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Evaluating the Game Approchability Principles for Designing Strategy Game Tutorials

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Abstract. The approachability of a game is determined by the ease of which a player may learn how to play it. Most often, the player is taught how to play a game during a specially designed first level, called the tutorial level. In order to evaluate the approachability of a game, Desurvire et al. created the Game Approachability Principles (GAP) [1] and suggested that GAP could potentially also be used to design game tutorials. This was tested in this paper by using GAP during an iterative design process of a strategy game tutorial. Each tutorial iteration was user-tested and heuristically evaluated. This study suggested that the use of GAP during the design process had resulted in a successful game tutorial. However, as there is a difference between identifying and solving an issue, some revisions to GAP were suggested to improve the usage during design processes'.

Keywords: Approachability, Game Design, Tutorials, Learning

*Dinosaur graphic on frontpage by Arks Designs[2]

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Sammanfattning Desto större och mer avancerat ett spel är, desto svårare kan det bli att lära sig. Moderna spel börjar ofta med att låta spelaren spela en övningsbana, även kallad "tutorial", för att lära spelaren spelet. För att mäta hur väl ett spel går att lära sig tog Desurvire et al. fram "speltillgänglighetsprinciperna", eller "The Game Approachability Principles" (GAP) [1]. Det föreslogs även att GAP skulle vara användbara vid skapandet av övningsbanor. I den här rapporten utvärderades det påståendet genom att applicera GAP vid skapandet av en övningsbana till ett strategispel. Slutsatsen blev att användandet av GAP resulterat i en framgångsrik övningsbana, men att principerna är möjliga att anpassa för användandet vid designprocesser. Därför föreslogs en reviderad version av principerna.

Keywords: Tillgänglighet, Speldesign, Tutorials, Lärande

Acknowledgement

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1   Introduction

In a study by the analytics company Nielsen Games from 2018, 66% of the American population above the age of 13 could be considered gamers [3]. Moreover, the American gamer spent more leisure time engaging in a game or e-sport (11%), than in a physical sport (10%). The study showed that gaming has become a widespread activity, partaken in by millions of people. The video and computer games industry is also rapidly growing. In 2018, the industry generated $43.4 billion in the USA, equalling the revenue of the American film industry [4]. During 2019, the global gaming market generated $152 billion and can be expected to produce $196 billion in revenue by 2022 [5]. Thus, improving the work methods used by game developers may affect thousands of players and game developers across the world.

The ease of learning how to play a game may be called it's "approachability". An approachable game is easy to learn, while an unapproachable game is difficult. During the '80s and '90s, games were often shipped together with a game manual with which a player was supposed to learn the game. For various reasons, modern games have abandoned the handbooks [6] and instead attempts to teach the player while they are playing. A common way to do this is through the use of a tutorial level. The tutorial level is most often the first level of a game and is specifically designed to teach the player how to play.

To evaluate the approachability in games, Desurvire et al. proposed a set of principles, the Game Approachability Principles (GAP), in 2008 [7]. An improved and expanded version of GAP was proposed by the same authors in 2010 [1]. The authors stated that the guidelines showed potential for use during both heuristic evaluation and user testing, but could also be used when designing game tutorials. If the latter claim could be tested and validated, then GAP could be used to formalize a design process for game tutorials. Such a method hold much potential, as it could shorten the on-boarding time for new recruits at game companies, help teach game approachability to aspiring game designers and make it easier to create a fun and efficient game tutorials. Designers who have not previously worked or considered game approachability would potentially be able to adopt and use the method without any great effort. A formal method would also be possible to iterate upon and study further.

If it would be possible to show that GAP has an effective use during the design process of a game tutorial, the guidelines may then help in creating a formalized method for making game tutorials. To evaluate the first part of the hypothesis, the GAP was used and evaluated during the design process of a computer strategy game tutorial. The resulting process and tutorial were used to evaluate how viable GAP was as a set of design guidelines.

The paper was written as a collaboration with the game publisher and devel-

oper Paradox Interactive. As such, the game prototype was designed to emulate aspects of a Paradox strategy game.

1.1 Paradox Interactive

Paradox Interactive is a Swedish game publisher and developer. The company started as Target Interactive, a subsidiary of the game publisher Target Entertainment. The company then became independent and known as Paradox Interactive in 2004 [8]. Paradox is primarily known for their deep and complex, computer, strategy games, such as Crusader Kings, Europa Universalis and Hearts of Iron [9]. The company found success in making complex games for a niche market and having a close relationship with their customers and fans [10].

2   Objective

To evaluate the use of the Game Approachability Principles during a design process of a game tutorial, the following research questions needed to be addressed:

- How viable is the use of the Game Approachability Principles as a set of guidelines for designing a strategy game tutorial?
- How can the Game Approachability Principles be modified to be more useful when designing strategy game tutorials?

2.1   Purpose

The purpose of this paper was to evaluate the use of the Game Approachability Principles (GAP) when designing a game tutorial. It was hypothesized that if GAP proved to be useful in the design process, it could later be used to propose a formal method for designing game tutorials.

2.2   Limitations

The scope of this study only involved the evaluation of the use of GAP during the design process of a tutorial for a computer strategy game. Other types of games were not considered or evaluated. GAP was not used or evaluated to design a strategy game; instead, the study was focused on the design process of the game tutorial. As such, the tutorial design process did not allow for any changes to the game mechanics or gameplay. The strategy game and the tutorial was primarily designed to be played by people already comfortable playing computer or video games.

3 Theoretical framework

In their work from 2003, Barendregt et al. evaluated the importance of distinguishing between usability problems and fun problems [11]. The authors found it important to make the correct categorization of an issue so that the correct set of heuristics could be used. As such, it was important to note the difference between an accessibility, approachability and usability issue and how they were to be defined in this paper.

3.1 Accessibility, usability & Approachability

Accessibility
Accessibility is in this paper differentiated from approachability and usability. The term is most often used regarding issues due to physiology of the player, or the games physical interface. If a player struggles with a game menu due to being colorblind, or reduced eyesight, those would be accessibility issues. Another example would be if a player struggles due to having reduced motor skills or a physical disability.

Usability
It is rare to see any work regarding usability that does not mention the work of Jacob Nielsen in some regard. In 1990, Nielsen et al. proposed a set of heuristics for evaluating usability in user interfaces [12]. Nielsen improved upon these later, in 1994 [13]. Though Federoff [14] showed that Nielsen's heuristics could also be applied to video and computer games, Federoff proposed a new set of heuristics tailored for that specific purpose.

Approachability
Approachability is often referring to issues concerning pedagogy and ease of learning. The term was defined as "the ease of which a player may learn a game, if he or she intends to do so" by Desurvire et al. in their work on the Game Approachability Principles from 2010[1], which is the definition that will be used in this paper.

3.2 Game Approachability Principles

The Game Approachability Principles (GAP) is a set of guidelines aimed at evaluating approachability in games and were first proposed by Desurvire et al. in 2008 [7]. The guidelines were based upon their previous heuristics, HEP [15] and $PLAY$ [16].

