Not So Different Games: An exploration of five years of student game designers

1st Zoë J. Wood
Computer Science
California Polytechnic State University
San Luis Obispo, CA, USA
zwood@calpoly.edu

2nd Enrica Lovaglio Costello
Art and Design
California Polytechnic State University
San Luis Obispo, CA, USA
elovagli@calpoly.edu

Abstract—Sixty percent of Americans play video games daily, with 45% of U.S. gamers identifying as female. Based on a 2017 survey by the International Game Developers Association, only 22% of the game industry is composed of women, while 81% of all respondents rated diversity in the workplace as important. This begs the question, how can we promote a more gender diverse gaming industry?

Academic settings, such as courses focused on game design, offer the opportunity for women and men to experiment, learn and play, while earning self-confidence and a sense that they equally belong to the field. Diversity of content in gaming is in demand and both genders' perspectives are needed. Understanding how game design approaches may or may not differ across genders can help inform pedagogical and curricular choices within academia. In this study, we observe students' design preferences in the making of video games over a five year period, and analyze how student game designers' choices with regard to elements such as setting and game-play fit into the conversation of promoting inclusive game design.

We examine whether different groups of student game designers create different games. In particular, our study focuses on teams that are composed of at least half female designers and those with less than half female team members. The results from two analyses that examined genre, setting, mood, aesthetic and others, showed no statistically significant difference among the two groups, with the exception of one criterion related to the presence of identifiable enemies. This study points to the fact that shared foci across genders are prevalent, indicating fruitful avenues for future game development that may be broadly appealing and inclusive.

Index Terms—Applied computing Computer games, Software and its engineering Interactive games, Social and professional topics: Gender

I. INTRODUCTION

Games are big business. Video game revenue in 2012 was valued at $14 billion and is expected to grow to $29 billion in 2021 [1]. However, the game industry and player community have a complex and sometimes hostile relationship towards the inclusion of women and girls. Events like Gamergate [2] bring into question how the lucrative gaming industry can embrace inclusivity and create games equally appealing to women and men. In this paper, we explore some of the factors that could contribute to promoting a more inclusive gaming community. We specifically examine whether the gender make-up of a team of students building their own games collaboratively reflects any differences in choices related to game play, mode and setting. We use this lens of study to explore broader questions of game design, genre and inclusivity.

II. BACKGROUND AND RELATED WORK

Despite gaming's reputation as a male dominated arena, an often quoted statistic from the ESA is that 38-48% of gamers are women (the number has varied over the last decade) [1]. However, even with a large percentage of the market being female, the game industry is still dominated by a narrow range of genres with action, sports and battle royale games topping the global market in 2018 [3]. One school of thought in terms of creating a more inclusive gaming community is to market games targeted for girls and women [4], however, this has been shown to be problematic [5]. An alternative is the promotion of female game designers and more inclusive games with appealing female characters. Yet another approach is generating games that are widely appealing to all players. The latter approach is at the center of our research and the current study.

When searching for a more inclusive gaming industry, it is important to examine what motivates individual players. In 2017 Quantic Foundry conducted a study [6] with 270,000 gamers that examined player motivation. This study found large variance in the percentage of players within a given genre based on gender. For example, 69% of the gamers playing Match-3 or family/farming simulators are female, while 98% of those playing sports games are male. This data seems to indicate that males and females prefer different games. However, genres such as casual puzzles, atmospheric exploration, interactive drama and high fantasy MMO are relatively popular with both genders (with approximately 40% female players and 60% male players). This points to the fact that there are genres that are more broadly appealing.

Moreover, the same Quantic Foundry study examined whether different players were motivated by different aspects of games, concluding that different primary motivations drive female and male players. For example, women prefer to complete games and become immersed in digital worlds, while in general men value competition and destruction. However,

the variance of the importance of competition between older males and younger males is twice that of the one between the genders [7]. This points to the fact that perhaps what motivates gamers in general is not completely gender coded. Similar work, examining middle school students choices [8], found that girls and boys designed and built very similar games.

Working to create a more inclusive gaming industry can start in academic settings, with instructors playing a key role in creating an environment to promote both female and male students' comfort and creative abilities [4], [9], [10]. Promoting women in computer science via modifications to educational settings is of high interest [11], [12]. Some successful programs closely related to the interactive entertainment industry include Georgia Tech's long history of promoting a more diverse computing student population via their 'media computation focus [13], [14]. Similar programs likewise report impressive gender mixes in their student body. Barker, et al. [15] report that 52% of the students enrolled in a similar program focused on interactive entertainment are women, and 62% of their graduates are women. A recent publication, examining a six year longitudinal program of Computing in the Arts, reports that 45.5% of its graduates are female (compared to only 19% females in their more traditional computing major) [16]. However, degrees focused solely on game design have variable demographics. For example the UCSC game design major has 15% female majors, while their traditional computer science major has 21% female majors [17]. When seeking to promote women in computing (and specifically game design), what can we learn from student game designers?

