Visit+10
20. GrowthSpurt(+1KaijuGrowth Unit)

Autumn

1. CranberryFestival+10
2. Storm(-20)
3. SchoolsStart(-10)
4. EmergencyPrep(+10)
5. Sea Level Rise (cut 1 wetland zone)
6. Fire (perm -2 z#)
7. KaijuTourism(+60)
8. HungryKaiju(-60)
9. GrouchyKaiju(-80)
10. SleepyKaiju(frozen)
11. Develop(perm +1 z#)
12. ShorebirdLoss(-10)
13. ShrebrdRecover+10
14. LazyDay(nothing)
15. NewResidents(+10)
16. PollutionSpill(-80)
17. Researcher Visit+10
18. HalloweenSpirit+10
19. BadStorm(-50, perm-2 z#)
20. GrowthSpurt(+1KaijuGrowth Unit)

Winter

1. King Tide (-10)
2. Storm (-30)
3. Crab Season (+10)
4. Bad Storm (-50 (perm -2 z#))
5. Sea Level Rise (cut 1 wetland each zone)

6. Holiday Tourism(+10)
7. Kaiju Tourism(+60)
8. Hungry Kaiju(-60)
9. Grouchy Kaiju(-80)
10. SleepyKaiju(frozen)
11. Fire (perm -2 z#)
12. Beach Tourists (+10)
13. EmergencyPrep(+10)
14. Develop(perm +1 z#)
15. ShorebirdLoss(-10)
16. ShrebrdRecover+10
17. LazyDay(nothing)
18. NewResidents(+10)
19. PollutionSpill(-80)
20. Researcher Visit+10

EVENT SHEET RULES:
This is the first Event Card test sheet. Roll D20 on turn for the corresponding season (starting with Spring). The corresponding numbered event is what happens.

Examples:
(+10) Means, in addition to the income determined by the board situation, add (+10 'k') to the Westport team bank.

(perm +1 z#) Means marking a permanent additional income unit to the safest (light green to dark red, whichever is safest in the zone) developable land in one of the five zones (to be determined by rolling a D6, if '6' is rolled, reroll).

List of Investment Options

- **Tame/Feed Kaiju** (1 unit of tame) - 100k
- **Calm Kaiju** (stop rage) - 100k
- **Lure Kaiju** (send to Grass Island / defend zone) - 50k
- **Restore/Expand Wetlands** (add 1 block of wetland to a zone) - 50k
    - Once wetland expansion exceeds default, it replaces developable land
- **Build Iconic Defensive Structure** - 300 k
- **Launch Kaiju** ?? ((roll for target zone)) - 50k
- **Build Minor Defense** like seawall (upgrades one block in one zone until destroyed) 50k
- **Encourage Zone Migration** (takes 2 turns; reduce costs/income from one zone by half and add that value onto another, lasts until a disaster hits preferred zone, further investments to reduced zone do not affect the preferred zone - can only use once at a time per board) - 100k
- **Adaptability Measures** (Reduce costs from a zone by half for 2 turns) - 100k
- **Develop Wetlands** (subtract block of wetland to add a risky source of income) - 50k
- **Tourism Campaign** (If you draw a tourism related Event, double the income) - 50k
- **Emergency Services** (If you draw a natural disaster Event, half the cost) - 50k