The Heuristics to Evaluate Playability (HEP) were first proposed in 2004 and featured 43 principles. The principles were categorized in one of four areas: "gameplay", "game story", "mechanics" and "usability". In 2009, the Principles of Game Playability $PLAY$ were proposed in follow up study. $PLAY$ was designed to be used by game designers throughout the entire design process,

but particularly during the early concept phase. *Play* was also designed to be applicable to a wider range of games than *HEP*. The list consisted of 48 principles, divided into the categories gameplay, emotional immersion, and usability & game mechanics. One difference from *HEP* is that each category is in turn divided into a number of subcategories, which may be used or excluded depending on the project. If a developer applied *PLAY* when designing a game without a story, then that subcategory may be excluded from the list.

GAP also includes a set of principles which were proposed by James Paul Gee [17]. These principles, referred to in *GAP* as the "Gee-game based principles", often focus on "learning by doing". In his work, Gee claims that games have a great advantage over other mediums, such as books and film, when it comes to learning by being interactive.

In the initial version of the guidelines, *GAP* consisted of only six principles. However, the authors improved and extended the list to include four more principles in 2010[1]. It was concluded that *GAP* could be used for heuristic evaluations, user testing, and potentially also when designing game tutorials and early phases of game concepting.

The *GAP* list included the following principles:

1. Amount and type of practice
   - There are multiple opportunities for the player to practice a new tool, game mechanic or skill.
2. Amount and type of demonstration
   - Rules, tools, game mechanics and skills are demonstrated more than once, and in more than one way.
3. Reinforcement
   - The player is given fitting feedback to their actions.
4. Self-efficacy
   - The player feels secure in their ability to succeed in the challenges presented by the game.
5. Scaffolding
   - Help is at first provided in broad terms, then more specific as the player needs it.
6. Gee-game based principles:
   - Co-design
     - Actions and choices made by the player help shape the game world.
   - Customize
     - The game allows the player to choose their own playstyle.
   - Identity
     - The player is able to identify with the world and the characters in the game.
   - Manipulation and distributed knowledge

- The player is able to manipulate objects in the game world in a natural and expected way.
    - Information is 'on demand' and 'just in time'
        - Information is given when the player feels they need it and when they can use it.
    - Sandbox
        - There exists some sort of safe space within the game where the player can try new things without worrying about the consequences or feel any pressure.
    - System-thinking
        - The understanding of rules, tools and mechanics of the game help the player understand the game as a whole.
7. *HEP* and *PLAY*-based guidelines
    - Gameplay
        - Includes principles such as the game providing varying activities, challenge and pacing. The goals of the game are clear and realistic to the player.
    - Game Story
        - Includes principles such as the player being emotionally involved and interested in the story.
    - Mechanics
        - Includes principles such as the game responding in a consistent, expected and exciting way to the player's actions. The game controls are intuitive and follow industry standards.
    - Usability
        - Revolves much around the user interface being efficient, non-intrusive and functional to the player.
8. Self-mastery
    - The player was able to practice new skills and tools in order to master the game.

[1]

The Game Approachability Principles has also been structured as a flowchart, in the Game Approachability Issue Definition (*GAID*), by Molin [18]. With *GAID*, the *GAP* guidelines became more approachable and efficient to use.

4 Methodology

4.1 Literature Study

An extensive literature study was conducted on subjects such as "game design", "learning theory", "interaction technology", "usability", "heuristics" and "approachability". The purpose of the study was to understand what studies had been in the fields previously, what findings had they gained, and thus to allow for data driven decisions. The databases used used were primarily Google Scholar[1], the digital library of Umeå University[2].

4.2 The Design Process

As creating a complete tutorial for a Paradox game would be too big for the scope of the paper, a game prototype was developed with the Unity game engine. The prototype was designed to emulate some of the base mechanics of a Paradox strategy game. Using the Game Approachability Principles (GAP) and an iterative design process, a tutorial was developed for the prototype. Each iteration of the tutorial was heuristically evaluated and user-tested. Before beginning the iterative tutorial design process, a pre-test was performed to evaluate the test itself. The pre-test was referred to as PT, while each iteration of the tutorial was referred to as $T0$, $T1$ and $T2$. The steps involved in each iteration were:

1. *Identification*: Identify approachability issues using methods such as user testing or heuristic evaluation. GAP was used for the heuristic evaluation.
2. *Ideation*: having identified one or more issues during the identification phase, each issue was evaluated using the GAP heuristics. An example of this could be that the controls of the game were unclear. The ideation phase would then consist of checking how the controls could be taught via each principle in GAP. The relevance of each principle depends on what the issue is.
3. *Implementation*: Implement the solution or solutions. Sometimes, it is discovered that a solution is not able to be implemented at this stage. If this is the case, then one should revert to the ideation phase and find another solution.
4. *Iteration*: Restart the process at the identification phase. If the implemented solutions are successful, the next round of identified issues are either fewer or less severe than the previous iteration.

4.3 User testing

User testing was performed with one participant at a time. The participant got to play the game for five minutes before answering a form and then three interview questions. The participants played the game on a Macbook Pro (2017 model) laptop while wearing headphones and controlling the game with the

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[1] Google Scholar: https://scholar.google.com
[2] Umeå University Library: https://www.umu.se/bibliotek

touchpad. The computer screen and the participant's voice was recorded, so that the gameplay could be analyzed more closely after the test. A test supervisor administered the test and gave the participants their instructions from a script. The script can be found in Appendix A. When playing the game, the supervisor would only help the participant if they encountered an issue which stopped them from playing. The participants were instructed to think aloud during the test, and while they had been told that the supervisor would not interfere or answer, they were still encouraged to ask questions when playing. After having played the game for five minutes, the participant would answer a form to gauge their satisfaction with the game and the tutorial. After answering the form, a brief, structured interview was held. Testing was performed in a quiet area, most often an office or private area.

4.3.1 Form
The form had the purpose of generating a normalized and empirical value of the success for each tutorial iteration. This value was called a *PLAY*-score. The form was divided into two parts, where the first part generated a *PLAY*-score, and the latter part regarded the participant and their gaming habits. After testing, the average *PLAY*-score for each test group was calculated. The complete form can be found in the Appendix C & D.

Playability (PLAY)
The largest part of the form regarded the game's playability and the participant's satisfaction with the game. The questions were based on the PLAY heuristics, developed by Desurvire et al. [16]. Each question was phrased as a statement, and was answered with a number from zero to four, where zero meant "I disagree completely", and four meant "I agree completely". The sum of all answers in the form was referred to as a *PLAY*-score and could range from zero to four. A low *PLAY*-score indicated great dissatisfaction with the game, while a higher score indicated great pleasure.

Participant background
The second part of the form regarded the participant and their gaming habits. This form included questions about age, gender, and how many hours they played video, mobile or computer games during a regular week.

### 4.3.2 Interview
At the end of the test, a brief structured interview was held. The purpose of this was to get the participant's own words about their experience. The interview questions can be found in Appendix B.