III. Setting

Within the context of academia, our study aims to examine how student game designers fit into questions of gender, genres and 'differences'. In particular we present an exploration of five years of student game designs from a traditional computer science program. Our institution does not offer a game design major, but it does offer an 'Interactive Entertainment' concentration for computer science majors. In addition, female participation in our computer science major has increased from 9% in 2009 to 25% from 2014 onwards. We seek to further promote the participation of women in computing including game design and interactive entertainment. More broadly, however, we seek to use our study to consider pedagogical methods for promoting gender inclusive game design.

This work was conducted at a large polytechnic University where the majority (90%) of the games were produced in an upper-division computer science course that required substantial programming experience. The course is a quarter long course (10 weeks) and all games were built from scratch using C++ and OpenGL for the graphics API. Teams were formed of the students' choosing, with any student allowed to pitch a game and any student allowed to join any pitched game as long as the teams final composition included 3-6 participants. This course has been taught by one of the authors since 2004, however, only games from the last five years

(2013 onward) were used, partially due to the fact that only more recently did a viable number of 'at least half female' teams exist. Teams are required to include a specific list of technical computer graphics requirements for each game and are instructed to only pitch games which are appropriate to an academic setting, both of which somewhat constrain game design choices. For example, no completely 2D games are allowed as the course learning outcomes focus on primarily 3D rendering techniques. Once teams are formed however, all student team members are required to contribute to the game design and realization equally. In this way, we examine student game designers' choices within the context of considering all team members as equal contributors to the final game design.

We consider the team make-up and game designs of 197 student game designers (33 of which are female). Specifically, we examine whether different groups of student game designers created different games with a focus on teams that are composed of at least half female designers and those with less than half female team members. In the context of this study *all team members* play the role of 'game designer' on their team as the games are truly a collaborative effort.

This study analyzes the work of 35 teams of three to six students each, who designed games using low level graphics APIs within a computer science class context. Based on the results from two surveys, that targeted genre, setting, mood, aesthetic and others, we can say that no statistically significant difference among the two groups was detected, aside from one criterion related to the presence of identifiable enemies. Our findings highlight the shared foci of student designers, indicating shared interests and motivations of young game designers. We feel that this examination of shared student game designers choices re-frames creative avenues for future game designs that can capture a broad and inclusive audience.

IV. Measures

To measure various aspects of student game designers' choices, we considered metrics that have been used in other settings to examine games. For example, we considered if the priorities of the game designers could be assessed in a similar fashion to the player motivations used in the Quantic Foundry study [6]. We also considered several measures of games [18], including aesthetics, such as Realism vs. Surprise and Coherence [19] and level of abstraction [20]. Similarly, we considered if it was valuable to examine the space used in the games similar to the work of Gingold [21].

We composed an initial survey with 28 questions and recruited two reviewers who were comfortable with the domain of video games and were not aware of the teams' gender composition, nor that their responses would be grouped based on team composition. Specifically, games were analyzed by a senior undergraduate whose studies focused on video games and a post-doctoral researcher who is very experienced with making games with the Unity game Engine. Both completed the analysis for all 35 games created by viewing videos of the game play.

The responses were evaluated with consideration for inter-rater reliability and some questions were removed from the study. We removed one set of questions related to game aesthetic because they had too much inter-rater variance, due to the fact that we failed to provide examples or context, thus independent perspectives varied too much. Lack of data forced us to remove another set of questions about motivations. For these questions, the reviewers seemed unwilling to assess game designers' priorities/motivations and most often skipped assigning numeric values to potential priorities (For example, one question in this section asked "Did the game designer prioritize that the player can finish/complete the game?", etc.,).

Eight of the questions, which were more quantitative than qualitative, were retained due to acceptable inter-rater reliability (fair to moderate agreement (Cohen's kappa coefficient) between the two reviewers). The questions retained for *survey 1* include:

1) Q1: Select as many of the following aspects which describe the setting of the game: *mostly urban setting (houses, car, roads, etc.), magical (fantasy), mostly natural setting (mountains, hills, plants, etc.), technology (robots, spaceships, etc.), other (with examples)*
2) Q2: Select as many of the game play elements that are present in the game:*collecting items, cooperative play, conflict driven encounters with hostile world, social justice themed game, racing against time or others, exploration based*
3) Q3: Are there identifiable enemies in the game(as opposed to just challenges or adversity)?: yes/no/maybe
4) Q4: How coherent is the artistic style of the game (i.e. the style of the characters match the style of the world and the game has a coherent style in general) (5 point Likert scale from 'very random' to 'very coherent')
5) Q5: Is the games syntonic? (Psychology characterized by a high degree of emotional responsiveness to the environment)?(5 point Likert scale from 'Not much emotional engagement' to 'very emotionally engaging')
6) Q6: How responsive is the world to the character (i.e. can the user change or effect the world, are there dynamic elements in the world)(5 point Likert scale from 'static, unresponsive' to 'dynamic, interactive world')
7) Q7: Did the designer create a world that is (Sense of space):*large/ vast, small/contained, made of different connected space, open, enclosed, labyrinthic, other*
8) Q8: What was the mood of the game: *happy/cartoon like, creepy/scary, action/adventure, suspense/expectation, promoting exploration and curiosity, strategic/battle focused*

Due to the realization that some of the more aesthetic questions needed guidelines and examples for evaluation, a second study was created with more structure for these types of questions. This second survey included example images and game references for the aesthetic questions. The same experienced reviewers evaluated a subset of 24 games (to reduce work load for the reviewers). The survey included

questions about the primary motivation of the game designer (similar to the Quantic Foundry study). These once again failed to garner information, leading us to conclude that examining game designer motivation from an outside perspective is perhaps an overly qualitative question.

