

Guidelines for Appealing Exergames

Interactive Qualifying Project Report completed in partial fulfillment
Of the Bachelor of Science degree at
Worcester Polytechnic Institute, Worcester, MA

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Abstract

Background: Exergames, video games that have activities based on the gamers, intention to exercise, improve, or maintain physical fitness, have the potential for entertainment and exercise. However, we hypothesize that exergames may not be as appealing as non-exergames. We evaluated exergames using three types of user studies: personal game reviews, user comment reviews, and user surveys. We came up with appealing elements in video games and wrote recommendation guidelines for an exergame with said elements.

Chapter 1: Introduction

Video games for health as a concept was probably one of the most obvious oxymoron thirty years back. In days gone by, most adults and other exemplary citizens would stereotypically frown at the prospect of teenagers spending prolonged hours and, worse, pumping countless quarters at local arcades instead of doing their algebra homework. The same could have been said for other emerging popular trends back in the 80's, but video games seem to have taken the biggest leap, as big as that of computers and programming technology. The first games for health, published in the 80's, were used for cognitive exercise and improving patients' medication behavior. Since then video gaming, and material innovation, has unfortunately and inevitably become a major part of modern life. As video gamers and members of a semi-technologically dependent generation ourselves, we see exergaming as an emerging trend with the potential to bring video gaming and healthy lifestyles to a new height; however, in order to make its first stand as such, exergames need at least a fighting chance against already popular entertainment games such as Call of Duty in the eye of window-shoppers at GameStop on Black Friday.

Although it may seem self-evident that - notwithstanding those who utilize this innovation on a regular schedule to promote physical health - most modern gamers pay minimal attention to games for health in favor of entertainment value and non-physical advantages of regular video games, we will explore this blatant assertion in our study. If proven true, it means that exergames cannot entertain as much as other addictive video games, with explosions, Hollywood clichés and other assorted degeneracies; or that the physical effort required to play exergames presents a barrier that makes gamers less likely to play them.

We hypothesize that exergames are not as appealing as other video games. We conduct user studies to assess exergames and compare them to non-exergames and will write a recommendation guideline for an appealing exergame based on the results of our user studies.

Research Questions

1. Does a gap exist between exergames and video games in general?
2. Would playing exergame make people healthier?
3. What elements in video games appeal to people?
4. Why do people prefer general video games to exergames?
5. If non-exergames are more appealing, how can we make exergames more appealing?

At the project's conclusion, we hope to have identified a combination of video gaming aspects which appeal to regular gamers and come up with guidelines of an exergame with the said combination.

Chapter 2: Background

2.1 Definition of game, gaming and exergame

According to a paper from the Meaningful Play conference 2010 [9], the author points out a contradiction in what had been known up to that time as exergaming: that the average consumer plays exergames largely for fun and without a schedule. Unlike regular physical activities, exergames in the past failed to generate enough physical exertion for casual gamers. The author goes on to propose a definition of exergaming as an activity based on the gamer's intention to exercise - improve or maintain physical fitness with a planned, repetitive, and structured format - rather than the content or mechanic of the exergames themselves. For example, a player who plays Wii Sports for fun is not exergaming, while another who plays the same game to maintain or lose weight on a schedule is exergaming. Refer to the terms and definitions page for definitions of exergames and other related terms.

2.2 A brief history of exergames

When we talk of exergames and exergaming, an uninformed listener will most likely think of Dance Dance Revolution as one of the first of its kind; however, exergaming predates Dance Dance Revolution for at least 16 years. Many sources contradict on where popular exergames actually began as many companies vied for market supremacy through innovative control systems. One of the first of these was the Joyboard, a 1982 balance board controller for the Atari 2600 platform developed only for and sold with the skiing game Mogul Maniac. The same year also saw an unrealized concept for an exercise bike controller by Atari. In 1989, Nintendo, who would later develop Wii; the world's most recognizable exergaming platform, came up with the Power Glove. Many other developers came up with new exergaming products, but it was not until 1998 that exergaming would become popularized by Namco's iconic Dance Dance Revolution. With its combination of popular tunes, dancing, competitive multiplayer functions, and user-friendly learning curve, it became a favorite all over the world. Other

exergaming milestones would come years later in forms of Nintendo Wii, 2010 Microsoft's Kinect for Xbox 360, and 2010 Playstation Move.

While Nintendo Wii specializes the console that track movement from a remote device, Microsoft and Sony relies on motion detection technology for their console, Kinect and Eye Camera respectively, which can detect players' body movements allowing for more freedom of control and more physical exertion. Xbox 360's Kinect is probably most well-known for its full body motion detection capability. Many games; including Kinect Sports, Kinect Star Wars, and Dance Central, are created based on Kinect's unique features and requires players to follow the movement shown on screen to successfully interact with object or characters.

In addition to the console games, with the fast adoption of smartphones since 2007 a number of exergames have been developed for mobile phones utilizing the GPS function. Considering half the adult population in the United States own at least one smartphone [11], exergame mobile apps may have the largest consumer base, though, whether regular gamers – our target population in this project – will pay as much attention to them as their console or PC counterparts remains to be seen.

2.3 Does the gap between exergames and other video games exist?

It is perhaps impossible to tell if a gap between exergames and other video games exist based on gaming literature. The two types of games are intrinsically different, and to the best of our knowledge no studies have explored similarities and differences between general video games and exergames. We know almost by common experience in the gaming community, however, that exergames do not sell as many copies as other video games. Only a handful of exergames make it to any top ten best-selling list, and even if we know how many copies of an exergames are sold, we cannot tell how many buyers are avid gamers and how many hours the games are actually played per week to

justify them being a regular mode of entertainment or exercise. To establish the existence of this gap, we will dedicate a part of our survey to determining metrics such as exercise hours per week, video game platforms respondents own, video gaming hours spent per week, familiarity with exergames, and exergaming hours per week of a generalized online group. From this survey, we will be able to graph exergaming hours based on gaming hours demographics and demonstrate that exergames are, as predicted, the underdog in the video game industry.

2.4 Would playing exergames make people healthier?

Exergaming can add health benefits to entertainment provided by video gaming experience.

Some of these benefits include [3]:

- Physical health management
- Cognitive benefits
- Social Benefits

These benefits, coupled with the fact that 51 percent of US households own a dedicated gaming console, with increasing numbers and diversifying demographics [4], means that exergaming can potentially stand on its own as a mixture of entertainment and exercise.

Many research papers exist that support the use of exergames for health promotion. In a study at the University of Stuttgart, researchers confirmed measured physiological benefits of the WiiBoxing game tested out by 15 sports science students [8]. Another study measured energy expenditure of exergaming in college students and found the average energy expenditure of three test exergames (3-Kick, Jackie Chan Studio Fitness Power Boxing, and Disney's Cars Piston Cup Race) to be 546 kcal/hour in males, which is almost equivalent to 588 kcal/hour of bicycling and swimming laps (Siegel, Haddock, Dubois and Wilkin, 2009.) [10] And although participants from the first study agree that exergaming

cannot substitute for real sports, they suggest that energy expenditure from regular exergaming is adequate for regular video gamers and can motivate them into being more physically active.

2.5 What Elements in video game appeal to people? Why do people prefer general video games to exergames?

Unlike the previous research question, to the best of our knowledge, previous studies did not address this question in the literature. Therefore, in our survey study we will ask those who do not play exergames their attitude towards them. We expect to have some varying and subjective results. Regardless, the data will give us enough information about attitudes towards exergames to contrast with another separate survey aimed at various online gaming communities. This survey will explore the appealing elements in video games categorized by genres. From this data, we will be able to tell what exergames lack as opposed to what other video games already have.

2.6 How do we make exergames more appealing?

Finally, from survey data and personal game reviews, we will write recommendation guidelines for exergames with appealing elements and examples of such elements from exergames that we shall review ourselves. Reviewed games will be scored based on review criteria. Supplementary online reviews of both consumers and critics will also be used to confirm survey data and personal reviews.

Chapter 3: Methodology

Our project is divided into three phases. We first formed a hypothesis of what to expect from exergames; by reviewing exergames from three console platforms (Xbox360, Wii, PS3) ourselves, we formed our opinion on many elements of exergames. We used a review scoring in the form of survey questions based on exergame review criteria from The Exergame Network Blog. In the second phase, we looked at customer comments on each exergame on Amazon.com for pros and cons. This helped us form a general idea of what those who play exergames think of them. The comments also helped us generate questions for our online survey. These customer reviews also helped confirm our reviews and served as examples when we write up the recommendation guidelines. In the third phase we conducted an online survey of gamers. By releasing this online survey onto social network such as twitter and Facebook, we were able to answer our research questions and confirm our formed hypothesis from personal exergame reviews and review of Amazon.com reviews.

3.1 Phase 1: Personal exergame reviews

The first step of our personal game review is game selection. Following extensive background research, we have come to agree that console platforms have the best exergaming technology, namely motion detection sensor. PC and hand-held game devices are lacking in this aspect, and there is not any exergame support on these platforms. Likewise, even though mobile phones have released exercise applications and games, only a handful of them support motion detection. Moreover, their visual representations are limited and cannot compete with fully developed games on console. However, their potential as a platform for wide dissemination of games was not overlooked, and some of our early game reviews were on mobile phones and tablets. We hypothesize that, like exergames for real exercises, games on mobile phones can substitute for console video games to a limited extent.

Figure 1 illustrates our game selection protocol for the first phase of our project. Each group member is assigned to a platform (Xbox360, PS3, Wii), and members select the top ten games for their platforms. The search terms for Xbox360 and PS3 are justified because the Eye Camera and Kinect sensor support full motion detection. There are also many other types of controllers such as the Wii balance board. However, games that support these controllers are scarce, and most of these controllers are game-specific and are typically packaged with the game (e.g. the Active Life series on Wii). These games are not among the top games as sorted using our game selection protocol.

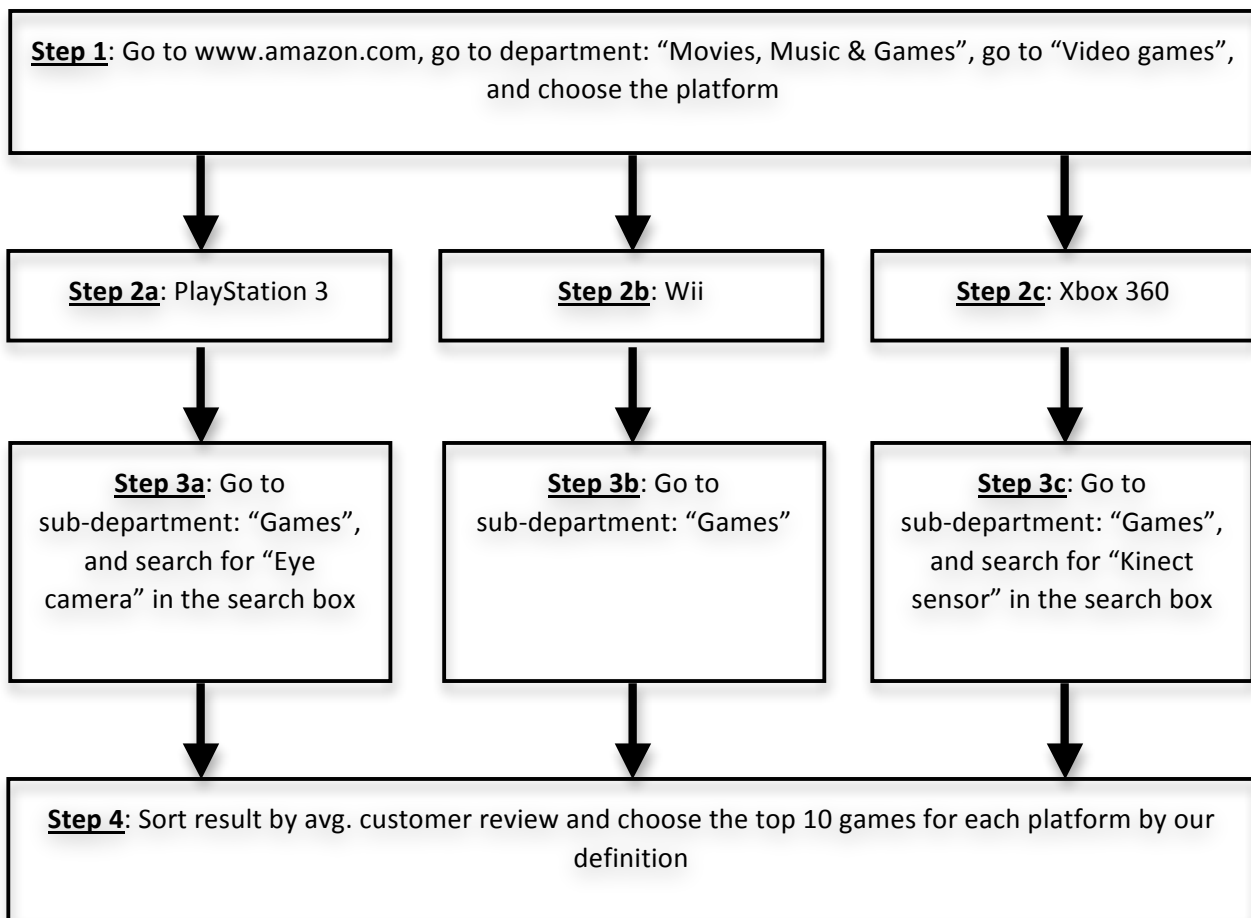
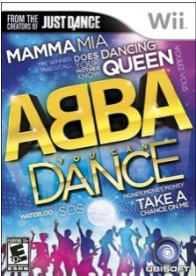










Figure 1 Game selection protocol for console games

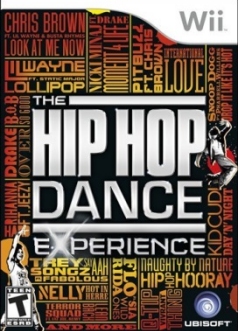


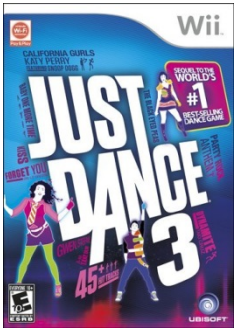


Also, in the case of games with sequels on the top-ten list, we decided to review all editions of the games to determine improvements. We also decided to review all versions of the games that are offered on different platforms in order to compare different features offered by different platforms.

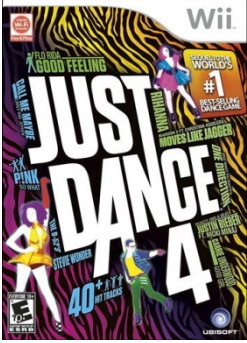





Once we determine the top 10 games for each platform, we review these games using the review form provided in appendix A. The statements in the survey are derived from exergame review criteria retrieved from The Exergame Network Blog. These criteria help us in determining questions that are appropriate for our online survey of gamers.


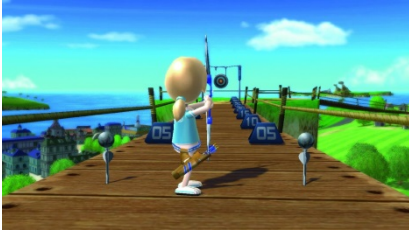




Table 1 Selected Exergames for Review

Title	Description	Screenshots
<p>ABBA You Can Dance (Wii)</p>  <p>Cover of <i>ABBA You Can Dance</i> (Image credit: Amazon.com)][1]</p>	<p>From the creators of the award-winning Just Dance franchise comes the game ABBA You Can Dance. Allows players to dance with up to four players or join in on vocals; ABBA You Can Dance is unforgettable fun for friends and family of every generation.</p>	 <p>Screenshot of <i>ABBA You Can Dance</i> (Image credit: Amazon.com)[2]</p>  <p>Screenshot of <i>ABBA You Can Dance</i> (Image credit: Amazon.com)[3]</p>
<p>The Black Eyed Peas Experience (Wii, Xbox 360)</p>	<p>Get the party started in your living room with the world’s hottest group in the world’s hottest new dance game. Perform iconic dance moves alongside members of the music group Black Eyed Peas (apl.de.ap, Fergie, Taboo</p>	

Title	Description	Screenshots
 <p>Cover of <i>The Black Eyed Peas Experience</i> (image credit: Amazon.com)[4]</p>	<p>and will.i.am) with authentic choreography designed exclusively for the group. Rock your own look by customizing your avatar's appearance and creating your own choreography. The Black Eyed Peas Experience is the ultimate dance game and the ultimate way to keep the party rocking.</p>	 <p>Screenshot of <i>The Black Eyed Peas Experience</i> (image credit: Amazon.com)[5]</p>  <p>Screenshot of <i>The Black Eyed Peas Experience</i> (image credit: Amazon.com)[6]</p>
<p>Dance Dance Revolution Hottest Party 2 (Wii)</p>  <p>Cover of <i>Dance Dance Revolution Hottest Party 2</i> (image credit: Amazon.com)[7]</p>	<p>The hottest-selling dance game returns, with an entirely new soundtrack, game modes and interactivity. Combines the physically engaging innovative and easy-to-pick-up-and-play mechanics of the Wii platform. This game is a sequel to Dance Dance Revolution 1.</p>	 <p>Screenshot of <i>Dance Dance Revolution Hottest Party 2</i> (image credit: Amazon.com)[8]</p>  <p>Screenshot of <i>Dance Dance Revolution Hottest Party 2</i> (image credit: Amazon.com)[9]</p>

Title	Description	Screenshots
<p>The Hip Hop Dance Experience (Wii, Xbox 360)</p>  <p>Cover of <i>The Hip Hop Dance Experience</i> (image credit: Amazon.com)[10]</p>	<p>Discover the first truly authentic hip-hop experience in the dance game category. With a variety of unique game modes, including fun multiplayer parties and dance battles, <i>The Hip Hop Dance Experience</i> is the ultimate way to drop it like it's hot with all your favorite hits.</p>	 <p>Screenshot of <i>The Hip Hop Dance Experience</i> (image credit: Amazon.com)[11]</p>  <p>Screenshot of <i>The Hip Hop Dance Experience</i> (image credit: Amazon.com)[12]</p>
<p>Just Dance 3 (Wii, Xbox 360, PlayStation 3)</p>  <p>Cover of <i>Just Dance 3</i> (image credit: Amazon.com)[13]</p>	<p><i>Just Dance 3</i> is the perfect dance game for any age and any dance ability, so it's easy for anyone to join the movement! With a variety of all-new gameplay modes, tracks that allow up to 8 players at once, and innovative cardio training options, <i>Just Dance 3</i> was made to bring the party and keep America dancing!</p>	 <p>Screenshot of <i>Just Dance 3</i> (image credit: Amazon.com)[14]</p>  <p>Screenshot of <i>Just Dance 3</i> (image credit: Amazon.com)[15]</p>





Title	Description	Screenshots
<p>Just Dance 4 (Wii, Xbox360, PlayStation 3, Wii U)</p>  <p>Cover of <i>Just Dance 4</i></p> <p>(image credit: Amazon.com)[16]</p>	<p>The world's #1 dance game brand is back with Just Dance 4! Just Dance 4 is the perfect catalyst for the best parties, no matter what the occasion, thanks to innovative new modes like the all-new Battle mode, and upgraded Just Sweat mode, and even more fun, exclusive modes for each platform. Everything you know and love about Just Dance gets even better with Just Dance 4-hot new tracks, fun irreverent dances, and more.</p>	 <p>Screenshot of <i>Just Dance 4</i> (image credit: Amazon.com)[17]</p>  <p>Screenshot of <i>Just Dance 4</i> (image credit: Amazon.com)[18]</p>
<p>Michael Jackson The Experience (Wii, Xbox 360, PlayStation 3, Nintendo DS, Sony PSP, Nintendo 3DS, PlayStation Vita)</p>  <p>Cover of <i>Michael Jackson: The Experience</i> (image credit: Amazon.com)[19]</p>	<p>Get ready to rock your body to decades of iconic tracks by the King of Pop. This unique interactive experience will have you hitting all the moves as if you've danced right into Michael's shoes. With Michael Jackson The Experience, anyone can dance like Michael to legendary hits such as Beat It and Billie Jean while mastering the moves he made famous in iconic environments inspired by his most popular music videos and stage performances.</p>	 <p>Screenshot of <i>Michael Jackson: The Experience</i> (image credit: Amazon.com)[20]</p>  <p>Screenshot of <i>Michael Jackson: The Experience</i> (image credit: Amazon.com)[21]</p>

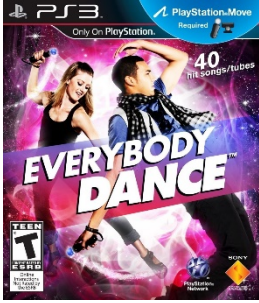

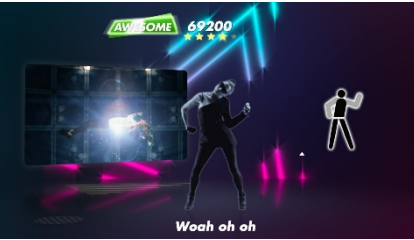

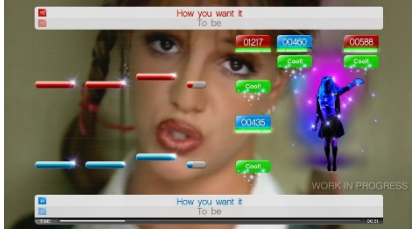
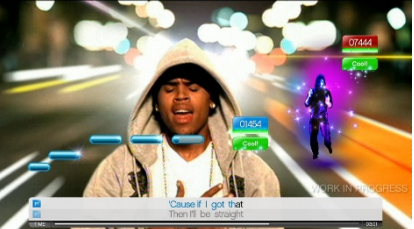
Title	Description	Screenshots
<p>Wii Sports Resort (Wii)</p>  <p>Cover of <i>Wii Sports Resort</i> (image credit: Amazon.com)[22]</p>	<p>Wii Sports Resort is a sequel to Wii sports, which takes the inclusive, fun and intuitive controls of the original Wii Sports to the next level, introducing a whole new set of entertaining and physically immersive activities. With the deep control enhancements of Wii MotionPlus, veteran Wii users and newcomers alike can enjoy unprecedented gaming precision as they cruise on a water scooter, duel with swords, throw a Frisbee and much more.</p>	 <p>Screenshot of <i>Wii Sports Resort</i> (image credit: Amazon.com)[23]</p>  <p>Screenshot of <i>Wii Sports Resort</i> (image credit: Amazon.com)[24]</p>
<p>Zumba Fitness 2 (Wii)</p>  <p>Cover of <i>Zumba Fitness 2</i> (image credit: Amazon.com)[25]</p>	<p>Zumba Fitness 2 is a multiplayer Dance – Fitness game for Wii that provides an outlet for players to get a great full body workout in a fun dance class environment. Gameplay incorporates 20 different dance styles and utilizes the included <i>Zumba Fitness</i> belt which hold the Wii Remote, allowing for hands-free action.</p>	 <p>Screenshot of <i>Zumba Fitness 2</i> (image credit: Amazon.com)[26]</p>  <p>Screenshot of <i>Zumba Fitness 2</i> (image credit: Amazon.com)[27]</p>




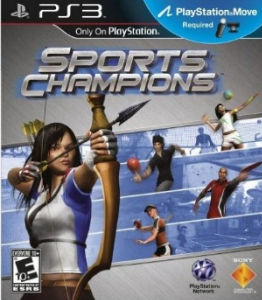


Title	Description	Screenshots
<p>Zumba Fitness Core (Wii, Xbox 360)</p>  <p>Cover of <i>Zumba Fitness Core</i> (image credit: Amazon.com)[28]</p>	<p>Zumba Fitness Core is the latest release in the best-selling video game franchise that has sold more than seven million copies of the exhilarating Zumba Fitness interactive workout. As the only fitness game that targets your core, Zumba Fitness Core is specifically designed to deliver the tight and toned abs that women crave.</p>	 <p>Screenshot of <i>Zumba Fitness Core</i> (image credit: Zumbafitnessgame.com)[29]</p>  <p>Screenshot of <i>Zumba Fitness Core</i> (image credit: Wiisworld.com)[30]</p>
<p>Dance Central 2 (Xbox 360)</p>  <p>Cover of <i>Dance Central 2</i> (image credit: Amazon.com)[31]</p>	<p>Dance Central 2 keeps the wildly addictive Dance Central experience going with a new focus on simultaneous multiplayer. Friends can now team up in Perform It or go head-to-head in a simultaneous dance off within Dance Battle. Additionally, players can seamlessly drop in or out at any point during a song, so the party never has to stop!</p>	 <p>Screenshot of <i>Dance Central 2</i> (image credit: Amazon.com)[32]</p>  <p>Screenshot of <i>Dance Central 2</i> (image credit: Amazon.com)[33]</p>

Title	Description	Screenshots
<p>Dance Central 3 (Xbox 360)</p>  <p>Cover of <i>Dance Central 3</i> (image credit: Amazon.com)[34]</p>	<p>With Dance Central 3, you'll travel back through time to learn the best dance crazes from across the ages, including disco moves of the 70's, hip-hop moves from the 80's and the hottest moves on the dance floor today. More friends can get in on the fun than ever before with a new multiplayer party mode for up to 8 players – jump right into the game and get everyone dancing!</p>	 <p>Screenshot of <i>Dance Central 3</i> (image credit: Amazon.com)[35]</p>  <p>Screenshot of <i>Dance Central 3</i> (image credit: Amazon.com)[36]</p>
<p>Kinect Adventures! (Xbox 360)</p>  <p>Cover of <i>Kinect Adventure!</i> (image credit: Amazon.com)[37]</p>	<p>Kinect™ Adventures will get you off the couch and into the game in a whole new way. You and your friends and family will jump, dodge, and kick your way through 20 pulse-pounding adventures set in exotic locations with 5 family-friendly mini-games: 20,000 Leaks, River Rush, Rally Ball, Reflex Ridge, and Space Pop.</p>	 <p>Screenshot of <i>Kinect Adventure!</i> (image credit: telegraph.co.uk)[38]</p>  <p>Screenshot of <i>Kinect Adventure!</i> (image credit: sportsillustrated.cnn.com)[39]</p>

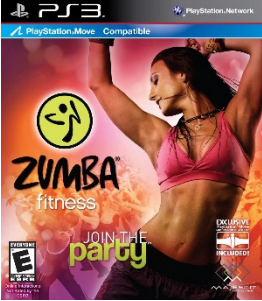
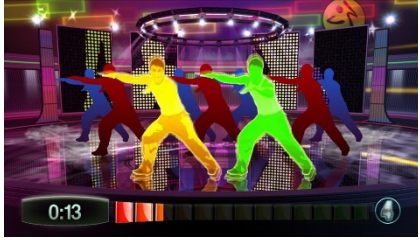

Title	Description	Screenshots
<p>Kinect Rush: A Disney Pixar Adventure (Xbox 360)</p>  <p>Cover of <i>Kinect Rush: A Disney Pixar Adventure</i> (image credit: Amazon.com)[40]</p>	<p>Kinect Rush: A Disney Pixar Adventure, invites families and fans of all ages to experience the worlds of five beloved Disney Pixar films like never before. Through the magic of Kinect for Xbox 360, scan yourself into the game to become a unique character in five Pixar worlds from your favorite Pixar animated movies: Cars, Toy Story, Ratatouille, The Incredibles, and UP.</p>	 <p>Screenshot of <i>Kinect Rush: A Disney Pixar Adventure</i> (image credit: Amazon.com)[41]</p>  <p>Screenshot of <i>Kinect Rush: A Disney Pixar Adventure</i> (image credit: Amazon.com)[42]</p>
<p>Kinect Sports (Xbox 360)</p>  <p>Cover of <i>Kinect Sports</i> (image credit: Amazon.com)[43]</p>	<p>With “Kinect Sports” you’re not only the star player, you are the controller – through the magic of Kinect for Xbox 360. See a ball? Kick it. Spike it. Even give it a little topspin. Simple, intuitive and instantly fun, “Kinect Sports” delivers the ultimate party experience – whether you are trying to outmaneuver the goalie to win the soccer match or cheering on your friends at ringside.</p>	 <p>Screenshot of <i>Kinect Sports</i> (image credit: wired.com)[44]</p>  <p>Screenshot of <i>Kinect Sports</i> (image credit: ign.com)[45]</p>

Title	Description	Screenshots
<p>Zumba Fitness Rush (Xbox 360)</p>  <p>Cover of Zumba Fitness Rush (image credit: Amazon.com)[46]</p>	<p>Following the worldwide best-selling original, Zumba Fitness Rush builds on that phenomenal success while elevating the exer-game category to a new level of fun, effective fitness. This cutting-edge experience layers in a wealth of exclusive content only available on Kinect, plus lots of new features and improvements that amp up the dance fitness play so you can party yourself into shape!</p>	 <p>Screenshot of Zumba Fitness Rush (image credit: Amazon.com)[47]</p>  <p>Screenshot of Zumba Fitness Rush (image credit: Amazon.com)[48]</p>
<p>DanceDanceRevolution (Wii, Xbox 360, PlayStation 3)</p>  <p>Cover of DanceDanceRevolution (image credit: Amazon.com)[49]</p>	<p>DanceDanceRevolution is a Rhythm/Dance game that blends classic, heart-pumping arcade DDR gameplay with Wii/Xbox 360/PlayStation3 centric functionality that together is designed to satisfy both longtime fans while also accommodating less advanced players and those coming to it for the first time.</p>	 <p>Screenshot of DanceDanceRevolution (image credit: Amazon.com)[50]</p>  <p>Screenshot of DanceDanceRevolution (image credit: Amazon.com)[51]</p>