4.4 Designing The Game

The requirements on the game prototype were that it should be similar in terms of game mechanics and challenge to a Paradox game, possible to develop in a

month, and easy to perform user tests with. The game prototype was designed using the method that game designer Asher Vollmer [19] presented during a talk at the Game Developer Conference in 2004. The method involved determining three to four design goals that the game should fulfil. Using Vollmer's method, it was decided that the game prototype had to be a complex, yet approachable, real-time strategy game, with the ability to pause. These goals can be seen in Fig. 1.
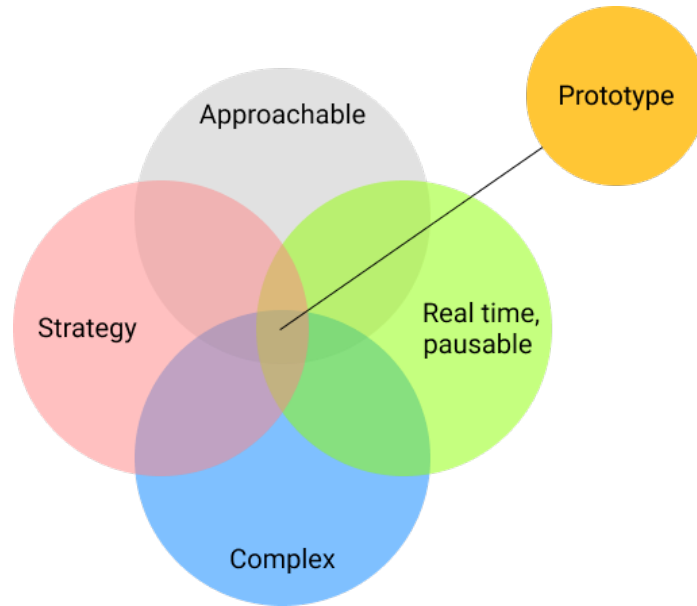
Fig. 1. Using the game design process discussed by Vollmer [19], it was decided that the game prototype would be designed to fulfill the four design goals shown in the image.

Approachable
The average participant would have to be able to play the game during the duration of the test. There would also be a need to perform several user tests, as the tutorial design process would be iterative. Thus, the faster a participant could learn the basic game mechanics, the more user tests could be performed, which in turn potentially would increase the reliability of the paper. Therefore, approachability would need to be one of the design goals.

Complex
Paradox has achieved success primarily thanks to their challenging and complex strategy games. For the game prototype to be similar to a Paradox game, it therefore had to deliver a similarly complex and challenging experience during a

test session. When combining the goals of complexity and approachability, the goals together formed Bushnell's law [20] of being easy to learn and hard to master, which is a fundamental concept in good game design.

Strategy

It was decided that the game had to be a strategy game, as that is the genre that Paradox is most known for. It was also decided that the game would revolve around manoeuvering units on a map, as it is a common game mechanic in many of Paradox strategy games.

Real-time, pausable

Computer strategy games are most often played in real-time or are turn-based. Paradox strategy games differentiate themselves by being played in real-time, while also allowing the player to pause. While paused, the player may reconsider their tactics and issue new orders. While the pause mechanic is not used exclusively in Paradox strategy games, it has become an expected and relied upon feature. It was therefore decided that the game prototype should be played in real-time, with a similar pause mechanic.

With the four goals decided, a prototype game was designed based on the idea of "rock, paper, scissors". It was hypothesized that this idea is intuitive to many people, while also it also could allow for complex strategies, thus achieving the goals of complexity and approachability. In the game, each player would be "chased" by another player, while also "chase" a third player. An example of this is illustrated in Fig. 2. This was implemented in the form of units defeating each other on a game map. The player would move their units in a way so that collided with the units of the player whom they chased, thereby defeating them. When a player had no units remaining, they were eliminated. The original goal of the game would be to eliminate the player who chased you. As a player was unable to eliminate the player who chased them directly, they had to "herd" other players into them. However, it was discovered during the pre-test, that the "herding" concept proved to be too complex for both the human and for the computer players. therefore, the goal was simplified and changed to "eliminate the player that you chase".

After an initial evaluation with different player counts, it was decided that four players would be optimal. It was first reasoned that three players would be the most intuitive, as it fits with the "rock, paper, scissors" concept. However, having four players created the most interesting configuration, as each player had one they chased, one who chased them and one "neutral" opponent. The neutral opponent could be a useful ally, to be used against your chaser, but could also win the game for themselves if relied upon too much. The new configuration is illustrated in Fig. 3. Having more than four players would only add more "neutral" players, which did not add much else but clutter to the game.

The game map was designed to accommodate four players, while also be played into the game's approachability and complexity. As can be seen in Fig. 4, the first map used was an open field, with a few randomly placed obstacles. This
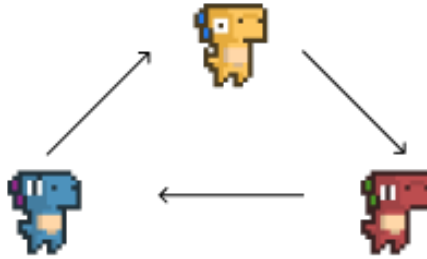
Fig. 2. The game concept was based on "rock, paper, scissors". Each player would chase another player, while at the same time being chased by a third player. In the example illustrated, the blue player would chase the yellow player, while also being chased by the red player. The original goal of the game would be to eliminate the player who chased you. In this example, blue would win when yellow eliminated red. This was changed after pre-testing, so the blue player would win when they eliminated yellow.
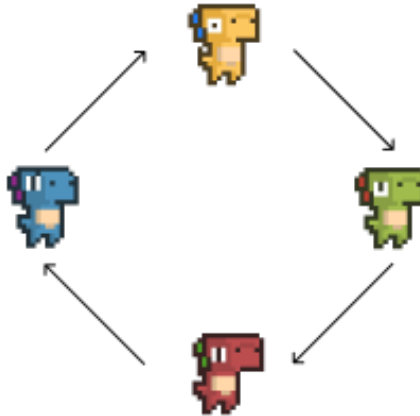
Fig. 3. Adding a fourth player to the game created a more interesting configuration than with only three. This created a "neutral" player, whom the player did neither chase or was chased by. The neutral player could be either a useful ally, an annoying obstacle, or a dangerous competitor. In this example, the ones with a neutral relationship are blue and green, and red and yellow.

map type resulted in cluttered and frantic games, where the human player would find it difficult to learn any patterns or use tactics. All the player's attention was dedicated to making sense of what was happening.

A new map was designed, inspired by the Multiplayer Online Battle Arena (*MOBA*) game genre and the concept of "lanes" [21]. With lanes, the map is

Fig. 4. The first game map was plain and open. The open map design often resulted in chaos and clutter, and no use for careful planning

divided in smaller paths, where it is only possible to change lane when lanes intersect. An early sketch of this concept is shown in Fig 5. When designing the map, there was an opportunity to convey the "rock, paper, scissors" concept of the game. This lead to each player being placed in their own corner of the map in such a way that when started, the computer players would chase each other in the same order as the illustration in Fig. 3. It was believed that this would give the human player an idea of what the game was about, and where to go.
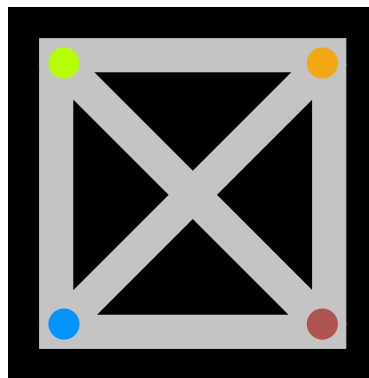
Fig. 5. Lofi sketch of the lane-based map. Black areas are blocked off, and grey areas are moveable. The yellow, blue, red and orange areas are where each player will start the game.

