World of Knowledge

Quantifying "Fun": Assessing the Market Value of Digital Entertainment Products

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◆ Evolution of Digital Entertainment Industry

IBM PC enters everybody's house during 80's, Internet makes the world flatter and smaller during 90's, and smart devices become the necessary part of people's life during the first decade of the 21st century. People are now connected to the world anytime and anywhere through smart devices with extreme computation power and affordable prices. A tweet spreading during March, 2011 remarks this tendency quite well. "*Your mobile phone has more computing power than all of NASA in 1969. NASA launched a man to the moon, but we launch a bird into pigs.*"

The tweet describes how "Angry Birds" being fashionable globally and elaborates how most people simply use their powerful smart devices for game play. Digital entertainment evolves with computing devices over time. At first, people play stand-alone games with PCs equipped merely monochrome monitors and beeping speakers. Then, people have fun in the virtual world online with others all over the world. Today, people enjoy their favorite music, video, and games with smart devices and ubiquitous mobile networks anytime. In 2012, the revenue for electronic gaming reaches a total of 66 billion US dollars globally, and is projected to be more than 70 billion US dollars a year at the end of 2013. Online media streaming is also booming. Online video and music produce 11 and 8.6 billion US dollars revenues in 2012 respectively, and threat the business of traditional entertaining media such as music CDs.

Competition rises along with the growth of business. Over 200 new online game titles are published every year. Each of them costs several to thousands of millions of US dollars for development and promotion, but many of them may survive only for 4 to 9 months on average. The situation for mobile games is even more extreme. For example, more than 150 thousands of games is available for download on App Store, while over 4000 new games are published on App Store every month. However, the top 100 games (less than 0.01% of the games on App Store) take up more than 30% revenue generated on App Store. Only the best game titles have huge returns. The mobile game market is full of uncertainty that the creator of Minecraft, an extremely successful computer game which has been sold in excess of 20 million copies and won a variety of awards, confesses that

the success of a mobile game is unique and hard to be replicated. Developers work round the clock to yield the best mobile game based on their imagination, but can only wish for gamers' favor after their works enter the market. Such a highly competitive market brings a demanding question. "*Is there a way to effectively predict whether a digital entertainment product can excel on the market?*"

◆   Evaluation of Entertaining Experiences

Except for the evaluation made by domain experts, the common approaches for assessing user experience are quite limited. For example, MOS (Mean Opinion Score) requires users to report their experiences via questionnaires. However, users' reports may be influenced by the primary effect (i.e., the first impressions) and recency effect (i.e., the most recent sensations), and thus may not reflect the true overall entertaining experiences. On the other hand, SSCQE (Single Stimulus Continuous Quality Evaluation) requires users to continuously report his/her own experiences during entertainment process with a real-time reporting tool such as a joystick, but this approach may disturb subjects during game play, music listening, and movie watching, and degrade the flow experience.

Intuitively, people pursue fun for the purposes of relax, distraction for works, or simply killing time. Evaluation of a digital entertainment product should start from quantifying the fun it invokes. People feel that time flies while having pleasant time; however, it is not the only way people having fun. People may also have fun after completing a challenging task. The excitement with terror from horror movies and roller coasters may also bring fun. The perception of fun is definitely subjective and varies among people; however, it seems to be always associated with *emotions*. During game play or movie watching, people experience a variety of emotions, such as joy, tension, excitement, where fun can be the sum of them. Once there exists an approach that can measure and analyze human's emotion responses against game play and movie watching, we may then quantify the potential value of an entertaining product before it enters the market.