The revisions to the aesthetic questions resulted in fair to moderate agreement (Cohen's kappa coefficient) between the two reviewers. Thus, the viable questions from *survey 2* include:

1) Q1: Did the designer use colors that are: *5 point Likert scale ranging from 'bright/highly saturated' to 'muted' and with example images from games provided for the two extremes*
2) Q2: Did the designer create a world in which: *5 point Likert scale ranging from 'elements are proportionate and realistic' to 'proportions or views are not realistic' with three example images from games showing three examples*
3) Q3: The design hierarchy generates the following: *5 point Likert scale ranging from 'eye is overwhelmed (not clear where to look)' to 'there is a clear distinction visually between protagonist and secondary elements in the game' and with example images from games provided for the two extremes*
4) Q4: Is the light: *5 point Likert scale ranging from 'high contrast for focus (lead viewer's eye) or drama' to 'flat, diffused, soft, low exposure' and with four example images from games demonstrating examples*
5) Q5: The player's view is from the perspective of a: *first person, third person, side scroller, top-down, fixed camera*(with example games titles provided for each)

V. ANALYSIS

Survey responses were assessed for inter-rater reliability and for statistical significance. Data was grouped between teams composed of 'at least half female game designers' (denoted 'alhf', with 8 teams) and those with 'less than half female game designers' (denoted 'lthf', with 27 teams). See Table I for the listing of the team members, percentage of females and one reviewer's classification of the setting. See Figure 1 for details about aggregate classification of setting.

Results from the analysis of the games show interesting trends in student game designer choices. Using a chi-squared homogeneity test, all questions but one showed that any observed variance was not statistically significant when comparing these groups. In other words, the student designers, whether there were at least half female designers or less then half female designers, made similar choices with respect to game design.

a) Commonalities: For question one (Q1) from survey one about setting, there were games found in all settings, including, mostly urban setting (houses, car, roads, etc.), magical (fantasy), mostly natural setting (mountains, hills, plants, etc.), technology (robots, spaceships, etc.), and other. And although a larger percentage of the alhf teams set their

label	team size	percent female	setting
t1	3	100%	magical (fantasy)
t2	4	100%	magical (fantasy)
t3	3	100%	other
t4	3	100%	mostly natural setting
t5	3	66%	magical (fantasy)
t6	4	50%	mostly natural setting
t7	4	50%	mostly natural setting
t8	4	50%	mostly urban setting
t9	6	33%	magical (fantasy)
t10	6	33%	mostly natural setting
t11	3	33%	magical (fantasy)
t12	4	25%	mostly urban setting
t13	5	20%	mostly natural
t14	5	20%	magical (fantasy)
t15	5	20%	magical (fantasy)
t16	5	20%	mostly urban setting
t17	5	20%	magical (fantasy)
t18	6	15%	mostly natural setting
t19	6	15%	mostly urban setting
t20	6	0%	mostly urban setting
t21	4	0%	magical (fantasy)
t22	5	0%	other
t23	6	0%	mostly urban setting
t24	5	0%	other
t25	5	0%	magical (fantasy)
t26	6	0%	magical (fantasy), mostly urban
t27	6	0%	magical (fantasy)
t28	6	0%	other
t29	3	0%	magical (fantasy)
t30	3	0%	technology
t31	3	0%	mostly urban setting
t32	4	0%	other
t33	5	0%	magical (fantasy)
t34	3	0%	mostly urban setting
t35	5	0%	other

TABLE I
SUMMARY INFORMATION ON TEAM MAKE UP AND ONE CLASSIFICATION OF GAME SETTING

Fig. 1. Classification of all student games grouped together based on setting (survey 1, Q1), *mostly urban setting (houses, car, roads, etc.), magical (fantasy), mostly natural setting (mountains, hills, plants, etc.), technology (robots, spaceships, etc.), other*. Data shown as a total count for each response of total games for survey 1.

Fig. 2. Classification of all student games based on game play (survey 1, Q2), *collecting items, cooperative play, conflict driven encounters with hostile world, social justice themed, racing against time or others, exploration based*. Data shown as a total count for each response of total games for survey 1.

games in a natural setting (50% versus less than 20% for lthf), the p value for this test was 0.346 (i.e. not significant).

When considered in aggregate the data about setting is more interesting. Figure 1 shows that when categorized together, we see that a magical setting is widely appealing to all student designers with 50% of all games being set in a magical/fantasy setting. This is consistent with the Quantic Foundry finding that high fantasy is popular with both male and female players. The next most popular setting is nature with 25% of the games in this setting.

Similarly for Q2 from survey one about game play, over 70% of at the alhf teams primary game mechanic is collecting versus 40% for lthf teams, however, a chi-squared homogeneity test results in a p-value of 0.279. Figure 2 shows again that considering the student games as a unified group shows interesting trends in game play with collecting and racing being the most popular game-play mechanics. Table II also shows the game-play classifications of the teams along with game mood and the presence of identifiable enemies.