Title	Description	Screenshots
<p>Everybody Dance (PlayStation 3)</p>  <p>Cover of <i>Everybody Dance</i> (image credit: Amazon.com)[52]</p>	<p><i>Everybody Dance</i> delivers a high-energy dance experience set to a soundtrack of 40 chart-topping party hits including Usher’s “OMG,” “Party Rock Anthem” by LMFAO, and “Barbra Streisand” by Duck Sauce, that feature the original artist’s music videos. Using the PlayStation®Move motion controller and PlayStation®Eye camera to track and score moves, players can test their dancing skills with three difficulty levels, each featuring unique routines for every track produces by world-renowned choreographers.</p>	 <p>Screenshot of <i>Everybody Dance</i> (image credit: Amazon.com)[53]</p>  <p>Screenshot of <i>Everybody Dance</i> (image credit: Amazon.com)[54]</p>
<p>SingStar Dance Party (PlayStation 3)</p>  <p>Cover of <i>SingStar Dance Party</i> (image credit: Amazon.com)[55]</p>	<p><i>SingStar Dance</i> for PlayStation 3 is a unique extension of the <i>SingStar</i> music gaming experience that adds dance gameplay to the familiar karaoke-like performance action that the franchise is famous for. Dance activities utilize Sony’s PlayStation Move motion controller and PlayStation Eye camera combination to replicate precisely choreographed routines on-screen, while singing gameplay uses standard USB microphones compatible with the PS3</p>	 <p>Screenshot of <i>SingStar Dance Party</i> (image credit: Amazon.com)[56]</p>  <p>Screenshot of <i>SingStar Dance Party</i> (image credit: Amazon.com)[57]</p>

Title	Description	Screenshots
<p>Sorcery (PlayStation 3)</p>  <p>Cover of <i>Sorcery</i> (image credit: Amazon.com)[58]</p>	<p><i>Sorcery</i> is a single player action role-playing game (RPG) for PlayStation 3 that utilizes Sony's PlayStation Move control system to create a dungeon crawling adventure like none before it. With the extreme motion-controlled sensitivity of the PlayStation Move motion controller and PlayStation Eye camera peripheral accessory combination* players enter, interact with and explore a world where their growing expertise with spells and potions will be the difference between the salvation of the world and its domination.</p>	 <p>Screenshot of <i>Sorcery</i> (image credit: Amazon.com)[59]</p>  <p>Screenshot of <i>Sorcery</i> (image credit: Amazon.com)[60]</p>
<p>Sports Champions (PlayStation 3)</p>  <p>Cover of <i>Sports Champions</i> (image credit: Amazon.com)[61]</p>	<p>Sports Champions will let you and your friends physically engage in an array of competitive sporting activities as you go head to head in six events. Use your PlayStation Move as a paddle in table tennis as you conduct high speed exchanges against your challengers; or ignite the arena as your PlayStation Move becomes a sword and swing your arm forward to battle your opponent. With the easy to use of PlayStation Move anyone can crush, spike and smoke the competition in the ultimate sports showdown.</p>	 <p>Screenshot of <i>Sports Champions</i> (image credit: Amazon.com)[62]</p>  <p>Screenshot of <i>Sports Champions</i> (image credit: Amazon.com)[63]</p>

Title	Description	Screenshots
<p>The Fight: Lights Out (PlayStation 3)</p>  <p>Cover of <i>The Fight: Lights Out</i> (image credit: Amazon.com)[64]</p>	<p>Grab your PlayStation Move motion controllers and step into the dark and gritty underground of bare knuckle brawling in <i>The Fight: Lights Out</i>. The power to climb to the top of the underground scene is in your hands. The only rule is that there are no rules – you decide how to take down your next challenger. Get them in a headlock and throw elbows to the skull, or go ballistic by swinging with all-out haymakers. Use the PlayStation Move motion controllers to dominate opponents with accurately tracked strikes.</p>	 <p>Screenshot of <i>The Fight: Lights Out</i> (image credit: Amazon.com)[65]</p>  <p>Screenshot of <i>The Fight: Lights Out</i> (image credit: Amazon.com)[66]</p>
<p>TV Superstars (PlayStation 3)</p>  <p>Cover of <i>TV Superstars</i> (image credit: Amazon.com)[67]</p>	<p>Use the PlayStation Eye camera's unique face-capture technology to place you, friends and family into the starring roles of five action-packed TV shows. Then use your PlayStation Move motion controller to physically compete and rise to the top of the "A list" to become a household name. Battle it out on the red carpet, pose for paparazzi photographs, and sign autographs to become the Star you've always wanted to be!</p>	 <p>Screenshot of <i>TV Superstars</i> (image credit: Amazon.com)[68]</p>  <p>Screenshot of <i>TV Superstars</i> (image credit: Amazon.com)[69]</p>

Title	Description	Screenshots
<p>Zumba Fitness (Wii, Xbox 360, PlayStation 3)</p>  <p>Cover of <i>Zumba Fitness</i> (image credit: Amazon.com)[70]</p>	<p><i>Zumba Fitness</i> is an exercise game and program for Wii/Xbox 360/PlayStation 3 that taps into the Zumba dance-exercise craze that has swept the nation. Surprisingly challenging, and addictively fun, the 30 heart-pounding Zumba routines that make up <i>Zumba Fitness</i> utilize the motion sensing capabilities of the Wii Remote/Microsoft Kinect/PlayStation Move controller which work along with the exclusive Wii Remote/Move motion controller belt, included with the game, to create a fun but result-producing workout.</p>	 <p>Screenshot of <i>Zumba Fitness</i> (image credit: Amazon.com)[71]</p>  <p>Screenshot of <i>Zumba Fitness</i> (image credit: Amazon.com)[72]</p>

3.2. Phase 2: Review of user comments

This part of the project involved conducting reviews of user comments left on amazon.com website for the exergames personally reviewed in Phase 1. Each member of our group was responsible for user comments for games that they reviewed.

We first sorted the reviews using ‘the most helpful’ option and reviewed the top 300 review comments per game by looking for recurring themes in comments. We then fit these comments into related criteria defined in our terms and definitions section. Along the way, we also looked for comments that do not fall into any existing criteria. We used these comments to form new criteria. An example of these would be comments on video game price, which was not one of the existing criteria. Note that we did not separate comments into pros and cons as both types of comments may exist in the

same criteria. We expected the comments to come to a saturation point where no new comments fit into any other criteria than the existing ones after at most 300 comments. If this saturation point came before our 300 comment limit, we recorded the saturation point. These collected user comments formed our general understanding of what people like and dislike in the selected exergames.

3.3 Phase 3: Online Survey

Our online survey was designed to have questions relating to gamers' opinions of exergames and general video games (For online survey, see appendix B). It should be noted that during the early stages of the project, we did not intend to use an online survey but instead intended to let people test exergames and then ask their opinions in an experimental setting. We realized that this approach was impractical. The online survey method was most suited for our purpose because we were able to reach a bigger target population, who are real users of the games we selected and are active participants in the gaming communities.

The survey was designed to help confirm our hypothesis and answer our research questions. By posting the survey on online communities, we expected to obtain diverse opinions from both exergamers and general video gamers with different video gaming habits. The survey questions were designed so that they addressed all our research questions from as many types of gamers as possible. Participants were sorted by gaming hours and also exercise hours per week. We also came up with more questions while reviewing our personal game review criteria. The collected data was expected to help confirm our hypothesis that exergames are not as appealing as general video games and tell us what exergames lack compared to general video games.

We distributed our surveys through WPI emails and Facebook. See appendix c for invitation letter.

Chapter 4: Phase 1 Results: Reviews by Team Members

Phase 1 involves personal reviews. Therefore, results are very subjective. For example, one member do not like dancing or physical exercise at all. Table 2 illustrates each team member's experience with video games, physical activity habits, technology ownership and helps place each member roughly into the same demographics as respondents in phase 3:

Table 2 Reviewer Profiles

	Amorn	Nuttaworn	Latthapol
Gender	Male	Male	Male
Age	21	22	24
Major	Mathematics	Mechanical Engineering	Aerospace Engineering
Gaming hours per week	8	10	7.5
Exergaming hours per week	0	0	0
Exercise hours per week	4	2	0
Smartphone owned	1	1	0
Computer owned	2	2	1

Figure 2 shows a summary of facts of the selected exergames. These facts are related to in-game functions that may contribute to their appeal. These are facts and will not change from person to person. Most of the selected exergames support non-networked multiplayer function and, like any other video game, score player’s performance. While some of the games have some form of energy expenditure indicator, all of them do not scale with the players’ weight and height. Most of the games are also dancing games. This indicates a lack of exercise diversity in popular exergames.

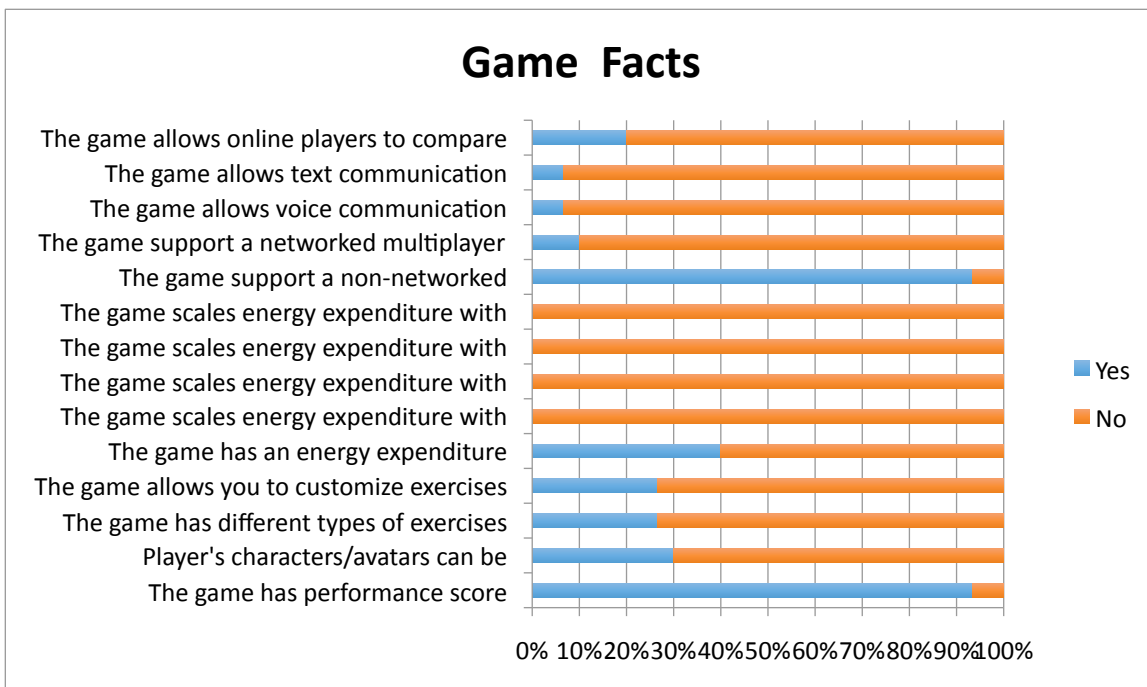


Figure 2 Game review facts

4.2 Exergame storyline

One of the first things that come to mind when browsing for games, movies, or books is that if their plot and story are interesting. A good story can keep us reading for hours or playing games in one sitting.

Figure 3 shows strong disagreement. We thought that most of the game storylines were not fun and

engaging. This is the case because most of the selected games had no story and some that do are too goofy and childish to be taken seriously.

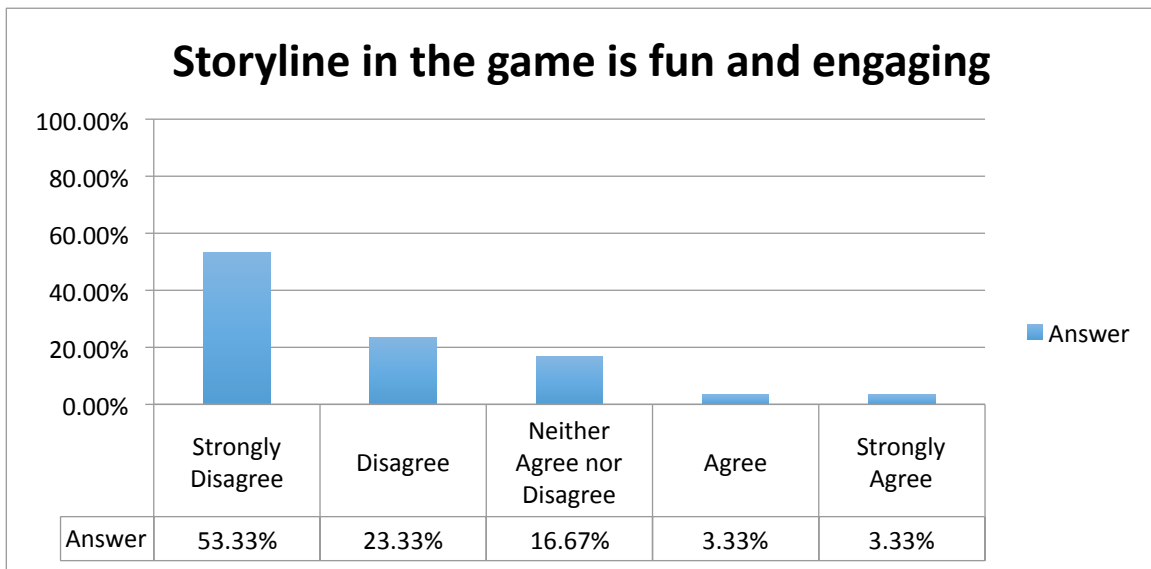


Figure 3 Storyline Satisfaction Results

4.3 Franchise's Fame

Sometimes people buy books, unfortunately, because it is a part of a famous series that they have read an earlier edition. We wanted to find out if similar buyers also existed for videogames.

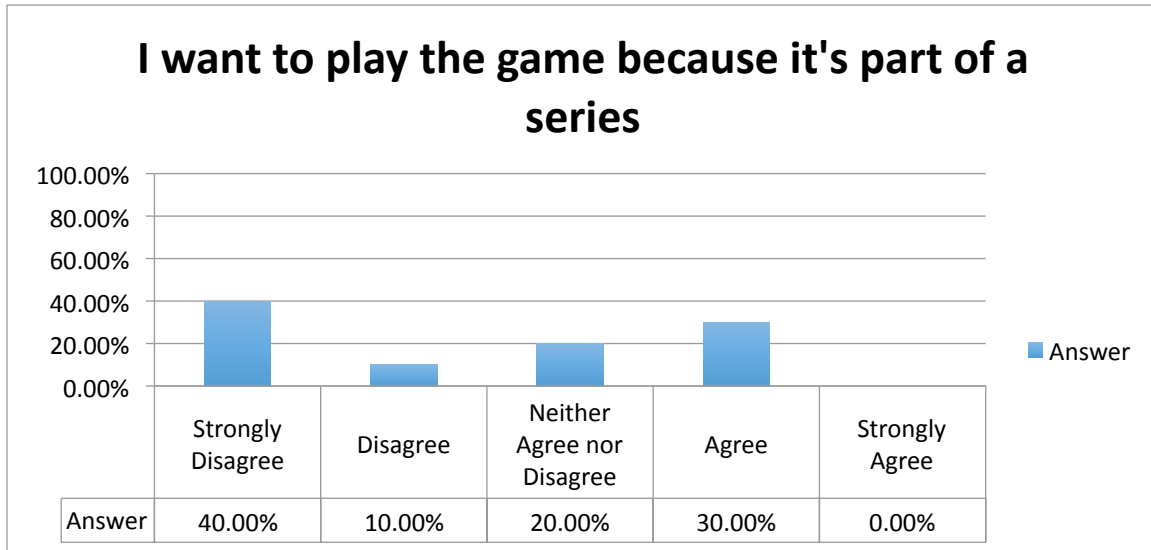


Figure 4 Franchise's fame

Figure 4 shows a bi-modal distribution. While in most cases, we did not choose to play a game because it was part of a series, in a few cases, we did. In some cases, our group members chose to play an exergame only if the series or franchise to which it belongs has a long-standing reputation, reaching back into our youth days. Since a significant number of the games reviewed were dance games and our team members did not like dance, it was also probable that dance-related franchises did not appeal to them and they did not know much about them. The neutral opinion shows, as of the review date, games that were not part of a series.

4.4 Exergame graphics

Visual representation in videogames is important. First impressions are always formed from a cursory observation, but for videogames, graphics must suit the context of the games. For instance, a family friendly game like Wii Sports should not have graphic violence. Figure 5 shows a relatively diverse opinion on the graphics of the selected games. Agreement was in favor of exergames with cartoonish graphics that kept up with the spirit and tone of the games. Disagreement corresponds to certain dancing games with uninteresting graphics or annoying visual effects.

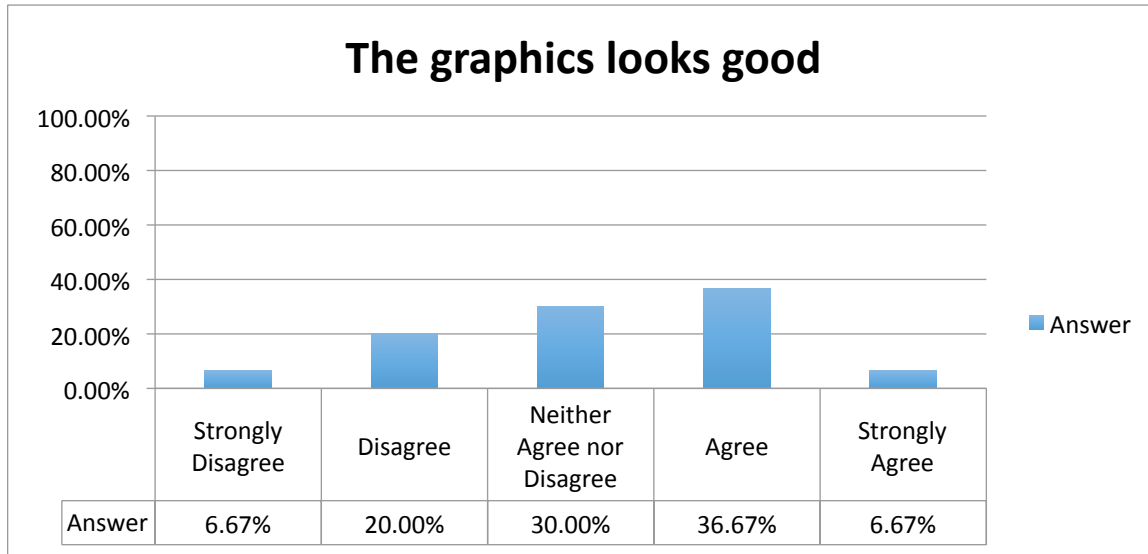


Figure 5 Assessment of Graphics

4.5 Doable Exercises

Some people may find some types of exercises more difficult. Figure 6 shows that all the team members are capable of doing exercises simulated in the selected games.

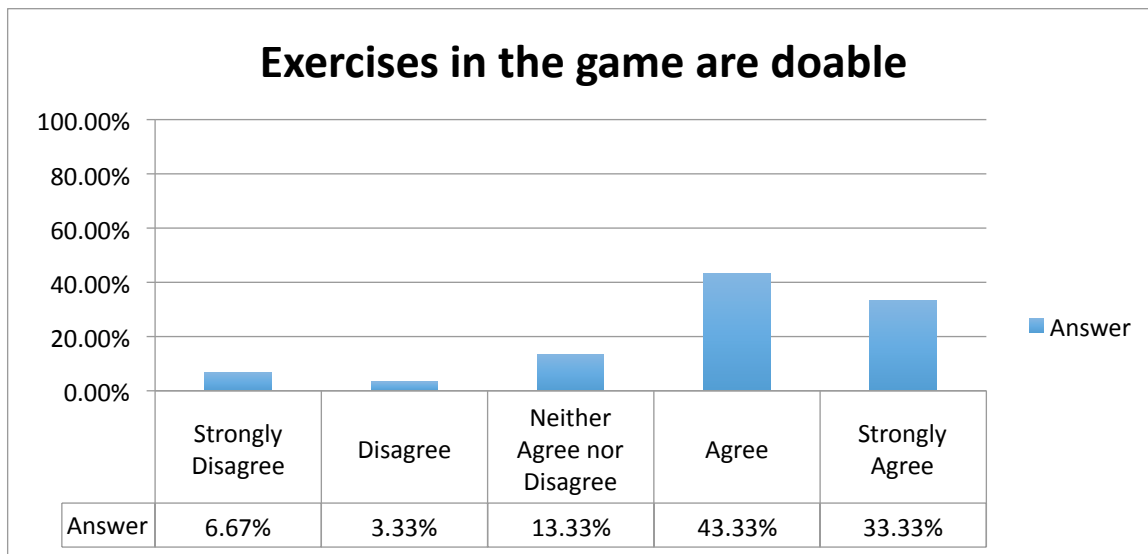


Figure 6 Assessment of Exercises in games

4.6 Appeal of Exercise and Game Design

Some people prefer one type of exercise to another and sometimes choose to play an exergame just for that reason. Figure 7 shows that, despite being doable, some team members did not like certain exercises. Figure 8 shows the same attitudes towards the overall game design.

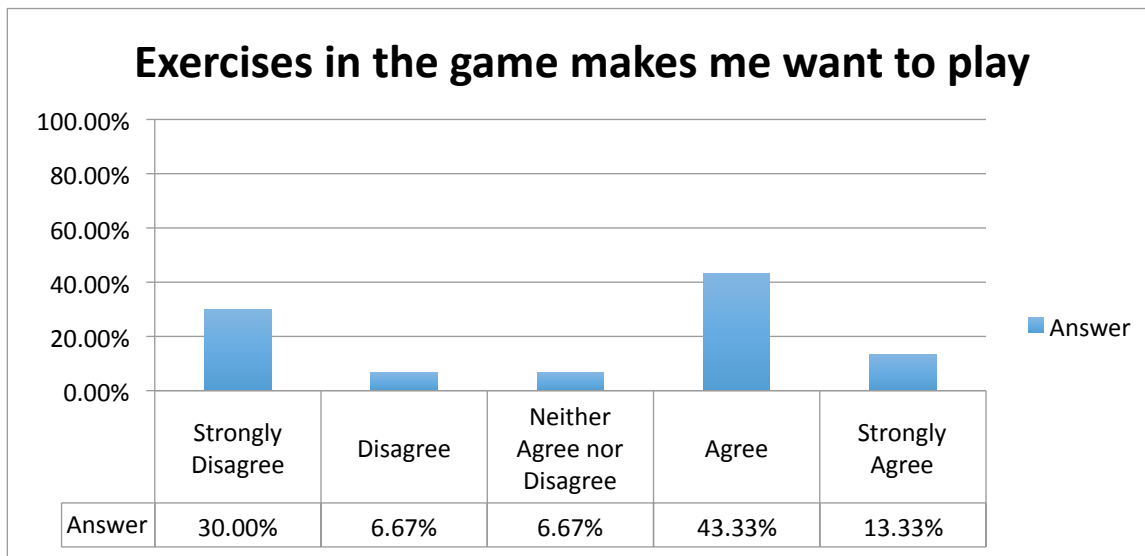


Figure 7 Exercise appeal

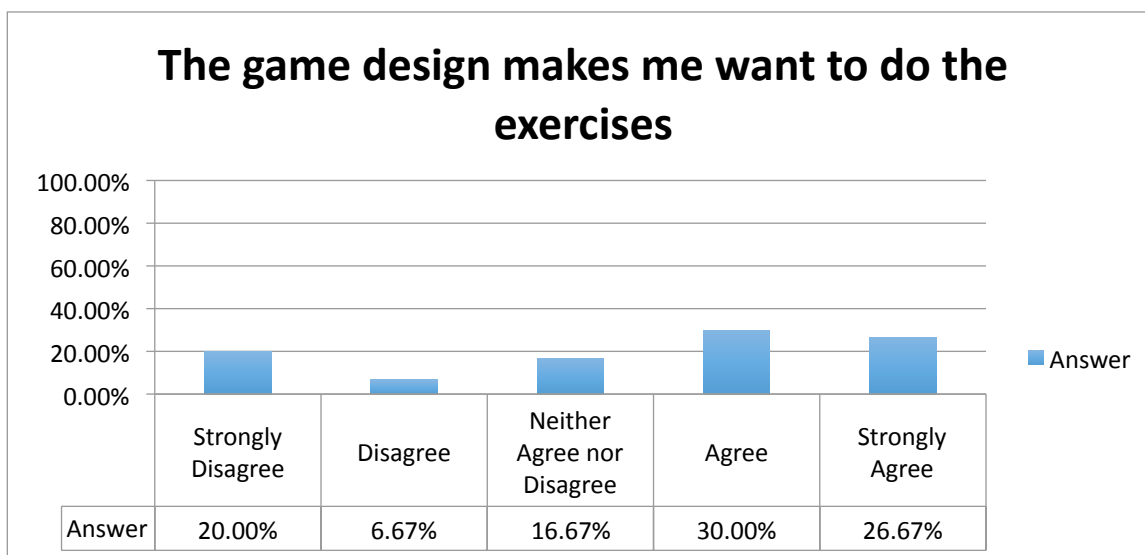


Figure 8 Game design appeal

4.7 Simulating real exercises

A goal of exergames with any sort of motion detection is, self-evidently, to simulate real exercises. Some types of exercises are easy to simulate, while others require finer motion detection, which is not available in video game technology at the moment. How well these games simulate real exercise also accounts for their success as a regular mode of exercise.

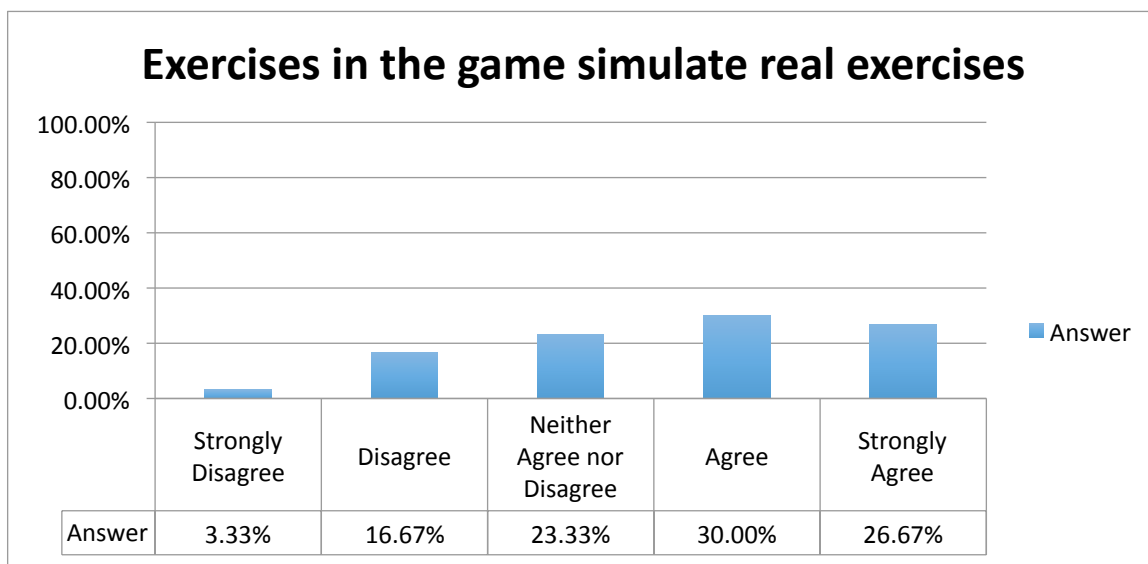


Figure 9 Simulation of real exercises

Figure 9 shows that all the selected games, most of which involves dancing, simulate real exercises well.

Some casual games, though failing in this aspect, can still stand on their own as a means to exercise.

Accurate movement detection makes for an enjoyable and smooth gaming experience.

