Project Romulus

Analyzing How Recreational Airsoft Affects People's Lives

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction:

The sports of airsoft and paintball are very popular sports today, with as many as 2.6 million Americans participating in 2023 (“U.S. Americans Who Played Paintball 2023,” 2024). Airsoft and paintball are very similar sports, they are both played using replica firearms that fire a pellet usually using compressed air. Ther are two main differences between the two. The first, is that in paintball you fire a gelatinous pellet made of paint that leaves a mark when it hits a player. The other main difference is that airsoft guns are generally more realistic looking and due to this more popular among adults.

In airsoft there are several ways to play, with the main three being skirmish, objective, and milsim (Duthie, 2024). Skirmish involves two teams trying to hit all the players on the other team. When a player is hit, they raise their hand to indicate it, and are either out of the game or can be brought back in by a teammate depending on the specific rules. In objective, the two teams are competing to try and capture some sort of objective, this could be anything from king of the hill to capture the flag. In milsim the players reenact military combat using the realistic airsoft guns, this form is usually more popular among dedicated players, rather than beginners.

All these forms of play involve a lot of physical activity and require a lot of skill. According to one research survey the some of the most important physical requirements to play airsoft are synchronization of body parts and reaction speed (Daniel, 2015). This makes sense as a player must be able to accurately aim the airsoft gun while running, taking cover, or being shot at. This can be very difficult especially for those with disabilities. This means that people who don’t have good hand-eye coordination, just naturally or from a disability, would be unable to compete with other players.

This is a missed opportunity for millions of people. Airsoft can be very impactful in peoples life, both psychologically and physically. One survey conducted in Poland found that 50% of respondents strongly believed that “Practicing airsoft is one of the best things I've ever done/been doing.” (Nowacki & Wiśniewska, 2015, p. 75). This survey also found that people’s largest reasons for playing airsoft were hanging out with friends, escaping from everyday life, experiencing strong sensations and experiences, maintaining physical fitness, and reducing mental tension. One respondent elaborated by saying, "It's great fun. Physical effort, great people, cooperation with others, goals to achieve, competition and all this with warfare in the background... something beautiful." (p. 78). All of this shows that airsoft has the potential to change peoples lives for the better, but there is a large skill based barrier to entry. To address this problem my group proposed an automated airsoft gun that assists a user in aiming to hit a target. There is however concern about if airsoft is truly good, in fact a majority of parents won’t allow their children to play with airsoft guns at all (Cheng et al., 2003). To alleviate this concern I will be researching the question, how does airsoft affect peoples’ quality of life and social well being?

Technical Description

Currently there is a massive DIY community centered on airsoft. Many players will modify their airsoft guns to improve accuracy or add features that they are looking for (“Airsoft Gun Modifications,” 2023). There have been several people in the past who have made auto-aiming airsoft guns. One such is a youtuber known as Excessive Overkill (Excessive Overkill, 2024). In his video he shows off an auto-aiming airsoft gun. This gun is completely custom and unique, made from the ground up to aim automatically. For our system we want to be able to install any airsoft gun and be able to aim it automatically. There is no existing product like this,

but we can still take inspiration from sources such as Excessive Overkill. Another similar product is JackIn airsoft, a research design that uses head mounted cameras and augmented reality goggles to display a mini-map to players and track their movements (Kono, Miyaki, & Rekimoto, 2017). This research project encountered several problems with the camera video being incomprehensible from motion blur, and other factors. We used this to help address similar problems with our system as we will be using a camera to find and identify bullseye targets. While neither of these products are the same as ours, they serve the same community and help address similar niches. Most importantly they show that airsoft players are interested in augmenting their gameplay with technology.

Our group has designed a system, named project Romulus, for the automatic aiming of any airsoft gun with picatinny rails. This system, pictured in Figure 1, consists of three main sections, the frame, the robot arm, and the imaging system. In Figure 1 every component that is white is part of the frame. It connects the airsoft gun to the robot arm and provides a place for the user to hold the whole system comfortably. The system also uses a secondary trigger as part of the handle, this way the user isn't holding the airsoft gun as it's pivoted. This is an important safety consideration as we don't want the user to fight the airsoft gun when it's moving.

Figure 1. 3D render of project Romulus, auto-aiming system

One of the most crucial parts of the airsoft gun is the robot arm. This arm is modeled off of the 3-RPS architecture for robots. This architecture is fairly simple, it consists of three of each type of joint, rotational, prismatic, and spherical. The rotational joint is a connection that allows for rotation along only one axis, think of an axle on your car. The prismatic joint is the motorized part of our project which you can easily see in the actuators in Figure 1. Lastly the spherical joint is a joint that has three rotational degrees of freedom, much like a ball joint found in old action figures. These joints can be articulated following equations known as inverse kinematics to pivot the airsoft gun to whatever angle we need.

The imaging system uses the camera as video input and an AI analysis to find our target. Currently our system is trained to find and track bullseye style targets as seen in archery. We chose these targets for safety and experimental reasons. More specifically, while we are developing our system we don't want to point it at people. Then we also want an empirical measurement of accuracy which is much easier with a bullseye.