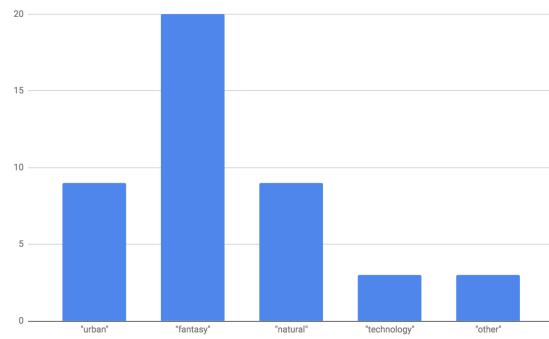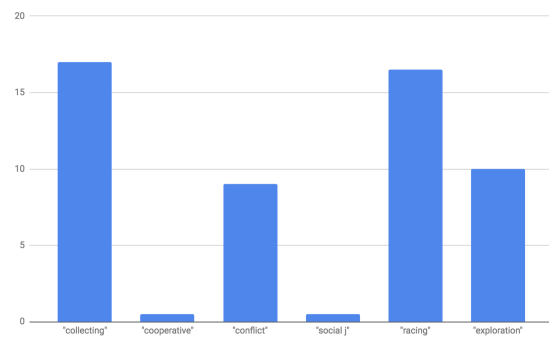For questions 4, 5 and 6 from survey one, again variance is observed between the groupings of the games. These questions, which included a 5 point Likert scale response, were binned into two categories to distinguish games which demonstrated a higher than average or not coherency of the art style (Q4), syntonicity (Q5) or responsiveness of the world (Q6). Figures 3, 4, and 5 show that even when plotting the two different responses of the groupings, one can observe that the student designers were fairly consistent with most games demonstrating:

- good consistency with art style (Figure 3)
- mixed sytonicity (Figure4)
- in general including less responsive worlds (Figure 5).

The fact that student games tended to have less responsive worlds is most likely due to time constraints for a 10 week game development cycle, however, the other factors in some ways contradict gender expectations such as females being more 'artistic' [22].

In terms of the kinds of spaces and moods the student game designers created, again when looking at chi-squared homogeneity for these questions between the grouping alhf and lthf, the p-values were too large for any differences to be considered significant. When considering differences in spaces, $p = .73$. This particular large p-value may be due to too few samples for the number of spatial categories allowed
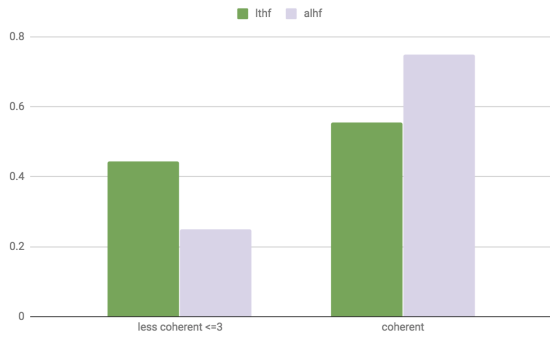
Fig. 3. Classification of student games grouped by alhf and lthf for 'how coherent is the artistic style' (survey 1, Q4) using (5 point Likert scale from 'very random' to 'very coherent') binned and shown as percentage. Difference is not statistically significant with chi-squared homogeneity $p = .32$.
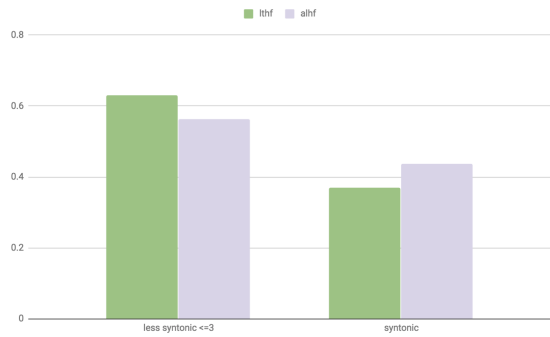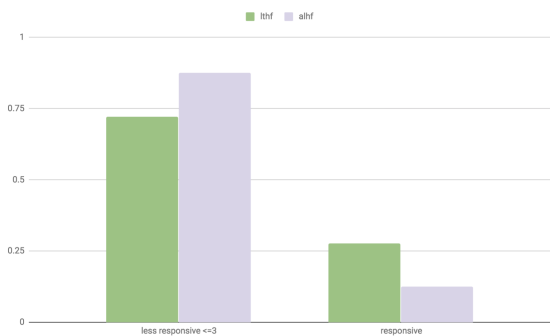

Fig. 4. Classification of student games grouped by alhf and lthf for 'is the games syntonic' (survey 1, Q5) binned and shown as percentage. No statistically significant difference measured using a chi-squared homogeneity $p = .73$.