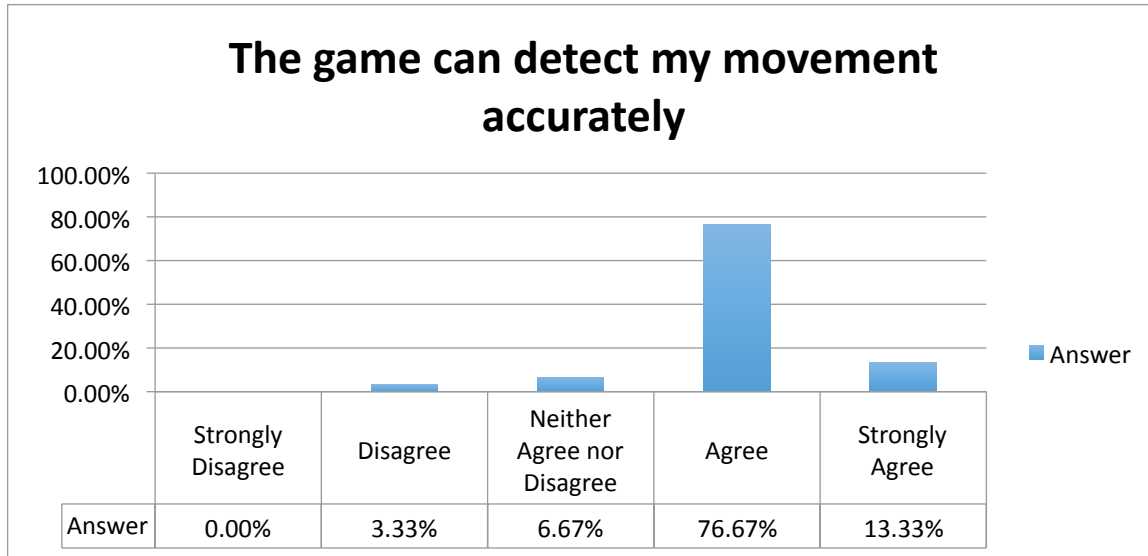


Figure 10 Accuracy

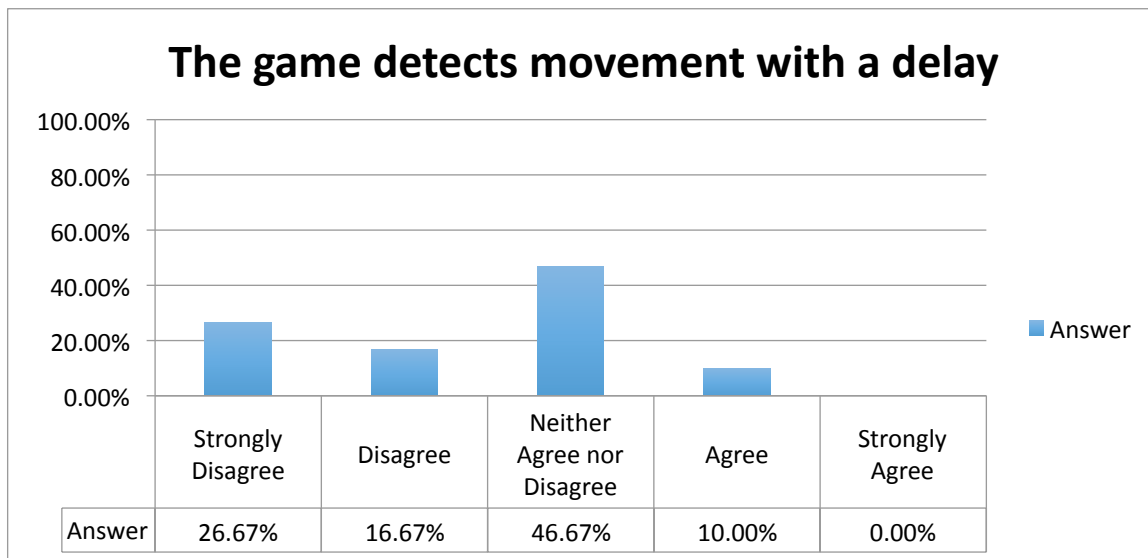


Figure 11 Detection delay

Figure 10 shows that all the selected games can detect movement accurately. Figure 11 shows that the selected games detect movement without or with negligible delay.

When looking at ease of use in video games, we look at their required learning curve, understandable instructions and user interface. This allows for people of different skills and age to access the games, not considering other content factors.

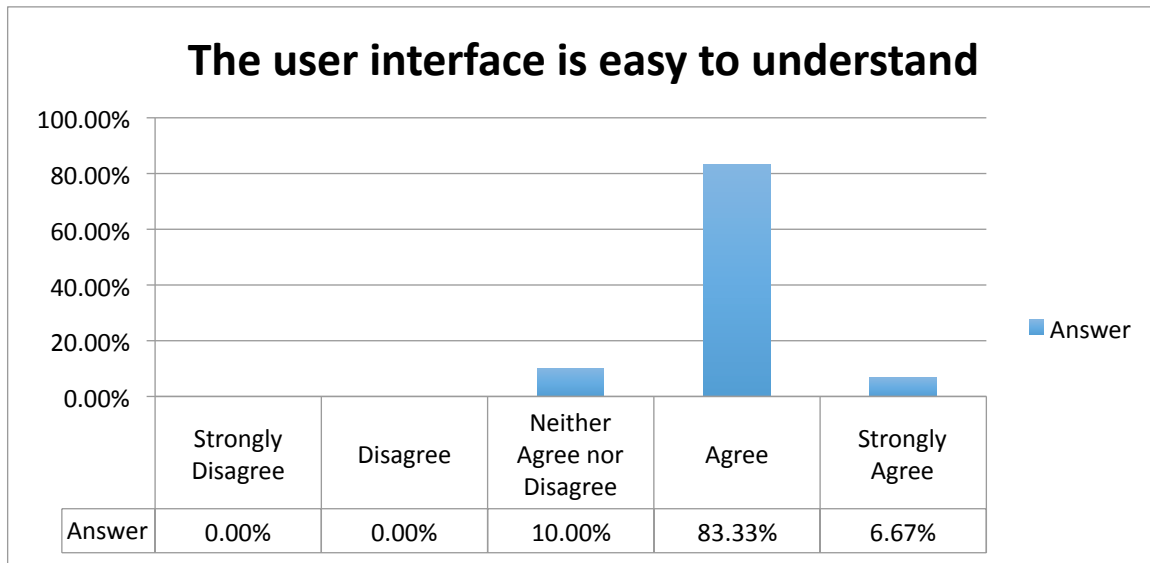


Figure 12 User interface

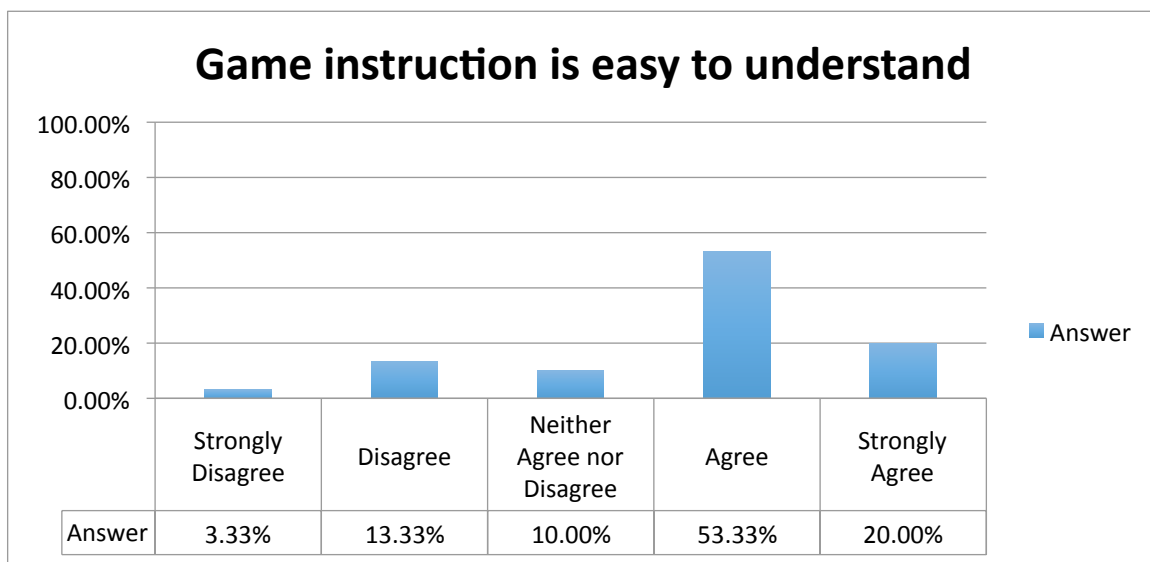


Figure 13 Instruction

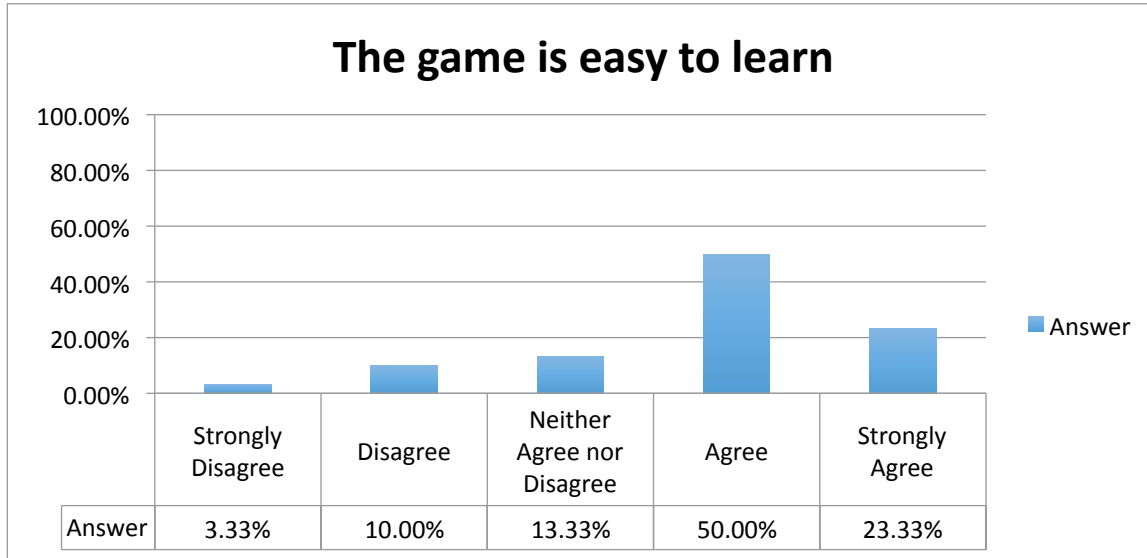


Figure 14 Learning curve

Figure 12 and 13 show that the games user interfaces were clear and that it is easy to follow what the game tells you to do. This is due in part to the non-complicated nature of the exercises portrayed in the games, which is reflected in figure 14.

4.10 Substitution for Real Exercise

To substitute for real exercise, exergames have to achieve many levels of realism including movement, physical exertion, social interaction in sports games, and tension in competition.

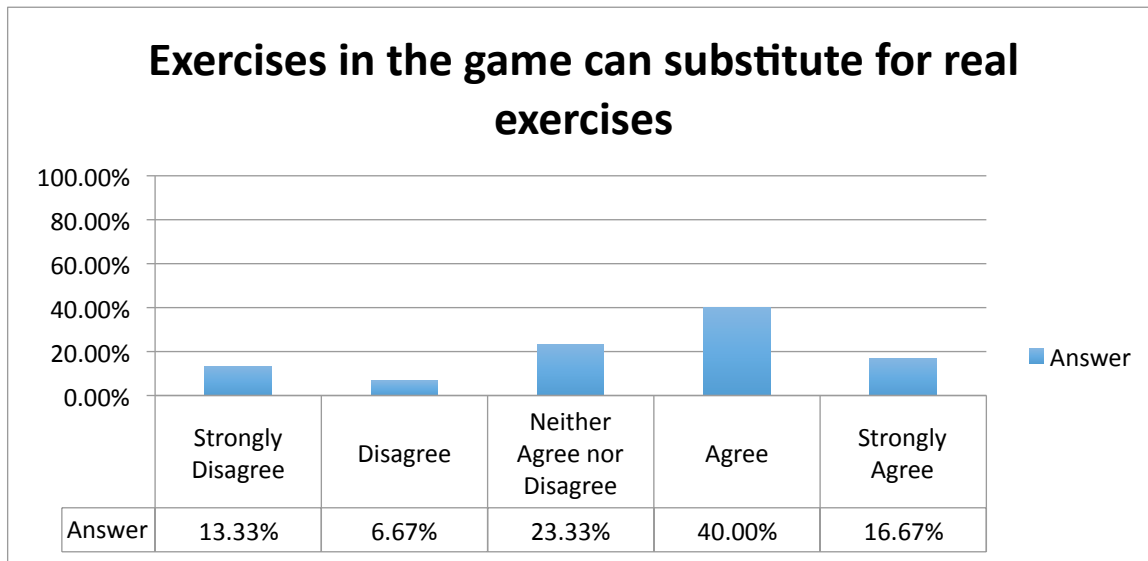


Figure 15 Substitution for real exercises

Figure 15 shows that only some of the in-game exercises, namely dancing, can substitute for real exercises; however, being that none of the team members has any experience in dancing, our judgment may not be entirely valid.

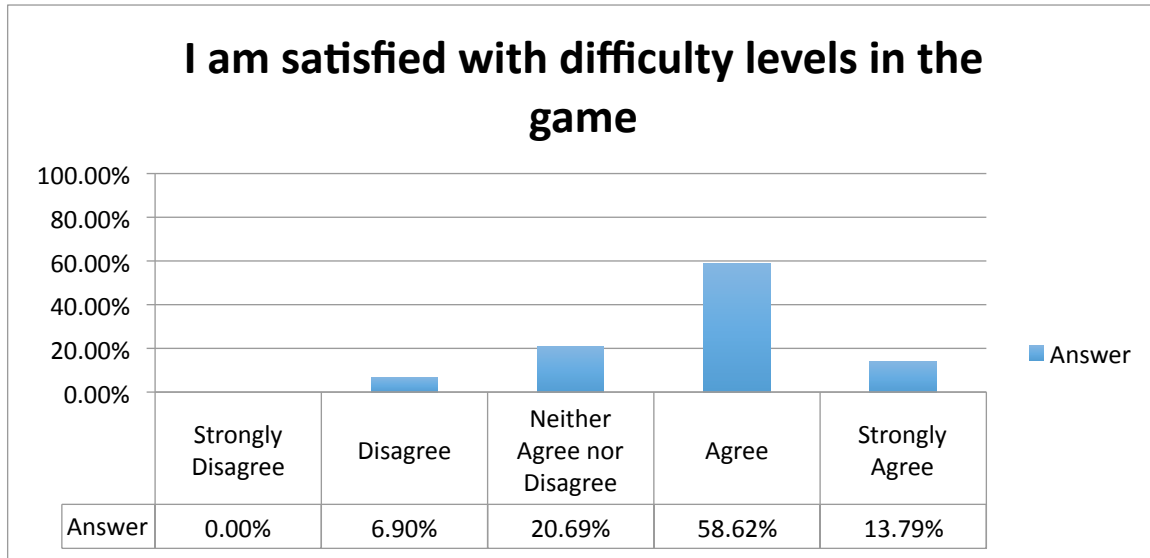


Figure 16 Difficulty level

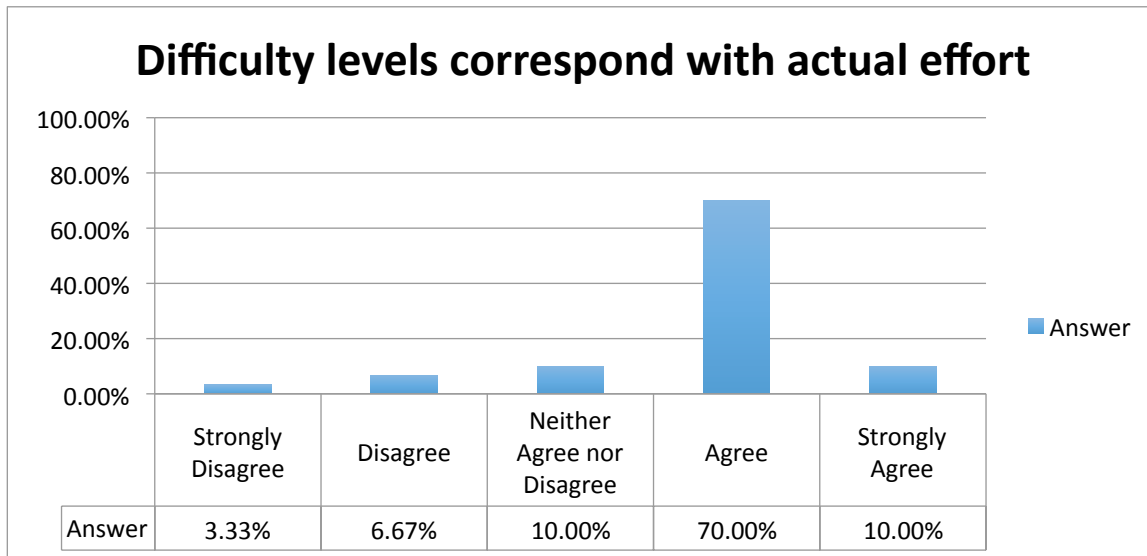


Figure 17 Effort corresponding with difficulty

Figure 16 shows that the team members were satisfied with how the difficulty levels scale with our skills: we felt neither overwhelmed nor underwhelmed by the games on an appropriate difficulty. Figure 17 corresponds with this: the higher the difficulty, the more effort we put in.

We have established that energy expenditure indicator in the selected exergames were not trustworthy. Therefore, we looked only at the score feedback of the exergames.

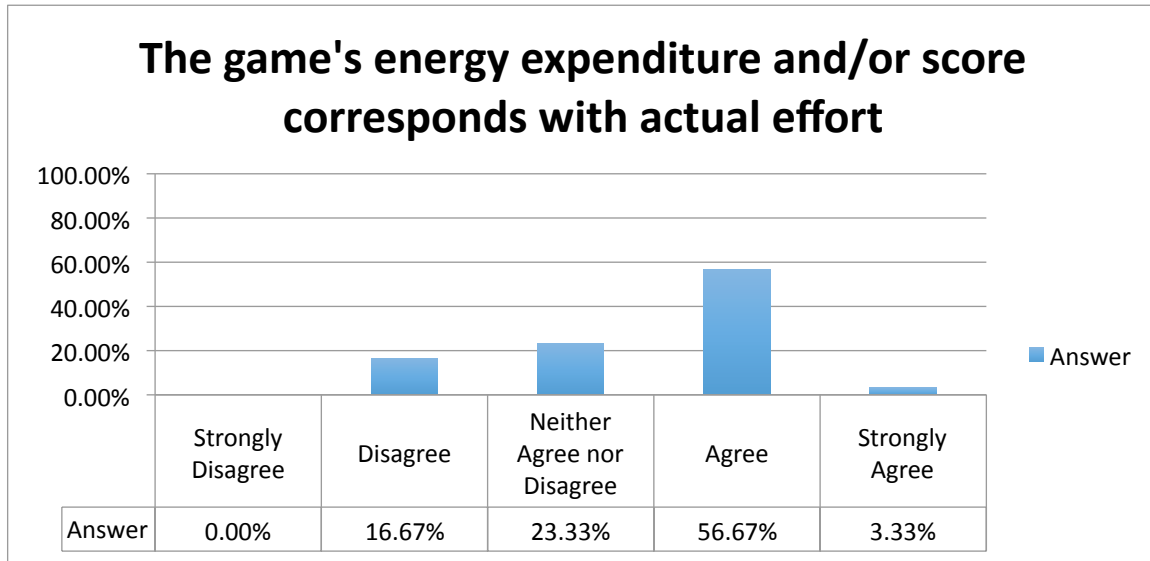


Figure 18 energy/score corresponding with effort

Figure 18 shows that score feedback corresponds with actual effort in most games. Some games, however, have a more lenient movement detection and give players a set base score even for doing absolutely nothing.

4.13 Customizable Exercises

Many players play exergames because they allow for customizable exercise programs. This is especially useful for those keep a strict schedule and have no time for outdoor exercises. For example, Zumba games allow for classes ranging from 20 to 60 minutes just like real Zumba fitness classes.

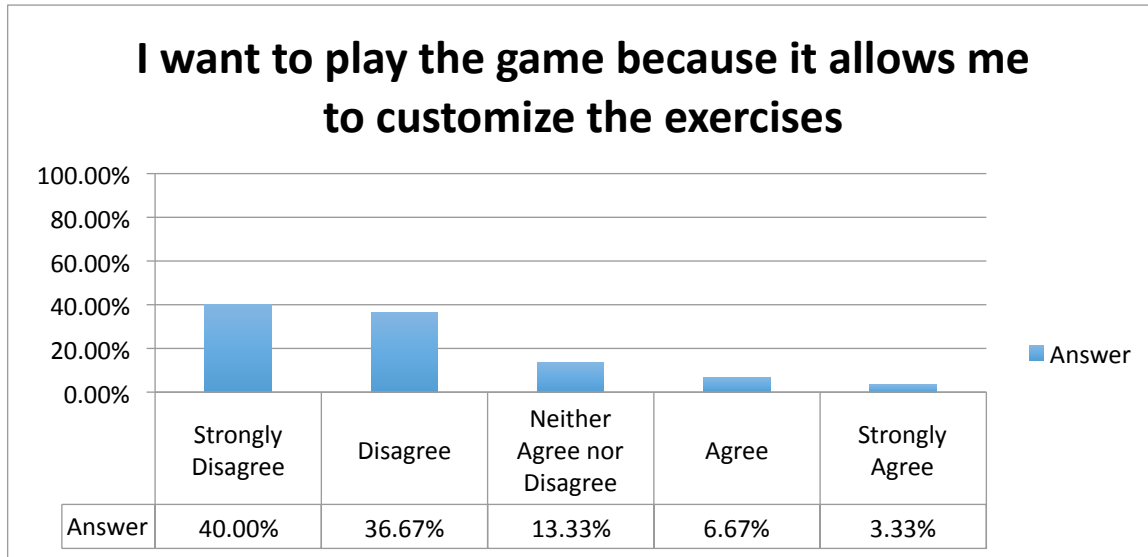


Figure 19 Customizability

Figure 19 shows that most of the selected games do not allow for such customization, and, even in cases where some games do, the team members do not have regular exercise schedules and do not benefit from this feature.

4.14 Sustainability

The overall effectiveness of an exergame as a substitute for a regular mode of exercise can be superficially determined from players' willingness to continue playing the game, be it the overall fun factor or the exercise itself that keeps them playing.

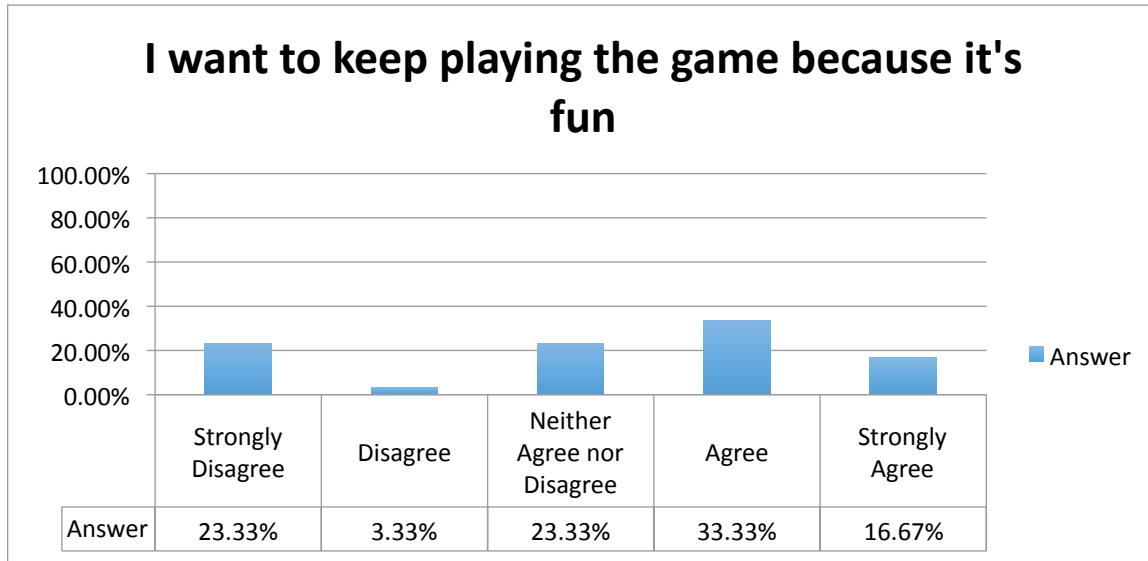


Figure 20 Sustainability by fun factor

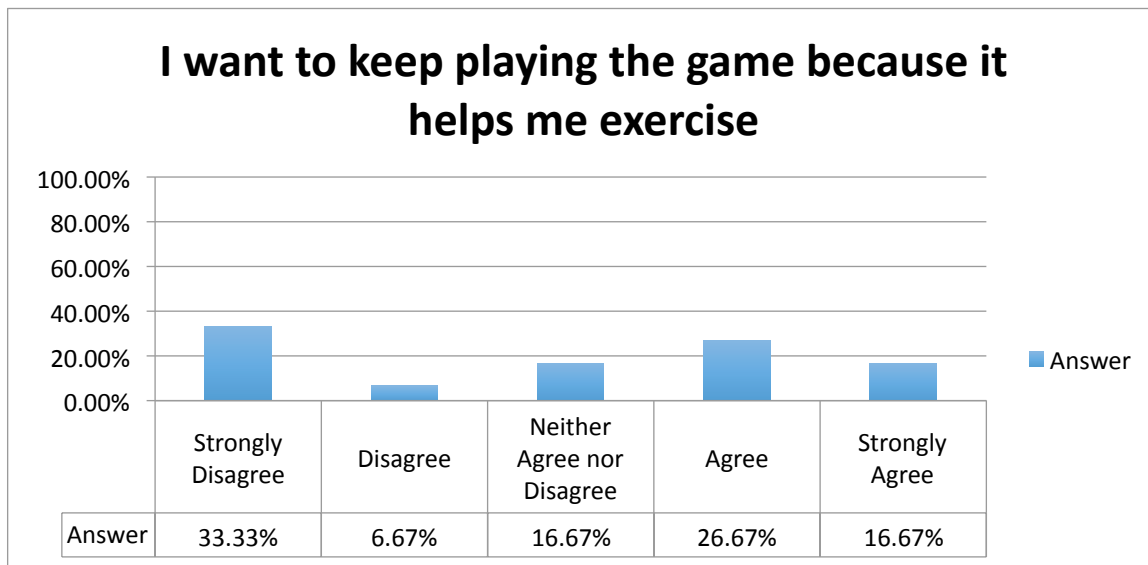


Figure 21 Sustainability by exercise

Figure 20 shows that the majority of the team thinks the games to be worth playing for the fun. Figure 21 is bi-modal and shows that team members would like to keep playing some games because it helps them exercise while they did not want to play some other games for exercise.

Like everything else with a price tag, the price of exergames should not exceed the content or fun they offer which is more often than not subject to each buyer’s expectations.

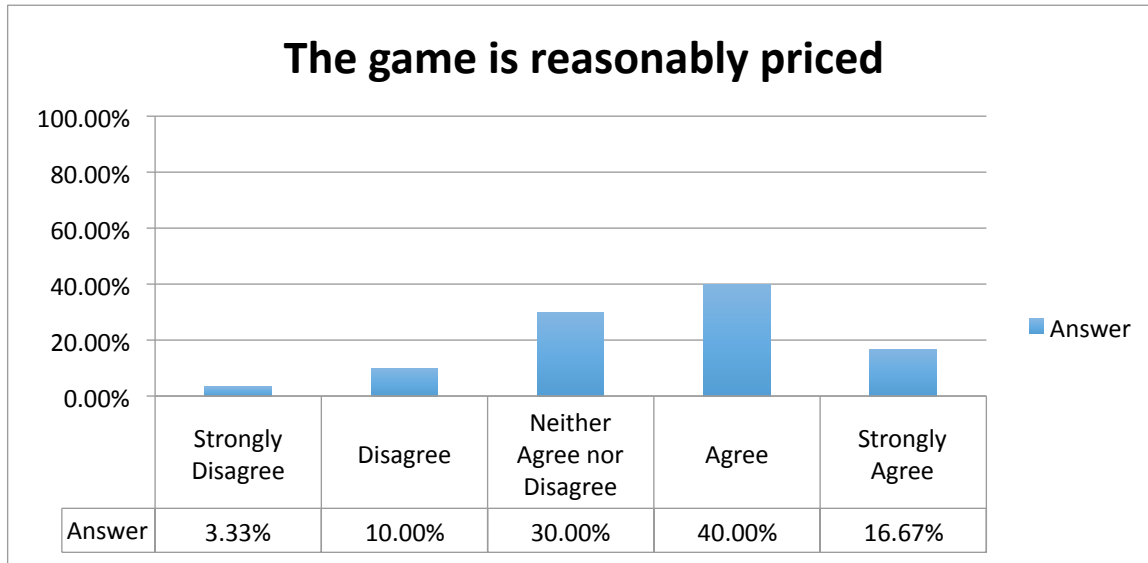


Figure 22 Reasonable price

Figure 22 shows that most of the selected games are reasonably priced for what they offer according to our expectations. Neutral opinion represents our opinion on games with about the same price as other general video games.

Phase 1 Conclusion

The team members found exergames lacking in many aspects: an accurate energy expenditure indicator, a fun and engaging story and game world, exercise customization. There also uneven opinions regarding the selected games: simulating and substituting for real exercises works differently for each game with different exercises, and franchise’s fame did not seem to appeal to some members. Notwithstanding these and other personal preferences, the team felt that exergames were doing well on graphics, accessibility to players of all ages and skill levels, movement detection, difficulty levels, pricing, and ease

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of use.

Chapter 5: Phase 2 Findings

A majority of the games chosen for phase 3 are dancing games, which have a unique gameplay aspect. Hence, it is fitting to separate user comments on into those of dancing game, sports games, and other games, which do not fall into either category.