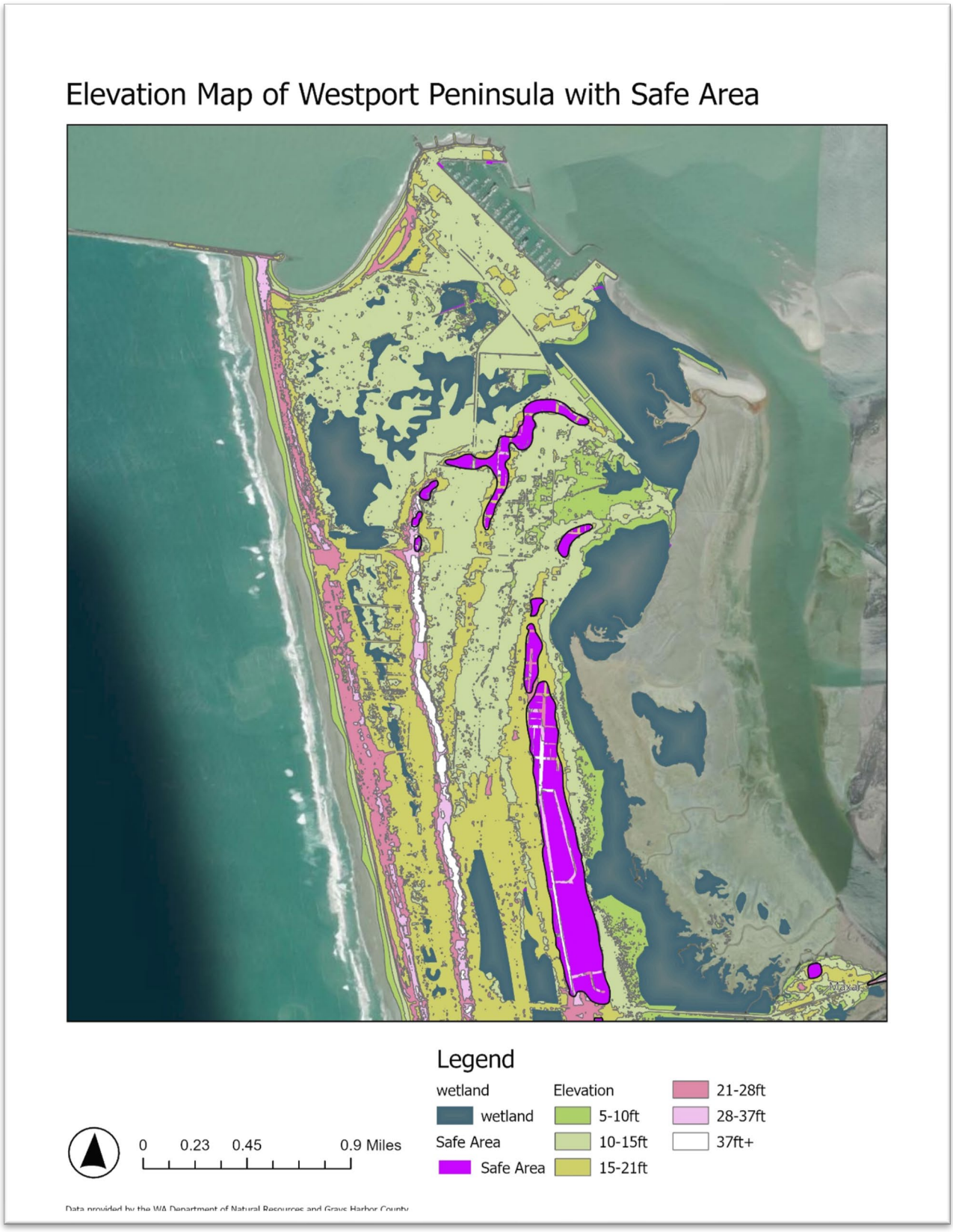
Kaiju Cards (Metaphors for Ecological Partnerships and Natural Disaster)

The combat system was reworked during playtesting such that, when combat is initiated, both sides roll a D10 to determine damage out of 100 total health points (modified by the advantages/disadvantages described on each card). These differences likely need to be refined and rebalanced.

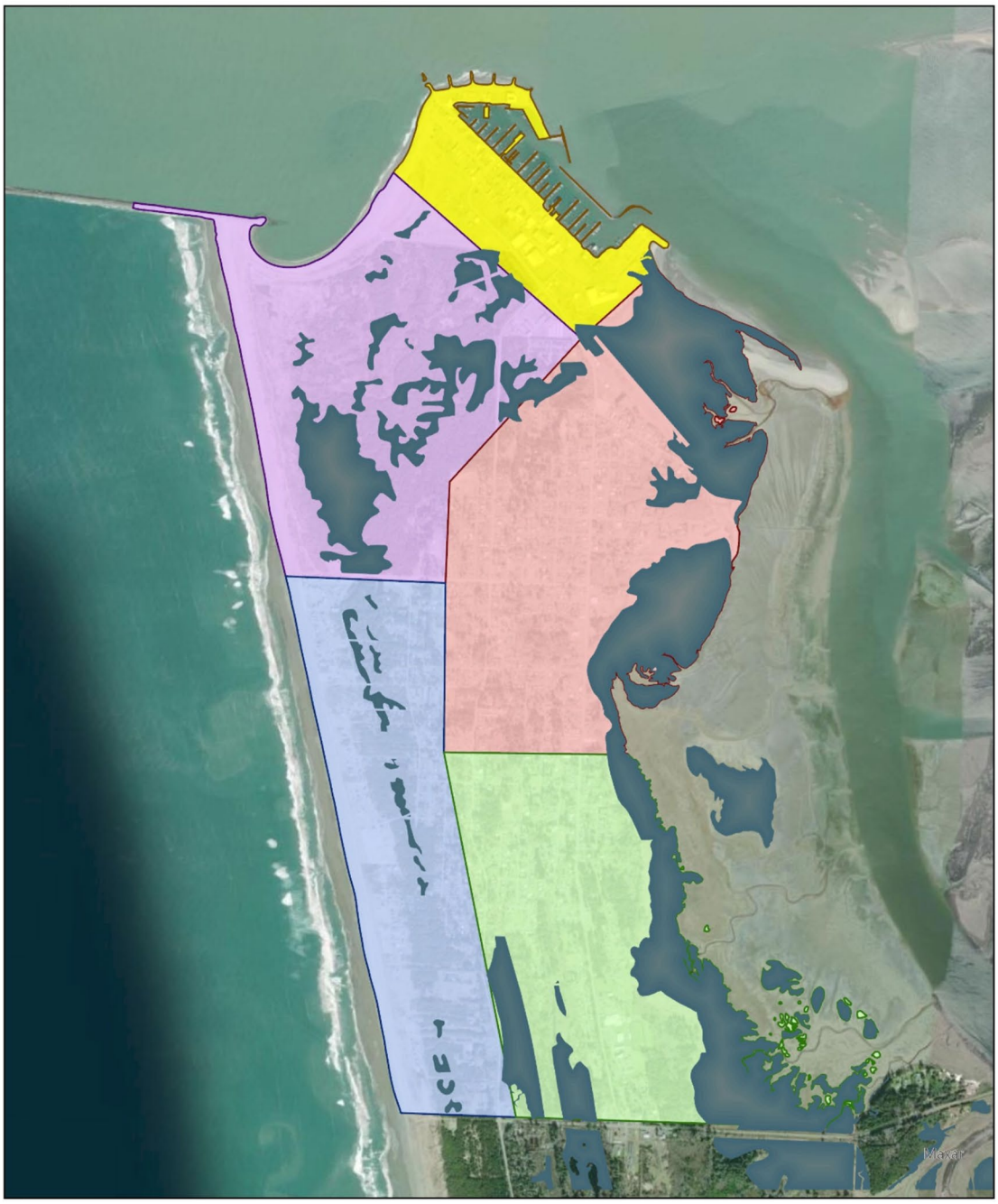
Game Boards (Red board is shown, but Blue is identical except for the hue) and Hazard Risk Cards