The lane-based map made keeping track and predicting where units would go much simpler, which in turn allowed the player to better use tactics. The finished lane-based map may be seen in Fig. 6.
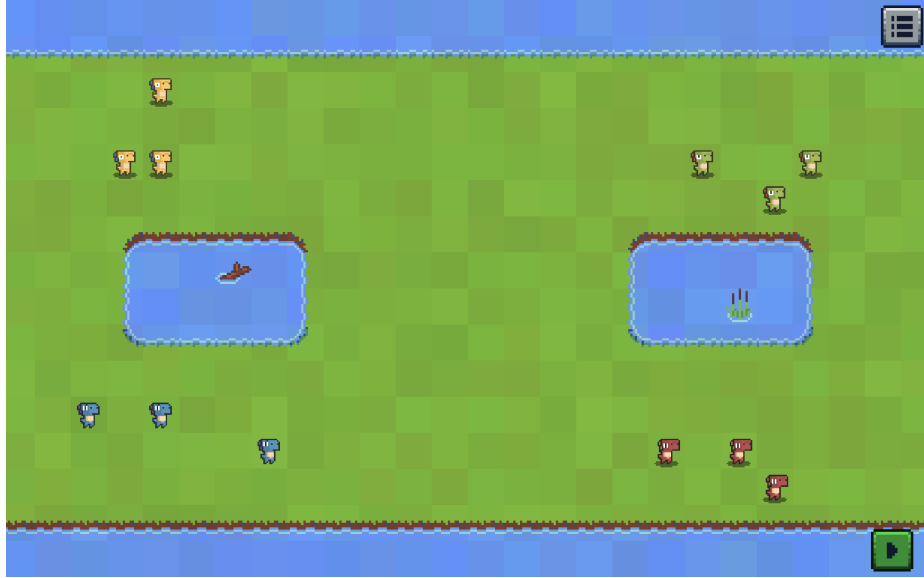
Fig. 6. A new map was designed using the concepts of "lanes", which allowed the player to focus more on using tactics. The unit sprites were made by Arks Design [2], the map sprites by Alex's Assets [22].

The behaviors and pathfinding of the computer-played opponents were then improved to fit the lane-based map better. Enemy avoidance and dynamic priorities were also added to help create a more dynamic experience. Background music made by chiptunistchippy[23] was also added.

4.5 Pre-test

The pre-test was performed for two main reasons. It was essential to verify that the game prototype accomplished the design goals and was complex enough to require some sort of tutorial. It was also important to evaluate the test itself, and aspects such as the amount of playtime given.

The pre-test was designed as a trial version of the actual test. The pre-test differed from the actual test by letting all test groups play the same version of the game. Instead of playing with different versions of a tutorial, the two test

groups (*PT0* and *PT1*) were given a different amount of information before playing the game prototype. *PT0* was given no information regarding the goal of the game, game controls or the game mechanics. *PT1* was informed about the goal of the game and who they would be playing as.

4.5.1 Participants

The participant's of the pre-test all had some gaming experience and played at least one hour every week. In total, eleven persons participated in the pre-test. More information on the participants is displayed in Tab. 1.

Table 1. Age and gender distribution, and weekly gaming hours for participants in the pre-test. Standard deviation (*SD*) is given in parenthesis.

Test	Age & SD	Gender (Male/Female/Non-binary)	Gaming hours & SD
PT0	24.5 (1.4)	6/0/0	18.5 (13.8)
PT1	25.4 (3.2)	4/1/0	5 (2.2)
Total	24.9 (2.3)	10/1/0	12.4 (12.1)

4.5.2 Result

The pre-testing had the purpose of evaluating both the test methodology and the game prototype itself. It was hypothesized that if the game was not complex enough, or too complex to learn to play in five minutes, the *PLAY*-scores reported would not have differed much between the two test groups. The resulting *PLAY*-scores, shown in Table 2, showed that *PT1* reported a 32.4% higher *PLAY*-score than *PT0*. The *PLAY*-score thus indicated that the more information a participant was given before playing, the higher their *PLAY*-score would be.

Table 2. Average *PLAY*-score gained from testing two groups of participants with different levels of knowledge about the game. Standard deviation (*SD*) is given in parenthesis. The *PLAY*-score showed that the participants who had gotten instructions before playing the game rated it higher.

Test	Avg. *PLAY*-score & SD
PT0	1.36 (0.53)
PT1	1.80 (0.75)
Total	1.56 (0.64)

The interviews showed that there were two main points of frustration for the participants: the game controls and how to win the game. Participants of *PT0* also found it frustrating not knowing what units they could control.

Controls
Participants found it confusing using the mouse to select and move units. The first thing most players did was click around on the keyboard until something happened. For many, this was how they discovered that spacebar paused and unpaused the game. However, all players did learn how to select and move units before the test was over.

Win condition
Participants of *PT0* were confused by the game concept, though they mostly figured out the rock-paper-scissors concept. They understood that they lost when all their units were eliminated, though they did not understand why they lost when they still had units left. The latter part was also true for participants of *PT1*. The participants of *PT1* were also frustrated when eliminating all yellow units caused them to lose the game. The interviews showed that participant of *PT0* had become frustrated by not knowing the goal of the game, though they did find some enjoyment in just surviving. Participants of *PT1* instead became frustrated by loosing when they believed they would win, which always happened if anyone else but their predator was eliminated. This fact had been explained to all participants of *PT1*, but it was quickly forgotten. When the game started, they were instead confused and thought that their goal was to eliminate the player they chased. The win condition thus proved to be a point of frustration, not an enjoyable challenge.

Other issues
Participants had conflicting views on the user interface (*UI*). Some participants found it intuitive, while others struggled with how to restart the game. When hovering on a unit, a window would pop up showing whom that unit is chasing and whom it is chased by. This "relationship window" was reported as both helpful and confusing. No participant reported having issues with the play-pause mechanic of the game. The only participants who mentioned the mechanic did so positively. A couple of participants noted that they liked the look of the game and found it "cute" or "nice". A number of technical issues were noted, mostly concerning AI behaviour and pathfinding. Some of these issues, such as units getting stuck outside the map, forced the participants to restart. For unknown reasons, these issues were rarely mentioned by the participants.

4.5.3   Discussion
The pre-test showed that the game was playable for someone with some gaming background, within at least five minutes. It also suggested that the playability of the game was increased when knowing some background information before starting to play the game.

The participants' main issues were learning the controls and how to win the game. Knowing the game concept and the player's role before starting the game improved the games playability, though most participants of both *PT0* and *PT1*

had trouble figuring out how to play the game. There were also some technical issues, primarily due to poor AI, that forced players to restart the game. It was decided that the best solution to the issues were to simplify the win condition from "eliminate the player who is chasing you" to "eliminate the player whom you are chasing", and adapt the AI to this. The new win condition would potentially be more intuitive to the player, while also be an easier goal for the computer to pursue. While it did allow the AI to play the game more effectively, the new goal would also decrease the complexity of the game. Eventually, the AI managed to reach a level of challenge made up for the simpler goal, and it was decided that the game had a satisfactory level of complexity.