5.1 Findings for dancing games:

- **Two types of dancing games**

There are two types of dancing games: casual dance games with emphasis on accessibility and multiplayer function, and more serious dance games with emphasis on choreography and the challenges they offer.

(Just Dance and Dance Central Series)

".....the Just Dance Series lives with simplicity, their game is designed for all ages to play! All of their moves are easy to understand and uses a cute grading system. As for Dance central its title lives up for Extreme dancers, ones who wants a challenge in dancing ..." – Randy Rang

(Dance Central)

"Dance Central definitely is a superior title if you're looking for a much higher degree of precision or something approaching "detailed dance instruction". On the other hand, Just Dance 3 is arguably the better title if you just want to hang out with friends and have a fun time." –

Nutwiisystem.com

(Just Dance)

"I also have complaint with the dances in Just Dance. So far they all seem to be ridiculous, goofy, and very comically clown like. At least Dance Central portrayed a serious dance routine..." –

Hashimo

- **Forgiving movement detection in casual dance games**

Casual dance games and games utilizing only the Move controller or Wiimote are more forgiving when detecting player's motion.

(Just Dance 3)

"... Just Dance 3 deals with motion detection is that it seems that the greatest emphasis (as with the Wii version) is placed on arm movements and general body movements, more so than precise detection of where your hands and feet are at any given time." – Nutwiisystem.com

(Just Dance 4)

"It only used on Move controller. So it's only tracking one arm movement, instead of two arms which will give a much more accurate body tracking." – JJ

- **Customization**

Players prefer to be able to customize their games; be it workout plans, music, or in-game avatar.

(The Hip Hop Dance Experience)

"The longest I was able to keep [the workout mode] going, on medium difficulty, was about 20 minutes. This isn't the game to go to if you want super-long, customized workouts." – Arrow

Dynamic Mom

(Zumba Fitness Rush)

"Classes come in three lengths, short, mid length, and full-length which contain 20, 45, and 60 minutes of music respectively (add 5-20 minutes more to account for breaks between songs and

rest time, and you're talking some major time investment). ... you can also design your own class

by stringing together your favorite songs.” – Nutwiisystem.com

(The Hip Hop Dance Experience)

“The only reason that I am giving it 4 stars instead of 5 is because the Wii game version does not allow for character customization like the Xbox version” – K. H.

- **Accessibility**

Most dancing games are accessible to people of all ages, not including infants of course. Accessibility comes in many levels: some will find difficulty levels to be appropriate for players with different skill levels and physical fitness, others might find music familiar to them to be appealing. It is also ideal for games to have a not-too-steep learning curve.

(The Hip Hop Dance Experience)

“I like the easy mode, as that seems to be hard enough for me (a 43 year old mom)” – Mindi

(The Hip Hop Dance Experience)

“This is NOT for kids. Sure they may not be familiar with some of the music anyway, but the key is that some of the tracks are not kid-friendly.” – ashertopia

(Michael Jackson Experience)

“Anyone can start playing right away and get into it right from the first play.” – Tommy Sixx

Morais

- **Burned calories indicator**

Burned calories are only approximate in dance games with calories indicator.

(Zumba Fitness Rush)

"I worked out for 45 minutes (medium intensity, medium length), sweated my butt off, drank a gallon of water, etc. and it tells me I only burned 200 calories!" – TheIntelHottie

(Zumba Fitness Rush)

"Video Games calorie counts are a joke." – Grizelda

(Dance Central 3)

" [the game] severely underestimate(s) calories burned. I hit over 85% of all the moves for the moderate, hard and advanced settings, danced for an hour, and only burned 115 calories!!!" – K. Schultz

(Dance Central 2)

"There's a fitness mode that tracks down how many calories you're burning (which isn't very accurate because every person burns calories differently according to size, fitness, etc) but it's a general estimate." – SenaR

- **Multiplayer limitations**

Multiplayer functions appeal to players at the cost of limited play area. Online multiplayer functions do not suffer from this drawback but are scarcely found in existing dance games on the market.

(Just Dance 3)

"... all four players have to squeeze together in a staggered pattern to fit within the Kinect camera range... you invariably end up hitting and bumping into each other." – Nutwiisystem.com

(Zumba Fitness Rush)

“the developers decided to remove a crucial fun factor, online multi-player mode. That's right, you can no longer play online with friends in faraway places.” – mzebony

- **Unlockables**

In-game unlockables and achievements appeal to most players. Games with these features have high replay value and keep players playing even after they have exhausted a majority of the game content.

(Just Dance 3)

“The game has several ways to reward you - points, sweat points (for those who play in lieu of going to the gym) and mojo which means new unlocked songs.” – N.L. Guy

(Zumba Fitness Core)

“It's more challenging - harder to get to the "Legend" status and a 90% or more grade than the previous game, so it keeps me pushing to get to that mythical status, haha.” – Megadeth

(Zumba Fitness Rush)

“This also lists the different achievements that you have gotten throughout your different workouts, including hidden, behind the scenes dances that you unlock as you go.” – moose angel

- **Gender-oriented dance moves**

Some dancing games have highly gender-oriented dance moves, making some male players feel embarrassed. No reports from female players on this particular finding.

(Zumba Fitness Core)

“As a man, I also feel "weird" dancing in such a sexual provocative manner.” – C.Jones

(Just Dance 3)

"I am convinced that the choreographer of most of these songs is a cheerleader. A vast majority of the choreography is very, very feminine." – Chris McCray

5.2 Findings for sports games:

- **Fewer sports games than dancing games**

There are significantly fewer sports games on the top selling exergames list compared to dancing games; only four out of thirty on our selected games list.

- **Two types of sports games**

Like dancing games, sports games are also divided into casual and more serious games. Casual games, such as Wii Sports Resorts and Kinect Sports, are less realistic and only imitate the actual sports with only some core features of the sports in the gameplay. More serious games, such as Sports Champions and the Fight: Lights Out, both on Playstation 3, have fewer limitations. The two categories have their own purpose; while casual sports games aim at socialization and fun, more serious games like The Fight: Lights Out seem to aim specifically at personal training and mimic sports quite realistically.

(Sports Champions)

"I played table tennis for over 2 decades, and I'm surprised that it's so realistic in a video game (about 80-85% real)." - M.Pu "haoafu"

(The Fight Light Out)

"If you do any boxing or martial arts in real life, this is the perfect game for you. It's a great work out plus you get to practice your reflexes and speed punching." - Richard Hermanto

(Wii Sports Resorts)

“The game aren’t very intricate. If you are a hard core golf fanatic and want to play realistic models of Pebble Beach, this probably isn’t the game for you” – Lisa Shea

(Wii Sports Resorts)

“In short, it’s a lazy game, both in play and design. No fun surprises except in Air sports, and those of dubious fun” – John

(Kinect Sports)

“Boxing is ok, but by far the most effective tactic is throw wildly rather than take a methodical approach...” – B. Klinko

(Kinect Sports)

“If you're looking for a simulation of your favorite sport, stop right now: Kinect Sports isn't for you. This game is best enjoyed in a party atmosphere and by people who play video games casually. It's not intended for serious gamers.” – Rob V.

- **Different gameplay experience on different platforms**

Again, the different motion detection devices on different platforms result in different gameplay experiences. Players prefer freedom of control, realism, ease of use, and precise movement detection; all of which can be achieved with or without a controller.

(Sports Champions)

“The Move control translates your motions precisely on the screen as if it was in real.” – ARK

(Sports Champions)

“The only activity or game I was not fully satisfied was with the archery game. I was using the two PS Move controllers and found that calibration, no matter how many times I did it correctly”

- Fair Consumer

"I simply found it difficult to perfect the timing used in the game. I also don't enjoy games where I cannot control my character's position, so that's another point against volleyball." - M.

Donnelly

(The Fight Light Out)

"Feet can't move around, which is an unnatural way to box/fight. Limited body movement tracking" – JJ

(Kinect Sports)

"The irony is that soccer should have the most movement of all the events (except track and field) but in gameplay, it has some of the least movement." – Patrick H. Nyugen

(Wii Sports Resorts)

"The controls are easy to learn. You want to slash sword? Just draw it down in front of you as if your Wiimote was an actual sword. These are games that anybody can pick up fairly quickly" –

Lisa Shea

(Kinect Sports)

"The boxing portion has a hard time recognizing movements, even with multiple calibrations of the Kinect." – A. Eide

(Kinect Sports)

"One such limitation is Kinect's lack of a trigger mechanism, which is a problem for games that require you to throw things. This is prominent in Kinect Sports bowling. Without a trigger, there's no means for the player to tell the game when he or she wants to release the ball." – Rob V.

- **Potential for exercise**

All the selected sports games have potential for exercise.

(Sports Champions)

“This game has made me do more exercise than anything I've ever see in a console.” –

malingenie

(Sports Champions)

“You get quite the work out and don't even realize it until your soaked in sweat” – Michael

(Sports Champions)

“This game almost feels like real sports, and there is a serious workout in table tennis, gladiator fight, and volleyball is a decent and light exercise.” - H. Gao

(The Fight Light Out)

“If you're looking for a good workout, this game is it! I can't believe I was winded and sweaty after two fights. I only played about 30 minutes and I have no complain about the accuracy of punches and moves.” – xo

(The Fight Light Out)

“I lost 5 lbs in about a week playing this game, and the best part is that it was a fun process, and I keep wanting to play despite my sore arms” – Steadystate

(Wii Sports Resorts)

“I am using this in place of a gym membership (which I have and never use!) I've done more exercising since it arrived that in the last 6 months” – S. Middleton

(Wii Sports Resorts)

“My kids play this game all the time, good workout for the entire family” – Faraz J Khan

- **Customization**

Players prefer to have a degree of customization in the games. Comments regarding this are not as numerous as in dancing games in which players are more likely to express their identity.

(Sports Champions)

“Characters and lack of customization therein” - William B. Partridge

(The Fight Light Out)

“The disappointing side is the lack of options in character customization. I did not see any long hair styles and on top of that for females who play you cannot be a woman.” - James E. Lindsey

- **Accessibility**

The more casual games are easily accessible to players of all ages and levels of video game skills

(Wii Sports Resorts)

“It’s super fun and easy for [4 and 5 year old sons] to operate and play with on their own” – hammonit

(Wii Sports Resorts)

“...the whole family has enjoyed playing this – so much fun and easy to learn even for us older folks” – Tina Easley

(Kinect Sports)

“My wife has very, VERY, limited video game skills, and she hopped on in, and was able to play instantly. And beat one more than one occasion.” – A. Eide

- **Calories burned indicator**

The only sports game on the list with calories indicator is The Fight: Lights Out, and, surprisingly, more accurate due to the game accounting for weight, height, age, and gender.

(The Fight Light Out)

"You start out by entering your weight, height, and age. Your BMI is calculated for you." -

Nutwiisystem.Com

(The Fight Light Out)

"The game also has a calorie counter which is a fun little addition. After playing for an hour, it says I burnt over 200 calories." - N. Vendatta

- **Multiplayer limitations**

Multiplayer modes are preferred. Local multiplayer modes, like those in dancing games, limit play area, while online multiplayer modes are not fully developed.

(Sports Champions)

"It would have definitely been nice to have online play, but I guess they are trying to concentrate on experimenting with motion controllers before they let us loose online." – Luigi

(The Fight: Lights Out)

"Finally, there is online play. However, it is hardly the main feature of the game. Ultimately, The Fight is best viewed from the perspective of a single player game. At least, from my point of view. The multiplayer is a nice addition, but the bulk of the game is single player." - M. Donnelly

(Wii Sports Resorts)

"This collection of games provides a good bit of fun - - lighthearted sports entertainment for you and some friends or family members" – Liran

(Wii Sports Resorts)

"My family and I really enjoy playing this. A good opportunity to really bond with one another and have fun while doing so" – Kansas Chic

(Kinect Sports)

“Playing with other players locally is kinda hard because of the movements required and it needs a large area.” – Ata Alqadi

(Kinect Sports)

“I purchased the Kinect and Kinect Sports for use with my family. We can all play with this together. You don't need any gaming experience and yet it is still fun.” – Big Geek

- **Required additional purchase**

Some games require players to purchase additional devices to be able to play. Most reviews are negative toward this.

(Wii Sports Resorts)

“...if you don't have the Wii-mote with the built-in motion plus sensors, than you unfortunately won't be able to play Wii Sports Resort” – Michael Kerner

(Wii Sports Resorts)

“I was not happy to find out that it will only work with the Wii Motion Plus remote. I had to purchase a remote before we could play” – IceQueen

5.3 Findings for non-dancing and non-sports games:

- **Even fewer top selling games that are not dancing or sports games**

There are only three non-sports, non-dancing games on our selected games list. One is a unique fantasy game; the other two are casual adventure games.

- **Limitations and repetitive activities**

The fantasy game (Sorcery, PS3), unlike other adventure video games, are limited by the motion detection device resulting in a linear gameplay experience, while the two casual games have repetitive activities.

(Sorcery)

*"The game world is incredibly linear, annoyingly so. Instead of an adventure game that allows exploration and back-tracking, this game *prevents* backtracking after you move onto the 'next area'." - Nemesis296*

(Kinect Adventures)

"It's the repetition that'll drive you nuts. In order to actually play the game you have to play the same water-rapids game and sit through at least half of the instructions every time you flip the game on. There are only a few mini-games that are very simple and yet they insist that you sit and see the instructions every time." – nlr8705

(Kinect Adventures)

"My disappointment, however, is that there are only four different activities. They were really easy, even in the advanced levels." – kterrell3

(Kinect Rush: Disney Pixar Adventures)

"...most of the mini-games are repetitive." – Bill

(Kinect Rush: Disney Pixar Adventures)

"Slow and repetitive actions bored my daughter." – pralhadgoggi

- **Potential for exercise**

The two casual games have exercise potential. This comment trend does not exist in Sorcery.

(Kinect Adventures)

"I couldn't help but playing until I was breathing hard and getting sloppy." – Sarah

(Kinect Adventures)

"I am not that fit and I finished all the adventures at all levels in two days. I felt like I got a good workout from the game, especially with the obstacle course adventures." – kterrell3

(Kinect Rush: Disney Pixar Adventures)

"[My son] runs so much (even though all you really need to do is swing your arms) that he gets tired! :)" – R. Hermann

(Kinect Rush: Disney Pixar Adventures)

"... on a rainy day, this is a fabulous option to stay mobile, active and entertained. " –

MdmSparkler0880

- **Accessibility for the casual games**

The two casual games are easy enough for players of all ages.

(Kinect Adventures)

"This is easy enough for the kids to operate on their own, but challenging enough for me and hubs to throw down on some friendly competition! " – *avonmiche1*

(Kinect Adventures)

"My grandson is 4, and this game is bar far his favorite of the many that we own, because he actually is able to complete each mission he has tried..." – D Martin

(Kinect Rush: Disney Pixar Adventures)

"My 2 year old can start the game without our intervention and can play alone if he wants." –

Chigirl

- **Unique game world**

Unique gameplay and world in *Sorcery* and *Kinect Rush: Disney Pixar Adventures* are what really draws people in. *Sorcery* has magic and action, while *Kinect Rush* has everybody's favorite Disney Pixar characters.

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(Kinect Rush: Disney Pixar Adventures)

"...they do a fantastic job of immersing you into the world of Pixar and their movies." – D Martin

(Sorcery)

"This is the Harry Potter game people were looking for when Harry Potter was still relevant" - S.

Schmidt

Chapter 6: Phase 3 Findings

Initially, we tried to distribute our survey through Twitter. This was unsuccessful because no one pays any interest in surveys without incentives. We then decided to distribute our survey through Facebook and various departments in WPI instead. Over three weeks, we received 130 complete responses from mostly WPI students of all departments.

6.1 Age and gender demographics

Number of Respondents by age ranges

Age	Number of respondents	Percentage
Less than 18 years old	1	1%
18-24 years old	123	93%
25-34 years old	8	6%
35-44 years old	0	0%
45-54 years old	0	0%
55-64 years old	0	0%
65 years old or over	0	0%
Total	132	100%

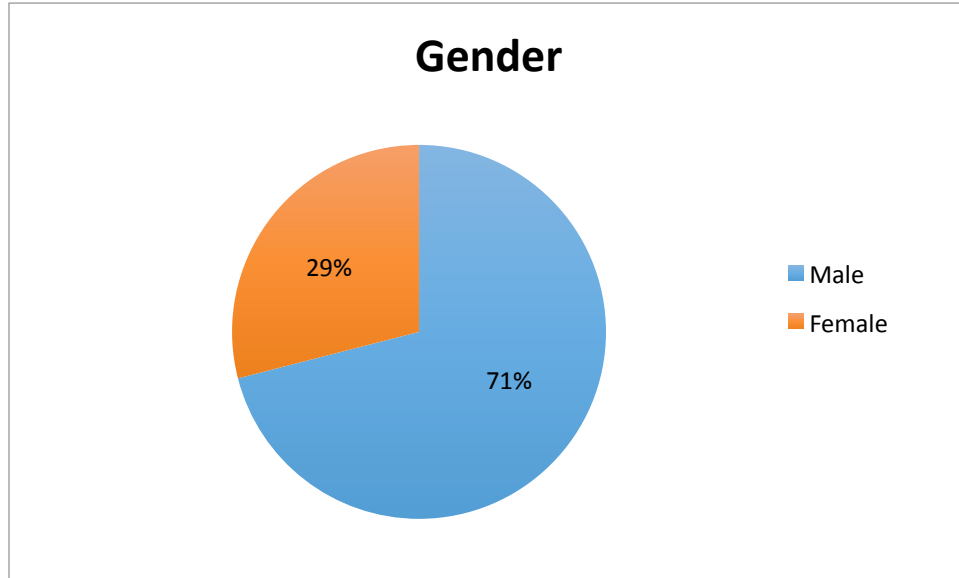


Figure 23: Gender of the participants

We can see from figure 23 that, with the majority of our survey released through WPI email, all respondents are in between the age of college students. There is also a significant size difference between the male and female demographics. We can speculate that there are more male gamers than female ones; also WPI has more male than female students in general.

6.2 Correlation between BMI, exercise hours, and gaming hours

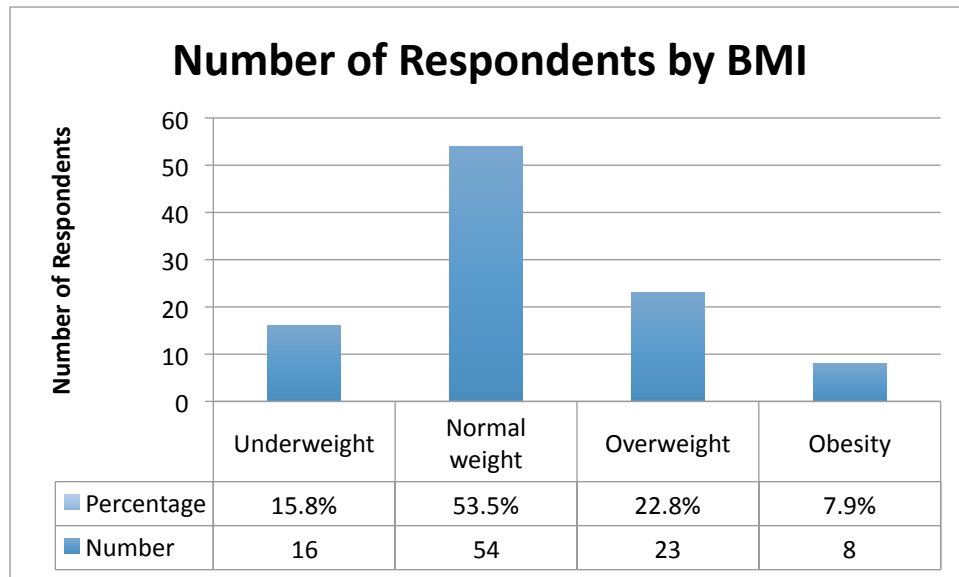


Figure 24 Number of Respondents by BMI

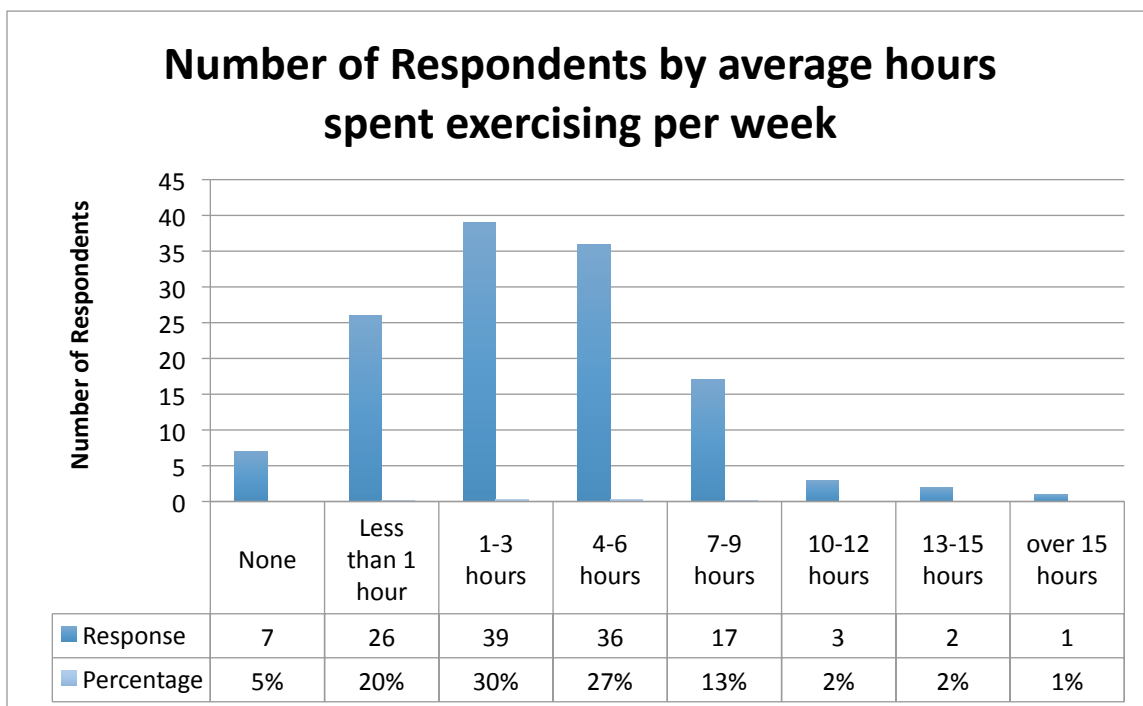


Figure 25 Number of Respondents by average hours spends exercising per week

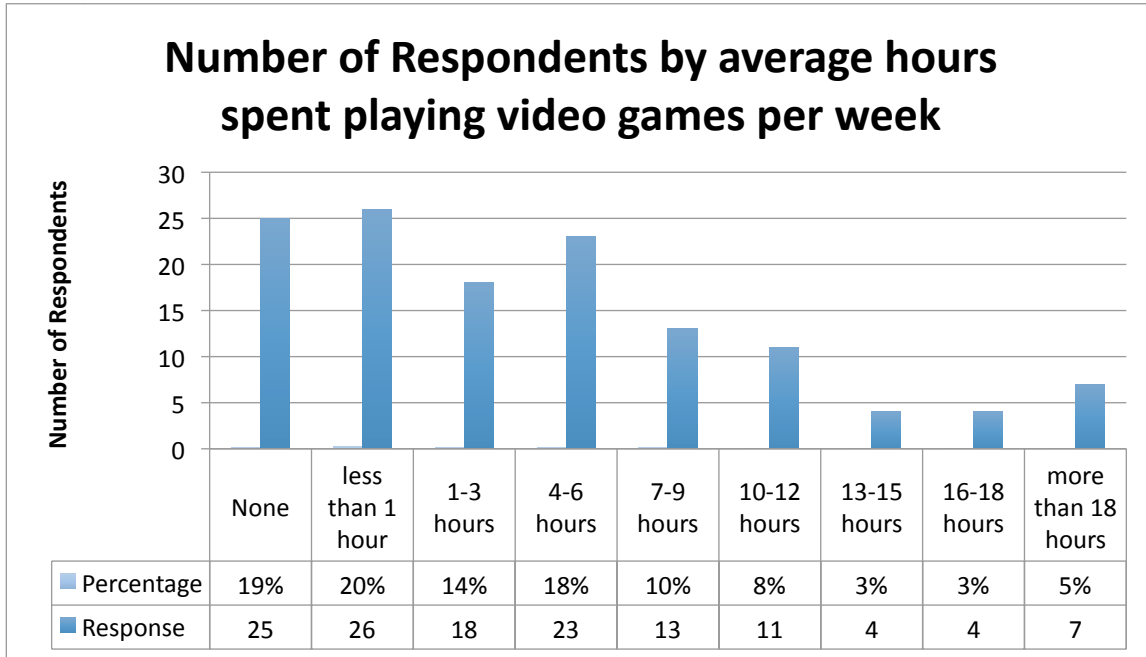


Figure 26 Number of Respondents by average hours spends playing video games per week

Figures 24 and 25 show that most of the respondents fall within the normal weight BMI category which seems reasonable considering their average exercise hours per week. We cannot further analyze, however, as there are more unknown factors, such as personal activities, diet and metabolism rate, that influence weight and height.

Surprisingly, contrary to our initial expectation, gaming hours bear no direct correlation to exercise hours and BMI. This is because gaming hours do not necessarily overlap with free time spent exercising: a gamer can set aside time for both physical health and immaterial joy.