The light blue squares on the board represent starting amount wetland available to the zone, pink squares represent permanent safe area (invulnerable to natural disaster). The gray-blue rectangles show where hazard risk cards are placed with the icon in the upper left showing which implemented hazard defenses the risk card is associated with. The one shown in the image shows a school bus (indicating the school defenses), on yellow ground (associated with the Docks zone), and the red-orange and red bars are divided into equal intervals which represent the costs associated with a disaster taking place in the zone (red and red-orange squares are the most costly, and yellow and green are the least costly). This should not be considered a final product. In some future iteration, the final game should be made by the youth co-developers themselves, using their own artistic abilities. This was a placeholder for testing.

Appendix F: Geospatial Mapping Done for Pilot Project

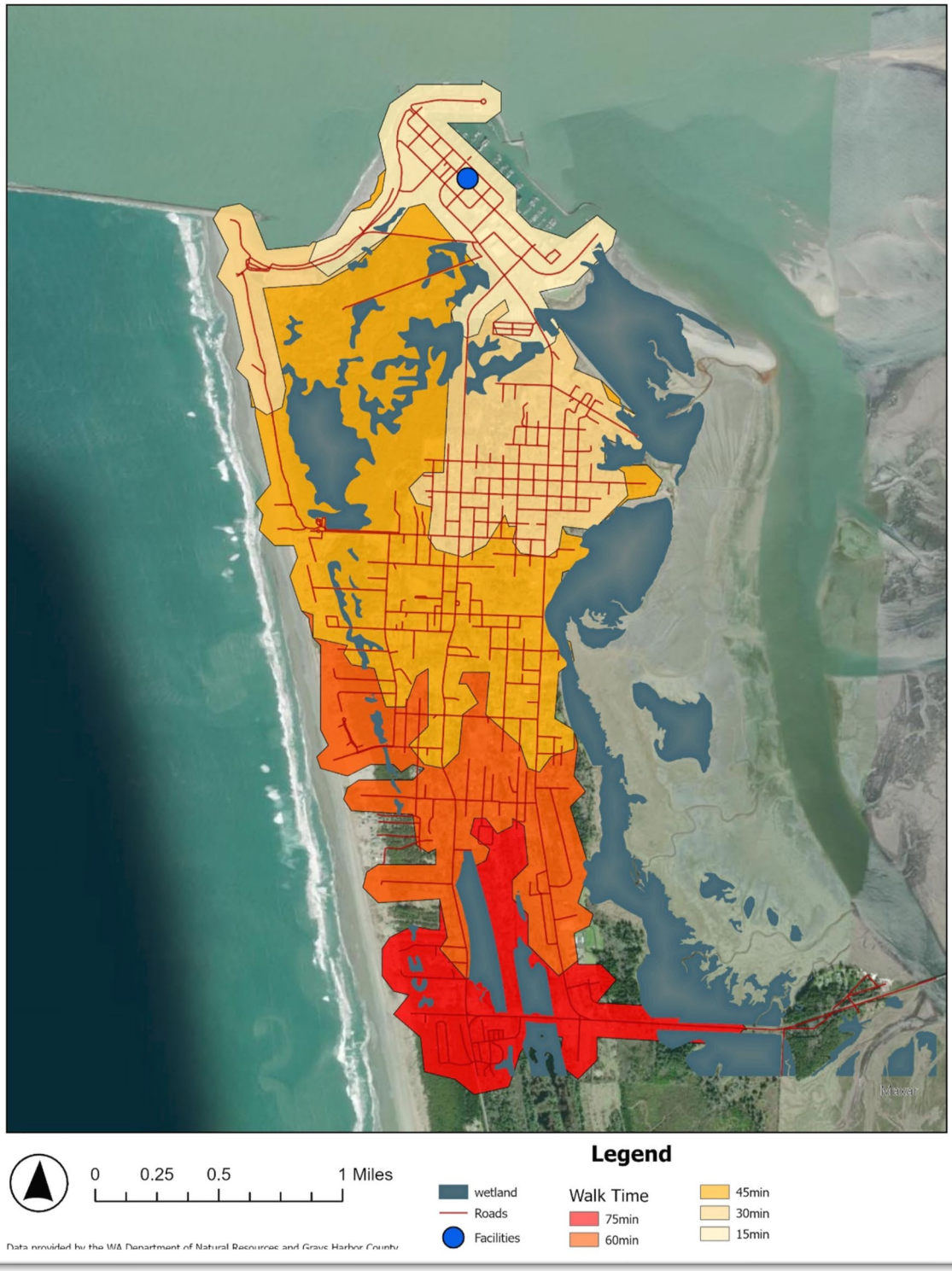


Characteristic Zones of Westport Defined by Young Locals



Westport Walk Time to Hypothetical Vertical Evacuation Facility

(In zone 'Docks' at locally defined site 'Maritime Museum')