Fig. 5. Classification of student games grouped by alhf and lthf for 'is the world responsive' (survey 1, Q6) binned and shown as percentage. Difference are not statistically significant with chi-squared homogeneity $p = .36$.
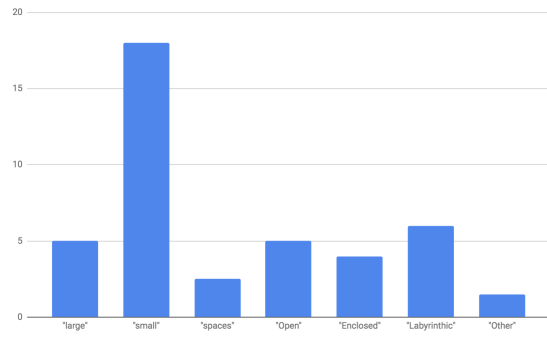

Fig. 6. Classification of all student games based on spaces (survey 1, Q7), *emphlarge/vast, small/contained, made of different connected space, open, enclosed, labyrinthic, other*. Data shown as a total count for each response of total games for survey 1.
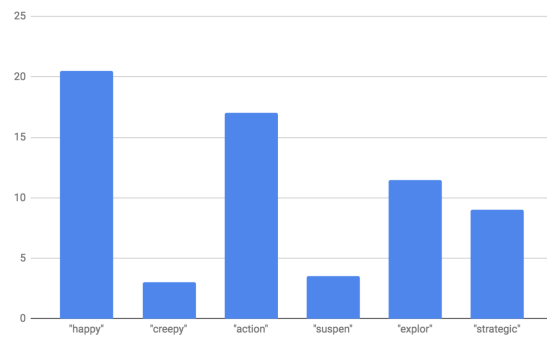

Fig. 7. Classification of all student games based on mood (survey 1, Q8), *happy/cartoon like, creepy/scary, action/adventure, suspense/expectation, promoting exploration and curiosity, strategic/battle focused*. Data shown as a total count for each response of total games for survey 1.

in the survey. In addition, although over 75% of alhf games are 'happy' compared to only 50% of the lthf games, $p = 0.39$ for the differences in mood. Once again, considering the results jointly reveals interesting commonalities. When considered in aggregate, overall the student designers strongly preferred 'happy' and 'action' based games (Figure 7 and Table II). In addition, as shown in Figure 6 it is clear that 'small' spaces are most common. This in part may be due to the constraints on game building in the course format, while the other choices are clearly a matter of student preference.

The primarily art and design focused questions in survey 2, likewise showed no statistically significant difference when using a chi-squared homogeneity test on the alhf and lthf groupings of the student designed games. These questions again, although originally expressed on a five point Likert scale, were analyzed by considering just a binary grouping of the games when computing statistical significance. From these questions we can see that student games tend towards:

- muted colors (Figure 8)
- normal proportions (Figure 9)
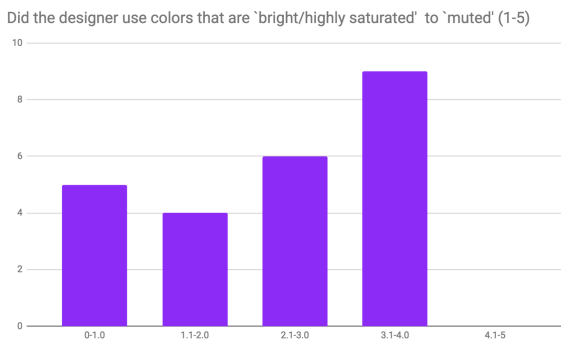- normal lighting, neither being too high contrast nor too flat (Figure 11)

Fig. 8. Classification of all student games based on color (survey 2, Q1), using a five point Likert scale ranging from 'bright/highly saturated' to 'muted', shown as the total games for each response for survey 2. Cohen's Kappa $= 0.75$, indicating good inter-rater agreement, but $p = 0.85$ indicating no statistical significance when comparing gender groupings.

Fig. 10. Classification of all student games based on design hierarchy (survey 2, Q3), using a five point Likert scale ranging from 'eye is overwhelmed (not clear where to look)' to 'there is a clear distinction visually between protagonist and secondary elements in the game', shown as the total games for each response for survey 2. Cohen's Kappa $= 0.6$, indicating moderate agreement, but $p = 0.23$ indicating no statistical significance when comparing gender groupings.
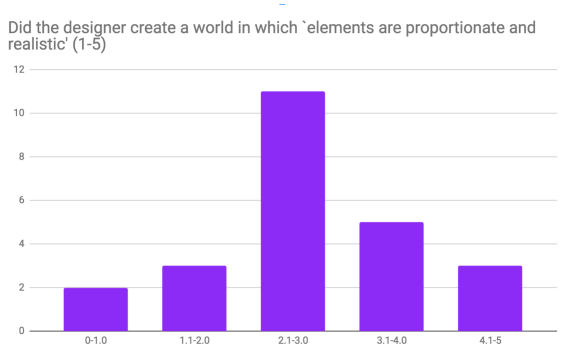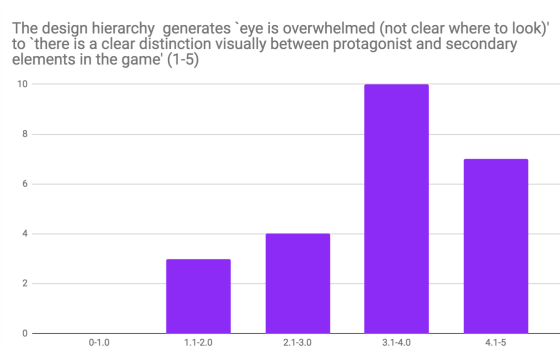