To better understand the participant's gaming background, three questions were added to the end of the form. These questions regarded how long the participant had played digital games and what sort of games they played.

4.6   Designing The Tutorial

The tutorial was designed using an iterative design process and the Game Approachability Principles (GAP). Each iteration of the design process consisted of identifying problem areas via user testing and heuristic evaluation, ideate solutions using the GAP and lastly to implement the solutions. After implementation, another iteration began at the first step of the process.

During the first iteration, there was no explicit tutorial present, which is why the iteration was referred to as "Tutorial 0" (*T0*). The first and second iterations of the tutorial were referred to as *T1* and *T2*.

4.6.1   Participants

Each tutorial iteration was user-tested by 9 participants. All participants, except three, were considered gamers. This meant that they played computer, mobile or video games regularly each week. The three participants who did not play any digital games regularly were all part of the first test group (*T0*). This can be seen by comparing the gaming engagement of participants in *T0* to the other test groups in Table 3. The gender ratio was also different between *T0* and the other test groups, as *T0* was the only test group being primarily female. The age and gender distribution is shown in Table 4.

Table 3. Average gaming experience and activity for participants of each test group. Standard deviations (SD) given in parenthesis.

Test group	Average weekly gaming hours & SD	Avg. years of gaming
T0	7.89 (8.3)	8.00 (7.9)
T1	17.89 (8.0)	18.56 (3.1)
T2	17.67 (12.6)	18 (5.3)
Total	12.78 (10.6)	13 (7.5)

Table 4. Age and gender distribution for participants of each test group. Standard deviation (SD) given in parenthesis.

Test group	Average age & SD	Gender (Male/Female/Non-binary)
T0	22.9 (2.6)	2/7/0
T1	23.6 (3.6)	9/0/0
T2	25.9 (3.4)	8/1/0
Total	24.4 (3.4)	19/8/0

4.6.2 Tutorial 0

Identification

User testing was performed with a group of nine participants. Six participants regularly played digital games, while three did not play at all. Participants had been recruited at the Umeå University campus. Tests were performed in a quiet and private office. The issues identified during user testing were:

1. All players found it difficult to determine who they were in the game world.
2. All players found it difficult to understand how to move their characters in the game world.
3. Most players attempted to use the keyboard to move their characters.
4. Most players misunderstood that characters could be given orders while the game was in pause-mode.
5. One player had difficulty differentiating the green from the yellow characters.
6. One player spent time looking for a help button.

Using *GAP* for a heuristic evaluation, the following issues were identified:

7. There was very little feedback showing that a character had been eliminated.
8. There was no feedback indicating that a character was about to be eliminated.
9. The player got no demonstration or practice on how to control their characters before the game started.
10. There was very little information showing what character the player could control.
11. There was very little help on-demand for the player.
12. There was no information showing what path a character would take to reach their destination.
13. There was no initial indicator showing what characters the player could control.
14. There was no information given on the play and pause mechanic.
15. In the start menu, there existed a non-functional rate-button. The button and the start menu may be seen in Fig. 7.

Of the issues identified, most could be sorted into one of two main problem areas: player identification ("What characters can I control?", "What can I do?") and controls ("How do I play? How do I move?").

Ideation

The two problem areas were addressed one at a time, using the Game Approachability Principles (*GAP*). For each issue, there was an attempt to solve it by using more than only one of the *GAP* guidelines. The sound effects added were made by JDWasabi[24]. It was decided that the potential accessibility issues concerning colorblindness in issue 5 were not addressed by any principle in *GAP*, and attempting to remedy them was therefor not part of the process.

Using the *GAP* design process, the following changes were introduced:

Fig. 7. Start menu of *T0* version of the game.

- A help window was added, featuring two tabs. One tab explained the goal of the game and the other showed who chased who. This replaced the previous window that showed the chase order of a character which the player hovered on. The help window was first shown upon starting the game. The window defaulted to the goal-tab. The window and the two tabs can be seen in Fig. 9. The principles that impacted the design of this solution were: "amount and type of demonstration", "scaffolding", "*HEP* and *PLAY*-based guidelines" focused on the goals of the game, the Gee-based guideline "information is on demand and just in time".
- A help button was added next to the menu button. Clicking it activated the help window. The principles that impacted the design of this solution were "scaffolding" and the Gee-based guideline "information on demand and just in time".
- Sound effects were added for when the player successfully eliminated another character. This was based on the *HEP* and *PLAY*-based guidelines on the game providing appropriate feedback to the player's actions.
- Sound effects were added for when the player lost one of their characters. This was based on the *HEP* and *PLAY*-based guidelines on the game providing appropriate feedback to the player's actions.
- A text was added to the game over-window, explaining who won and how. This window can be seen in Fig. 8 This solution was based on the *GAP* principle "amount and type of demonstration", the *HEP* and *PLAY* principles on clear game goals, and Gee's principle on system-thinking.

- Before the player has selected a unit for the first time, instructions on how to do it was displayed in the game. The text disappears after a unit is selected. This solution was based on the *GAP* principle "amount and type of demonstration", "amount and type of practice", and the Gee-principle on information being provided when it is needed.
- After selecting their first unit, instructions were shown on how to move the unit. Once a move order has been issued, the text disappeared. This solution was based on the *GAP* principle "amount and type of demonstration", "amount and type of practice", and the Gee-principle on information being provided when it is needed.
- The rate-button was removed, as it could be distracting for the player. This was as a result of the *HEP* and *PLAY* guidelines.

Fig. 8. Text was added to the game over window for the *T1* version of the game. The text would inform the player of why the game had been won or lost.

4.6.3   Tutorial 1

Identification

User testing was performed with a group of nine participants. All participants were frequent gamers and were recruited during a LAN-party. The tests performed during the LAN-party, in a secluded and quiet area. The issues identified during user testing were:

1. All players struggled with understanding what path their characters would take when given a move order.
2. Most players struggled with understanding who chased who.
3. Several players found it unclear what characters they could control.
4. Several players found it difficult to understand in what order characters moved.
5. When in paused, some players had trouble telling if a unit had been given a move order or not.
6. Some players found it difficult to see where their characters were going.
7. One player noted that it could be difficult to distinguish between the green and yellow units.

   Using *GAP* for a heuristic evaluation, the following issues were identified:

8. It was difficult to notice the "target" tab. therefore, many players did not notice it could be clicked on.
9. There was not much indicating that the play-button could, and should, be pressed.
10. There was nothing indicating how close another player was to victory.
11. Nothing told the player that spacebar would pause or unpause the game.
12. There was no way of seeing how a character would move to their ordered coordinate.

When compared to the identified issues of *T0*, some issued remained, though they were far less severe. These remaining issues regarded whom the player could control and who could attack who. One issue that was reported by those who played *T1*, but not reported by those who played *T0* was the need for some pathfinding visualization.

Using the *GAP* design process, the following changes were introduced:

Ideation

1. The help window was enlarged, in order to show the content of both tabs at the same time. The clickable tabs were removed completely. The new start menu may be seen in Fig. 10. This was decided using the *PLAY* heuristic focused on providing a clear game goal.