Data provided by the WA Department of Natural Resources and Grays Harbor County

Westport Walk Time to Hypothetical Vertical Evacuation Facility

(In zone 'Forest' at locally defined site 'Lighthouse')

0 0.25 0.5 1 Miles

Data provided by the WA Department of Natural Resources and Grays Harbor County

Legend

wetland
Roads
Facilities

Walk Time
75min
60min

45min
30min
15min

Westport Walk Time to Hypothetical Vertical Evacuation Facility

(In zone 'Residential 1' at locally defined site 'Shop N Kart')

0 0.25 0.5 1 Miles

Data provided by the WA Department of Natural Resources and Grays Harbor County

Legend

wetland
Roads
Facilities

Walk Time
75min
60min

45min
30min
15min

Westport Walk Time to Hypothetical Vertical Evacuation Facility

(In zone 'Residential 2' at locally defined site 'Chateau')

0 0.25 0.5 1 Miles

Data provided by the WA Department of Natural Resources and Grays Harbor County

Legend

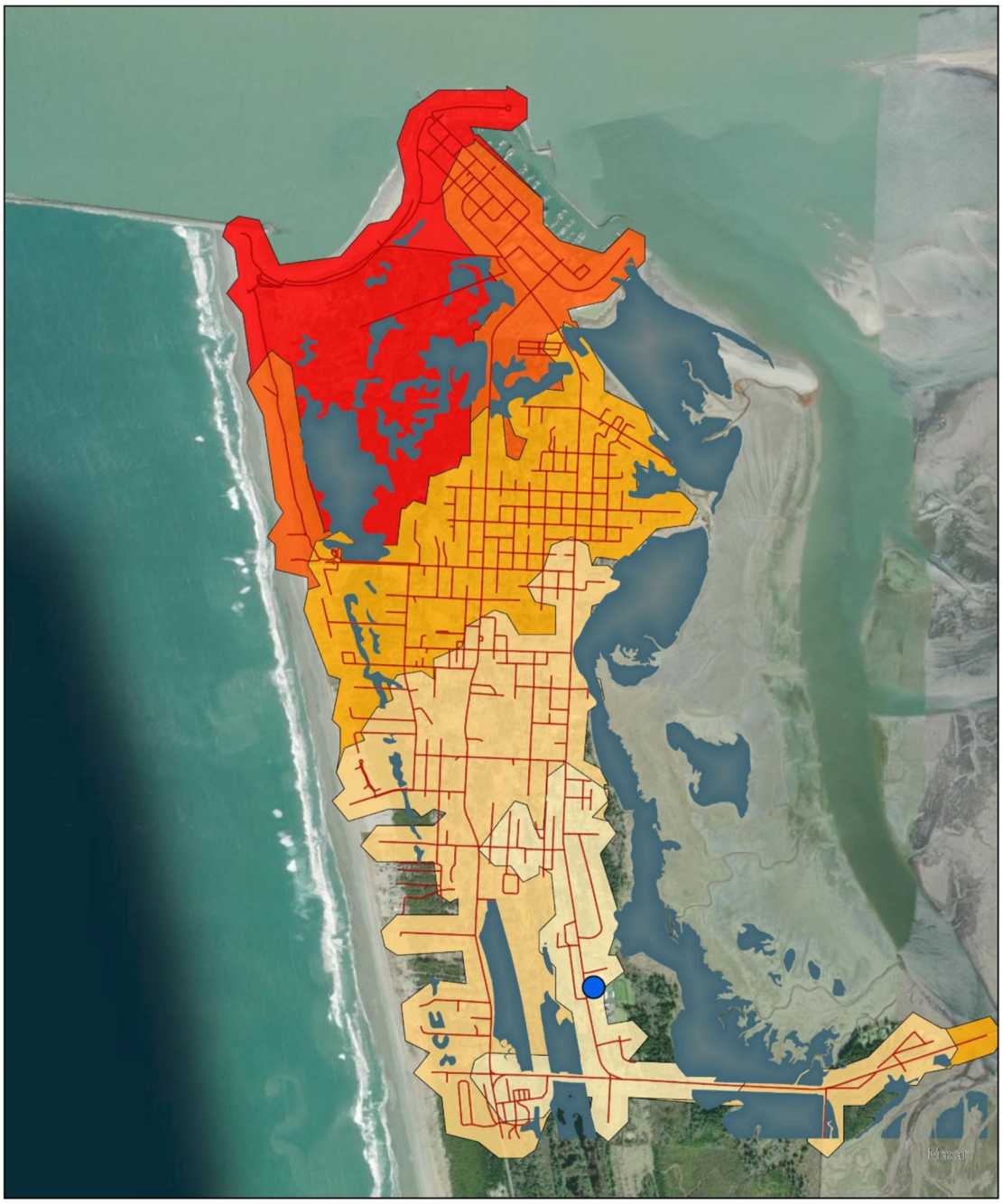
- wetland
- Roads
- Facilities

Walk Time

- 75min
- 60min
- 45min
- 30min
- 15min

Westport Walk Time to Hypothetical Evacuation Facilities

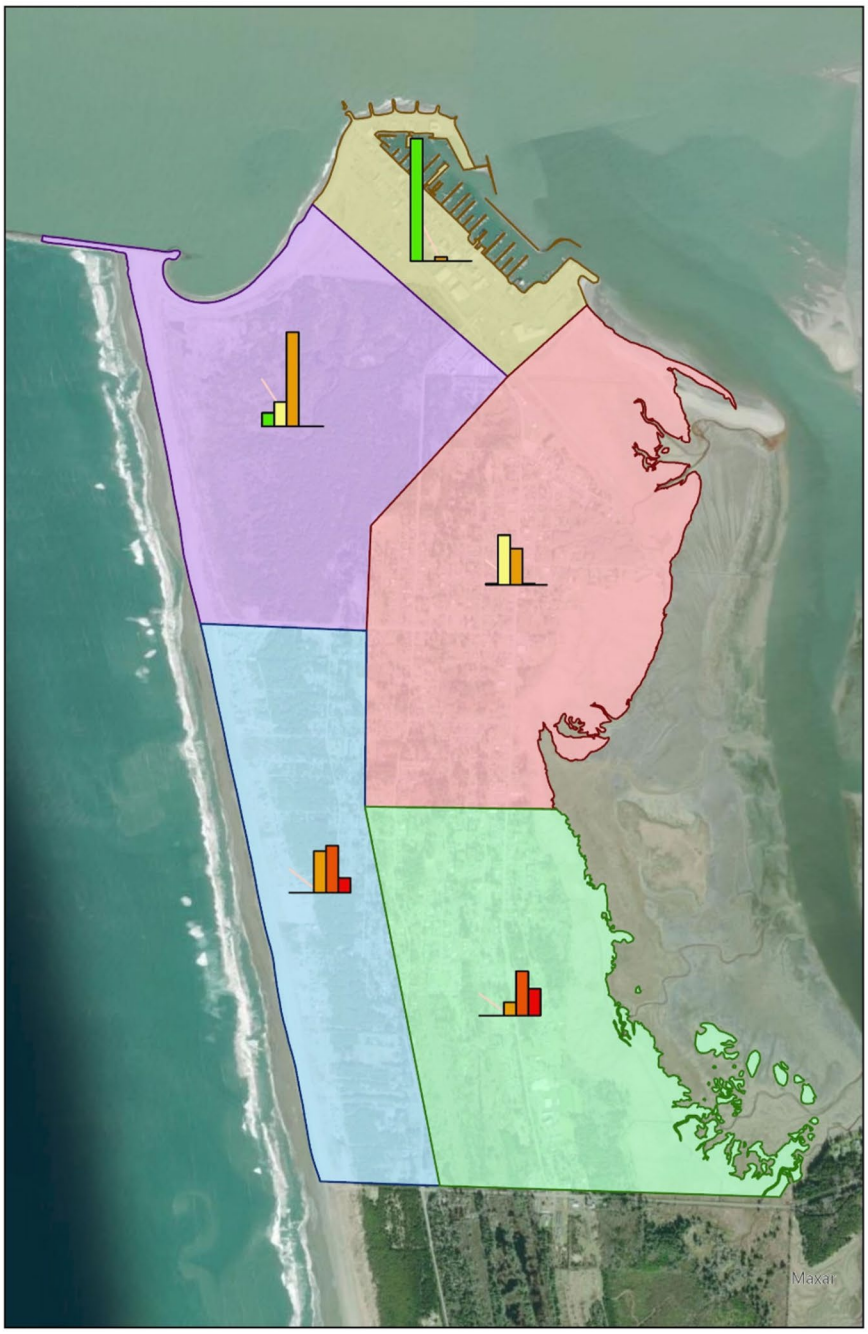
(In zone 'School' at locally defined site 'School')