This system when fully realized will allow anyone to aim an airsoft gun with extreme accuracy. This should solve the problem of needing good hand-eye coordination by removing the need to aim. Without needing to aim, physically challenged players can just hold our system and run around like all the other players. This should help address some accessibility problems in airsoft, but admittedly doesn't solve any of the underlying issues. It will work in the short term for a few people but in the long term it would be better to institute para-airsoft leagues to promote inclusion without specialized equipment. These have already been instituted with the Paralympics which has incorporated different events for para-shooting and para-archery (Puce et al., 2024).

STS Analysis

As stated in the introduction, airsoft is in general a controversial area, with often conflicting findings on its effects on people. According to a study that tracked the heartrate of airsoft players while they played, the amount of physical activity conducted during an airsoft game exceeds the ACSM and WHO recommendations and is 305% more then the average of American adults (Tornero-Aguilera, Sanchez-Molina, & Clemente-Suarez, 2021). This shows that airsoft could be a great source of exercise for modern Americans and can help combat obesity. Another study did a survey of 500 paintball players to determine how paintball affects their quality of life (Venter & Kruger, 2018). Participants reported that paintball was particularly important to them as a leisure sport, and they ranked their quality of life very high. This shows how paintball and by extension airsoft can fulfill people's needs as a leisure activity, and improve their quality of life. There have even been findings that airsoft could be used to treat combat-based PTSD (C-PTSD) (Weber, 2018). Weber conducted several interviews of veterans with symptoms of C-PTSD who played airsoft recreationally. The veterans reported that playing airsoft allowed them to socialize more easily and use skills they worked hard to develop in the military. They even found that playing airsoft reduced the effects of triggering events, as playing airsoft could expose veterans to triggers in a safe and comfortable space.

Looking at the above findings it would be reasonable to conclude that airsoft is a good thing, that it improves physical fitness and helps develop social wellbeing. However, there are also several studies that find that airsoft instead promotes violence, especially in children. One study observed how children played with different types of toys, including toy guns (Watson & Peng, 1992). They found that playing with toy guns predicted that there would be real aggression during play and negatively predicted fake aggression. In other words, they found that among

young children toy guns, such as airsoft guns, increased violence during play. Another study followed adults and asked them to fill out a questionnaire on their mood and political beliefs before and after playing paintball (Gilmore, 2015). They found that playing paintball had little effect on the mood of participants but that after playing paintball they answered more aggressively on one question in particular. This question was on the US response to Arab Spring with more participants wanting to forgo a diplomatic solution in favor of sanctions after playing paintball.

These findings show that airsoft has an effect on its audience even if there is no conclusion on quite what that effect is. Using Actor-Network theory (ANT) this effect can be studied and analyzed. According to ANT each object, person, organization, or other entity is an actant. Every actant is connected to every other actant in a network where they can influence and change each other (Callon, 2001). When a technology is created or designed there are certain morals baked into it, these morals are a program of action. A car beeps when you don't have your seatbelt on, this is a program of action, the designers want the user to wear a seatbelt. Certain tasks are also given or taken over by technology, this is called delegation to technology. The aim assistance system described above takes over the action of aiming an airsoft gun, this action has been delegated to technology. Technology can also force humans to change or develop new behaviors, this is prescription. Everyone carries around a phone and checks it constantly, this action is prescribed onto humans. Technology can also discriminate. A technology can't change from person to person, so some people won't be able to use it as well or at all. Blind people often can't use computers and the internet, due to the way the information is displayed. Using these principles of ANT I can analyze how airsoft interacts with and affects society and those who play it.

Research Question:

As stated previously I am interested in answering the question, how does airsoft affect people's quality of life and social well-being? This is an important question as no study has been conducted to quantify multiple aspects of how airsoft affects people's lives. To answer this question, I will be participating in several airsoft games conducting an observational study. I personally have never played airsoft before so this will give me a good understanding of how it changes my life if at all. Additionally, while playing I can observe other players to see how they interact with each other. It is also quite convenient because there are 19 airsoft fields in Virginia, with the closest only 30 minutes away from my home ("Virginia Airsoft Fields | The Official List of Airsoft Fields in the US," 2024). I will also watch videos of other people participating in airsoft games for further observations. Then I can apply the principles of ANT discussed above to my observations to quantify airsoft's effect on its community. Most pertinent to answering the research question will be identifying how airsoft as a technology discriminates and what actions or characteristics it prescribes to those around it. This will illuminate how airsoft affects people's quality of life and social well-being.

Conclusion

Airsoft is a very physically demanding sport that requires amazing hand-eye coordination and reaction speed. This could be a problem for people with disabilities such as Parkinson's or arthritis. To address this problem, me and my associates are building a robotic interface that will automatically aim any compatible airsoft gun at a desired target. This will remove the need for participants to aim and increase accessibility in airsoft as a whole. However, this brings up the question of whether or not more people playing airsoft is a good thing. To answer this I will play

several airsoft games as a beginner and conduct observations of other first time players as well as seasoned veterans. This will show what effect if any airsoft has on its players.

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