**Author(s):** Kari, Tuomas; Karhulahti, Veli-Matti

**Title:** Do E-Athletes Move? : A Study on Training and Physical Exercise in Elite E-Sports

**Year:** 2016

**Version:**

**Please cite the original version:**

Kari, T., & Karhulahti, V.-M. (2016). Do E-Athletes Move? : A Study on Training and Physical Exercise in Elite E-Sports. International Journal of Gaming and Computer-Mediated Simulations, 8(4), 53-66. https://doi.org/10.4018/IJGCMS.2016100104

This is the authors' manuscript. Final version published in International Journal of Gaming & Computer-Mediated Simulations, 8 (4), pp. 53–66.
DOI: 10.4018/IJGCMS.2016100104

# Do E-athletes Move? A Study on Training and Physical Exercise in Elite Esports

**Tuomas Kari***

*University of Jyvaskyla, Finland*

*Department of Computer Science and Information Systems*

tuomas.t.kari@jyu.fi

**Veli-Matti Karhulahti**

*University of Turku, Finland*

*Department of Media Studies*

vmmkar@utu.fi

## ABSTRACT

This article offers possibly the first peer-reviewed study on the training routines of elite e-athletes, with special focus on the subjects' physical exercise routines. The study is based on a sample of 115 elite e-athletes. According to their responses, e-athletes train approximately 5.28 hours every day around the year on the elite level. Approximately 1.08 hours of that training is physical exercise. More than half (55.6%) of the elite e-athletes believe that integrating physical exercise in their training programs has a positive effect on esport performance; however, no less than 47.0% of the elite e-athletes do their physical exercise chiefly to maintain overall health. Accordingly, the study indicates that elite e-athletes are active athletes as well, those of age 18 and older exercising physically more than three times the daily 21-minute activity recommendation given by World Health Organization.

***Keywords:*** Sport, athletics, esport, physicality, training, practice, exercise, empirical, quantitative

## INTRODUCTION

Esports have recently become a significant part of our sports cultures. Expectedly, a number of journalists, policy-makers, and academics have thus ended up conceptualizing the cultural identity of the phenomenon. What are the relations between esports and sports, e-athletes and athletes, and esport play and physical exercise? (see Hemphill, 2005; Wagner, 2006; Jonasson & Thiborg, 2010; Taylor, 2012; Von Hilvoorde & Pot, 2016, Hamari & Sjöblom, 2017) What does esport require, and what makes it gratifying to begin with? (see Reeves, Brown, & Laurier, 2009; Lee & Schoenstedt, 2011; Witkowski, 2012a; Harper, 2013; Martončik, 2015, Karhulahti, 2016).

This study is not concerned with the above questions but provides a cluster of empirical data that the people asking those questions, among others, might find interesting. In what follows we provide possibly the first peer-reviewed study on the training routines of elite e-athletes, with special focus on their physical exercise.

The solitary earlier academic contribution that we were able to find on the topic comes from Andreas Hebbel-Seeger's (2012). He quotes a study from esport organization ESL (Electronic Sports League) that apparently issued an unpublished German thesis written by Lüttmann (first name unobtainable) in 2007. According to Hebbel-Seeger (2012), the study claimed that e-athletes are more active in sports than the average population, with no less than 95% of them exercising traditional sports as well.

Since we have not been able to acquire the referenced study—and since it appears to be unpublished, non peer-reviewed, and in German—we take its results with a small grain of salt. For instance, it is not clear whether the study's results concerned professional players, high-level player, amateurs, or fans. Hence, we recognize our study as an exploratory one, that is, *a priori* hypotheses are not proposed. Training, physical exercise, and players' perceptions will be examined at a descriptive level without utilizing any prior theoretical framework. We disclose the article along three sections: Methodology, Results, and Conclusions.

## METHODOLOGY

The results of the study lean on a quantitative data set that we gathered with an online survey between September 2015 and June 2016. The survey was created with the LimeSurvey 2.05+ software. We pre-tested it quantitatively with ten and qualitatively with four scholars from the fields of play research, videogame research, information systems research, and sports research. Based on the received feedback we made small adjustments before the launch.

### Reaching Respondents

In 2013 the global player base of videogames was estimated to exceed 1.2B, while recent speculations talk about figures beyond 1.5B (Spilgames, 2013). Of those only about 9000 have ever played videogames professionally (Bräutigam, 2015), the number of currently active e-athletes thus being drastically even smaller. Consequently, quantitative data gathering from elite e-athletes differs significantly from quantitative data gathering from the general player population.

We set a goal to reach a hundred elite e-athletes. To reach them we contacted 161 professional esport teams and 68 professional e-athletes directly by email and asked them to participate in the study. Expectedly, only a fraction of them responded, leaving the total number of individual respondents to 31. Notwithstanding, due to our direct contact method, we have strong reasons to believe that all the above respondents are *professional e-athletes* (PRO) factually, as defined by their team contracts or achievements in international tournaments.