Data provided by the WA Department of Natural Resources and Grays Harbor County

Walk Time Access to Hypothetical Docks Evacuation Structure

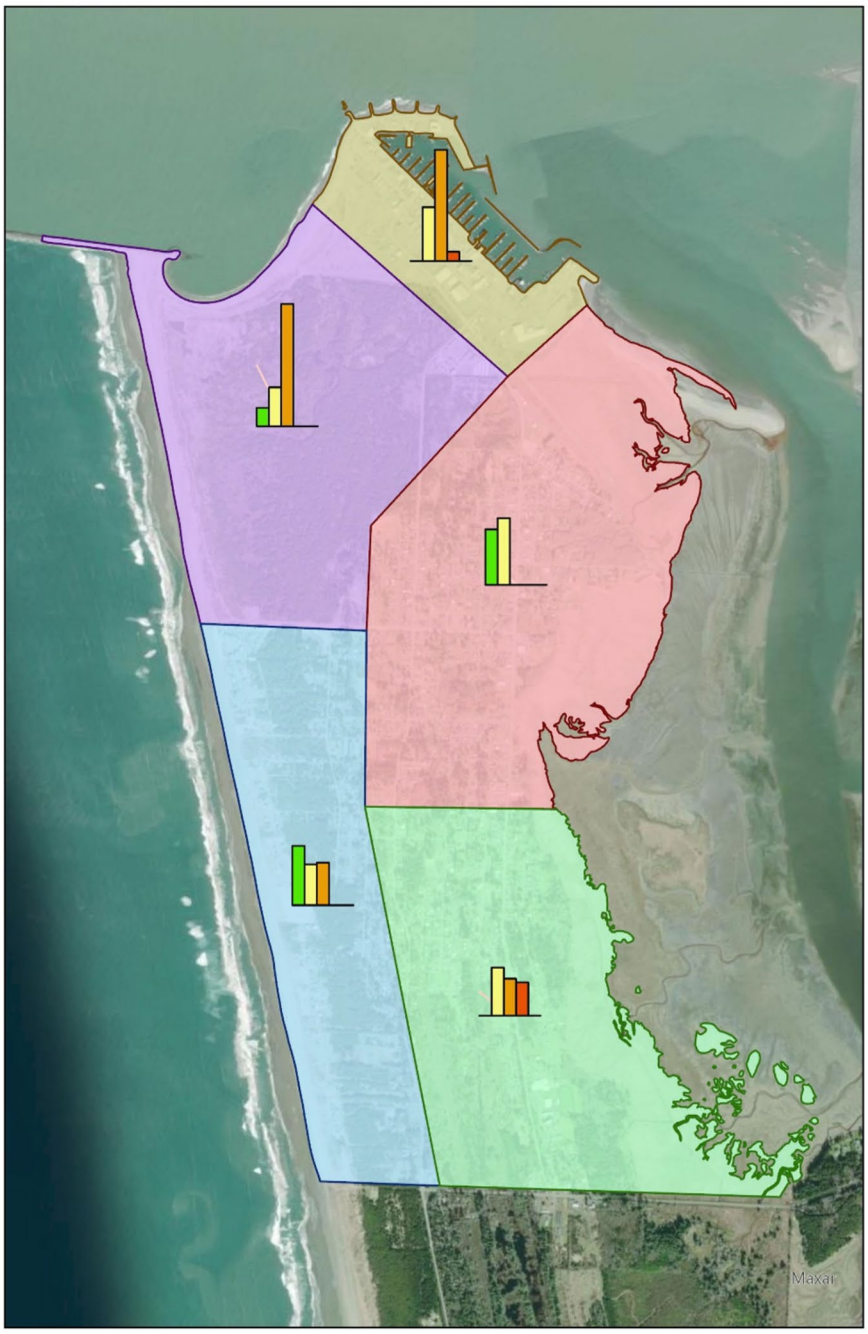
(Based on new Dock VES Network Analysis)



Data provided by the WA Department of Natural Resources and Grays Harbor County

Walk Time Access to Hypothetical Forest Evacuation Structure

(Based on new Forest VES Network Analysis)