6.3 Familiarity with exergames

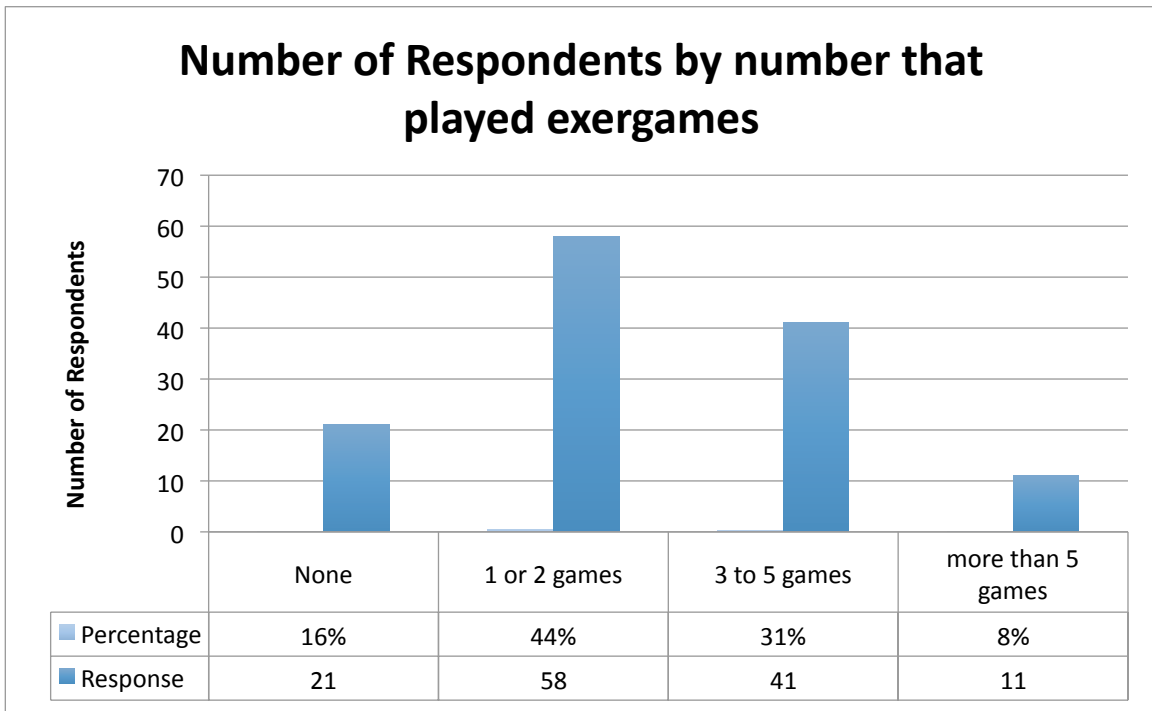


Figure 27 Number of Respondents by number of the played exergames

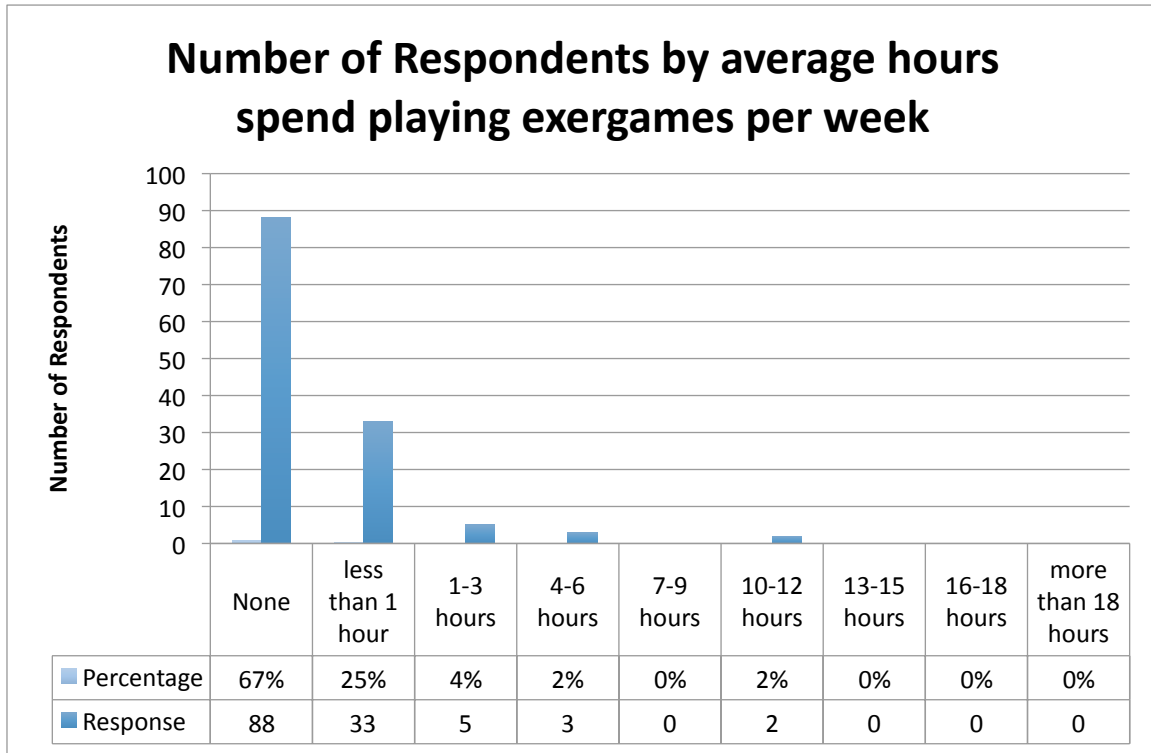


Figure 28 Number of Respondents by average hours spent playing exergames per week

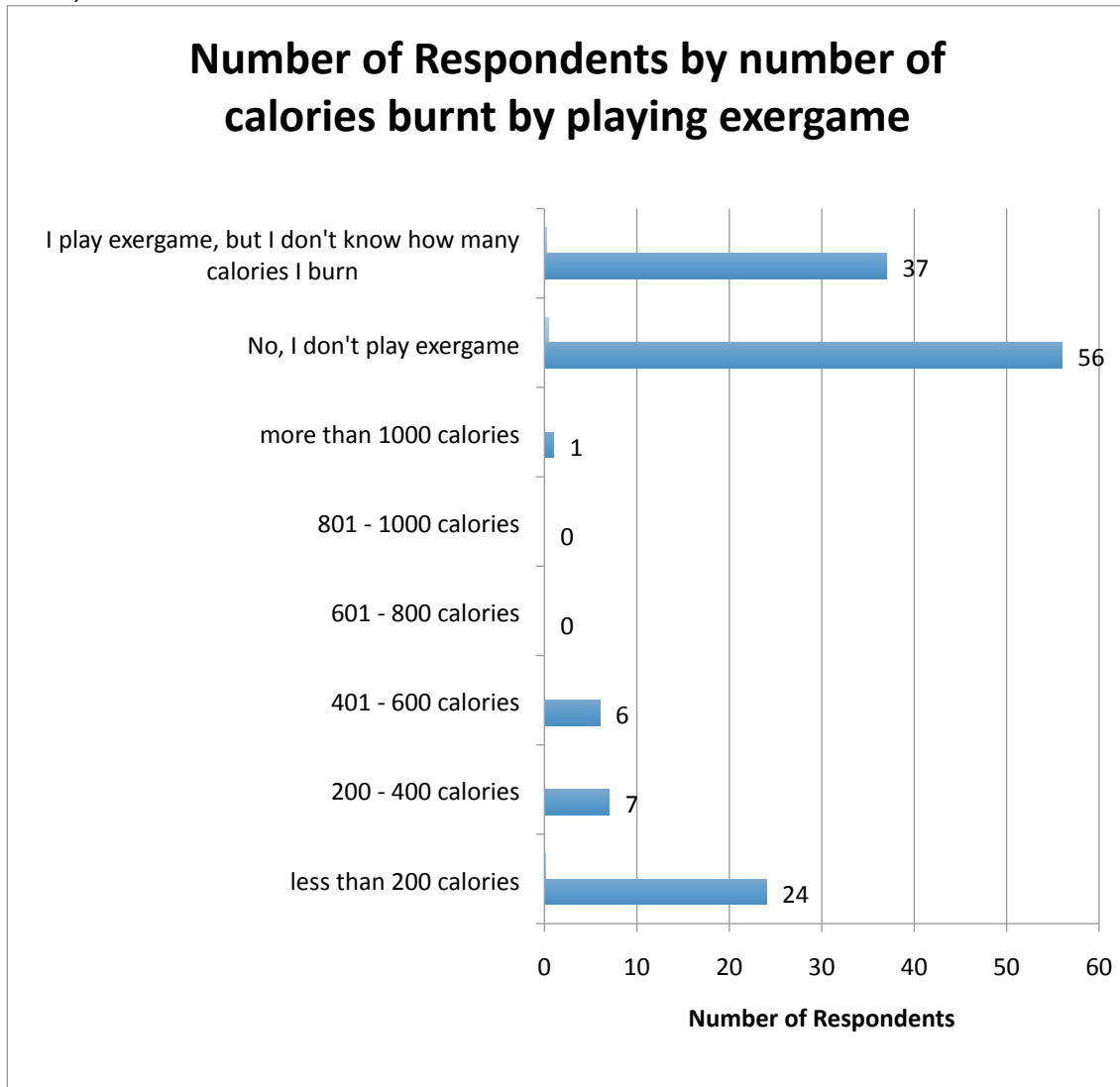


Figure 29 Number of Respondents by number of burnt calories by playing exergame

As expected, most respondents are familiar with only a few exergames, possibly during exergames' breakthrough into the mainstream market. This is also reflected in figures 27, in which most respondents never spend a regular weekly period for exergames, and in figure 28, with its overwhelming response to the negative for known burnt calories spent on exergames.

6.4 Correlations between exergaming, exercising, and gaming hours

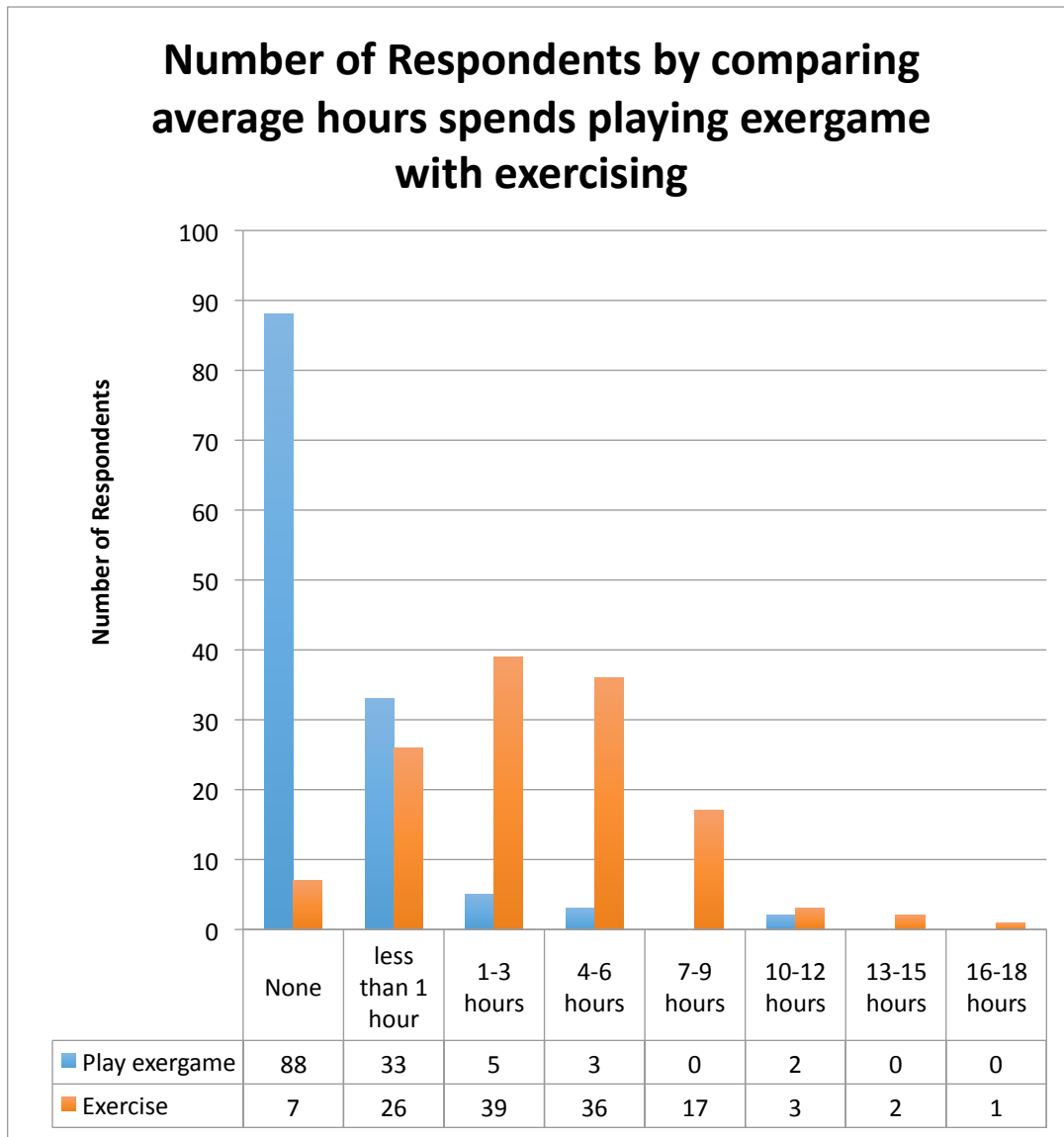


Figure 30: Number of Respondents by comparing average hours spends playing exergame with exercising

Figure 30 shows a contrast in exergame and exercise hours. We can speculate that, even if the respondents use exergames as a means to exercise, it is by no means the sole contributor to weekly

exercise hours. However, we must account for respondents who do not consider playing exergames as exercising.

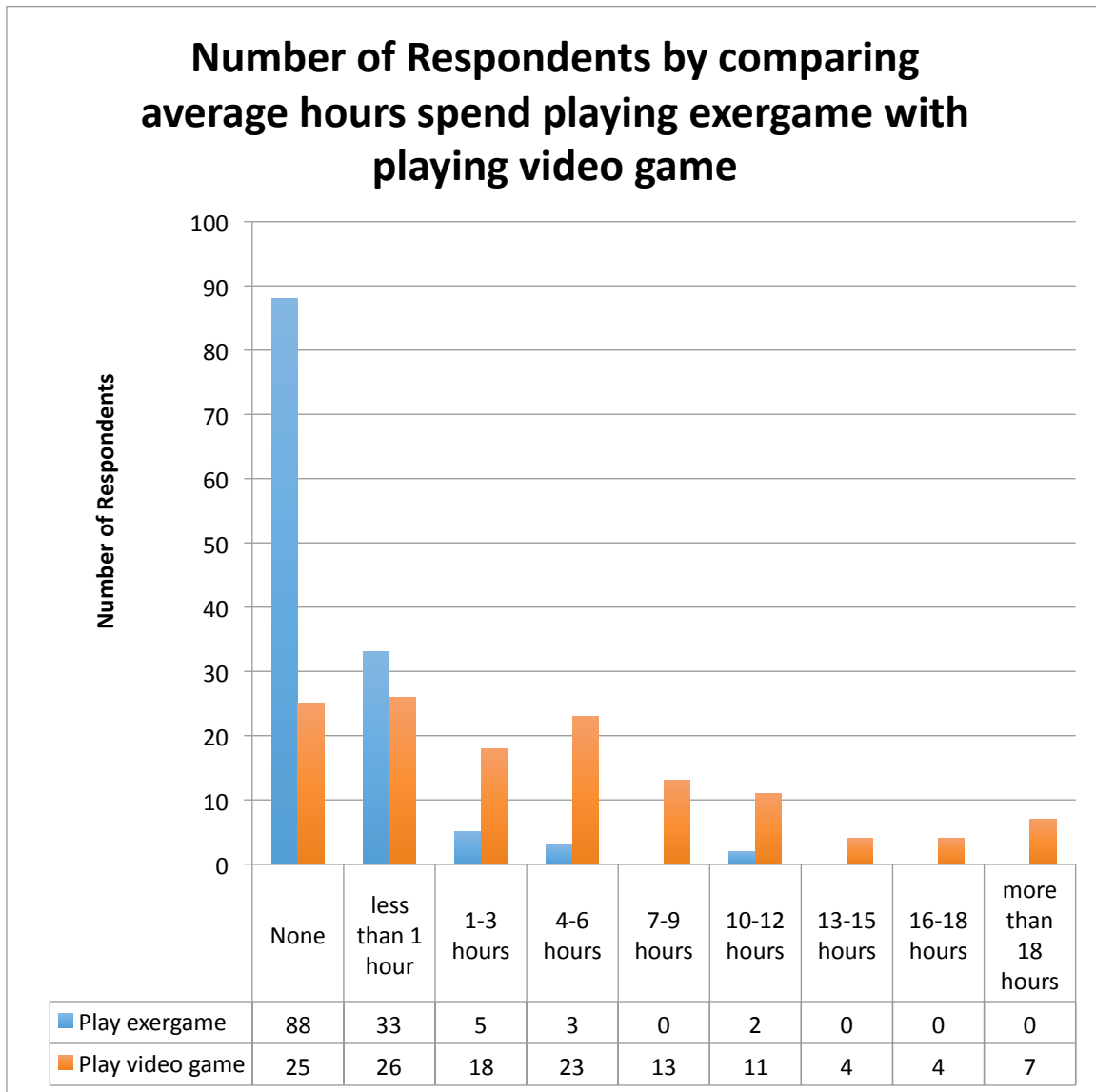


Figure 31 Number of Respondents by comparing average hours spends playing exergame with playing video game

Unlike in figure 30, exergaming hours will always count as gaming hours. From figure 31, we see that the number of exergaming hours is significantly smaller than gaming hours per week. This confirms our assertion that people play more general video games than exergames.

6.5 What people look for when buying videogames

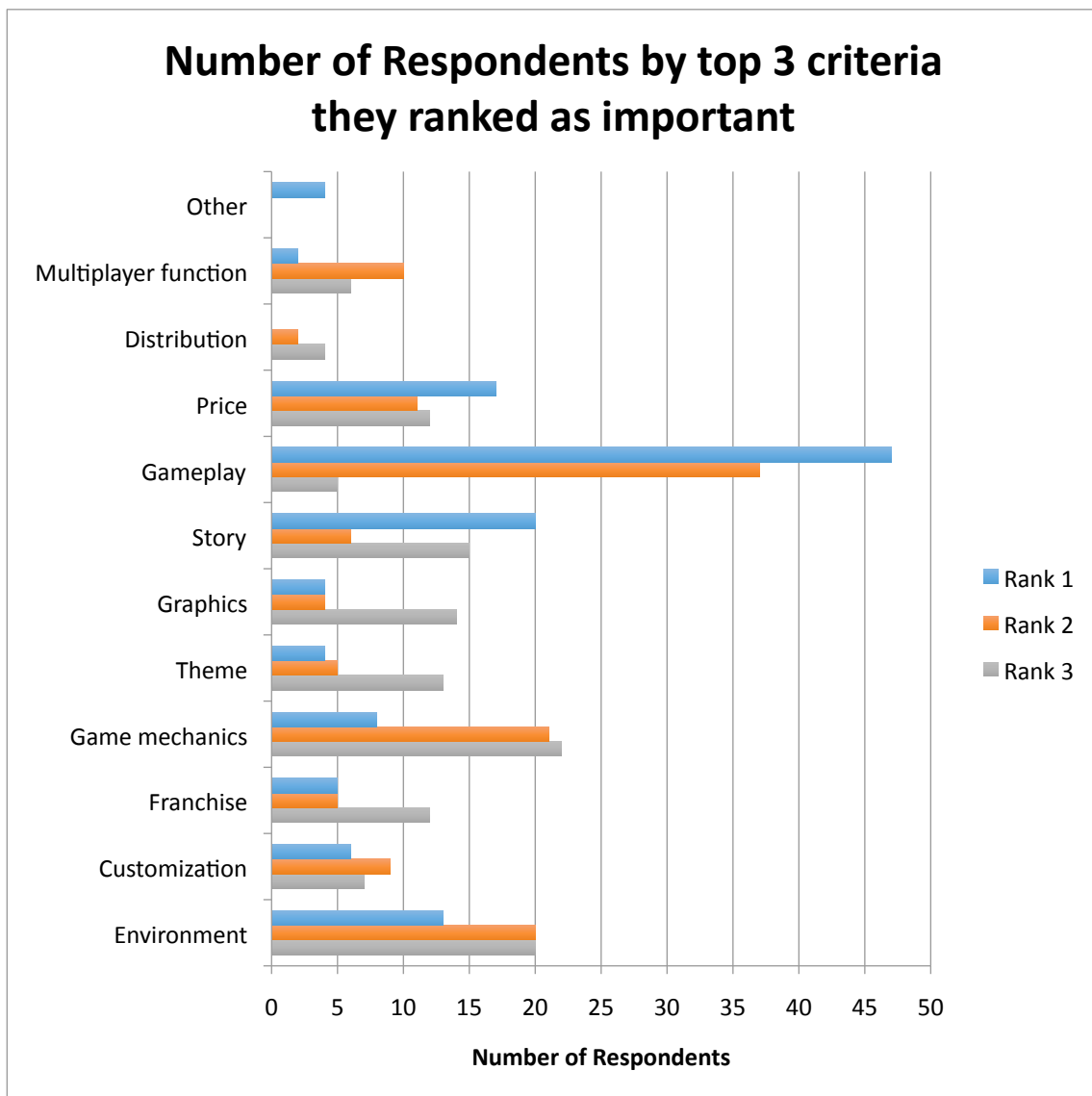


Figure 32 Number of Respondents by ranking top 3 criteria

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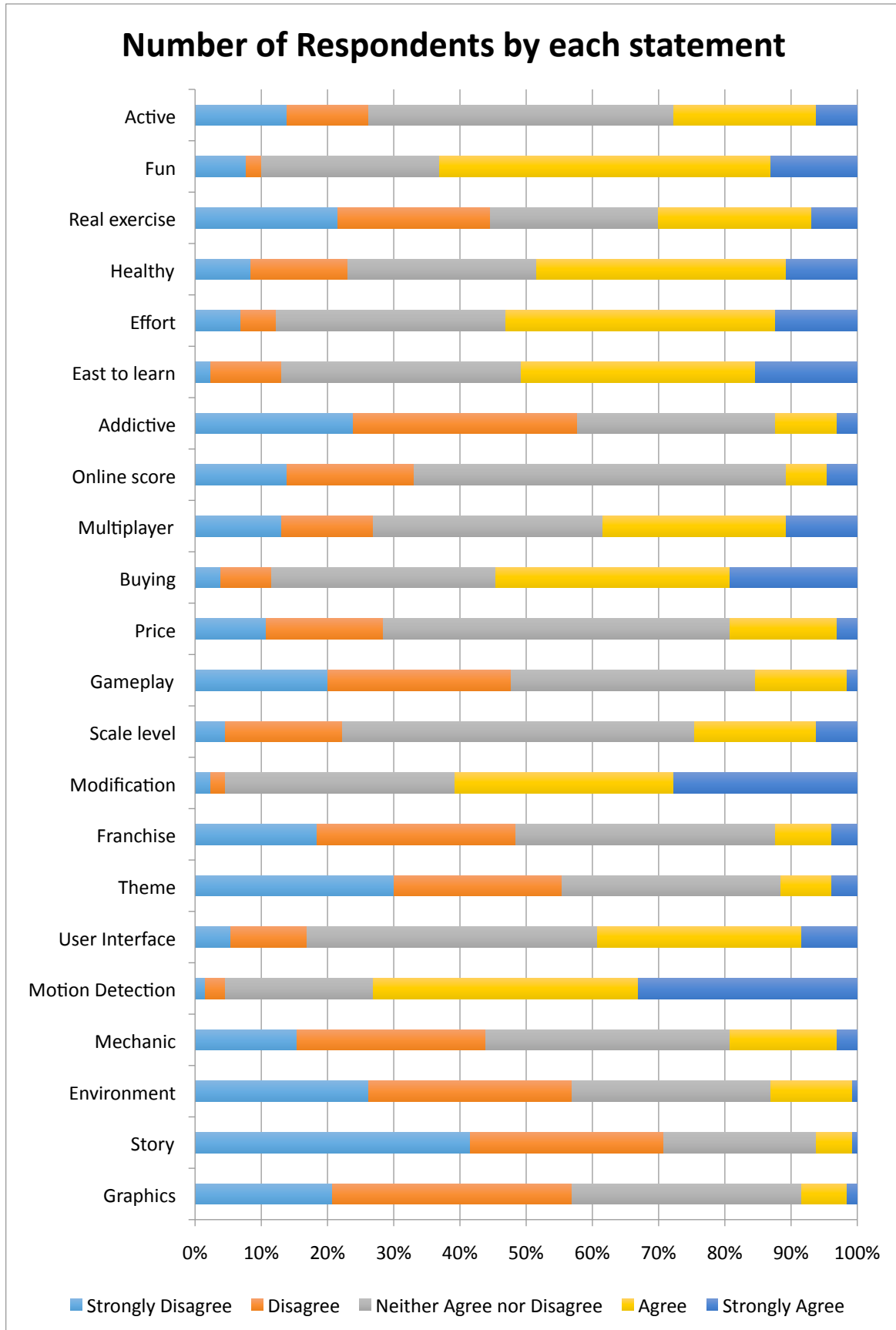
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Figure 32 shows that, when buying video games, people favor gameplay, player's interactions with the game world, the most. Game mechanics, technical aspects of the games, and environment, equivalent to mood and atmosphere in literature, come in as close second and third respectively. Perhaps game mechanics may not be favored as much were the surveyed released outside the predominantly-technical WPI.

Representative	Statement
Graphics	Exergames have better graphics than general video games
Story	Exergames have better stories than general video games
Environment	Exergames have better environments than general video games
Mechanic	Exergames have better mechanics than general video games
Motion Detection	Exergames utilize motion detection technology better than general video games
User Interface	Exergames' user interfaces are easier to understand than in general video games
Theme	Exergames have more diverse themes than general video games
Franchise	Exergames franchises are more famous than other video game franchises
Modification	General video games allow more content modification than exergames
Scale level	The difficulty level in exergames are scaled well with player's skill than general video games
Gameplay	Exergames have better gameplay than general video games
Price	Exergames are more reasonably priced than general video games
Buying	You can buy exergames anywhere you can buy any other video games
Multiplayer	Exergames have better multiplayer functions than general video games

Online score	Exergames have better online score ranking system than general video games
Addictive	Overall, exergames are more addictive than general video games
Easy to learn	It is easier to learn to play exergames than general video games
Effort	The effort required to play exergames is worth the fun
Healthy	I feel that playing exergames makes me feel healthier
Real Exercise	I feel that playing exergames can substitute for regular exercise
Fun	I play exergames because they are fun
Active	I play exergames because they help me stay active



6.6 Responses to comparison statements

It should be noted that neutral responses to the following statements may result from respondents' inexperience with exergames. In which case, neutral responses will not affect our analysis in cases where there are obvious extremes.

6.6.1 Graphical appeal and story

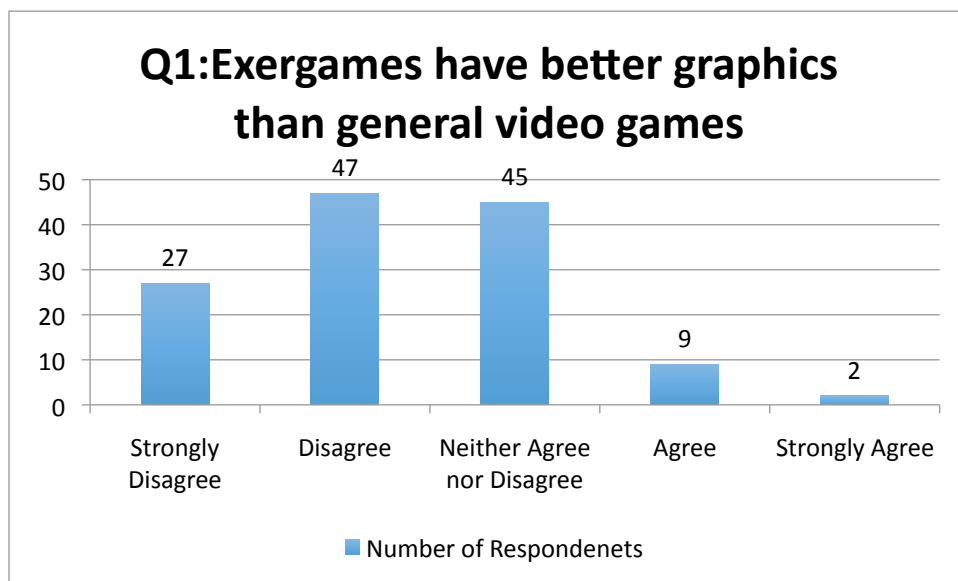


Figure 33 Number of Respondents by graphic

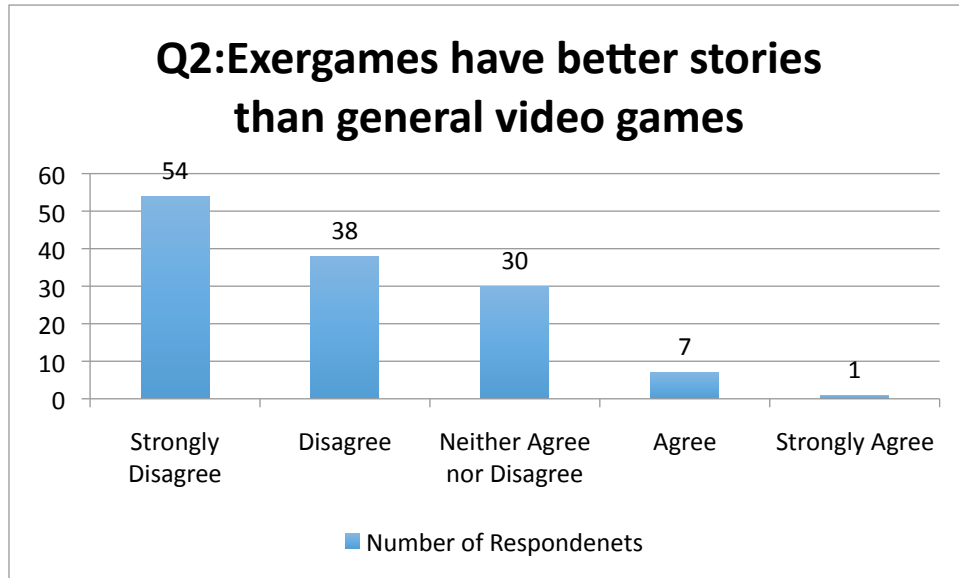


Figure 34 Number of Respondents by story

Respondents seem unanimous in figure 33; and rightly so, graphics engines in general video games have come far. Also, storytelling seems lacking in exergames; which is self-evident from the fact that exergames focus more on player's physical action.