Due to the low response rate we started looking for more elite e-athletes via popular media in early 2016. We promoted the survey through Twitter and also posted a call to six major Reddit sub forums: Counter Strike: Global Offensive (CSGO), Dota 2 (DOTA), Hearthstone (HS), Heroes of the Storm (HOTS), League of Legends (LOL), and StarCraft 2 (SC2). Our goal was now not to reach PRO players alone, but also those who were seriously striving for a PRO career. We did, however, add requirements so that each respondent should be at the very topmost tiers of the ranked player base of their esport; e.g. CSGO players were demanded to have played within the top three ranks, SC2 players were demanded to have played within the top two ranks, and LOL players we demanded to have played in Diamond 3 or higher. Such tiers of play represent very small fractions of the active esport populations. ~~For instance, while LOL currently hosts 103M monthly active players, only some thousands of them (approximately 0.037%) play in Diamond 3.~~

Altogether the Twitter and subreddit calls reached 91 self-proclaimed elite e-athletes who were competing or seriously striving to compete as a professional. We went through the data manually and removed seven responses that were visibly unreliable. With reference to the widely recognized psychological factors of response bias (e.g. Nederhof, 1985; Furnham, 1986; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003) and illusory superiority (e.g. Hoorens, 1995), there is some likelihood that part of the respondents have exaggerated their status as elite e-athletes. We took this factor into consideration by not mixing these respondents to the PRO group that was reached directly, and addressing them as a distinct group of *high-level e-athletes* (HL) even though many of the respondents identified themselves explicitly as professionals.

Overall, we thus managed to reach 115 consistent responses from PRO and HL e-athletes with various backgrounds. While the number is not exceedingly high, it does consist of two marginal and challenging target groups. This makes the data an exceptional material for analysis (such large groups of professional and semi-professional athletes being not too common in sports science in general).

## Survey

The survey questionnaire consisted of three main sections. The total number of questionnaire items presented to each respondent was 23, some of which were conditional. The key items are presented in Appendix A. The descriptive questions concerning training, physical exercise, and players' perceptions were all closed-ended multiple-choice questions, with the exception of the two questions regarding the hours of training to which the respondents were asked to insert a numerical value. The respondents also had the response option "cannot say" with some of the questions to avoid forced responses. We grouped the respondents into two sub-samples, PRO (N = 31) and HL (N = 84), which are henceforth distinguished by the term *level of expertise*.

For analyzing the collected data we used IBM SPSS Statistics 22 software. The statistical significance and the strength of the dependencies between the responses and level of expertise (and others) were analyzed through contingency tables (crosstabs), the Pearson's $\chi 2$ tests of independence, and the Cramér's V coefficients. These methods enabled us to examine not only linear but also non-linear dependencies, which suited the explorative nature of the study well.

In some cases the common condition for the validity of $\chi 2$ test—"No more than 20% of the expected counts are less than 5 and all individual expected counts are 1 or greater" (Yates, Moore, & McCabe, 1999, p. 734)—was not met. Hence, as suggested by the widely used guidelines by Agresti (2002) and Cochran (1954), the results of Pearson's $\chi 2$ tests of independence were advanced by using exact tests; in this case, Monte Carlo. The Monte Carlo test was based on 10 000 sampled tables and 99 % confidence level. This procedure is considered reliable and independent of the dimension, allocation, distribution, and the balance of the analyzed data (Mehta & Patel, 2012). The level of significance was set to $p < 0.05$.

## RESULTS

The descriptive statistics of the whole sample of 115 respondents are presented in Tables 1a and 1b. The responses to the questions regarding training, physical exercise, and perceptions regarding their influence are summarized in Table 2. Table 3 summarizes the results of the Pearson's $\chi^2$ tests of independence and Monte Carlo exact tests, which were used to examine the statistical significance and strength of dependencies between levels of expertise (those who stated "Cannot say" were excluded).

There were no statistically significant dependencies within levels of expertise, i.e. the differences between PRO and HL regarding the responses concerning training, physical exercise, or perceptions regarding their influence were not statistically significant. Also, when classifying the respondents based on their yearly esports income (those who earn less than 5000 USD and those who earn 5000 USD or more) no statistically significant dependencies between the groups arose.