Legend

Walk Time to Safety

15 min
30 min
45 min
60 min
75 min

Selected fields

70
35
0

0 0.25 0.5 1 Miles

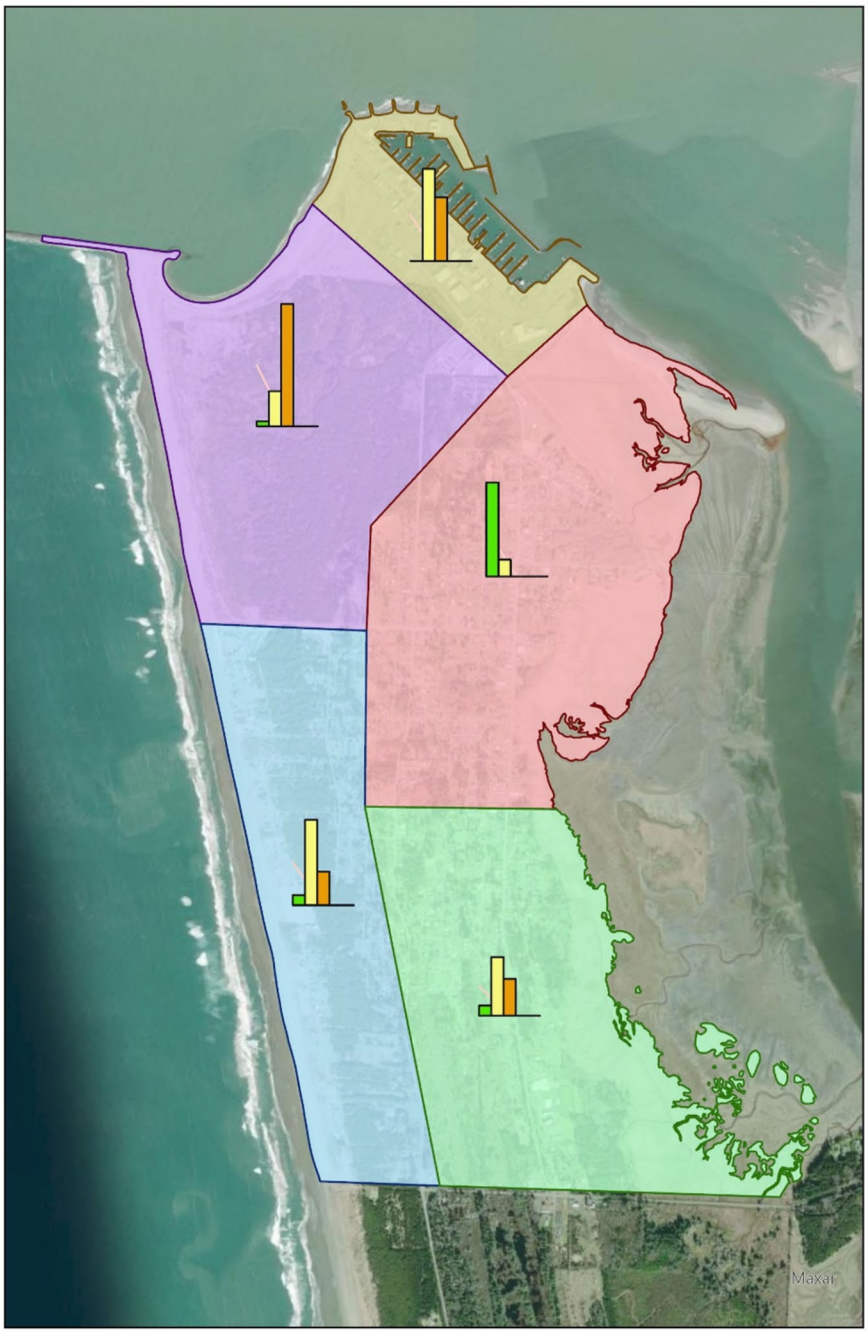
Zones of Westport

Docks
Forest
Residential 1
Residential 2
School

Data provided by the WA Department of Natural Resources and Grays Harbor County

Walk Time Access to Hypothetical Residential 1 Evacuation Structure

(Based on new Residential 1 VES Network Analysis)