Fig. 9. The two tabs of the start menu used in the *T1* version of the game. By default, the "goal" tab was always displayed first. Most players missed that the "target" tab was clickable, and had to spend time figuring out what units they should evade and chase.

2. A blue character (identical to the ones controlled by the player) was animated in the help window, to differentiate it further from the computer-controlled characters. This was done to enforce the GAP principle of "amount and type of demonstration".

3. A visual indicator was added to show the path a selected character would take. How this was implemented is shown in Fig. 11. This implementation and how it was designed was influenced by the GAP principle "self-mastery", "amount and types of demonstration", the $PLAY$ principles concerning the player feeling in control, and the Gee-principle "system-thinking".

4.6.4 Tutorial 2

Fig. 10. In the *T2* version of the game, the two tabs in the *T1* version had been merged into a single window.

User testing was performed with a group of nine participants. All participants were frequent gamers and were recruited on the Umeå University campus grounds. Testing was performed in a quiet room with few distractions. The issues identified during user testing were:

Identification

1. Most players found it difficult controlling all three characters at the same time.
2. Most players wanted their units to take other paths than the one that the pathfinding algorithm found.
3. Some players missed that they could pause and give move-orders. They only clicked the play/pause button to start each round.
4. Some players tried to put manual waypoints along a path when issuing move-orders.
5. Some players had to play more than one round before understanding whom they would chase.

Fig. 11. To better visualize what path their characters would take to reach their destination, the planned path of a selected player character would be colorized.

Using the *GAP* for a heuristic evaluation, the following issues were identified:

6. There was nothing indicating how close another player was to victory.
7. There was nothing to help teach the player how to use the user interface and buttons.
8. There was very little that encouraged the player to use the pause function after a round had begun.

Ideation
Using the *GAP* design process, the following changes were introduced:

1. Affordances could be added to indicate which player chases who. As an example, the red player could be given a fire icon, and the blue player a water icon. Thus, the player might find it easier to remember that blue (water) defeats red (fire). This could also be accompanied by some brief background history on why the players are chasing each other. This could be done using Gee's principle of "identity", the *PLAY* principles in subcategories "game story immersion" and "terminology". The *GAP* principle of "self-efficacy" may also be applied as a sort of measurement during the design phase, as the design of the solution should make it intuitive whom chases who.
2. There should be a shortcut for switching between characters, similar to how spacebar is a shortcut to pause and play. This shortcut would encourage "self-mastery", as well as allow for more "amount and type of practice" of

the pause and play mechanic. Gee's principle of "system-thinking" may be useful when explaining and designing the interaction with this mechanic.

3. The pause and play button should display different color and animations dependant on what state the game is in. For example, when paused, the button could be pulsating, thus indicating it should be pressed. To further increase the effect, there could also be a subtle sound effect, such as the music slowing down when the game is paused. This could be designed using the "amount and type of demonstration" principle, and the *PLAY* principles on-screen layout.

4. The help-button could be animated when it is noticed that the player is struggling in some way. The button could begin to glow or pulse if the player loses the first round. When designing this, the *PLAY* principles on-screen layout, and Gee's principle of "information is on demand and just in time" could be used.

The final version of the game and game tutorial may be downloaded from https://jesperb.itch.io/rby-thesis-project. The game is only available to play on Mac OS.

5 Result

To determine how valid the use of the Game Approachability Principles (*GAP*) were during a design process, it was important to evaluate if the usage of *GAP* resulted in a successful game tutorial. This was done by comparing the *PLAY*-score reported for each iteration of the game tutorial. It was also important to evaluate how *GAP* was used during the design process.

5.1 *PLAY*-score

Resulting *PLAY*-score between each iteration of the tutorial may be seen in Table 5. A higher *PLAY*-score indicated a higher level of playability and player satisfaction. The average *PLAY*-score was 58% higher for *T2* than *T0*.

Table 5. Average *PLAY*-score reported for each iteration of the game tutorial. Standard deviation (*SD*) given in parenthesis.

Iteration	*PLAY*-score	delta
T0	1.84 (0.86)	-
T1	2.42 (0.58)	+0.58
T2	2.92 (0.54)	+0.50
Total	2.38 (0.79)	-

5.2 GAP usability

There was a varying degree of usage of the different *GAP* principles. Some were easy to apply to any issue, while others proved to be very situational. Some principles were also used more during the first iterations than the latter ones, and for others the opposite was true. How often and when each principle was used during the ideation phases of the design process is shown in Table 6.

Table 6. Usage of each *GAP* principle during the iterative design process.

Principle	T0	T1	T2	Full Process	% of applied
Amount and type of practice	2	0	1	3	10.0%
Amount and type of demonstration	3	2	1	6	19.0%
Reinforcement	0	0	0	0	0.0%
Self-efficacy	0	0	1	1	3.0%
Scaffolding	1	0	0	1	3.0%
Gee-game based guidelines	5	1	3	9	27.0%
HEP and *PLAY*-based guidelines	6	2	3	11	33.0%
Self-mastery	0	1	1	2	6.0%
Total	17	6	8	31	100.0%

6 Analysis

The success of the resulting game tutorial is best measured against how the game performed without any tutorial at all. When comparing the *PLAY*-scores in Table 5, it is shown that the tutorial increased the score by 58%. This may be interpreted as the tutorial being successful and helped the players play better.

There was a varying degree of usability among the Game Approachability Principles. How frequent each *GAP* heuristic affected what would be implemented in the game is shown in Fig. 12 and Table 6. The two most used principles were the use of Gee's principles, and the use of the *HEP* and *PLAY* guidelines.

HEP and PLAY-based guidelines
The use of the *HEP* and *PLAY* heuristics was the *GAP* principle which was applied most often during the design process. This could be the result of the heuristics being both quite extensive, with 43 and 48 principles, respectively. The *PLAY* list was also modular and principles not relevant to a project may be disregarded, which made the *PLAY*-list more approachable to use.

Many of the *PLAY* heuristics were easy to apply during ideation, though they could often overlap with other principles in the *GAP* list. One such example is the overlap between the "reinforcement" principle in *GAP* and the two *PLAY* principles in the subcategory "game provides feedback". There also existed several useful *PLAY* principles that were not present in the *GAP* list, such as the principles focused on good game controls or the goals of the game.