*Table 1a. Descriptive Statistics of the Whole Sample and the Sub-samples*

| | **Whole sample (N =115)** | | **Professional (N = 31)** | | **High-level (N = 84)** | |
|---|---|---|---|---|---|---|
| | **N** | **%** | **N** | **%** | **N** | **%** |
| **Gender** | | | | | | |
| Male | 112 | 2.6 | 29 | 93.5 | 83 | 98.8 |
| Female | 3 | 97.4 | 2 | 6.5 | 1 | 1.2 |
| **Age** | | | | | | |
| –19 yrs. | 50 | 43.5 | 12 | 38.7 | 38 | 45.2 |
| 20–24 yrs. | 49 | 42.6 | 16 | 51.6 | 33 | 39.3 |
| 25–29 yrs. | 12 | 10.4 | 3 | 9.7 | 9 | 10.7 |
| 30– yrs. | 4 | 3.5 | 0 | 0.0 | 4 | 4.8 |
| **Yearly esports income** | | | | | | |
| –4999 USD | 58 | 50.4 | 13 | 41.9 | 45 | 53.6 |
| 5,000–14,999 USD | 16 | 13.9 | 8 | 25.8 | 8 | 9.5 |
| 15,000–24,999 USD | 8 | 7.0 | 3 | 9.7 | 5 | 6.0 |
| 25,000– USD | 8 | 7.0 | 1 | 3.2 | 7 | 8.3 |
| No answer | 25 | 21.7 | 6 | 19.4 | 19 | 22.6 |
| **Highest education** | | | | | | |
| Primary education | 17 | 14.8 | 5 | 16.1 | 12 | 14.3 |
| Upper secondary | 45 | 39.1 | 10 | 32.3 | 35 | 41.7 |
| Uni of applied sciences | 26 | 22.6 | 9 | 29.0 | 17 | 20.2 |
| University (BS or MS) | 21 | 18.3 | 6 | 19.4 | 15 | 17.9 |
| Doctoral level | 1 | 0.9 | 0 | 0.0 | 1 | 1.2 |
| Other | 5 | 4.3 | 1 | 3.2 | 4 | 4.8 |
| **Nationality** | | | | | | |
| European | 63 | 54.8 | 21 | 67.7 | 42 | 50.0 |
| North-American | 35 | 30.4 | 4 | 12.9 | 31 | 36.9 |
| Other | 11 | 9.6 | 4 | 12.9 | 7 | 8.3 |
| No Answer | 6 | 5.2 | 2 | 6.5 | 4 | 4.8 |

*Table 1b. Descriptive Statistics of the Whole Sample and the Sub-samples*

| | Whole sample (N =115) | | Professionals (N = 31) | | High-level (N = 84) | |
|---|---|---|---|---|---|---|
| | **N** | **%** | **N** | **%** | **N** | **%** |
| **Individual vs. team** | | | | | | |
| Individual (P vs. P) | 31 | 27.0 | 10 | 32.3 | 21 | 25.0 |
| Team (team vs. team) | 78 | 67.8 | 20 | 64.5 | 58 | 69.0 |
| N/A | 6 | 5.2 | 1 | 3.2 | 5 | 6.0 |
| **Main esport** | | | | | | |
| Counter Strike | 51 | 44.3 | 8 | 25.8 | 43 | 51.2 |
| StarCraft II | 15 | 13.0 | 7 | 22.6 | 8 | 9.5 |
| DOTA 2 | 14 | 12.2 | 1 | 3.2 | 13 | 15.5 |
| League of Legends | 12 | 10.4 | 7 | 22.6 | 5 | 6.0 |
| Other | 23 | 20.0 | 8 | 25.8 | 15 | 17.9 |
| **Continent of team/self** | | | | | | |
| Europe | 64 | 55.7 | 21 | 67.7 | 43 | 51.2 |
| North America | 40 | 34.8 | 8 | 25.8 | 32 | 38.1 |
| Australia | 4 | 3.5 | 1 | 3.2 | 3 | 3.6 |
| Asia | 2 | 1.8 | 0 | 0.0 | 2 | 2.4 |
| Other | 5 | 4.3 | 1 | 3.2 | 4 | 4.8 |
| **Main reason for physical training** | | | | | | |
| Physical health | 54 | 47.0 | 14 | 45.2 | 40 | 47.6 |
| Physical capacity | 8 | 7.0 | 1 | 3.2 | 7 | 8.3 |
| Physical appearance | 20 | 17.4 | 7 | 22.6 | 13 | 15.5 |
| Fun or enjoyment | 6 | 5.2 | 1 | 3.2 | 5 | 6.0 |
| To be more successful in esports | 10 | 8.7 | 2 | 6.5 | 8 | 9.5 |
| Other | 4 | 3.5 | 2 | 6.5 | 2 | 2.4 |
| Does not do any physical training | 13 | 11.3 | 4 | 12.9 | 9 | 10.7 |
| **Who plans physical training program** | | | | | | |
| Myself | 81 | 70.4 | 19 | 61.3 | 62 | 73.8 |
| Personal coach | 6 | 5.2 | 2 | 6.5 | 4 | 4.8 |
| Team coach etc. | 5 | 4.4 | 1 | 3.2 | 4 | 4.8 |
| No training plan | 21 | 18.3 | 7 | 22.6 | 14 | 16.7 |
| Other | 2 | 1.7 | 2 | 6.5 | 0 | 0.0 |