6.6.2 Environmental and technical appeals

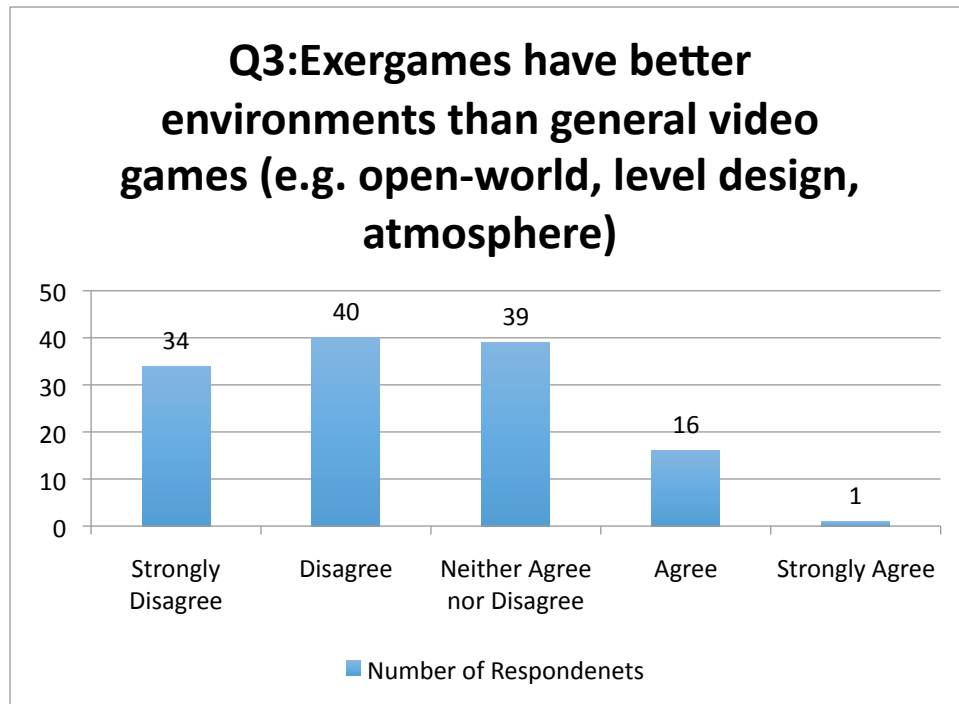


Figure 35 Number of Respondents by environment

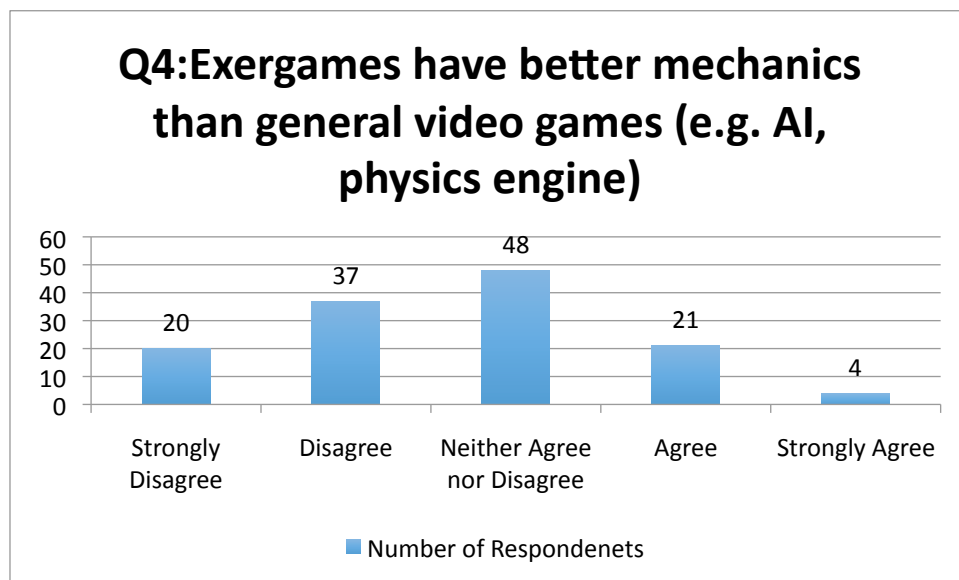


Figure 36 Number of Respondents by mechanic

Both figures 35 and 36 follow the same trend as the two previous responses. Strong disagreement predominates figure 35; understandable when considering that environment is a top criteria for buying video games.

6.6.3 Motion detection and user interface

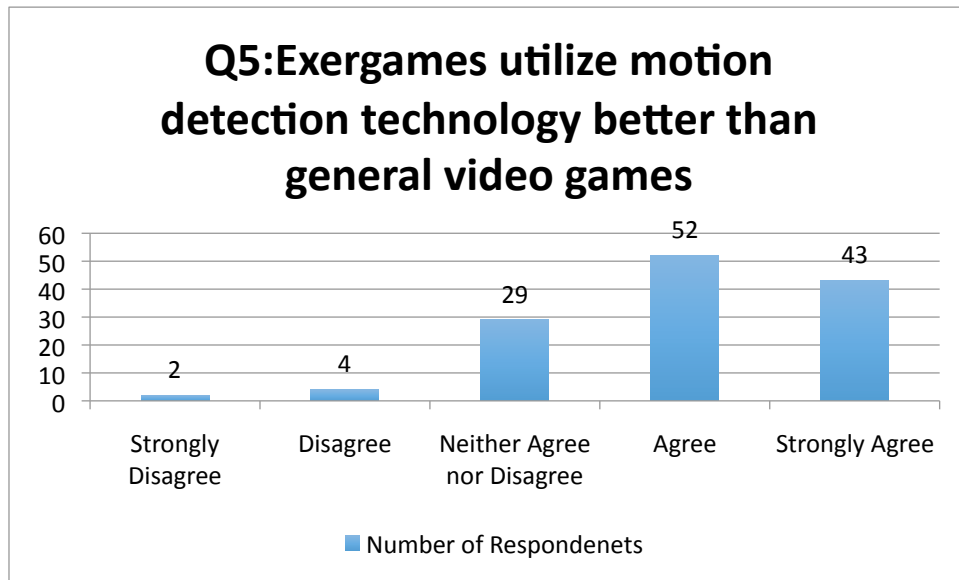


Figure 37 Number of Respondents by motion detection

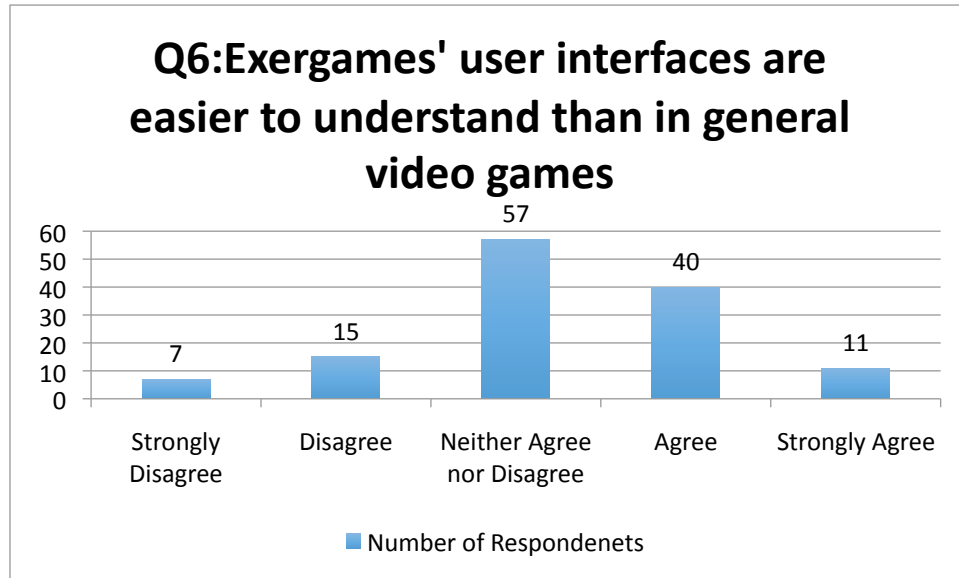


Figure 38 Number of Respondents by user interface

In figures 37 and 38, we see a break from the trend. Of course, exergames have better motion detection technology than general video games. These motion devices are manufactured mainly for exergames. Opinions on user interface seem valid; exergames tend to be more age-friendly than general video games, hence its clearer interface.

6.6.4 Themes in exergames

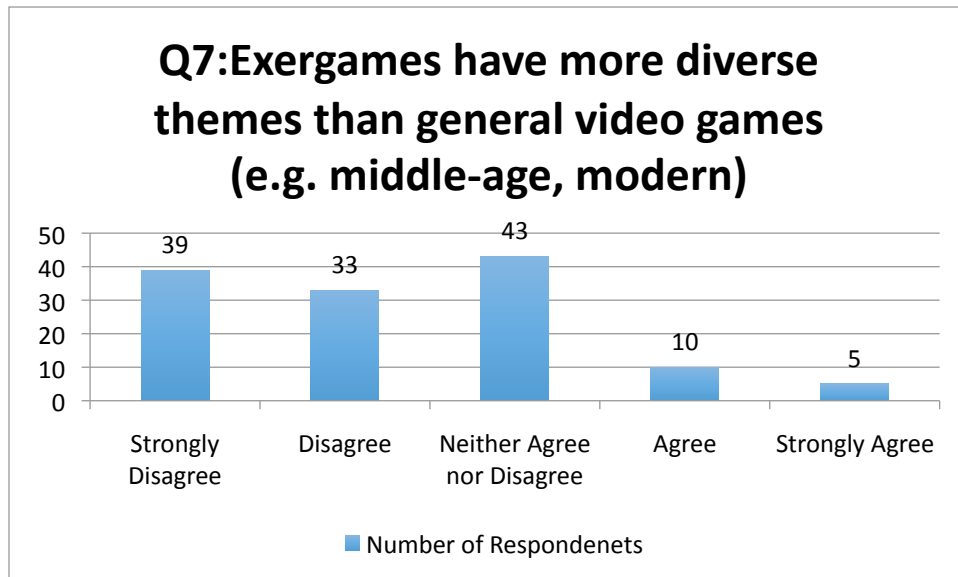


Figure 39 Number of Respondents by theme

Themes in video games equal to fiction genres. Most exergames are limited to sports, dancing, and other party-type games, as categorized in Phase 2 findings.

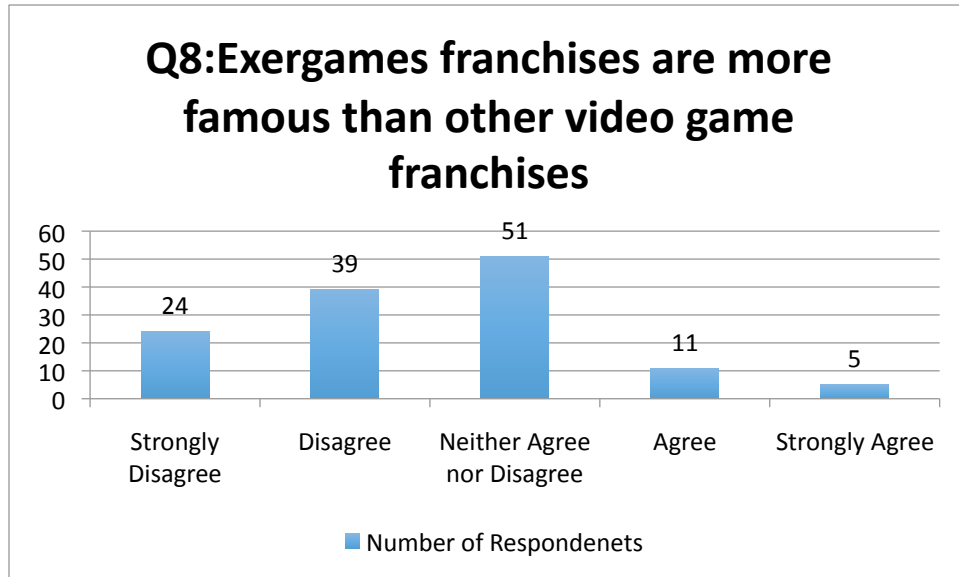


Figure 40 Number of Respondents by franchise

Figure 40 shows that most respondents think that franchises of general video games are more well-known than those of exergames. This opinion is probable, considering the correlation between gaming hours and exergaming hours pointing toward respondents being general gamers.

6.6.6 Content modifications

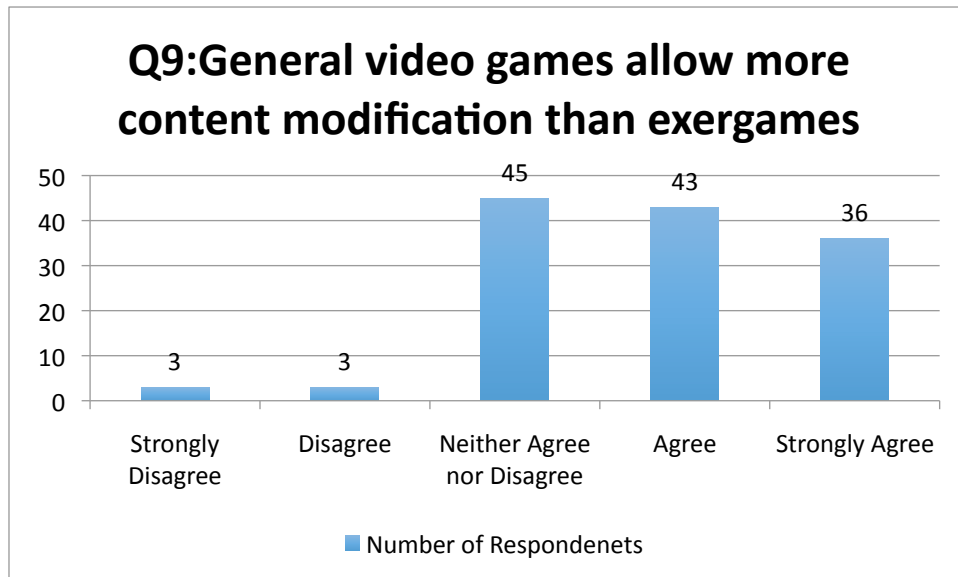


Figure 41 Number of Respondents by modification

Undisputedly, general video games, especially computer video games, allow for in-depth content modifications of the game. This may positively alter gameplay experience of gamers. Also, the more physical nature of exergames may not allow for modifications.

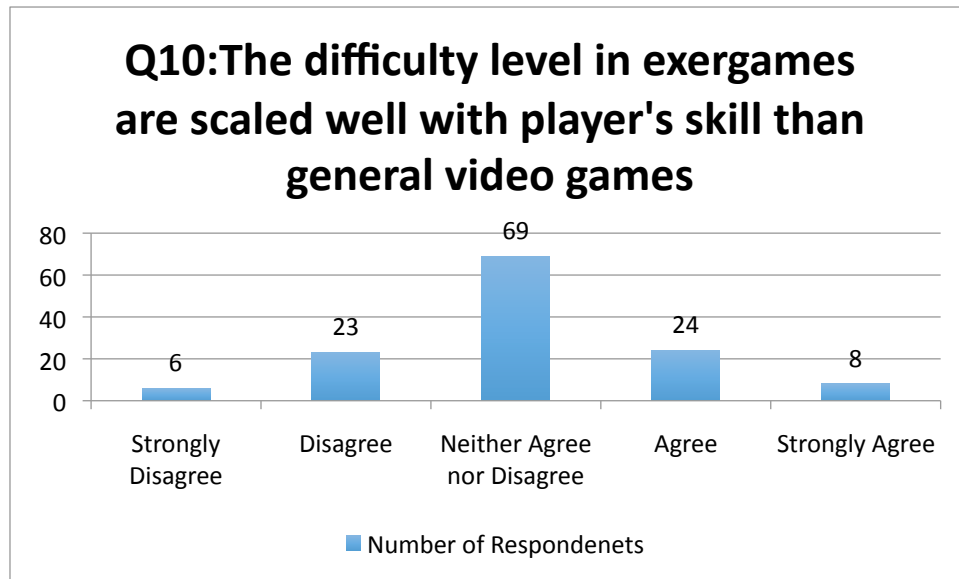


Figure 42 Number of Respondents by scaling level

Figure 42 shows a mostly neutral opinion on difficulty level. This is because difficulty in different video games can stand on its own without comparison. We cannot objectively compare the difficulty of Zumba dancing with that of a first person shooting video game.

6.6.8 Gameplay comparison

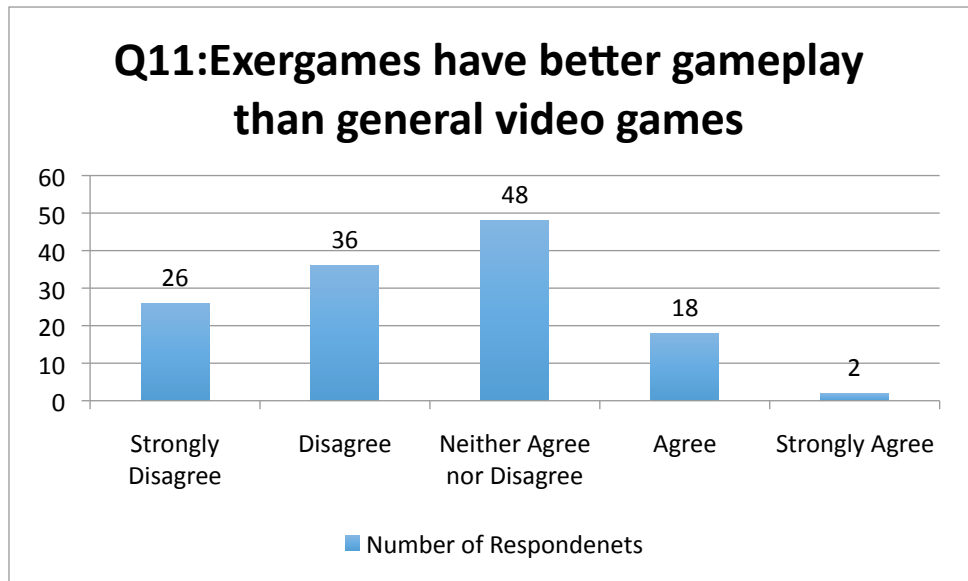


Figure 43 Number of Respondents by gameplay

As expected, figure 43 follows the same trend as that of figure 33 to 36, in which the statement involve top ranked criteria for buying video games.

6.6.9 Price and where to buy

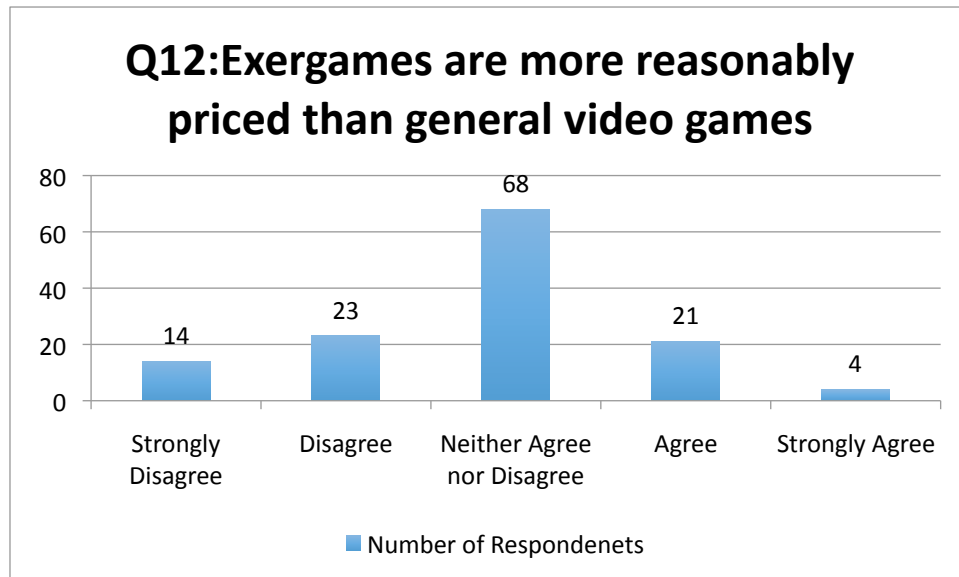


Figure 44 Number of Respondents by price

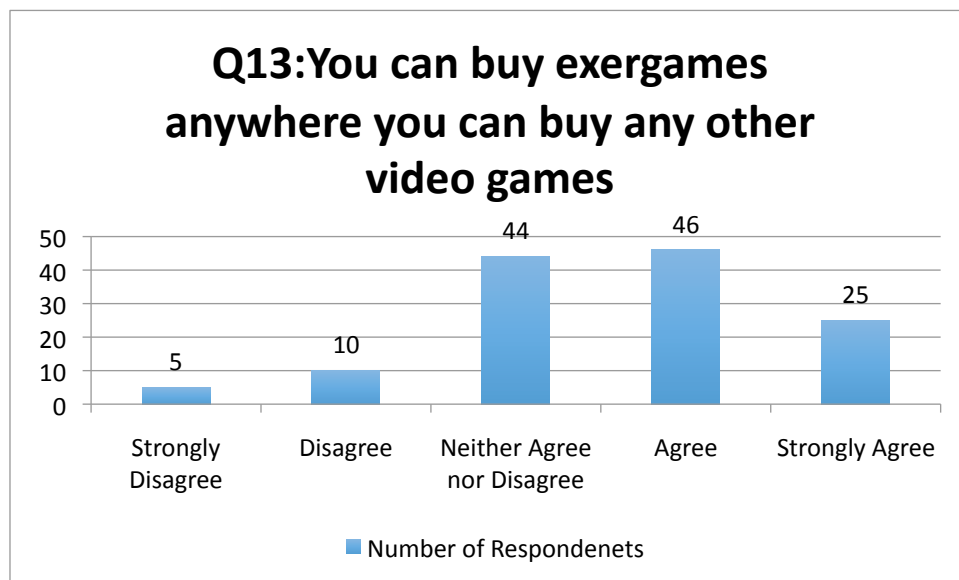


Figure 45 Number of Respondents by places to buy games

Figure 44 shows a neutral opinion towards exergames' price. This may be due to respondents' comparing exergames' price to general video games' price rather than comparing it to the content

it offered like we initially did. This comparison is made apparent in figure 45 where respondents can find

exergames wherever general video games are sold.

6.6.10 Online and multiplayer functions

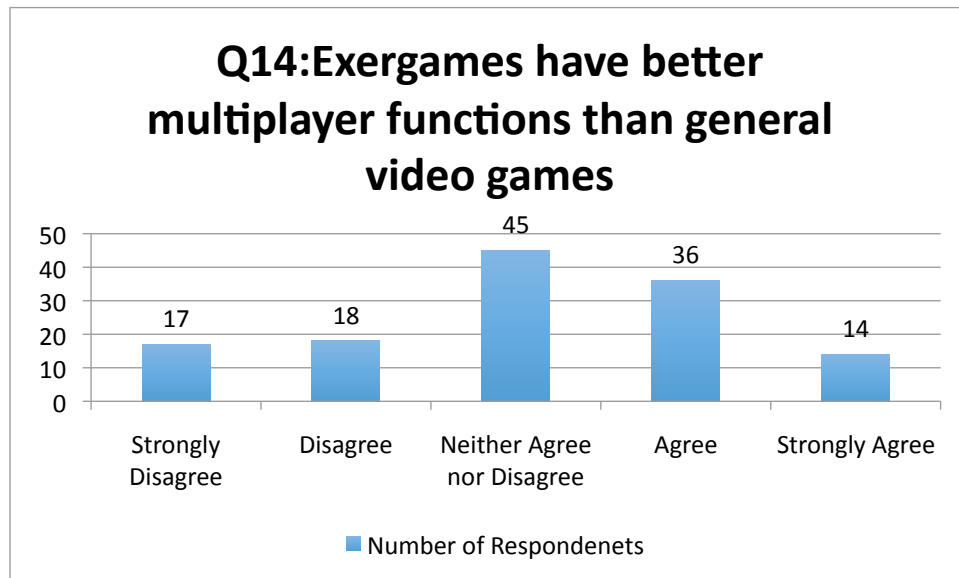


Figure 46 Number of Respondents by multiplayer

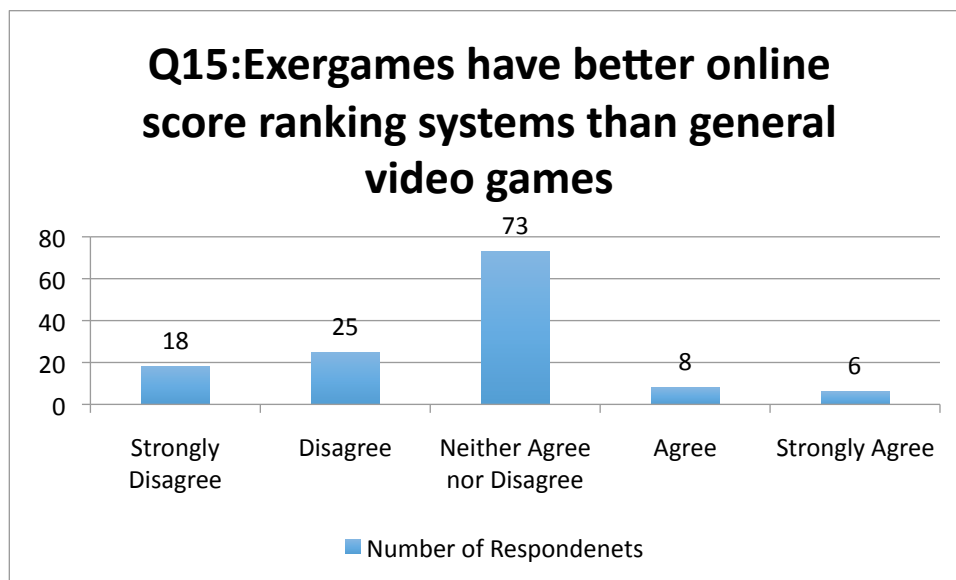


Figure 47 Number of Respondents by online score

Figure 46 shows that respondents think that exergames have better multiplayer functions than general video games. Note that respondents may compare either the local or online multiplayer functions between the two types of games.

6.6.11 Addictive exergames

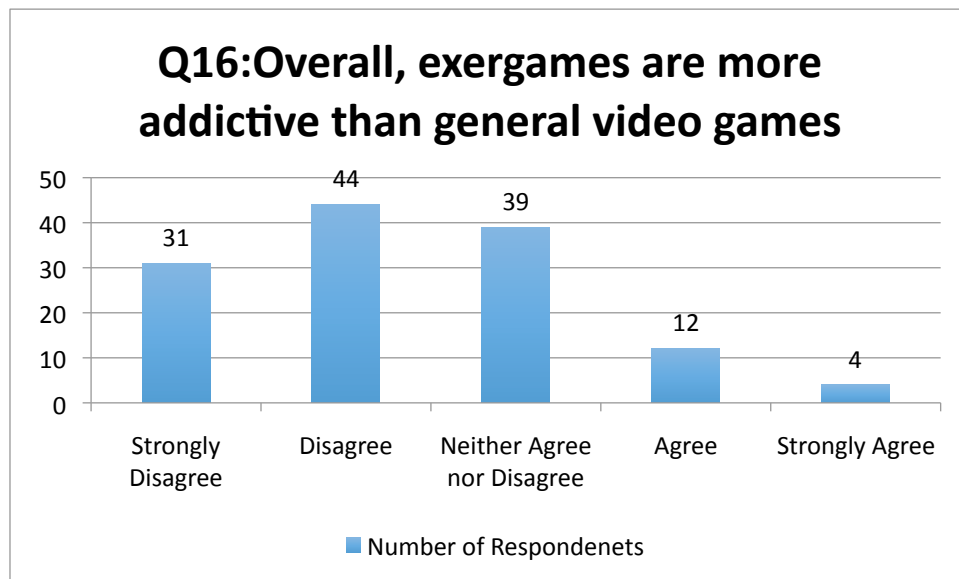


Figure 48 Number of Respondents by addiction

Figure 48 shows that respondents think that exergames are not as addictive as general video games. This corresponds with statement opinion so far; exergames are beaten by general in every criteria except for the multiplayer function, which rate pretty low on the criteria ranking list.

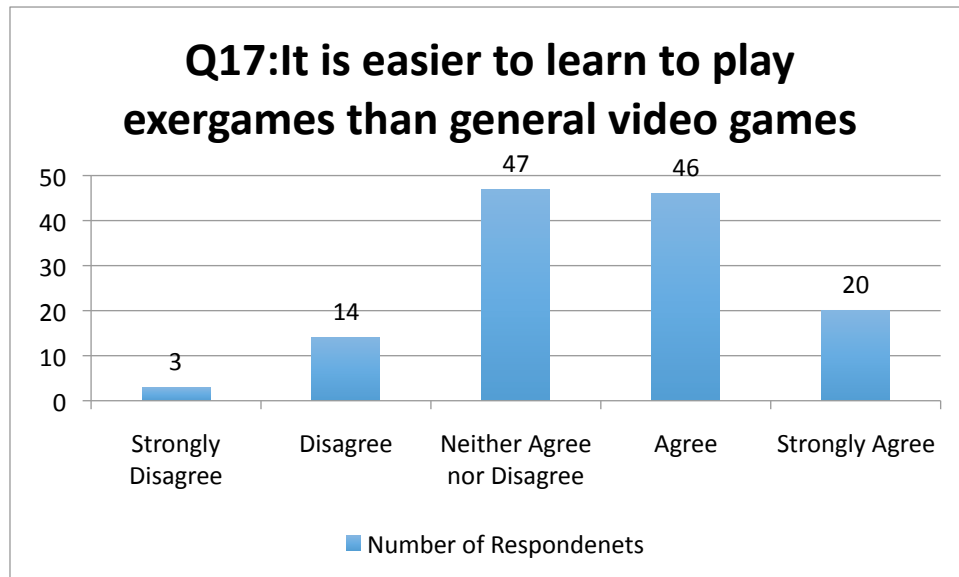


Figure 49 Number of Respondents by learning curve

Like opinion on user interface in figure 38, exergames tend to be more accessible to all age demographics thanks to their low learning curve.