Total usage of each GAP principle during the design process
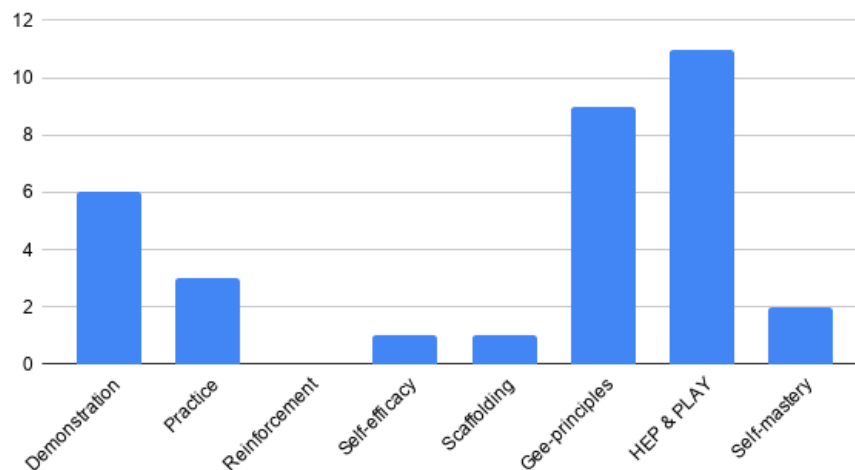
Fig. 12. Usage of each GAP-heuristic during the entire design process

Gee-game based principles
Each Gee-principle had been carefully explained and documented by Gee in the original paper from 2005[17]. This made their use efficient and easy to apply during the ideation phases. Gee's principles had some overlap with the *GAP* principle "amount and type of practice", as they are based on "learning by doing". Similar to that *GAP* principle, Gee's principles proved to be the most useful during the first ideation phase, possibly because of the costly changes that they often resulted in.

Amount and type of demonstration
During ideation, it was very useful to force ourselves to consider more than one way to demonstrate or practice a game mechanic. Most often, it was easier to come up with ideas for demonstration, than new ways to practice. It was also simpler to implement or change a demonstration since it often only involved working with text or images. To exclude the in-game text that explained the game controls from the help-window, and instead of displaying it on the game map, was one example of demonstrating something in a new way.

Amount and type of practice
Many ideas on how to practice a skill that were brought up during ideation proved too be complicated to implement successfully. They were also often quite work-intensive, and their implementation could potentially affect other systems in the game. As a result of having to keep ideating new ways of practicing a skill, even after already having found a solution, more efficient and elegant solutions

were often discovered. As such, when the principle could be applied to a problem, it proved to be one of the most useful principles in the *GAP* list. As evident in Table 6, the principle was mostly applied during the first tutorial iteration. This could indicate that the principle is the most applicable during the early phases of a design process.

Self-mastery

Similar to "self-efficacy", "self mastery" was not suited for ideation as it is framed as a desired effect. There was also some perceived overlap between the two principles, as both are focused on the player's skills when playing the game. During the design process, "self-mastery" was mostly applied in ways that could separate an experienced player from a beginner, such as being able to predict unit movements and knowing what keys on the keyboard may act as shortcuts.

Self-efficacy

Self-efficacy was difficult to apply during ideation, as it was perceived more of a goal than a tool. The means by which self-efficacy would be achieved was most often decided by using other principles in the *GAP* list. "Self-efficacy" was applied only once during the design process, where it influenced how the player would learn what player were dangerous in a more intuitive way.

Scaffolding

As phrased in the *GAP* list, the focus of "scaffolding" was to prevent player error and to provide the player with information in a more approachable way. During the design process, this principle only impacted the original design of the help window. One theory for this could be because of the relative simplicity of the game. There was not much information that the player needed to know, and the essential information could be given directly. A larger or more rule-based game project may find this principle more useful.

Reinforcement

The "reinforcement" principle had much overlap with *PLAY* principles under the subcategory "game provides feedback". The *PLAY* principles were also better documented, as they had been described in the works about both *HEP* [15] and *PLAY* [16]. The focus of the "reinforcement" principle was valid and useful, though it was always preferred to use the more direct *PLAY* principles with the same foci.

7 Discussion

The Game Approachability Principles (GAP) was used for evaluating, user testing and designing a game tutorial. As can be seen in Table 5, each iteration of the game tutorial resulted in a greater $PLAY$-score, thereby showing that the design process resulted in a successful tutorial. While iterating, the greatest changes to the tutorial were made between $T0$ and $T1$. However, the change in $PLAY$-score between $T0$ and $T1$, and $T1$ to $T2$ were similar, with an increase of 0.58 and 0.50 $PLAY$-score. This could mean that greater changes may have a similar impact as smaller, but more detailed changes.

The GAP principles that were used most frequently were Gee's principles and the HEP and $PLAY$ guidelines. In total, these heuristics were used 58% of the time during the design process. It may then be argued that the majority of the success of the GAP may be attributed to these other heuristics and not GAP itself. The HEP and $PLAY$ guidelines included several useful principles that were not present in the GAP list, while also included several items that created overlap with other items in GAP. The guidelines were also quite extensive, even when excluding irrelevant principles and subcategories. To make the GAP list more approachable and more independent, a number of changes may be made to the GAP.

7.1 Recommendations

When using the Game Approachability Principles (GAP) to design a tutorial, it is important to put the heuristics in a context, such as the design process used in this paper. Using the heuristics without such a context might make them difficult to apply during ideation.

7.2 Limitations

This paper was not focused on any particular type of gamer, and it did not exclude any participants due to their gaming habits. The scope of this project was limited to designing a tutorial for a computer strategy game.

8 Revised *GAP*

A major revision to the *GAP* list would be to include the most useful *HEP* and *PLAY* principles directly in *GAP* instead. They could either be added as new items to *GAP*, or some existing principles in *GAP* could be expanded or rephrased to incorporate a few *HEP* and *PLAY* principles. The two *GAP* principles that are currently phrased as desired effects; "self-efficacy" and "self-mastery" could include aspects about intuitive and precise game controls, or clear and realistic game goals. "Self-mastery" could also be expanded to include many aspects regarding the challenge and endurance of the game. Another *GAP* principles, "scaffolding", could also be expanded to include the *PLAY* heuristics about "error prevention" and "screen layout".

One perceived flaw with the *GAP* was that there was little to prevent a tutorial from becoming "bloated", or overbearing. It could be beneficial for the design process to include a principle that encouraged elegant and efficient ideas. This principle would remind the designer to minimize the cognitive load of the player and not explain things which the player might find more exciting to discover for themselves. In order to not have to create and evaluate new heuristics, the subcategory "burden on player" in category 3 of the *PLAY* principles which may instead be added to *GAP* as a standalone principle.

A revised version of the *GAP* list designed specifically for use during a design process might look like the following:

1. Amount and type of practice (unchanged)
   - There are multiple opportunities for the player to practice a new tool, game mechanic or skill.
2. Amount and type of demonstration (unchanged)
   - Rules, tools, game mechanics and skills are demonstrated more than once, and in more than one way.
3. Reinforcement (expanded)
   - Principle is expanded to also include the *PLAY* heuristics category 2: D1 and category 3: C1, C2.
   - The game provides consistent, expected, exciting and immediate feedback to the player's actions.
   - The game provides auditive, visual or visceral feedback in the most proper way.
4. Self-efficacy and good game controls (expanded)
   - The previous *GAP* "self-efficacy" is expanded to include *PLAY* heuristics category 1: F1, F2 and category 3: B1, B3, B4, E2. The focus of the principle is to improve the player's sense of control and ability to succeed in what they attempt to do.
   - The player feels secure in their ability to succeed in the challenges presented by the game.

- The game controls are consistent, intuitive, natural and makes the player feels like they are in control.

5. Scaffolding, error prevention and efficient user interface (expanded)
   - The GAP principle "scaffolding" is expanded to include $PLAY$ heuristics category 3: F1, F2, F3, F4, H1, H2, H3, H4, H5.
   - Help is at first provided in broad terms, then more specific as the player needs it. Information given is context-sensitive and relevant to the current state of the game.
   - The user interface is efficient, consistent and functional.