*Table 2. Training, Physical Training, and the Perceptions Regarding its Influence*

| | Whole sample (N =115) | | Professionals (N = 31) | | High-level (N = 84) | |
|---|---|---|---|---|---|---|
| | **N** | **%** | **N** | **%** | **N** | **%** |
| **Overall training /day** | | | | | | |
| 1-2.49 hours | 10 | 8.7 | 1 | 3.2 | 9 | 10.7 |
| 2.5-4.99 hours | 42 | 36.5 | 11 | 35.5 | 31 | 36.9 |
| 5-7.49 hours | 43 | 37.4 | 13 | 41.9 | 30 | 35.7 |
| 7.5- hours | 20 | 17.4 | 6 | 19.4 | 14 | 16.7 |
| **Physical training /day** | | | | | | |
| 0 | 18 | 15.7 | 7 | 22.6 | 11 | 13.1 |
| 0<>1 hours | 23 | 20.0 | 7 | 22.6 | 16 | 19.0 |
| 1-1,5 hours | 46 | 40.0 | 11 | 35.5 | 35 | 41.7 |
| 1.51-2 hours | 23 | 20.0 | 6 | 19.4 | 17 | 20.2 |
| 2- hours | 5 | 4.2 | 0 | 0.0 | 5 | 6.0 |
| **Influence of physical training on esports** | | | | | | |
| Significantly negatively | 1 | 0.9 | 0 | 0.0 | 1 | 1.2 |
| Somewhat negatively | 4 | 3.5 | 1 | 3.2 | 3 | 3.6 |
| No significant effect | 21 | 18.3 | 3 | 9.7 | 18 | 21.4 |
| Somewhat positively | 45 | 39.1 | 10 | 32.3 | 35 | 41.7 |
| Significantly positively | 19 | 16.5 | 6 | 19.4 | 13 | 15.5 |
| Cannot say | 25 | 21.7 | 11 | 35.5 | 14 | 16.7 |
| **Physical appearance can influence the performance of others** | | | | | | |
| Yes | 34 | 29.6 | 11 | 35.5 | 23 | 27.4 |
| To me | 21 / 34 | 18.3/29.6 | 7 | 22.6/35.5 | 14 | 16.7/27.4 |
| To my opponent(s) | 27 / 34 | 23.5/29.6 | 10 | 32.3/35.5 | 17 | 20.2/27.4 |
| No influence at all | 81 | 70.4 | 20 | 64.5 | 61 | 72.6 |
| **Physical training compared to teammates** | | | | | | |
| Significantly less | 4 | 3.5 | 2 | 6.5 | 2 | 2.5 |
| Somewhat less | 7 | 6.1 | 1 | 3.2 | 6 | 7.1 |
| About the same | 34 | 29.6 | 9 | 29.0 | 25 | 29.8 |
| Somewhat more | 29 | 25.2 | 4 | 12.9 | 25 | 29.8 |
| Significantly more | 11 | 9.6 | 4 | 12.9 | 7 | 8.3 |
| N/A or cannot say | 30 | 26.1 | 11 | 35.5 | 19 | 22.6 |

*Table 3. Level of Professionalism Dependencies on Training, Physical Training, and the Perceptions Regarding its Influence*

| | N | $\chi^2$ | df | p | $p_{(Monte\ Carlo)}$ | V |
|---|---|---|---|---|---|---|
| Overall training hours /day | 115 | 1.801 | 3 | 0.615 | 0.621 | 0.125 |
| Physical training hours /day | 115 | 3.513 | 4 | 0.476 | 0.490 | 0.175 |
| Influence of physical training on esports performance | 90 | 2.031 | 4 | 0.730 | 0.765 | 0.150 |
| Physical appearance can influence the performance of others | 115 | 0.714 | 1 | 0.398 | $0.490_{(exact)}$ | 0.079 |

## Sample Analysis

As to gender distribution, the full sample is very unbalanced with only three female respondents and 112 male respondents. This is most likely because the already-small group of elite e-athletes is very male-dominant (see Taylor, 2009; Maric, 2011; Chee, 2012; Zolides, 2015; Adams, 2016). We tried to fix the unbalance first by contacting three more institutions with striving female e-athletes and later by contacting ten known successful female e-athletes directly. We received one reply. Therefore, the distribution did not allow us to compare responses between genders.

Next to gender bias another widely held detail or assumption concerning elite e-athletes is age. Esport players are generally believed to be teenagers or young adults (McTee, 2014). Some studies, especially those by Thompson, Blair, Chen, and Henrey (2013) and Thompson, Blair, and Henrey (2014), have even provided empirical findings concerning this presumed state of affairs. We confirm these assumptions, the mean age of our respondents being 20.8 years (SD = 4.4 years) in the whole sample. We should remark, however, that this age average of elites is by no means an anomaly in sports. For instance, the average age of women swimmers in this year's Olympic finals was exactly 20.8 years (combined male and female average 21.7), whereas gymnasts are generally believed to reach their best at 16 or 17 with an average age of 19 in London Olympics four years ago. E-athletes are young, but so are many other athletes. We found no statistically significant differences concerning training, physical exercise, or perceptions regarding their influence between younger and older age groups.