Fig. 9. Classification of all student games based on proportion (survey 2, Q2), using a five point Likert scale ranging from 'elements are proportionate and realistic' to 'proportions or views are not realistic', shown as the total games for each response for survey 2. Cohen's Kappa $= 0.34$, indicating fair agreement, $p = 0.85$ indicating no statistical significance when comparing gender groupings.
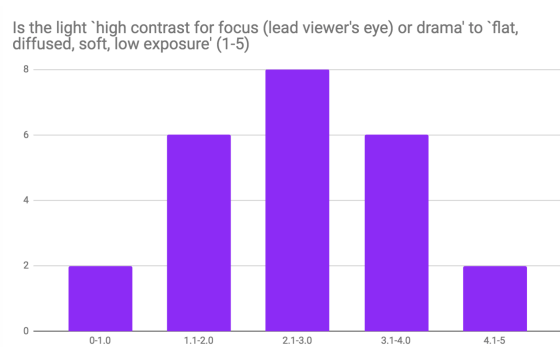

Fig. 11. Classification of all student games based on light (survey 2, Q4), using a five point Likert scale ranging from 'high contrast for focus (lead viewer's eye) or drama' to 'flat, diffused, soft, low exposure', shown as the total games for each response for survey 2. Cohen's Kappa $= 0.34$, indicating fair agreement, but $p = 0.27$ indicating no statistical significance when comparing alhf and lthf groupings.

Analysis likewise showed that students are creating games with fairly good design hierarchies. Figure 10 shows that, over all, the games do not overwhelm the eye of the viewer, with 71% of all the games including good distinctions between the protagonist and the secondary elements in game. And not surprisingly, Figure 12 shows that student game designers mostly created games with a third person camera (42% of all games analyzed).

b) Variance: The one criteria which showed a statistically significant difference when grouping the games between teams with at least half female and those with less than half female was Q8 in survey 1: "Are there identifiable enemies in the game (as opposed to just challenges or adversity)?: yes/no/maybe". Figure 13 shows the variance in the presence of identifiable enemies, which the chi-squared homogeneity test of $p = .039$.

Limitations It is worth noting that within the context of our study there are limitations based on the setting. For example, students are limited to a short ten week time frame, thus they mostly make single player games with a relatively
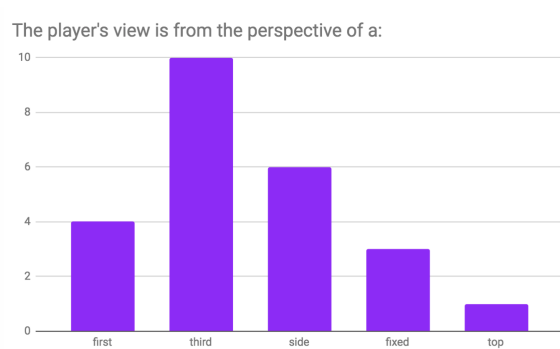

Fig. 12. Classification of all student games based on player's view: *first person, third person, side scroller, fixed camera, top-down* (survey 2, Q5), shown as the total games for each response for survey 2.
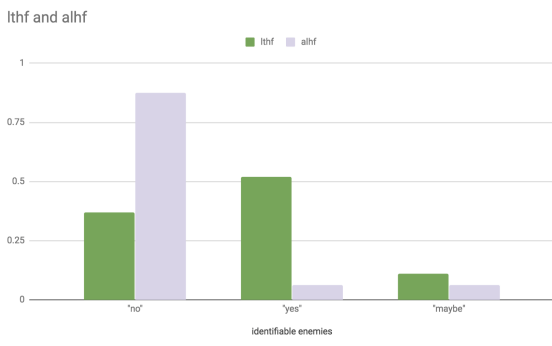
Fig. 13. The presence or lack of identifiable enemies is the only criteria shown to have a statistically significant difference measured using a chi-squared homogeneity between alhf and lthf teams, $p = .039$. The data shown here is the percentage of the total games with yes, no or maybe responses .

label	game play	game mood	identifiable enemies
t1	1, 5	h, a	no
t2	3	h, a, str	yes
t3	1, 3	a	no
t4	1, 6	h, a, ex	no
t5	1	ex	no
t6	6	ex	no
t7	5	h, a	no
t8	1, 6	h, a	no
t9	5	h	yes
t10	1	cr, str	no
t11	3, 6	sus, str	yes
t12	5,6	cr, ex	maybe
t13	3	h,a	yes
t14	3	str	yes
t15	3	h, str	yes
t16	3, 6	a, sus, str	yes
t17	1	, a, ex	no
t18	1, 3, 5	h, a, str	yes
t19	1, 5	a, ex	maybe
t20	3, 6	h, a, str	yes
t21	1, 3	a, str	yes
t22	5, 6	a, str	no
t23	1, 3, 5, 6	a, sus, ex, str	yes
t24	1,5	h, str	no
t25	3	sus, str	yes
t26	1, 3,6	a, ex, str	yes
t27	1	a	no
t28	1, 5	a	yes
t29	1, 3, 6	h, cr, str	yes
t30	6	a, ex	no
t31	5	h, cr, ex	no
t32	5	a,ex	yes
t33	5	h, a	no
t34	5	h, a	maybe
t35	3	a, str	yes