6. Gee-game based principles (unchanged):
   - Co-design
     - Actions and choices made by the player help shape the game world.
   - Customize
     - The game allows the player to choose their own playstyle.
   - Identity
     - The player is able to identify with the world and the characters in the game.
   - Manipulation and distributed knowledge
     - The player is able to manipulate objects in the game world in a natural and expected way.
   - Information is 'on demand' and 'just in time'
     - Information is given when the player feels they need it and when they can use it.
   - Sandbox
     - There exists some sort of safe space within the game where the player can try new things without worrying about the consequences or feel any pressure.
   - System-thinking
     - The understanding of rules, tools and mechanics of the game help the player understand the game as a whole.

7. Self-mastery, good game goals and enduring play (expanded)
   - The principle is expanded to enable self-mastery via fun and challenging game goals. The $PLAY$ heuristics in category 1 are included in this principle.
   - The player was able to practice new skills and tools in order to master the game.
   - The player finds the game fun by experiencing a constant level of appropriate challenge and varying pacing.
   - The player finds the goals of the game realistic, challenging and clear. Long term goals may be divided into a set of short term goals.

8. Keep it simple (new)
   - The $PLAY$ heuristics in subcategory E "burden on player", in category 3 may be added as a new item to the GAP list. The principle would encourage efficient ideas and solution, in order to reduce both the cognitive load of the player as well as the implementation cost of all solutions during the design process.

- – The game does not put an unnecessary burden on the player.
- – The game encourages the player to learn via experimentation and discovery, rather than giving direct instructions.

The proposed revisions to the *GAP* list is to be taken as inspiration or a suggestion for future studies. The revised list has not been evaluated or tested. The purpose of the revised *GAP* list would be to be used during the design process of computer strategy game tutorials.

9 Conclusion

In this paper, an iterative design process used the Game Approachability Principles (GAP) to design and evaluate a game tutorial for a computer strategy game. In total, 38 participants participated in user testing the game and game tutorial. The resulting game tutorial increased the playability of the game by 58%. It also showed that GAP could successfully be used to create a tutorial for a strategy game. During the design process, it was revealed that some principles in GAP were framed in such a way that they were difficult to apply during ideation. It was also shown that the most useful aspects of the GAP list was found in the two other sets of heuristics provided by in GAP; the $PLAY$ and HEP heuristics, and Gee's guidelines. There also existed much overlap between them and the principles in GAP. As such, a revised version of the GAP was suggested to use during design processes. The revised version expanded some of the existing principles in GAP to include several of the $PLAY$ heuristics. A new principle was also suggested to be added to the GAP, in order to encourage more efficient design. The revised list has not been tested in the paper and is meant as a suggestion or inspiration for future work and studies.

9.1 Future Work

While the Game Approachability Principles (GAP) were successfully applied during the design process of the strategy game designed in this paper, their usefulness may differ in other contexts. To evaluate this, the guidelines would need to be applied during the design process of other games, such as virtual reality-games, mobile games or fighting games. Other factors that may affect the viability of GAP would be what design process is used, the size of the development team or the subjective interpretation of the more abstract principles in GAP. As such, another study could be performed to compare the design process used in this paper to methods such as the "Rational Game Design" [25] or the "designing with lenses" method [26].

The GAP was not used in the design process of the game prototype developed in this paper. Instead, GAP was only used and evaluated during the creation of the game tutorial. As it was shown that GAP helped produce a successful game tutorial, a follow-up study might evaluate the usage of GAP during the creation of a game from the earliest concept phase. Another study may also use GAP in order to formalize a method for creating game tutorials and improving the approachability of both new and existing games. Lastly, the revised GAP list proposed in this paper would need to be evaluated and compared to the original GAP or another set of heuristics.

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Appendices

A   Script read to test participants

Hej, tack för att du är med. Du ska få spela ett strategispel, för en studie om game approachability. Game approachability är ungefär hur man lär sig och lär ut spel. Du kommer få spela i 5 minuter och sen få svara på en enkät, som är på engelska. Efter enkäten kommer jag ställa några frågor om ditt spel. Under testet så kommer skärmen och din röst spelas in. Du får gärna tänka högt medan du spelar, dvs berätta vad du tänker och vad du gör i spelet. Du får gärna be om hjälp i spelet, men jag kommer bara ingripa om det är något som stoppar dig från att fortsätta spela. Det är spelet och teorierna bakom som testas, inte du. Du får närsomhelst avbryta om du inte vill fortsätta, och studien kommer vara helt anonym.

Spelet är baserat på sten, sax, påse. Varje spelare jagar någon annan men blir jagad av en tredje. Försten som lyckas eliminera den man jagar vinner.

*Sätt på hörlurar. Starta spel. Starta skärminspelning. Starta timern.

Jag startar timern nu.

*Starta timern

Då var speltiden slut och nu ska du få fylla i ett formulär om hur du upplevde det. Fråga gärna om det är något du inte förstår.

*öppna enkät.

Tack. Då har jag några korta följdfrågor.

- Hur skulle du beskriva din spelupplevelse?
  - Varför?
- Stötte du på något hinder, problem eller oklarhet?
- Finns det något du ville säga eller kommentera som frågorna inte har täckt in?

*stoppa och spara inspelning.

B   Interview questions

- "How would you describe your experience with the game?"
  - "Why?" (as a follow-up question)
- "Did you encounter any obstacles, problems or uncertainty with the game?"
- "Is there anything else that you would like to comment or say, that the answers haven't asked for?"

C PLAY form

During user testing, the participants were asked to answer a form after having played the game. The first part of the form consisted of questions regarding their experience while playing the game. Each question could be answered with a number from zero to four. Zero meant "I completely disagree", while four meant "I completely agree". The questions were based on the PLAY heuristics [16].

- I would play this game again if it was available to me.
- I would play this game over an extended period of time.
- The game was challenging me, without frustrating or boring me.
- The games difficulty made me try different strategies.
- The goal/goals of the game was clear to me.
- The goal/goals of the game was within reach of my abilities.
- The game supported a variety of play styles.
- I felt that I had control in the game.
- I felt an emotional connection with the characters of the game world.
- The game world felt unique and interesting.
- The game used visual, audio or haptic feedback to increase my immersion.
- The game felt playable without reading a manual or other documentation.
- The game controls felt intuitive and natural.
- The game reacted to my actions in a consistent, immediate, and natural way.
- I always knew what skills I needed to use or master, in order to accomplish my goals.
- The game gave rewards that further increased my immersion.
- The game did not burden me with too many, or too difficult tasks.
- The UI felt intuitive and visually pleasing.
- I rarely felt stuck or interrupted in the game.
- I had fun playing this game.
- I felt immersed in the game.

D   Gaming habits form

The second part of the user test form regarded the participant's gaming habits and experience. For the second question, the participant could answer "male", "female" or "non-binary".

– What is your age?
– How do you identify yourself?
– On average, how many hours of video, computer or mobile games do you play during a week? What types of digital games do you usually play?
– What digital games do you usually play? Leave blank if none
– Approximately, how long ago did you start playing mobile, computer or video games (years)? Leave blank if you do not play games regularly.