Based on their nationalities, the respondents were distributed among three regional categories: Europe, North America, and the rest of the world. Since it is reasonable to believe that Asia covers a significant part of the professional e-athlete population (Lee, 2005; Chee & Jin, 2008; Dongsheng Xiaohang, & Daofeng, 2011; Szablewicz, 2011; Guorui, 2012) and only a few of the respondents identified themselves as Asian, our data cannot be considered fully representative in this regard. As the groups of distinct nationalities were expectedly small, there is no reason to compare the practices between the represented nationalities per se. Instead, we compared the two distinguishable groups by region, North America and Europe, but found no statistically significant differences concerning training, physical exercise, or perceptions regarding their influence.

Many elite e-athletes do not play in their home country, but in teams and institutions around the world. These locations have their own cultural traditions and practices, which we believed to affect the e-athletes' training routines. Therefore, we additionally asked about the

continent in which the respondents or their team was located. Again, the dominant continents were Europe (64) and North America (40). When comparing the responses between these two groups, the only part with a statistically significant dependency was the question whether "Physical appearance can influence the performance of others" ($\chi 2$ (1) = 4.199, $p < 0.04$, V = 0.201). Of Europe-based respondents 23.4% stated yes, while within North America-based players the agreement rate was 42.5%. This implies that in North American esport scenes appearance (perhaps related to external play dynamics like trash-talk) may hold a more significant role than in those of Europe.

We also inquired about the e-athletes' specific esport, but the response distribution did not allow us to draw any reasonable conclusions game-wise (44.3% of the respondents coming from CSGO). A reasonable distinction could be made, nonetheless, between team e-athletes (team vs. team esports) and solo e-athletes (player vs. player esports), the former group consisting of 78 respondents and the latter of 31 respondents. We found no statistically significant differences between these two groups concerning training, physical exercise, or perceptions regarding their influence.

Lastly, we inquired about the respondents' education level and financial income from esport sources, both questions being optional. Based on the responses, the majority of contemporary e-athletes come from primary and upper secondary schools (53.9%), while some of them have already reached an applied sciences (22.6%) or a university (18.3%) degree. This makes sense with reference to the average e-athlete age. Also, more than half (50.4%) of all respondents (including those in the PRO group respectively) declared that they earn less than 5 000 USD from esport play per year, which coheres with the fact that noteworthy prize pools and salaries recompense only a small part of present elite e-athletes. We found no significant response variance as to education levels or financial compensation (cf. Parshakov & Zavertiaeva, 2015).

## Training Analysis

The main reason for elite e-athletes to do physical exercise is *to maintain or improve overall physical health* (47.0%). This applies to both levels of expertise in our study (PRO 45.2%, HL 47.6%). Only 8.7% of all respondents considered the main purpose of their physical exercise *to be more successful in esport*. Likewise, only 11.3% stated that they do not do any physical exercise, meaning that 88.7% of PRO and HL e-athletes do. Additionally, 81.7% claimed to have a physical exercise program. Most of the respondents (70.4%) planned their physical exercise themselves. Only 5.2% had a personal coach to plan the program and for 4.4% the team coach or equivalent was the planner.

The respondents did an average of 5.28 hours (SD = 2.57 hours) of overall training per day including 1.08 daily hours (SD = 0.83 hours) of physical exercise. Among the sub-samples the averages were 5.90 hours and 0.89 hours for the PROs (SD = 3.07 hours, SD = 0.70 hours) and 5.05 hours and 1.15 hours for the HLs (2.33 hours, SD = 0.86 hours).

Less than a third of the respondents (29.6%) believed that the amount of their physical exercise was about the same as their teammates'. A quarter of the respondents (25.2%) believed it was somewhat more and a tithe (9.6%) believed it was significantly more. Lastly, another tithe (9.6%) believed that the amount of their physical exercise was somewhat or significantly less than what their teammates did, while 26,1% could not state their belief. These numbers suggest that the responses of the reached team e-athletes represent quite well the teams in which they play (with regard to questions concerning physical exercise).

As for the perceived influence of physical exercise on one's own esport performance level, most perceived it positively: either somewhat positively (39.1%) or significantly positively (16.5%). Only 18.3% stated not to have perceived significant effects one way or another, and 4.4% perceived the influence negatively.

We also asked the respondents whether they believed that the physical appearance of a player could influence the competitive performance of others. Less than a third (29.6%) stated "Yes" and 70.4% stated "No." Of all respondents 23.5% believed that their opponent had been intimidated by their (or their teammate's) physical appearance, and 18.3% stated to have been personally intimidated by the physical appearance of their opponent.

To satisfy our special interest in the respondents' overall training hours, we ran an additional t-test over PRO and HL groups. As revealed earlier, we were not able to find statistically significant differences between PRO and HL groups on either overall training hours ($t=1.596$, $df=113$, $p=0.424$) or physical exercise hours ($t=-1.518$, $df=113$, $p=0.498$) even with the t-test.

## CONCLUSIONS

Our quantitative study, based on a sample of 115 elite e-athletes, allows three conclusions concerning the present state of expert esport play, summarized as follows.