6.6.13 Fun worthy of effort

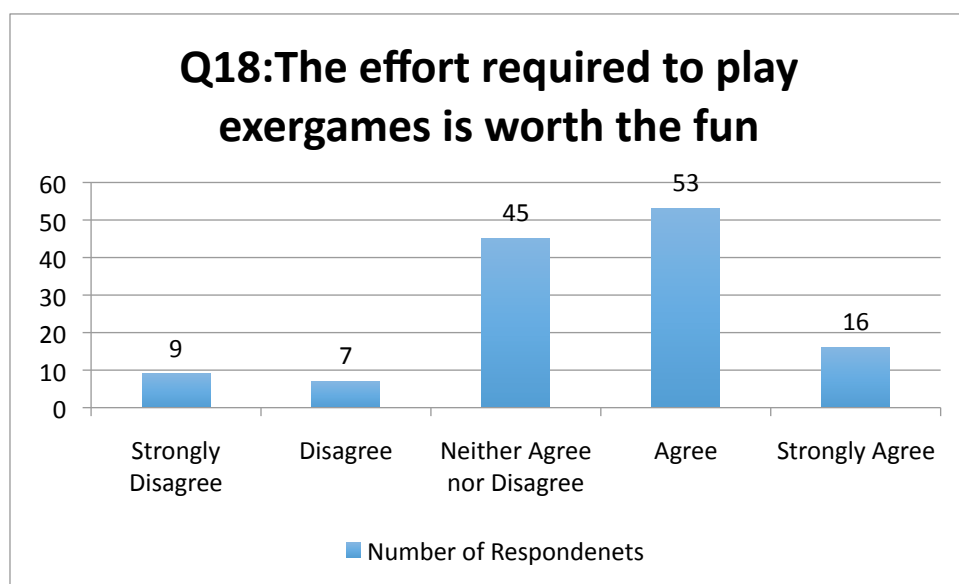


Figure 50 Number of Respondents by effort requirement

Figure 50 shows that most respondents think that the effort, physical and/or mental, required to play exergames is worth the fun. This does not contradict our initial assertion, and facts arising from previous statement opinions, that people play more general video games than exergames. The effort is subjective to each individual, and the end result, the fun, is different across all games. We can only explore this statement in relation to the top ranked criteria.

6.6.14 Substitution for real exercises

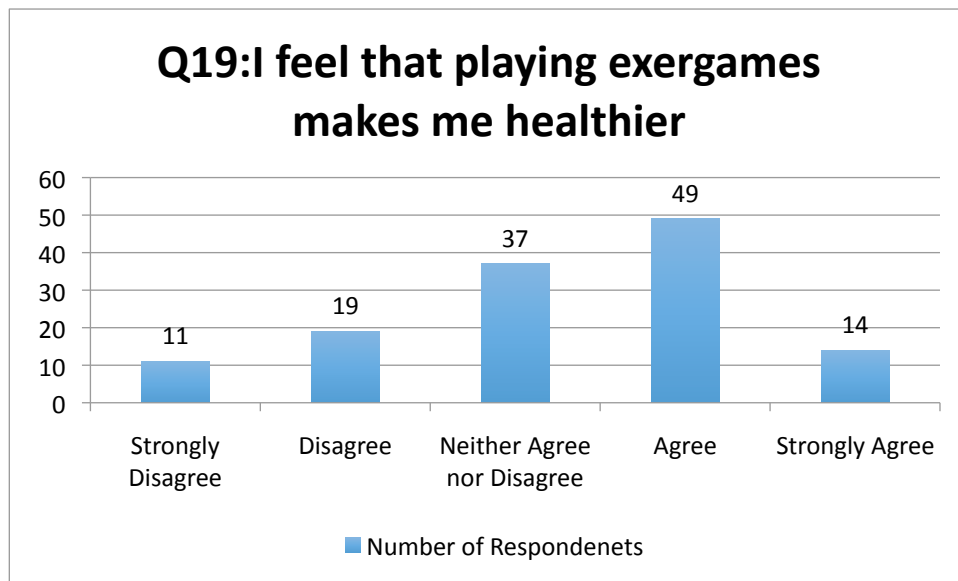


Figure 51 Number of Respondents by healthy

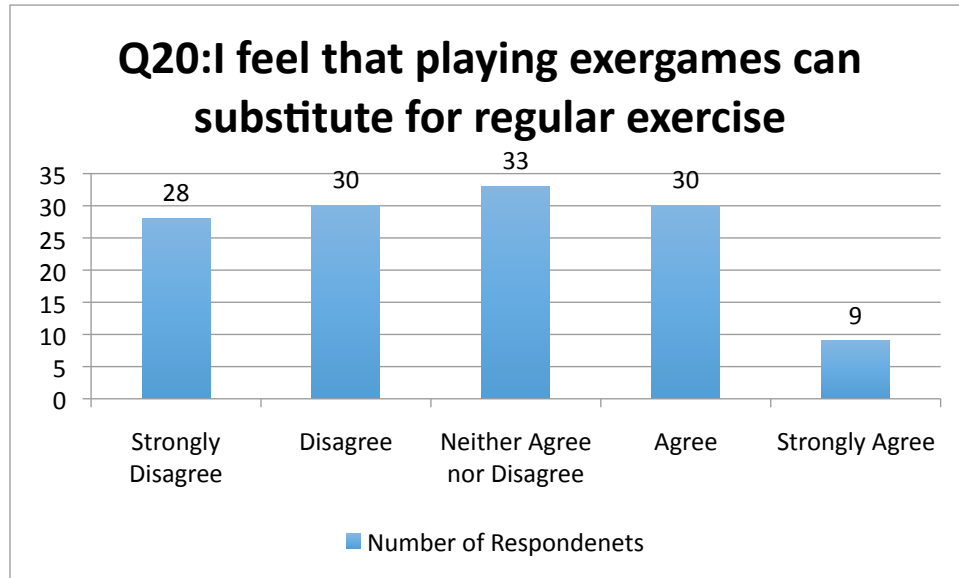


Figure 52 Number of Respondents by substitution regular exercise

Figure 51 shows that respondents think playing exergames make them feel healthier. Considering their inexperience with exergames, this feeling may not be the same over any extended period of time. This inexperience also makes for the diverse opinion in figure 52; we can see that only a small number of respondents play exergames regularly.

6.6.15 Potential for fun and staying active

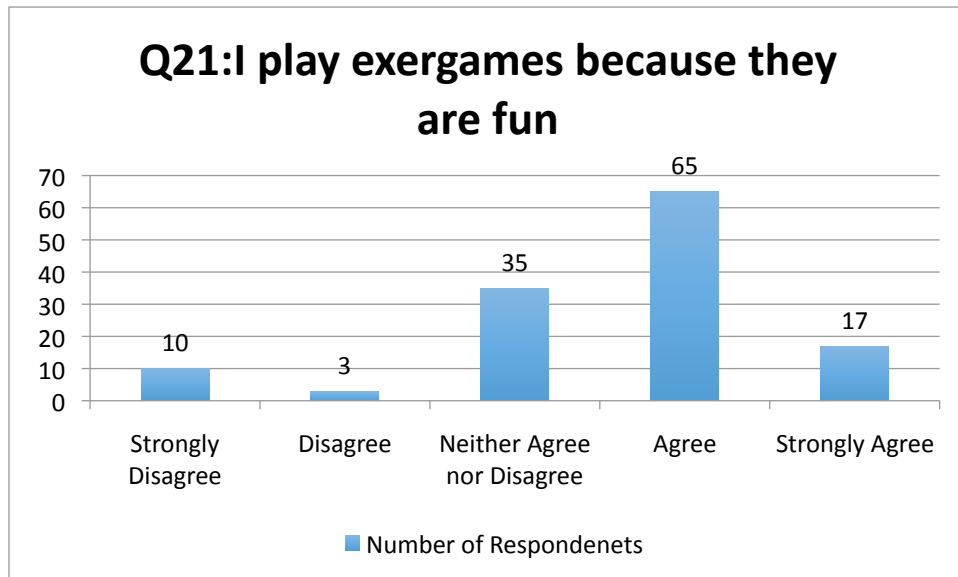


Figure 53 Number of Respondents by fun



Figure 54 Number of Respondents by staying active

Figure 53 shows that most respondents think that exergames are overall fun, corresponding with figure

50 Figure 54 shows a neutral opinion on exergames helping to stay active. Again, inexperience with exergames is responsible for this.

Phase 3 conclusion

The most predominant theme of assertion that arises from the survey results is respondents' inexperience with exergames. Although this confirms our hypothesis, it creates a problem when assessing what people actually think of exergames. Regardless, we gained some insight from respondents' ratings of various criteria. General video games beat exergames in every top ranked criteria, making statements which stand alone, such as exergames' being fun and worth the effort required to play, only valid without considering these criteria. And though there is potential for exercise in exergames, most people either have a schedule for real exercises or favor general video games for the aforementioned criteria. Further study into the effects of the gaming aspect in exergames on people's perception of exergames as a mode of exercise may shed light on this conflict between the virtual and traditional physical activity. Above all, we have identified why people prefer general video games and the criteria that make it so.

Chapter 7: Discussion

Though not all research questions are answered, the survey result from phase 3 has helped us in answering some of them:

Does a gap exist between exergames and video games in general?

The gap between exergames and general videogames exists as evident from the overwhelming positive responses to general video games in comparison statements. Also, from figure 3.6, we can see that 67% of respondents do not play exergames frequently as opposed to 81% of respondents from figure 3.4 who play video games weekly.

What elements in video games appeal to people?

From figure 3.10, we can see that people look for good gameplay, game mechanic, and environments when buying video games. From the same figure, we also see how important other criteria are relatively to each other.

If non-exergames are more appealing, how can we make exergames appealing?

The following guideline for an appealing exergames helps answer this question.

Statistical comparison between phase 1 and phase 3 results

The following figures compare some relevant opinion on exergames between the team members (phase 1) and survey respondents (phase 3.) It should be noted that P-value correlation cannot be found because survey responses in phase 3 were made comparing exergames to general video games while the team members expressed opinion on exergames alone. Regardless, opinions in some figure such as figures 4.2 and 4.6 are either expressed towards exergames alone or do not differ when compared to general video games.