TABLE II

SUMMARY INFORMATION ON GAME PLAY AND MOOD. FOR GAME PLAY, NUMBERS DENOTE: (1) COLLECTING ITEMS, (2)COOPERATIVE PLAY, (3)CONFLICT DRIVEN ENCOUNTERS WITH HOSTILE WORLD, (4) SOCIAL JUSTICE THEMED GAME, (5) RACING AGAINST TIME OR OTHERS, (6) EXPLORATION BASED. FOR GAME MOOD, LETTERS DENOTE: (H) HAPPY/CARTOON LIKE, (CR)CREEPY/SCARY, (A)ACTION/ADVENTURE, (SUS) SUSPENSE/EXPECTATION, (EX) PROMOTING EXPLORATION AND CURIOSITY, (STR) STRATEGIC/BATTLE FOCUSED

straight forward map. The number of networked multi-player games is limited to usually one per cohort (approximately five over the period of this study). Thus, although there are other aspects to games which may be interesting to examine, such as cooperative play versus competitive play, such criteria did not fit within the context of this study. In addition, only minimal support is offered for model creation and development. Students are encouraged to work with fellow students enrolled in a Maya modeling class and most teams make use of this resource. However students often find many of the models they need for their design online or learn modeling skills for the purpose of creating their games. A small number of games (3) were produced under similar academic conditions (and are similar styled 3D interactive computer games) but over a two quarter period, using existing game engines. In general, students are given enough choice and overall their games exhibit substantial variance. The extent of the student's freedom of choice does allow reflection upon student's preferences and allows for valuable insight into the variance and commonalities of student game designers' choices. Another limitation of this study is the relative homogeneity of the cultural backgrounds of most student designers. The student body which produced the examined work over the five year period primarily matched the demographics of our College of Engineering, which is 50.2% White, 18.4% Asian American, 14.3% Hispanic/Latino with the remaining 15.3% identifying as Multi-racial, Unknown, African-American, Native American or Hawaiian Pacific Islander and 1.8% being Non-Resident/Alien.

VI. CONCLUSIONS AND FUTURE WORK

We have presented the analysis of five years of choices made by student game designers with respect to various aspects of their games. These 35 games were assessed for multiple criteria related to game-play and aesthetic. In addition to considering all the games, we also grouped the student teams into those that included at least half female team members and those with less than half female team members. Interestingly, only a single criteria showed a statistically significant difference when considering these groupings which relates to the games including identifiable enemies. We leave it to future work to consider why this one criteria does appear to vary between the groups.

Overall, when considering the gender composition of teams of student game designers, for the most part, they create not so different games. Some of the trends seen in the students' games are likely due to the limitations of our academic setting, i.e. mostly featuring small worlds that were not especially responsive to the player. However, others indicate clear directions for consideration. There were no strong identifiable aesthetic differences such as lighting, color choice, or use of proportions. In general, the students tended to make action/collection based games with a magical/fantasy setting and with a predominantly happy mood. These games in fact tend to reflect trends already highlighted by the Quantic Foundry study that show men and women tend to equally be drawn
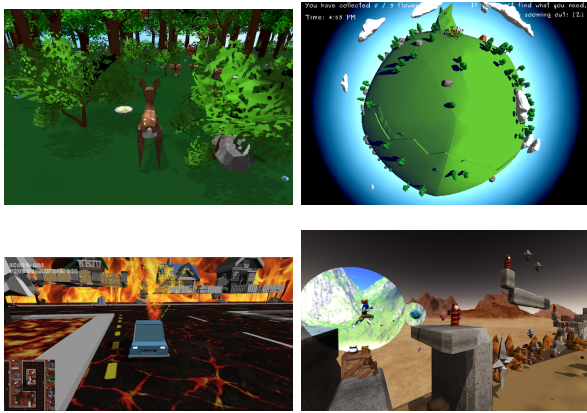
Fig. 14. Images from 4 different student games to help illustrate the types of games produced in this setting, including alhf teams.

to some genres (casual puzzles, atmospheric exploration, interactive drama and high fantasy MMO). We believe that looking careful at these shared interests is key for future game development as they potentially offer a path towards creating a more inclusive gaming community of shared interest to both male and females.

In the future we would like to continue our exploration of student game designers' choices and expand this study to other audiences. Using the exact survey metric used for middle school students [8] would be valuable for a more direct comparison to this related work. Additionally, in the future, it would be useful to pair our analysis with surveys on student designers' attitudes. We acknowledge the limitations of this study in terms of size and design constraints (and indeed game designer population as all students are upper division computer science students) but we also hope this study will inspire other academics and/or game-jam organizers to consider their own data to see if trends can be confirmed and help focus on commonalities and shared interests.