Firstly, the study implies that the overall time that elite e-athletes spend on training tends to get heavily exaggerated by the press. While journalists and other media contributors present e-athletes' daily training times frequently between 12 and 14 hours (e.g. DiChristopher, 2014; Jacobs, 2015; Stanton, 2015), the average of our respondents was "only" 5.28 hours. There are multiple potential explanations for this. Initially, it is possible that players who take their esport seriously are engaged with the activity all around the clock, but only part of that time gets spent on actual training. In other words, elite e-athletes might well spend 12–14 daily hours on esport-related activities such as team meetings, video analysis, strategic discussions, sponsored events, interviews, etc.; but what they count as training is solely the time they play or physically exercise. Another possible explanation is that the high numbers presented in various media concern merely the very top of the esport elite, a large part of which resides in Asia and were thus not represented manifestly in our sample.

Secondly, the study implies that elite e-athletes are relatively active also when it comes to physical exercise. On average, an elite e-athlete does physical exercise 1.08 hours every day. This is more than World Health Organization's (2010) physical activity recommendation for both children of 5–17 years (60 minutes daily) and adults of 18–64 years (21 minutes daily). Keeping in mind that the average age of our respondents is 20.8, it appears that adult elite e-athletes do physical exercise more than three times the globally recommended amount. When it then comes to the balance between the physical activity recommendations of children and the training requirements of elite play, we can thus conclude that the current age restrictions set by many esport tournaments and leagues, usually at the minimum of 17, are accurate. We also entertain the possibility that the non-trivial amounts of physical exercise in top-ranked e-athletes' training regimes might have positive effects on the physical activity behaviors of amateurs and new players who see them as idols or role models (e.g. Dix, Phau & Pougnet, 2010).

Thirdly, the study implies that the reasons behind elite e-athletes' relatively high physical exercise amounts are not so much in their desire to improve competitive performance, but rather in their increased awareness concerning the benefits of healthy lifestyles. Almost half of the respondents (47.0%) considered the upkeep of their overall health as the main reason for their

daily physical exercise, whilst more than half (55.6%) believed it to have a positive side effect on their competitive careers as well. As we disagree with scholars who decline all parallels "in the physical efforts of competitive athletes and e-athletes" (Wimmer, 2012, p. 533) and agree with those who consider the physical involvement of esport to be "identifiable not just in quick hands or self-control [but also in] managing and engaging with multiple bodily senses and actions" (Witkowski, 2012b, p. 362), it seems that the greatest potential of esport as a physically noteworthy cultural practice lies in its tendency to inform those involved about the benefits of physically enriched routines.

While regular physical exercise may or may not have direct positive effects on elite e-athletes' performance, those who play esport on the elite level seem to have grasped the likely advantages that regular physical exercise generates for their overall health mentally and physically (see Warburton, Nicol, & Bredin, 2006). As for the ongoing and future debates concerning the "physicality" of esport and its suitability for children in particular, we would be less concerned about the time that aspiring young e-athletes spend training inside, and more concerned about the building of social structures that enable those e-athletes to recognize the advantages of training outside too as early as possible.

## LIMITATIONS AND FUTURE RESEARCH

Our study has evident limitations that should be noted. The first one relates to the operationalization of the surveyed concepts (e.g. "physicality") in a relatively simplistic manner, measured by single item measures. Future research could use more rigorous operationalization by measuring concepts with multiple questions that would enable evaluating their reliability and validity.

Another limitation derives from the fact that our measures were based on the respondents' subjective perceptions. Future studies could benefit from actually following e-athletes and teams, using objective measures to track their general training and the role of physical exercise in it.

Thirdly, our study did not include any exergame e-athletes (see Kari, 2014; Kari & Makkonen, 2014). This deficiency can also be seen as strength, as the physical activity patterns of exergame e-athletes presumably differ significantly from those studied above. It would probably be best to study them as a distinct player group.

Finally, the respondent numbers and variance could have been greater in general. With greater numbers and variance, potential gender differences would be a significant subject of study. Likewise, a parallel study on Asian elite e-athletes in particular should provide an interesting point of comparison.

Despite these limitations our results should stand as a decent basis for future research. We specifically look forward to studies with other collection methods and more advanced methods of data analysis. It would also be interesting to find out how much the training routines of the herein studied elite e-athletes differ from those of amateur and casual esport players. Comparative studies concerning the training of elite e-athletes, elite drivers, elite shooters, elite chess players, and other elite athletes with alike competitive requirements would yield fascinating results.

## REFERENCES

Adams, J. L. (2016). Female Fighters: Perceptions of Femininity in the Super Smash Bros. Community. *Press Start*, *3*(1), 99-114.

Agresti, A. (2002). *Categorical data analysis*, New York, NY: Wiley.

Bräutigam, T. (2015, September 15). Esports Statistics: The Growth of Our Industry in Five Charts. The Esports Observer. Retrieved from: http://esportsobserver.com/esports-statistics-the-growth-of-our-industry-in-five-charts/

Chee, F. (2012). Online Games as a Medium of Cultural Communication: An Ethnographic Study of Socio-Technical Transformation. Doctoral Dissertation. Fraser University.