Legend

Walk Time to Safety

15 min
30 min
45 min
60 min
75 min

Selected fields

70
35
0

0 0.25 0.5 1 Miles

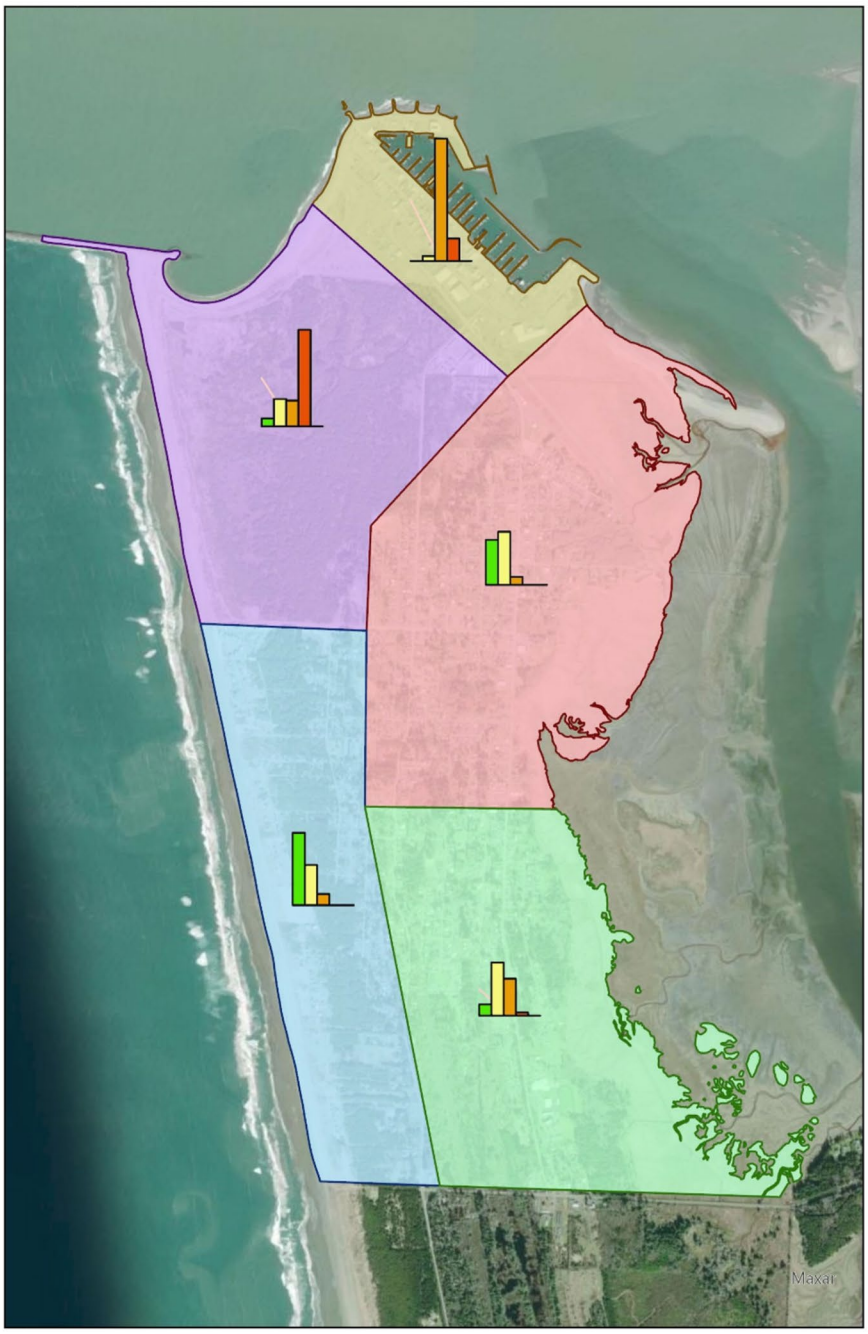
Zones of Westport

Docks
Forest
Residential 1
Residential 2
School

Data provided by the WA Department of Natural Resources and Grays Harbor County

Walk Time Access to Hypothetical Residential 2 Evacuation Structure

(Based on new Residential 2 VES Network Analysis)



Legend

Walk Time to Safety

15 min
30 min
45 min
60 min
75 min

Selected fields

80
40
0

0 0.25 0.5 1 Miles

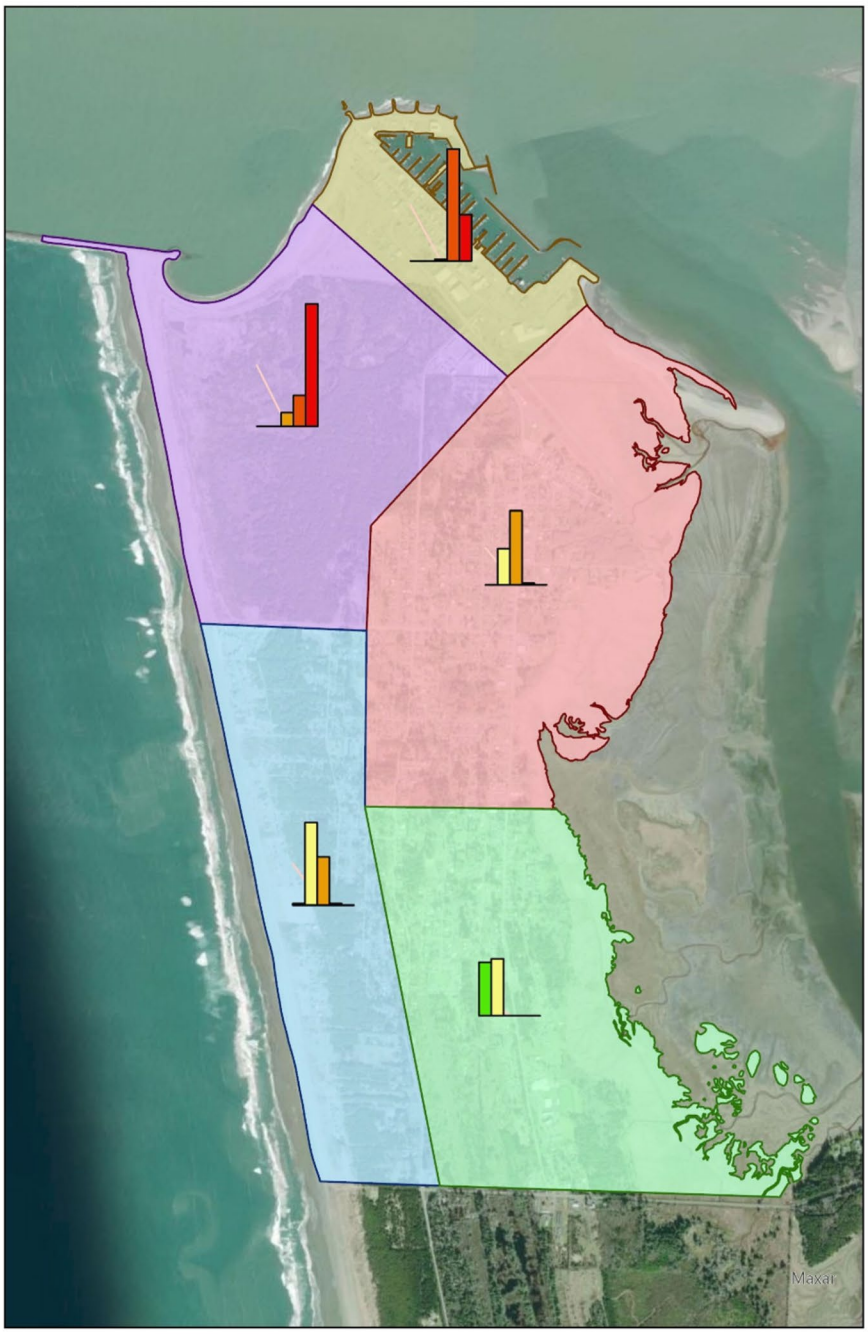
Zones of Westport

Docks
Forest
Residential 1
Residential 2
School

Data provided by the WA Department of Natural Resources and Grays Harbor County

Walk Time Access to Existing School Evacuation Structure

(Based on new School VES Network Analysis)



Data provided by the WA Department of Natural Resources and Grays Harbor County