Psychophysiology can be one of the potential approaches for quantifying fun. Psychophysiology measures one's mental and physical status such as cognition behavior and emotional responses through recording his/her physical signs via non-invasive methods like functional neuroimaging, brainwaves, heart rate, muscle potentials, skin conductance, and so on. With facial electromyography (fEMG) and skin conductance measurement, Ravaja et al. found that people feel relaxed while his/her game character being killed in a violent video game, and losing control of the character is even more annoying than being killed [1]. Nacke et al. identified the relationship between the gamers' emotional responses and the audio stimuli in first-person shooting (FPS) games [2]. With functional magnetic resonance imaging (fMRI), Salimpoor et al. confirmed the correlation

between the degree of activity in the mesolimbic pathway, one of the dopaminergic pathways in the brain, and the price one willing to pay for a tune [3].

◆ Forecasting Online Game Market Values

Since users' motions are somewhat constrained during fMRI measurement, fMRI may not well suit for the evaluation of digital entertainment products. Therefore we measure gamers' emotional responses during game play with fEMG. Facial expressions are the primary means for people to express their emotions. People smiles while feeling positive, and frown on the contrary. fEMG can probe the electrical impulse generated from the facial muscle groups non-invasively and continuously during game play while introducing limited interferences. In our study, the electrical potentials generated from gamers' two facial muscle groups, corrugators supercilii (relevant to frowning) and zygomaticus major (relevant to smiling), are recorded and analyzed. As indicated in Figure 2, we developed a prediction model based on the gamer emotion studies in lab and the market performance of published online games, and then use the model to predict the market performance of future products.

In our pilot study [4], we attempt to forecast a game's addictiveness based on players' emotional responses when they are first exploring the game. To verify our proposal, we first quantify the addictiveness of 11 real-life commercial games based on their account usage traces, conduct a user study which involves 84 subjects and 155 hours of emotion traces, and then analyze whether the games' addictiveness is predictable based on the players' emotions during game play. Our results indicate that such forecasting is feasible. More specifically, our prediction model can forecast a game's addictiveness with a reasonable accuracy given the positive and negative emotion measures from a small focus group. We believe that our forecast model will be helpful in several ways. For example, for game development firms, the model can be used to ensure that a game's design is on the right track in its early development stages. In addition, the model can help game operators in assessing the potential market value of a game before publishing it. All in all, we hope that with our methodology, the game industry can optimize the odds of successful investments and be able to more accurately target the provision of a better entertaining experience.

◆ Outlook

To analyze human's mind and to quantify "fun", a concept composed of purely subjective feelings, sounds like a crazy idea at the first glance. However, the continually progressive psychophysiological measurement technologies provide an opportunity to reveal the mystery of fun. One day, people may truly understand why a tune cheers them up, why a movie never fades away as time goes by, and why some computer games are so

attractive that people are willing to give up meals and sleep for game play from dawn to dusk. That day, we, the human beings, may truly realize the meaning of fun, the indispensable part within life.

Reference

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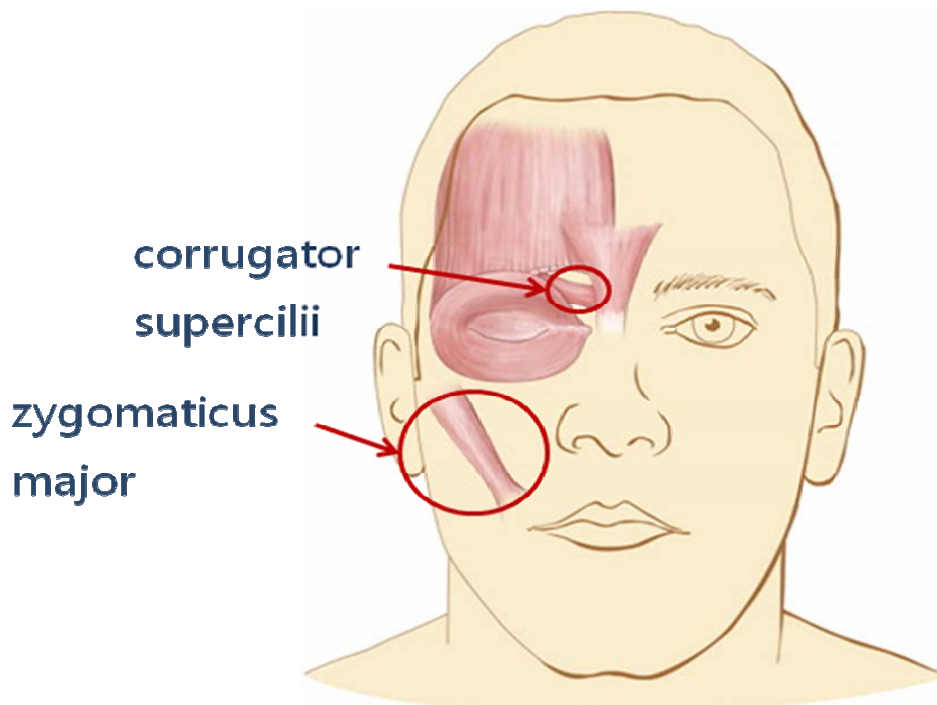
Figures