Cochran, W. G. (1954). Some methods for strengthening the common χ 2 tests. *Biometrics*, *10*(4), 417-451.

DiChristopher, T. (2014, February 3). Pro gamers story: Get big, burn out, retire young. CNBC. Retrieved from http://www.cnbc.com/2014/02/01/pro-gamers-story-get-big-burn-out-retire-young.html.

Dix, S., Phau, I., & Pougnet, S. (2010). "Bend it like Beckham": the influence of sports celebrities on young adult consumers. *Young Consumers*, *11*(1), 36-46.

Dongsheng, Y., Xiaohang, Y., & Daofeng, K. (2011). The Present Situation and Development Trend of E-sports Games in China. In *2011 International Conference on Future Computer Science and Education (ICFCSE)* (pp. 384-386). IEEE.

Furnham, A. (1986). Response bias, social desirability and dissimulation. *Personality and Individual Differences*, *7*(3), 385-400.

Guorui, Z. (2012). Bibliometric Analysis on E-Sports in China. In *Advances in Computer Science and Engineering* (pp. 111-118). Springer.

Hamari, J., & Sjöblom, M. (2017). What is eSports and why do people watch it? *Internet Research, 27*(2), (advance online publication).

Harper, T. (2013). The Culture of Digital Fighting Games: Performance and Practice, New York, NY: Routledge.

Hebbel-Seeger, A. (2012). The relationship between real sports and digital adaptation in e-sport gaming. *International Journal of Sports Marketing and Sponsorship*, *13*(2), 43-54.

Hemphill, D. (2005). Cybersport. *Journal of the Philosophy of Sport, 32*(2), 195-207.

Hoorens, V. (1995). Self‐favoring biases, self‐presentation, and the self‐other asymmetry in social comparison. *Journal of Personality*, *63*(4), 793-817.

Jacobs, H. (2015, May 11). Here's the insane training schedule of a 20-something professional gamer. Business Insider. Retrieved from: http://www.businessinsider.com/pro-gamers-explain-the-insane-training-regimen-they-use-to-stay-on-top-2015-5?r=US&IR=T&IR=T.

Jonasson, K., & Thiborg, J. (2010). Electronic Sport and Its Impact on Future Sport. *Sport in Society, 13*(2), 287-299.

Lee, A. (2005). E-Sports as a Growing Industry. (Research Report). *Samsung Economic Research Institute*.

Lee, D., & Schoenstedt, L. J. (2011). Comparison of eSports and traditional sports consumption motives. *The ICHPER-SD Journal of Research in Health, Physical Education, Recreation, Sport & Dance*, *6*(2), 39.

Karhulahti, V. (2016). Prank, Troll, Gross and Gore: Performance Issues in Esport Live-streaming. In *Proceedings of the 1st International Joint Conference of DiGRA and FDG*. Digital Games Research Association and Society for the Advancement of the Science of Digital Games.

Kari, T. (2014). Can Exergaming Promote Physical Fitness and Physical Activity?: A Systematic Review of Systematic Reviews. *International Journal of Gaming and Computer-Mediated Simulations, 6*(4), 59-77.

Kari, T., & Makkonen, M. (2014). Explaining the Usage Intentions of Exergames. In *Proceedings of the 35th International Conference on Information Systems (ICIS) 2014*. AIS.

Maric, J. (2011). Electronic Sport: How Pro-gaming Negotiates Territorial Belonging and Gender. *Platform: Journal of Media and Communication, ECREA Special Issue, 3*(2), 6-23.

Martončik, M. (2015). E-Sports: Playing Just for Fun or Playing to Satisfy Life Goals? *Computers in Human Behavior, 48*, 208-211.

McTee, M. (2014). E-Sports: More Than Just a Fad. *Oklahoma Journal of Law & Technology, 10*, 1-27.

Mehta, C. R., & Patel, N. R. (2012). *IBM SPSS Exact Tests*. Cambridge, MA: IBM Corporation.

Nederhof, A. J. (1985). Methods of coping with social desirability bias: A review. *European Journal of Social Psychology*, *15*(3), 263-280.

Parshakov, P., & Zavertiaeva, M. A. (2015). Success in eSports: Does Country Matter?. SSRN Scholarly Paper 2662343. Retrieved from: http://papers.ssrn.com/abstract=2662343 (accessed 2 March 2016).

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879-903.

Reeves, S., Brown, B., & Laurier, E. (2009). Experts at Play Understanding Skilled Expertise. *Games and Culture, 4*(3), 205-227.

Spilgames (2013). State Of Online Gaming (Industry Report). Retrieved from: http://auth-83051f68-ec6c-44e0-afe5-bd8902acff57.cdn.spilcloud.com/v1/archives/1384952861.25_State_of_Gaming_2013_US_FINAL.pdf.