As educators, we propose that faculty who wish to create an inclusive classroom environment in order to promote female and male game designers' sense of belonging in the gaming field focus on shared commonalities in gaming. Educators interested in supporting mixed gender teams, should likely consider, when creating a course focused on games (be it game design or even a history of games), the inclusion and in fact emphasis on examples that come from the genres and with the spirit identified in this study to be of interest to the majority of student designers (i.e., action/collection based games with a magical/fantasy setting with a predominantly happy mood or those shown to be broadly appealing, i.e.casual puzzles, atmospheric exploration, interactive drama and high fantasy MMO). For example, our program has recently created a joint minor 'computing for the interactive arts', which attracts a large number of female students [23] and we strive to make the program inclusive. This study gives us direction to consider when presenting options for capstone projects and for curricular development in general.

REFERENCES

[1] (2015) Essential facts about the computer and video game indsutry. [Online]. Available: http://www.theesa.com/wp-content/uploads/2015/04/ESA-Essential-Facts-2015.pdf

[2] C. Dewey, "The only guide to gamergate you will ever need to read," *Washington Post*, Oct 2014. [Online]. Available: https://www.washingtonpost.com/news/the-intersect/wp/2014/10/14/the-only-guide-to-gamergate-you-will-ever-need-to-read

[3] (2018) Top 10 most popular game genres in the world 2018. [Online]. Available: https://www.technavio.com/blog/top-10-most-popular-game-genres

[4] Y. B. Kafai, C. Heeter, J. Denner, and J. Y. Sun, *Beyond Barbie and Mortal Kombat: New Perspectives on Gender and Gaming*. The MIT Press, 2008.

[5] (2017) Girl games: Adventures in lip gloss. (13 February 1998)Gamasutra. [Online]. Available: http://www.gamasutra.com/view/feature/3252

[6] N. Yee. (2017) Beyond 50/50: Breaking down the percentage of female gamers by genre. [Online]. Available: https://quanticfoundry.com/2017/01/19/female-gamers-by-genre/

[7] ——. (2017) Dispelling myths about female gamers. [Online]. Available: http://blog.yalebooks.com/2017/07/28/dispelling-myths-about-female-gamers/

[8] J. Denner, E. Ortiz, S. Campe, and L. Werner, "Beyond stereotypes of gender and gaming: Video games made by middle school students," *Handbook of Digital Games*, 2014.

[9] E. Gee, "Women, video gaming and learning: Beyond stereotypes," *TechTrends*, 2005.

[10] J. Jenson, S. de Castell, and S. Fisher, "Girls playing games: Rethinking stereotypes," in *Proceedings of the 2007 Conference on Future Play*, ser. Future Play '07. New York, NY, USA: ACM, 2007, pp. 9–16. [Online]. Available: http://doi.acm.org/10.1145/1328202.1328205

[11] M. Klawe. How can we encourage more women to study computer science? Computing Research Association - Women. [Online]. Available: https://cra.org/cra-w/629/

[12] N. C. for Women and I. Technology. Top 10 ways. [Online]. Available: https://www.ncwit.org/resources/type/top-10-ways

[13] M. Guzdial, "Exploring hypotheses about media computation," *Proceedings of the ninth annual international ACM conference on international computing education research - ICER '13*, 2013.

[14] ——. The most gender-balanced computing program in the usa: computational media at georgia tech. Computer Education Blog, September 2, 2014. [Online]. Available: https://computinged.wordpress.com/2014/09/02/the-most-gender-balanced-computing-program-in-the-usa/

[15] L. J. Barker, K. Garvin-Doxas, and E. Roberts, "What can computer science learn from a fine arts approach to teaching?" *Proceeding of the 36th ACM technical symposium on computer science education - SIGCSE 2005*, 2005.

[16] W. Bares, B. Manaris, and R. McCauley, "Gender equity in computer science through computing in the arts–a six-year longitudinal study," *Computer Science Education*, vol. 28, no. 3, pp. 191–210, 2018.

[17] UCSC. 2018 fall quarter undergraduate major count* by gender. [Online]. Available: https://mediafiles.ucsc.edu/iraps/student-majors/fall-term/2018-19/fall-undergraduate-majorsbygender-mc.pdf

[18] D. Myers, "A q-study of game player aesthetics," *Simulation & Gaming*, vol. 21, no. 4, pp. 375–396, 1990. [Online]. Available: https://doi.org/10.1177/104687819002100403

[19] X. Retaux and J. Rouchier, "Realism vs. surprise and coherence: Different aspect of playability in computer games," in *Playing With the Future conference*, Manchester, April 2002.

[20] J. Juul, "A certain level of abstraction," in *Situated Play: DiGRA 2007 Conference Proceedings*, Tokyo, 2007, http://www.jesperjuul.net/text/acertainlevel/.

[21] C. Gingold, "Miniature gardens and magic crayons: Games, spaces, and worlds (master's thesis)," Master's thesis, Georgia Institute of Technology, Atlanta, GA, USA, 2003.

[22] R. B. Townsend. Taking note: How about those undergraduate arts majors? [Online]. Available: https://www.arts.gov/art-works/2017/taking-note-how-about-those-undergraduate-arts-majors

[23] Z. Wood, E. Costello, C. Eckhardt, and A. Keen, "A cross-disciplinary minor to engage students creativity and engineering skills," in *ASEE PSW 2019*, 2019.