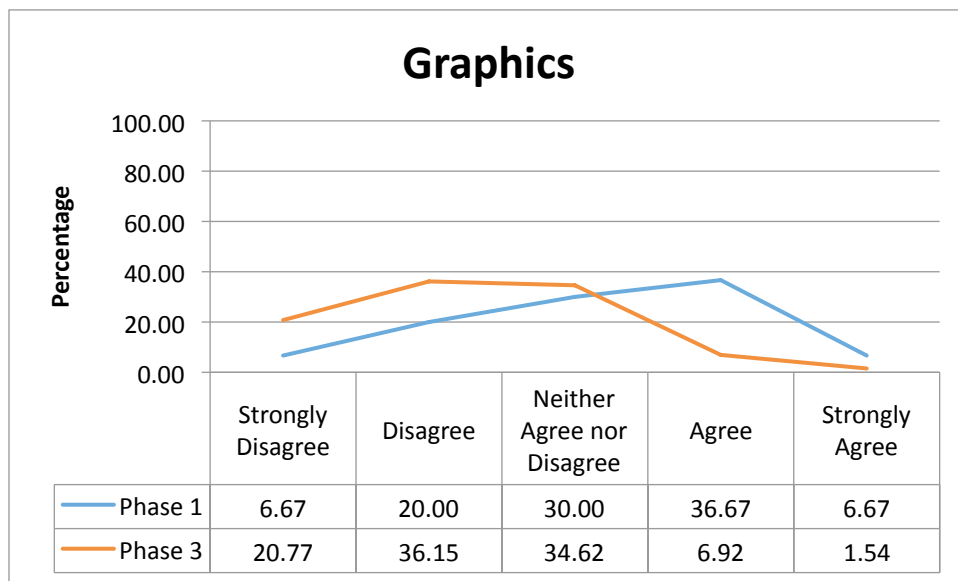


Figure 55 Graphics

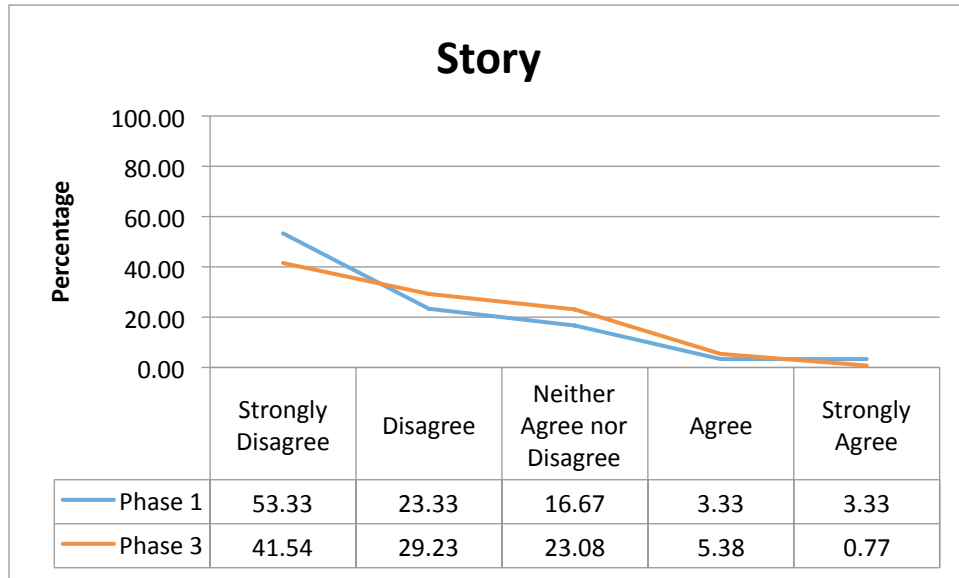


Figure 56 Story

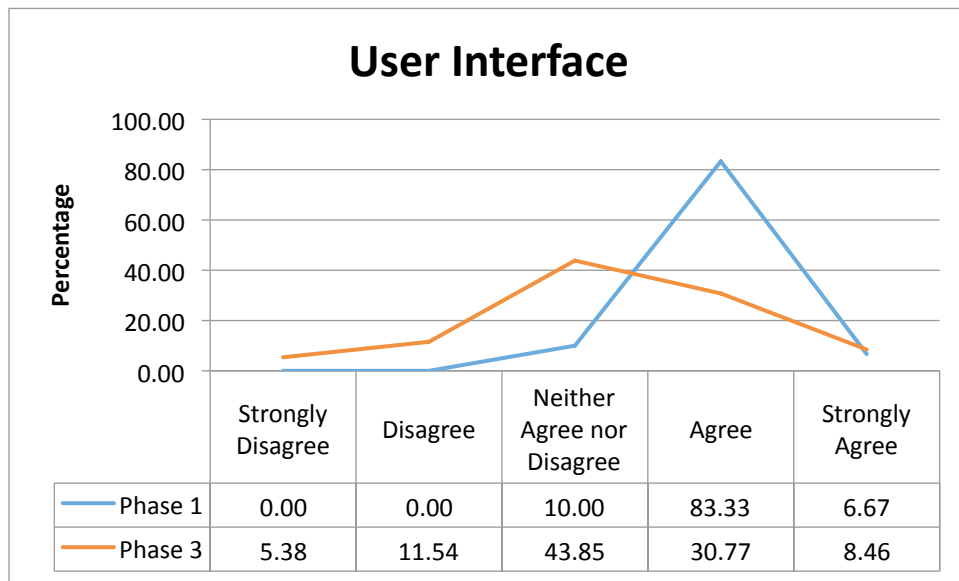


Figure 57 User interface

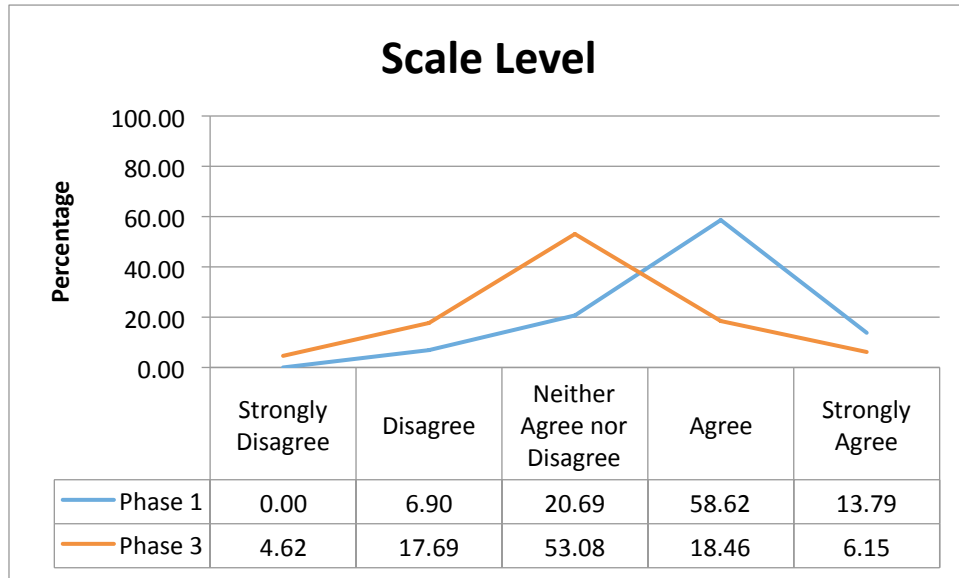


Figure 58 Difficulty scaling

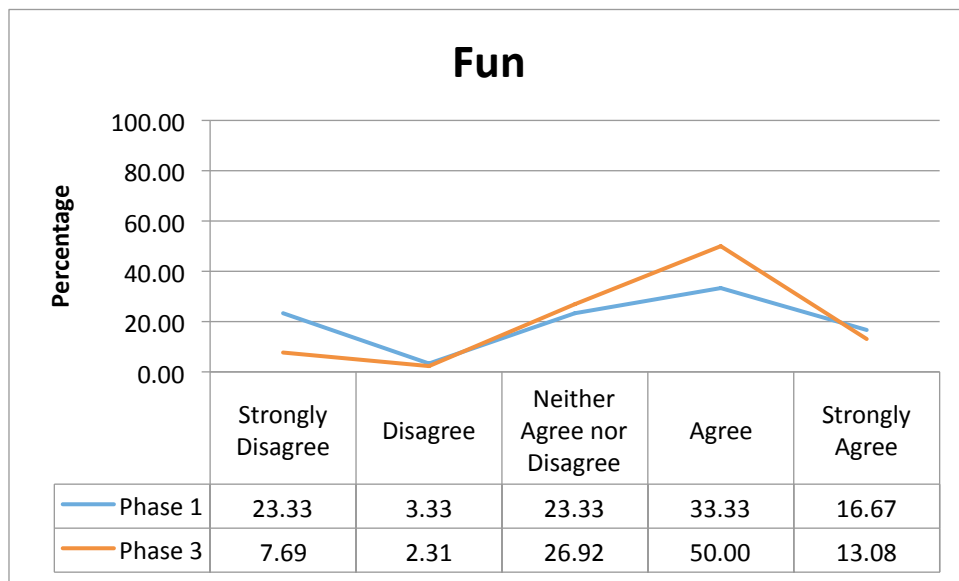


Figure 59 Overall fun factor

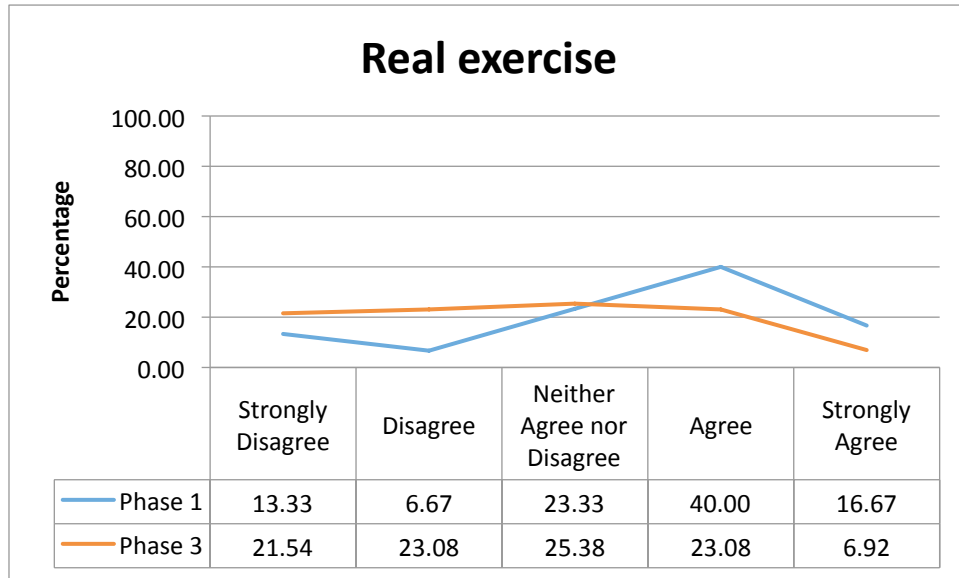


Figure 60 Comparison to real exercise

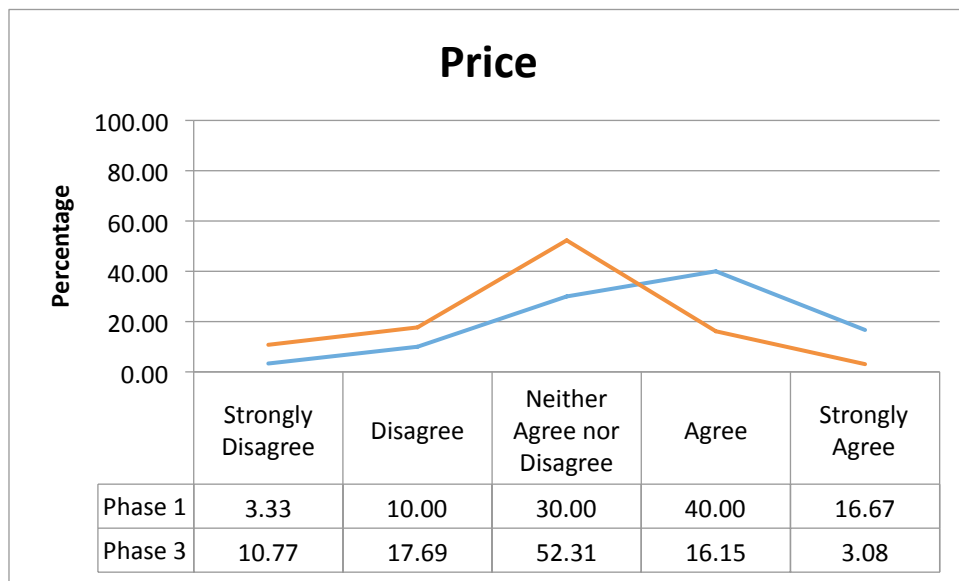


Figure 61 Pricing

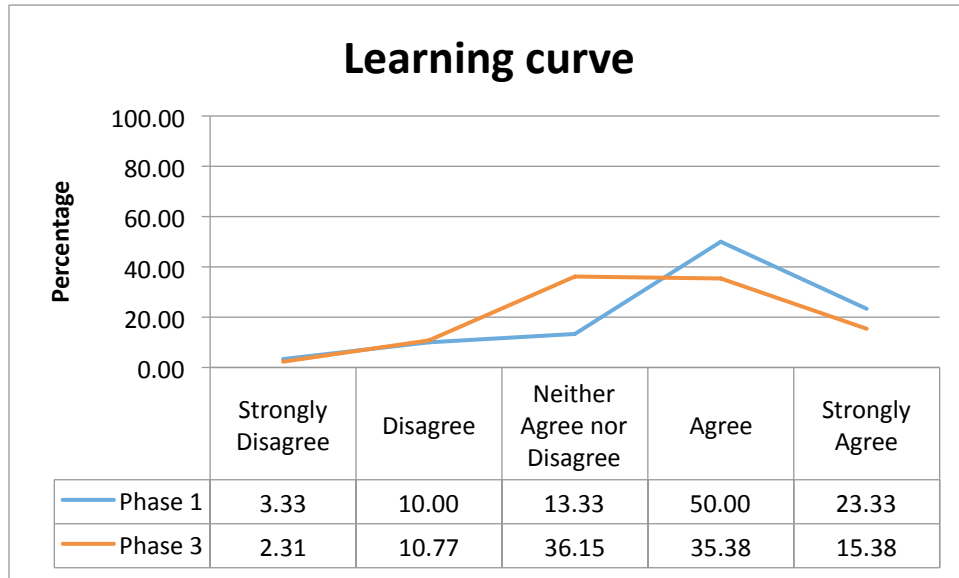


Figure 62 Learning curve

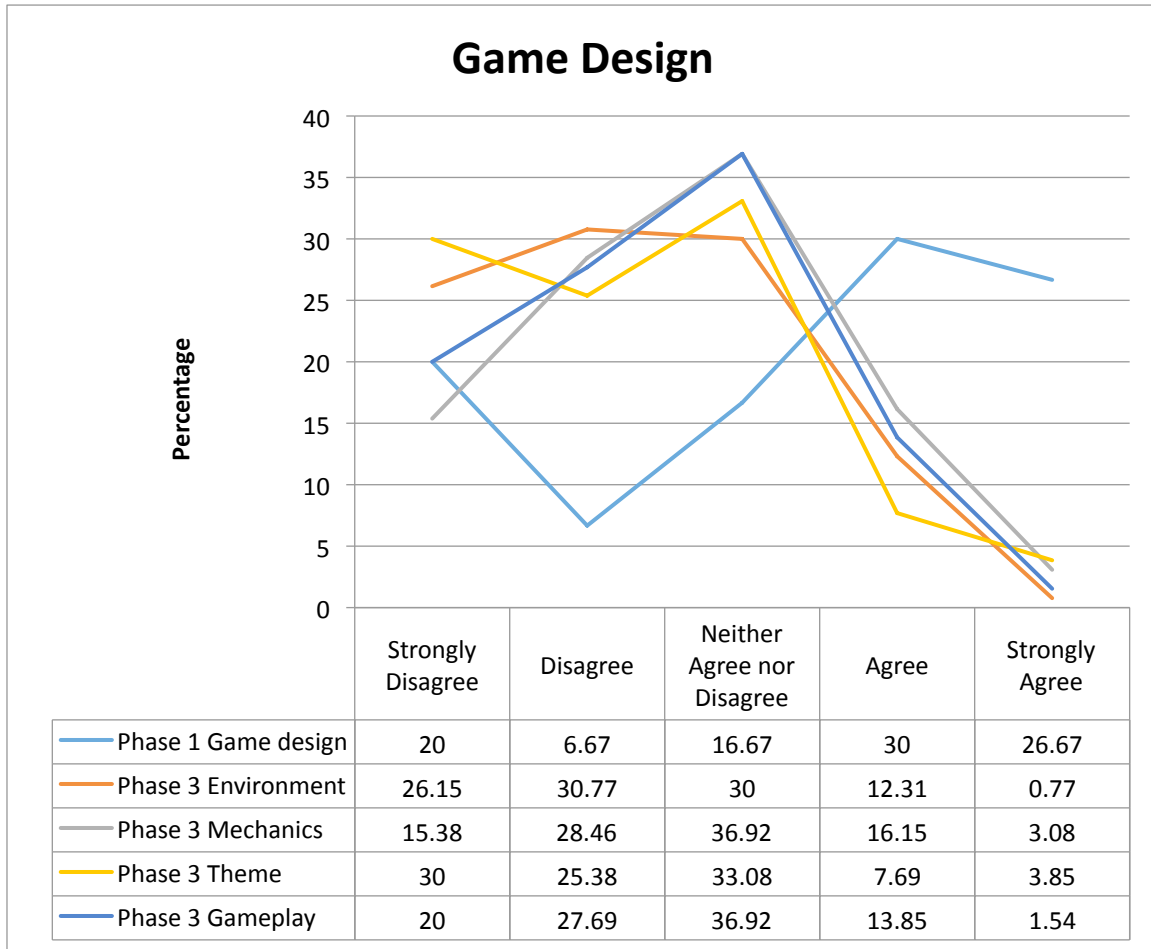


Figure 63 Game design

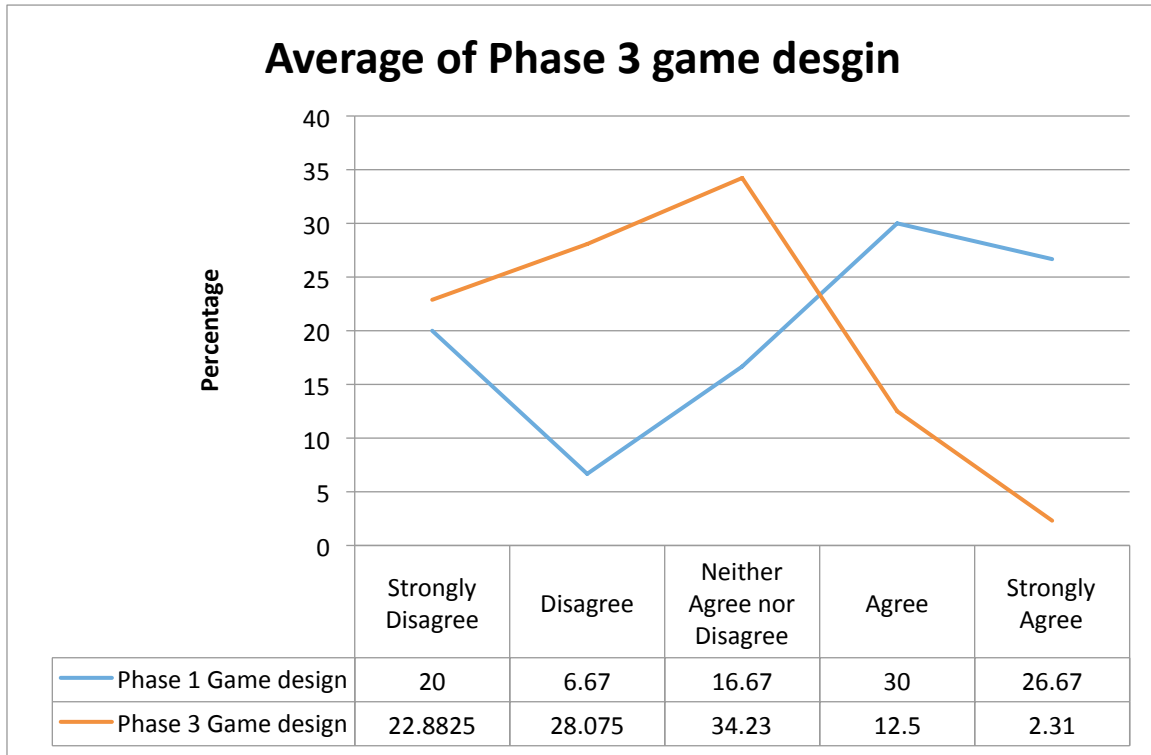


Figure 64 Game design average

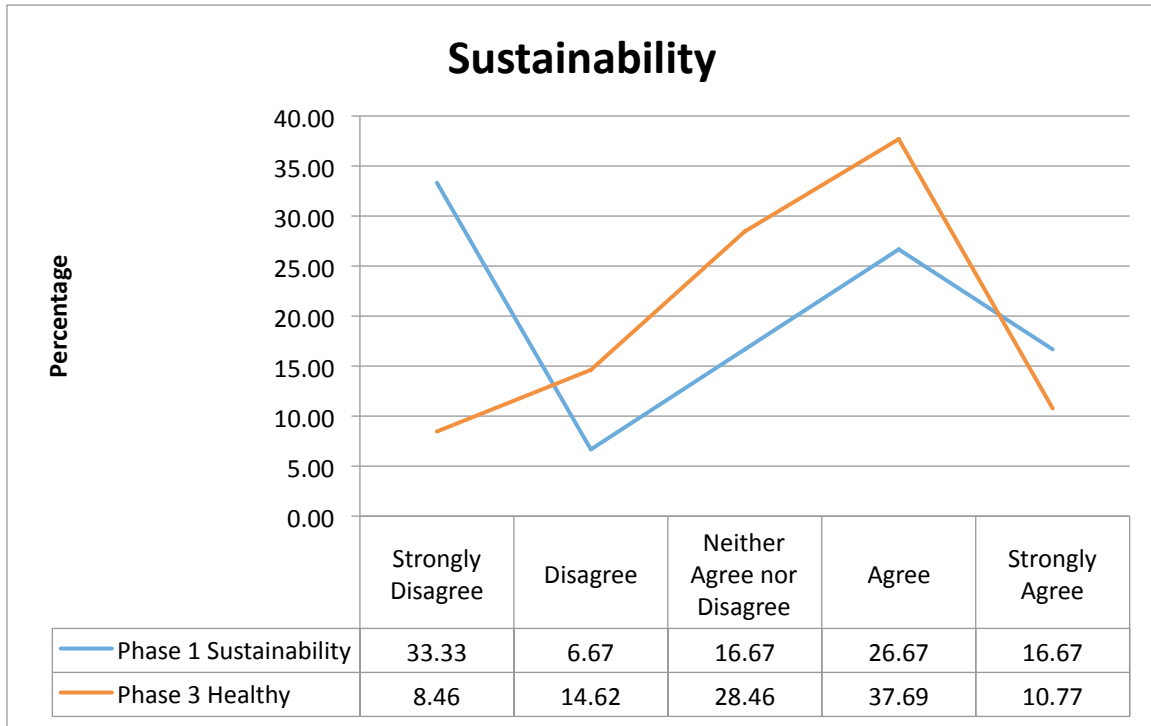


Figure 65 Sustainability

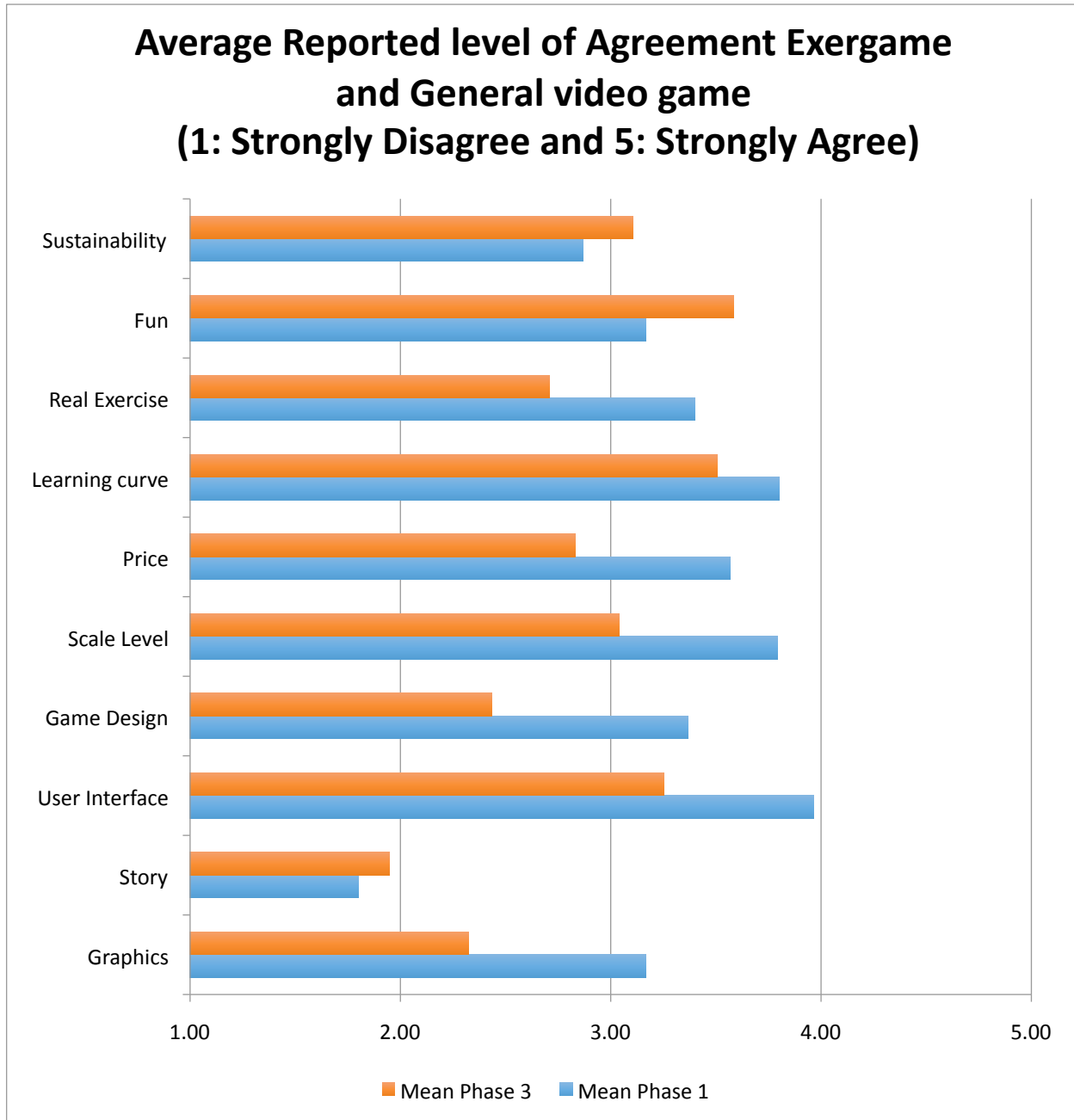


Figure 66 Average value

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	Mean Phase 1	Mean Phase 3	SD. phase 1	SD. phase 3	Mean Difference
Graphics	3.17	2.32	1.04	0.93	0.84
Story	1.80	1.95	1.05	0.96	0.15
User Interface	3.97	3.25	0.41	0.96	0.71
Game Design	3.37	2.43	1.45	1.04	0.93
Scale Level	3.79	3.04	0.76	0.89	0.75
Price	3.57	2.83	0.99	0.93	0.74
Learning curve	3.80	3.51	1.01	0.95	0.29
Real Exercise	3.40	2.71	1.23	1.23	0.69
Fun	3.17	3.58	1.39	1.01	0.42
Sustainabilit y	2.87	3.11	1.52	1.10	0.24

Chapter 8: Guidelines for appealing exergames on console

platforms

Gameplay and mechanics

From figure 3.22, respondents seem to prefer their in-game avatar's interaction with the game world in general videogames. Figure 3.15 follows the same trend. Although this may involve other dynamics, gameplay and mechanic variety maybe superficially classified as genres. If that is the case, it is hardly surprising that exergames' lack of 'genres' account for its low appeal. We recommend that, like general video games, exergames should not limit to only dancing, sports, and adventure games. But we must also take exergames' limitations into account when incorporating another genre. For instance, making a first person shooting game out of an exergame is not viable due to lack of a precise motion detector, you wouldn't be able to move your avatar as freely in a first person shooting exergame. This limitation stands as the biggest obstacle in player's physical interaction with the game. However, in a shooting game, if we eliminate character's freedom of movement we may be able to develop a rail shooting game centering its exercise mechanics on ducking and shooting. Also, in order to compensate for lack of movement on the player's part, we can incorporate the duck and cover mechanics into the game using motion detection devices – camera and belt – instead of pedal to encourage full-body movement (see the definition page for definition of rail shooter.) For the game to be successful as a regular mode of exercise, the game must force players to use this duck and cover mechanics repeatedly without feeling forced. This can be done by raising the game's base difficulty level or, as in the game *Time Crisis*, requiring player to duck in order to reload.

Story

Stories in exergames are clearly inferior to general video games. This may be due to the non-serious tone of most exergames, a result of the aforementioned gameplay and mechanic limitation or an intentional design aiming for specific audiences or purposes. For instance, events must subject to actions in a dancing game. We propose that making exergames have a story is a good start. For example, rail shooting exergames may use zombie or action movie stories, and a more mature dancing game may involve a character's dramatic rise through a particular dance scene, which of course will require the game mechanics to change accordingly.

Environment and theme

Environment is almost akin to atmosphere in literature, while theme is equivalent to setting and/or literary genre. Diversity of themes maybe thought of as diversity in stories in video games. Examples of environment design of exergames with the proposed stories: zombie exergames may have settings in a post-apocalyptic world, and the dance game may be set in the dance world represented in a linear story starting from dance school to the world stage.

Multiplayer functions

There should be both online and local multiplayer options in a game. Their functions depend on the kind of game they are, for instance a chess game or a puzzle game would not support more than two players playing at once but may have online ranking system. For our proposed rail shooting game, there should be both online and local multiplayer up to four players with online score ranking.

Customization

Since we are dealing only with console games, due to lack of motion detection in computer games, free content modification programming by player is too difficult and we can only look at in-game freedom to customize. In a role-playing game, customization would come in forms of equipment and

items, in a dancing game, character appearance or workout length. For our proposed, rail shooting game, limited by lack of freedom of movement, there should be a streamlined custom map editor for players to design their own stages.

Conclusion

Our proposed idea for an appealing exergame would be a rail shooting zombie apocalypse game with duck and cover mechanics, a built-in map editor, and online co-op functions. Also, in order to improve the appealing aspect of existing exergames, developers should consider audience's mood rather than physical action; shifting the game's main purpose from physical activity to something else, while maintaining physical activity as the main user interaction with the game world.

Examples of rail shooting games:

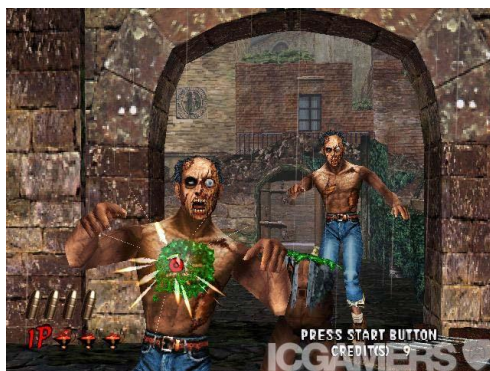
The House of the Dead:

The House of the Dead is a first-person, light gun arcade game released in 1996 and internationally in 1997 by Sega. Players assume the role of agents Thomas Rogan and “G” in their efforts to combat the products of the dangerous inhumane experiments of Dr. Curien, a mad scientist.

Screenshots:



Image credit: brothersoft.com [73]



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Image credit: djboyali.weebly.com [74]



Image credit: arcade-museum.com [75]

Ghost Squad:

Ghost Squad and *Ghost Squad: Evolution* are light gun rail shooter arcade games developed and published by Sega.

Screenshot:



Image credit: jameswoodcock.co.uk [76]

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Image credit: realmofgaming.com [77]

Time Crisis is a three-dimensional first person rail shooter similar to *Virtua Cop* and *The House of the Dead* installments, in which the player holds a light gun and goes through the motions of firing at on-screen enemies. *Time Crisis* is best known for its cover system, in which players can duck behind cover to avoid enemy fire and reload his weapon.

A foot pedal which performs multiple functions: when the pedal is released, the player takes cover to conserve hit points while reloading the gun. While the pedal is released, the player cannot attack.

Arcade machine:



Image credit: libertygames.co.uk [78]



Image credit: arcadehype.com [79]



Image credit: destructoid.com [80]

Virtua Cop:

Virtua Cop (known as *Virtua Squad* for the North American Windows version) is a first-person lightgun shooter arcade game created by Sega AM2 and headed by Yu Suzuki.

Players assume the role of police officers in a first-person perspective and use a light gun to shoot criminals and advance through the game, which penalties for shooting civilians. The players could also shoot power ups that grants him a weapon or a life. The weapon is lost if the player is hit, but not if he shoots a civilian.

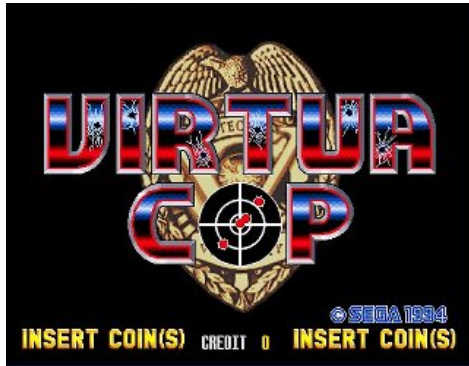


Image credit: arcade-museum.com [81]



Image credit: mobygames.com [82]



Image credit: gamespot.com [83]

Terms and Definitions

Terms	Definitions
<p>Game (Ferguson, 2012) [6]</p>	<p>A form of play or sport especially a competition played according to rules and decided by skills, strength, or luck. Element of game:</p> <ul style="list-style-type: none"> i. A specific goal the people are willing to work for; a sense of purpose ii. Rules that stimulate creativity within specified boundaries iii. A feedback system that lets individuals know how they are doing with respect to the goal iv. Voluntary acceptance of the goal, rules, and feedback information
<p>Physical Exercise (Oxford Dictionaries)</p>	<p>Activity requiring physical effort, carried out especially to sustain or improve health and fitness</p> <ul style="list-style-type: none"> i. A task or activity done to practice or test a skill ii. A process or activity carried out for a specific purpose, especially one concerned with a specified area of skill
<p>Exergame (Oh, 2010) [9]</p>	<p>An activity based on the gamers’ intention to exercise, improve, or maintain physical fitness with a planned, repetitive, and structured format, rather than the content or mechanic of the exergame themselves.</p>

Review Criteria (*The Exergame Network (TEN) blog: Exergame ratings,*) [5]

<p>Gameplay</p>	<p>The overall quality and “fun” factor of the game. Are the challenges in the game balanced, well-designed and engaging</p>
<p>Interface</p>	<p>Does the game’s interface(s) allow an immersive seamless and accurate response between the use and the game – Wiimotes,</p>

	balance board, camera, interactive screen, exercise equipment etc.
Exercise	How much physical energy is required to complete the challenges or mini-games (approximately average result)
Customization	Can “gameplay” aspects be altered and reorganized to suit the player’s preferences (e.g. can you customize your avatar, can you choose which exercises to combine)
Accessibility	Does the game allow for a player of any skill level to take part, and does the game scale in difficulty with the players increasing skills and abilities
Biometric Feedback	Is the player able to view, store, and retrieve fitness, health and competition data from the game (e.g. the players score, their BMI, skill level graphs, etc.)
Socialization	Does the game offer local and online multiplayer or cooperative play, which offers support & socialization between players
Sustainability	Does the overall exercise and gaming experience lead the user to desire repetition of the experience. This factor is the ability gain health benefits through prolonged use.

Types of game design (Brathwaite & Schreiber, 2009) [13]

World design	The creation of the overall back-story, setting, and theme of the game.
System design	The creation of rules and underlying mathematical patterns in a game
Content design	The creation of characters, items, puzzles, and missions
Game writing	The writing of dialogue, txt, and story within the game world
Level design	The crafting of level in a game, including the layout of maps and placement of objects and challenges within those maps
User interface	Design consists of two things: i. How the player interacts with the game

	ii. How the player receives information and feedback from the game.
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Rail Shooter:

A rail shooter is the shooting game in which the player does not manually control movement. The in-game character moves for himself or herself, with objects moving in and out of the screen, as if it were “on rails”. Turns and paths are predetermined, though some games give the player an option on which path to go down.

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[4] Cover of *The Black Eyed Peas Experience*, Amazon.com, URL: <http://ecx.images-amazon.com/images/I/51NzeNjVGuL.jpg>

[5] Screenshot of *The Black Eyed Peas Experience*, Amazon.com, URL:<http://ecx.images-amazon.com/images/I/51rXiBS2-CL.jpg>

[6] Screenshot of *The Black Eyed Peas Experience*, Amazon.com, URL:<http://ecx.images-amazon.com/images/I/51y91qGQVXL.jpg>

[7] Cover of *Dance Dance Revolution the Hottest Party 2*, Amazon.com, URL:<http://ecx.images-amazon.com/images/I/51AyhBltWYL.jpg>

[8] Screenshot of *Dance Dance Revolution the Hottest Party 2*, Amazon.com, URL:<http://ecx.images-amazon.com/images/I/61R7nlbzFqL.jpg>

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[46] Cover of *Zumba Fitness Rush*, Amazon.com, URL:<http://ecx.images-amazon.com/images/I/81bFzUNi-SL. SL1500 .jpg>

[47] Screenshot of *Zumba Fitness Rush*, Amazon.com, URL:<http://ecx.images-amazon.com/images/I/718eVNTcEKL. SL1280 .jpg>

[48] Screenshot of *Zumba Fitness Rush*, Amazon.com, URL:<http://ecx.images-amazon.com/images/I/717MnuanxUL. SL1280 .jpg>

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[50] Screenshot of *DanceDanceRevolution*, Amazon.com, URL:<http://ecx.images-amazon.com/images/I/81BlggL4T7L. SL1500 .jpg>

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[52] Cover of *Everybody Dance*, Amazon.com, URL:<http://ecx.images-amazon.com/images/I/71MPopHocgL. SL1200 .jpg>

[53] Screenshot of *Everybody Dance*, Amazon.com, URL:<http://ecx.images-amazon.com/images/I/61gmOSxCEqL. SL1280 .jpg>

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Appendix A: Personal game review form

Game

Platform

- PlayStation 3
- Xbox 360
- Wii

List Price

Price

Release Date (mm/dd/yy)

Game Review (Fact)

	Yes	No
The game has performance score	<input type="radio"/>	<input type="radio"/>
Player's characters/avatars can be customized	<input type="radio"/>	<input type="radio"/>
The game has different types of exercises	<input type="radio"/>	<input type="radio"/>
The game allows you to customize exercises input	<input type="radio"/>	<input type="radio"/>
The game has an energy expenditure indicator	<input type="radio"/>	<input type="radio"/>
The game scales energy expenditure with your gender	<input type="radio"/>	<input type="radio"/>
The game scales energy expenditure with your age	<input type="radio"/>	<input type="radio"/>
The game scales energy expenditure with your weight	<input type="radio"/>	<input type="radio"/>
The game scales energy expenditure with your height	<input type="radio"/>	<input type="radio"/>
The game support a non-networked multiplayer function	<input type="radio"/>	<input type="radio"/>
The game support a networked multiplayer function (LAN, Online)	<input type="radio"/>	<input type="radio"/>
The game allows voice communication between online players	<input type="radio"/>	<input type="radio"/>
The game allows text communication between online players	<input type="radio"/>	<input type="radio"/>
The game allows online players to compare scores	<input type="radio"/>	<input type="radio"/>

Storyline in the game is fun and engaging

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

Comment

I want to play the game because it's part of a series

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

Comment

The graphics looks good

Strongly Disagree



Disagree



Neither Agree nor
Disagree



Agree



Strongly Agree



Comment

Exercises in the game are doable

Strongly Disagree



Disagree



Neither Agree nor
Disagree



Agree



Strongly Agree



Comment

Exercises in the game make me want to play

Strongly Disagree



Disagree



Neither Agree nor
Disagree



Agree



Strongly Agree



Comment

The game design makes me want to do the exercises

Strongly Disagree



Disagree



Neither Agree nor
Disagree



Agree



Strongly Agree



Comment

Exercises in the game simulate real exercises

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

Comment

The game can detect my movement accurately

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

Comment

The game detects movement with a delay

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

Comment

The user interface is easy to understand

Strongly Disagree



Disagree



Neither Agree nor
Disagree



Agree



Strongly Agree



Comment

Game instruction is easy to understand (you know what the game tells you what to do)

Strongly Disagree



Disagree



Neither Agree nor
Disagree



Agree



Strongly Agree



Comment

Exercises in the game can substitute for real exercises

Strongly Disagree



Disagree



Neither Agree nor
Disagree



Agree



Strongly Agree



Comment

The game is easy to learn

Strongly Disagree



Disagree



Neither Agree nor
Disagree



Agree



Strongly Agree



Comment

I am satisfied with difficulty levels in the game

Strongly Disagree

Disagree

Neither Agree nor
Disagree

Agree

Strongly Agree

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

Comment

The game's energy expenditure and/or score corresponds with actual effort

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

Comment

Difficulty levels correspond with actual effort

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

Comment

I want to play the game because it allows me to customize the exercises

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

Comment

I want to keep playing the game because it's fun

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

Comment

I want to keep playing the game because it helps me exercise

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

Comment

The game is reasonably priced

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

Comment

Appendix B: Phase 3 Survey

Default Question Block

Survey on exergames and general video games

This survey has been developed to help us understand the public's opinion toward exergames in contrast to video games in general. The responses gathered will be used in conjunction with other data to help us write a recommendation guideline for an exergame which appeal to gamers who normally pay no attention to exergames.

To participate in the study, please read the Informed Consent Agreement below. You must be 18 years or older to participate in this study. Click ">>" to confirm your agreement to participate under the specified terms.

Informed Consent Agreement for Participation in a Research Study

Investigators:
Amorn Chokchaisiripakdee
Latthapol Khachonkitkosol
Nuttaworn Sujumnong

Contact Information:
Tel. 508-762-7372, Email: achokchaisiripak@wpi.edu
Tel. 978-992-2582, Email: khachonkitkosol@wpi.edu
Tel. 508-847-1463, Email: nsujumnong@wpi.edu

Title of Research Study: Design requirements for exergames

Introduction:

You are being asked to participate in a research study. Before you agree, however, you must be fully informed about the purpose of the study, the procedures to be followed, and any benefits, risks or discomfort that you may experience as a result of your participation. This form presents information about the study so that you may make a fully informed decision regarding your participation.

Purpose of the study:

The purpose of this study is to explore appealing aspects in general exergames compared to general video games. The data collected in this study will help investigators write recommendation guidelines for designing exergames that appeal to video gamers in general.

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Procedures to be followed:

Participant will complete an online survey. The survey can be completed in 10 to 15 minutes.

Risks to study participants:

There are no risks involved.

Benefits to research participants and others:

Participants will not directly benefit from this research; however, were the recommendation guideline to be used to create a real exergame, the public will have access to an enjoyable exergame.

Record keeping and confidentiality:

We will not collect any identifiable information. The trait information we collect (such as age, gender) and the responses of subjects to our survey will be kept in an online database at WPI before deletion at the expected end of the research. Only the research investigators and project advisors will have access to these records while they are kept. Records of your participation in this study will be held confidential so far as permitted by law. Any publication or presentation of the data will not identify you.

Compensation or treatment in the event of injury:

No risk of injury or harm is involved. You do not give up any of your legal rights by consenting to this statement.

For more information about this research or about the rights of research participants, or in case of research-related injury, contact:

Investigators:

Amorn Chokchaisiripakdee, Tel. 508-762-7372, Email: achokchaisiripak@wpi.edu

Lattapol Khachonkitkosol, Tel. 978-992-2582, Email: khachonkitkosol@wpi.edu

Nuttaworn Sujumnong, Tel. 508-847-1463, Email: nsujumnong@wpi.edu

WPI IRB Chair:

Professor Kent Rissmiller, Tel. 508-831-5019, Email: kir@wpi.edu

University Compliance Officer:

Michael J. Curley, Tel. 508-831-6919, Email: micurlev@wpi.edu

Your participation in this research is voluntary. Your refusal to participate will not result in any penalty to you or any loss of benefits

to which you may otherwise be entitled. You may decide to stop participating in the research at any time without penalty or loss of other benefits.

By agreeing that you are older than 18 years old and clicking ">>" to continue to the next page, you acknowledge that you have been informed about and consent to be a participant in the study described above. Make sure that your answers are satisfactory before continuing.

- I agree
 I disagree

What is your Age?

- less than 18 years old
 18-24 years old
 25-34 years old
 35-44 years old
 45-54 years old
 55-64 years old
 65 years old or over

What is your Gender?

- Male
 Female
-

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How much do you weigh? (only choose one)

in pound (lb)

in kilogram (kg)

How tall are you? (only choose one)

in feet (ft)

in meters (m)

On average, how many hours do you spend exercising per week?

- None
 - Less than 1 hour
 - 1-3 hours
 - 4-6 hours
 - 7-9 hours
 - 10-12 hours
 - 13-15 hours
 - over 15 hours
-

On average, how many hours do you spend playing video games per week?

- None

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None

- less than 1 hour
 - 1-3 hours
 - 4-6 hours
 - 7-9 hours
 - 10-12 hours
 - 13-15 hours
 - 16-18 hours
 - more than 18 hours
-

How many exergames have you ever played?

(Exergames: video games that require player's physical exertion (e.g. Wii Sport, Dance Dance Revolution, Just Dance, ZombieRun, etc.)

- None
 - 1 or 2 games
 - 3 to 5 games
 - more than 5 games
-

Which exergames have you played?

- Dance games (e.g. Dance Dance Revolution, Just Dance, Zumba, etc.)
- Sports games (e.g. The Fight: Lights Out, Sports Champions, UFC Personal Trainer, etc.)
- Adventure games (e.g. Active Life franchise, Sorcery, Disney's Pixar Adventure, etc.)
- Other

On average, how many hours do you spend playing exergames in a week?

- None
 - less than 1 hour
 - 1-3 hours
 - 4-6 hours
 - 7-9 hours
 - 10-12 hours
 - 13-15 hours
 - 16-18 hours
 - more than 18 hours
-

How many calories do you burn every time you play an exergame?

- less than 200 calories
- 200 - 400 calories
- 401 - 600 calories
- 601 - 800 calories
- 801 - 1000 calories
- more than 1000 calories
- No, I don't play exergame
- I don't know

I play exergame, but I don't know how many calories I burn

What platform or device you ever played or owned

- None
- PC
- Xbox 360
- Xbox 360 + Kinect
- Playstation 3
- Playstation 3 + Move
- Wii
- Nintendo DS / 3DS
- Smartphone (iOS / Android)
- Other

Please rank top 3 criteria when buying video games

- Environment (e.g. Open-world, level design, atmosphere) _____
- Customization _____
- Franchise (e.g. Dance Dance Revolution, Just Dance, Dance Central) _____
- Game mechanics (e.g. AI, physics engine) _____
- Theme (e.g. Medieval, Modern) _____
- Graphics _____
- Story _____
- Gameplay
(Gameplay = your in-game interaction with the game's environments, challenges, plots, etc.
e.g. Counter Strike gameplay would be shooting
Need for Speed gameplay would be driving
Skyrim gameplay would be traveling and advancing character's level
and Dance Dance Revolution would be dancing, etc.) _____
- Price _____
- Distribution (e.g. retail, PSN, Steam) _____
- Multiplayer function _____
- Other

Please respond to these statements below

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Exergames have better graphics than general video games	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Exergames have better stories than general video games	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Exergames have better environments than general video games (e.g. open-world, level design, atmosphere)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Exergames have better mechanics than general video games (e.g. AI, physics engine)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Exergames utilize motion detection technology better than general video games	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Exergames' user interfaces are easier to understand than in general video games	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Exergames have more diverse themes than general video games (e.g. middle-age, modern)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Exergames franchises are more famous than other video game franchises (e.g. Dance Dance Revolution, Just Dance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
General video games allow more content modification than exergames	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The difficulty level in exergames are scaled well with player's skill than general video games (you don't feel overwhelmed on higher difficulties)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Exergames have better gameplay than general video games	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Exergames are more reasonably priced than general video games	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
You can buy exergames anywhere you can buy any other video games (e.g. on Steam, Amazon.com, GameStop, BestBuy, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Exergames have better multiplayer functions than general video games	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Exergames have better online score ranking system than general video games	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Overall, exergames are more addictive than general video games	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is easier to learn to play exergames than general video games	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The effort required to play exergames is worth the fun	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel that playing exergames makes me feel healthier	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel that playing exergames can substitute for regular exercise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I play exergames because they are fun	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I play exergames because they help me stay active	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