Stanton, R. (2015, June 22). The secret to eSports athletes' success? Lots – and lots – of practice. ESPN. Retrieved from: http://www.espn.com/espn/story/_/id/13053116/esports-athletes-put-hours-training-reach-pinnacle.

Szablewicz, M. (2011). From Addicts to Athletes: Participation in the Discursive Construction of Digital Games in Urban China. In *Selected Papers of Internet Research 12.0* (pp. 1-21). Association of Internet Researchers.

Taylor, N. (2009). Cheerleaders, Booth Babes, *Halo* Hoes: Pro-gaming, Gender and Jobs for the Boys. *Digital Creativity, 20*(4), 239-252.

Taylor, T. L. (2012). Raising the Stakes: E-Sports and the Professionalization of Computer Gaming. Cambridge, MA: The MIT Press.

Thompson J. J., Blair M. R., Chen L., & Henrey A. J. (2013). Video Game Telemetry as a Critical Tool in the Study of Complex Skill Learning. *PLoS ONE, 8*(9), e75129.

Thompson J. J., Blair M. R., & Henrey A. J. (2014). Over the Hill at 24: Persistent Age-Related Cognitive-Motor Decline in Reaction Times in an Ecologically Valid Video Game Task Begins in Early Adulthood. *PLoS ONE, 9*(4), e94215.

Von Hilvoorde, I., & Pot, N. (2016). Embodiment and fundamental motor skills in eSports, Sport. *Ethics and Philosophy, 10*(1), 14-27.

Wagner, M. (2006). On the Scientific Relevance of eSport. In Proceedings of the 2006 International Conference on Internet Computing and Conference on Computer Game Development (pp. 437-442). CSREA Press.

Warburton, D., Nicol, C., & Bredin, S. (2006). Health benefits of physical activity: the evidence. *Canadian Medical Association Journal, 174*, 801-809.

Wimmer, J. (2012). Digital Game Culture(s) as Prototype(s) of Mediatization and Commercialization of Society. In J. Fromme & A. Unger (Eds.), *Computer Games and New Media Cultures: A Handbook of Digital Game Studies* (pp. 525-540). Heidelberg: Springer.

Witkowski, E. (2012a). Inside the Huddle: The Phenomenology and Sociology of Team Play in Networked Computer Games. Doctoral Dissertation. IT University of Copenhagen.

Witkowski, E. (2012b). On the Digital playing Field: How we "Do Sport" With Networked Computer Games. *Games and Culture, 7*(5), 349-374.

World Health Organization (WHO). (2010). *Global recommendations on physical activity for health.* (Report). Geneva: WHO Press.

Yates, D., Moore, D., & McCabe, G. (1999). *The Practice of Statistics*. New York, NY: W.H. Freeman.

Zolides, A. (2015). Lipstick Bullets: Labour and Gender in Professional Gamer Self-Branding. *Persona Studies, 1*(2), 42-53.

## **Appendix A.** Key Questions Regarding Training and Esports[1]

**1. How many hours of training do you do daily? (Hours per day on average)**

Total amount of all training related to being a better or more successful player.

You can also report uneven hours by using a dot. For example: 1hours 30minutes = 1.5 (hours) and 30 minutes = 0.5 (hours).

**2. How many hours of PHYSICAL training do you do daily? (Hours per day on average)**

For example: running, cycling, strength, gym-training, yoga, etc.

You can also report uneven hours by using a dot. For example: 1hours 30minutes = 1.5 (hours) and 30 minutes = 0.5 (hours).

**3. Who plans your physical training program?**

- o I do it myself
- o My personal coach
- o Team's head coach
- o Team's physical coach/physiotherapist
- o My team buys this as a service from outside
- o I have no physical training plan. I just do whatever and whenever I feel like it
- o Other: [specify your choice in the accompanying text field]

**4. What is your MAIN reason for doing physical training?**

- o To maintain or improve my overall physical health
- o To maintain or improve my physical capacity
- o To lose weight, gain muscles, or tone my body (physical appearance)

[1] Detailed descriptions of all the other questions are available from the authors by request.

- For fun or enjoyment of exercising
- To be more successful in esports
- I don't do any physical training
- Cannot say
- Other: [specify your choice in the accompanying text field]

**5. How do you perceive that doing PHYSICAL training has affected your performance level in esports?**

- Significantly negatively
- Somewhat negatively
- No significant effect
- Somewhat positively
- Significantly positively
- Cannot say

**6. Compared to your teammates, do you believe you are doing more or less physical training than they do?**

- Significantly less
- Somewhat less
- About the same amount
- Somewhat more
- Significantly more
- Cannot say

**7. Do you believe that the physical appearance of a player can influence the competitive performance of others?**

Please choose all that apply:

- ☐ Yes, I believe my opponent has been intimidated by my (or my teammate's) physical appearance
- ☐ Yes, I have been intimidated by the physical appearance of my opponent
- ☐ No, I don’t believe that there is any influence

Choose all 'Yes' -options that apply OR 'No' -option.