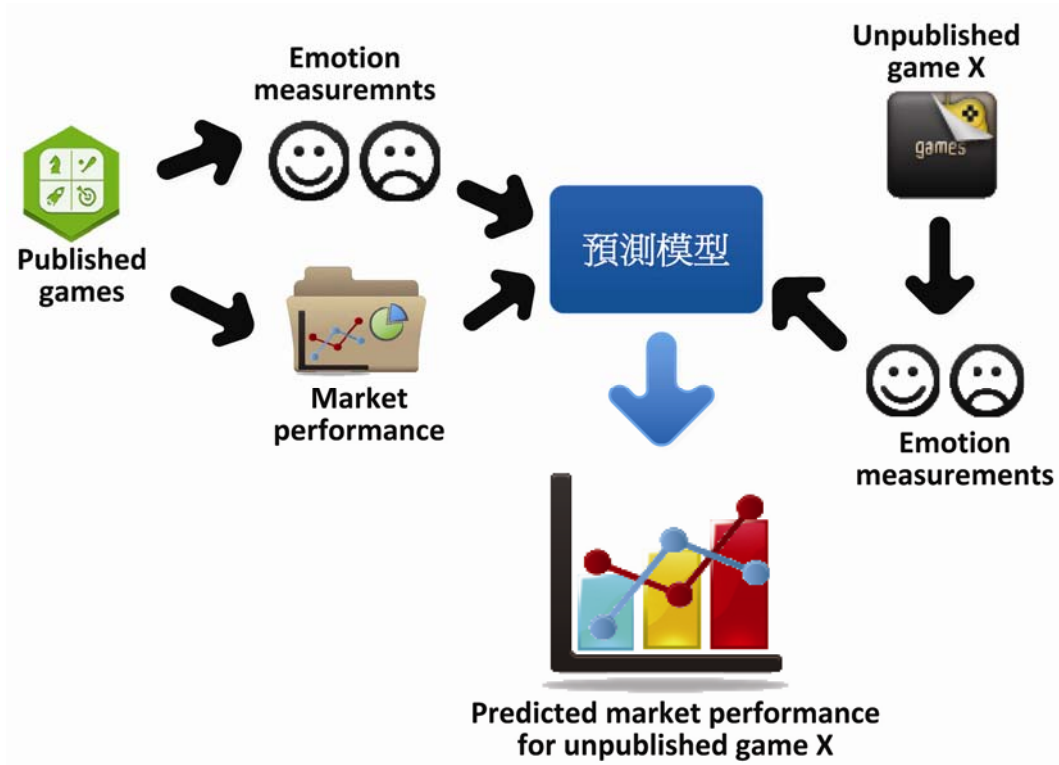Figure 1. The position of corrugators suupercilii and zygomaticus major on face

Figure 2. Constructing the model for predicting the market value of a digital entertainment product using lab emotion studies