The Expressions of Colours

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ABSTRACT

A whole world is presented in front of the eyes of a gamer. This world has shapes and colours. What do colours transmit? Is this considered in digital games? These are the main issues of this work.

We are part of a culture which has been decanting meanings for ages, including those of colours. These coded meanings are shared connotations of feelings, sensations, atmosphere, thoughts, and moods. Repeatedly, this symbolism is used without realizing how colours communicate. So, if colours can express, gamers would get messages which contain reactions and sensations. Diverse elements of digital games will be taken into account: characters, landscapes, clothes, objects, interfaces. A better understanding of the uses of colours would improve game experience.

Keywords
colour, emotion, psychology, game aesthetic, game art

INTRODUCTION

Digital games are presented as the only entertainment media that is inherently interactive, this characteristic allow games to be different from the film media. [19] Regardless of the kind of game, gamers interact mainly through visual stimulus. Moreover, people use the visual sense as the main source to recollect information, about the 60% out of total [11]; and, it is the most developed sense of human evolution. [8] When a person perceives, s/he sees colours. It is possible to increase or reduce some emotions through the use of colours. [6, 11, 16, 22]

COLOURS

What are Colours?

White light can be divided into different colours, each one defined by a range of wavelengths. That light reflected or projected by objects is of a certain wavelength amount that is caught by the eyes, and interpretived by the brain as a defined colour. The specific part of the eye that sifts the light is the retina. There are two kinds of photoreceptors in the human retina called cones and

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rods. Cones detect colours and shapes, and are strongly involved during diurnal vision. Rods work when luminance is weak. There are three types of cones, sensible to different parts of the longitude wave spectrum; ones react to red, some to green, and other to blue. The brain areas compromised with perception are the occipital lobules cortex. [8] Finally, by psychological processes the person "sees" colours. [1, 5, 7, 13, 25, 22]. See figure 1.

In shortly, colours have three parameters: hue (what tint), brightness (how light) and saturation (how pure).

Some people have dyscromatops, they can not discriminate colours accurately, especially those with high components of red and green. The Ishihara Test is used to detect dysfunction (See Figure 2). Dyscromatops affects mostly men. About 1 out of 12 men have dyscromatops, and since the majority of players is still male, it is a relevant detail to take into account, especially for games in which colour is a key to succeed, such as in puzzles games, action and strategy games for identifying the enemies.

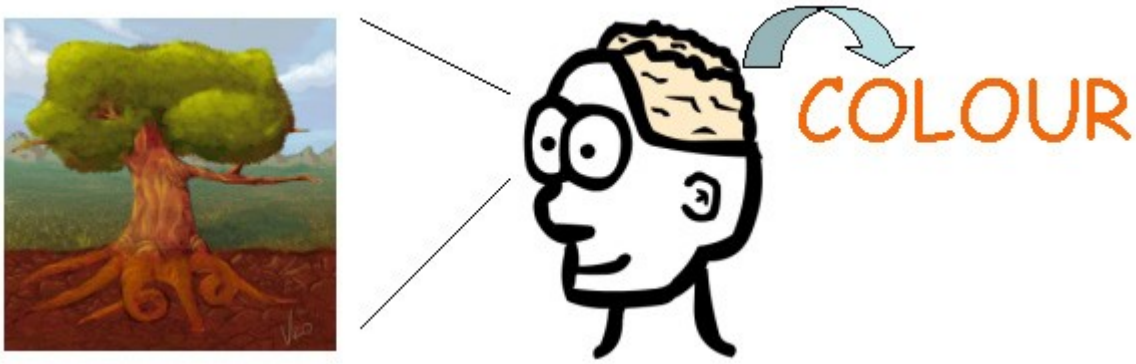

Figure 1. Seeing colours is the result of physical and psychological processes.

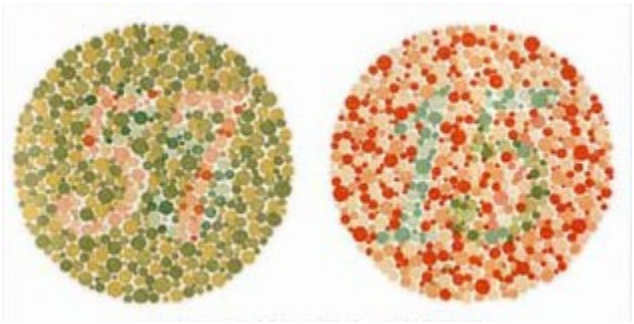

Figure 2. People with dyscromatops will not be able to see these number.

Colour Systems

There are different colour systems, like Munsell, Ostwald, and CIE systems. They were designed in order to unify criteria about colours. There are also digital colour systems which are based on hues red, green, blue (RGB). Every colour can be made from these three, by specifying

the amount each hue is needed. In spite of the colours produced by web-safe system can be determined exactly, it is not possible to refer extensively to certain colours in digital media, because the devices that display colours (monitor, television) are not equally calibrated. This is a common problem that the game industry is not quite aware of. [17] Moreover, if we see the same colour on two different backgrounds, we would perceive them as different colours. [7] Another con to a specific agreement regarding digital colours is that people play games in different places with different lightning; this also modifies the perception of colours.

So, considering the weaknesses of the colour systems to apply them at digital game studies, it would be necessary to use a classic method of colours that already consider shortcomings, such as colour naming. This method has been extensively used, and has the advantage can be addressed to different cultures. It has been found that internal categorization of colours is universal, and all non-primitive cultures named at least up to eleven colours. [5, 12, 13] It has been also found that the lack of colours terms does not necessarily show inability to distinguish them. [15]

Common people do not refer to colours by using instruments or searching them in catalogues. Colour naming would allow us to talk about certain colours regardless of the culture and the limitations of devices in the digital game studies field.

Colours and meanings

It is possible to do a theoretical distinction of three backgrounds for meanings attached to colour: an innate, a personal, and a cultural background. The first one hypothesizes from anthropological and behavioural research, for several subhuman species colours are very important signals in order to survive and adapt, and human colour space (internal categorization of colours) is universal; so, it would be possible that information from subcortical structures triggers associations between colours and moods as a trace of our evolution by regulating arousal when we see colours. [5, 7, 8] The second background comes from each of our personal experiences. [1, 25] The third background implicates culture. We are born and bred in cultures that are full of meaning. As we grow up, we learn those meanings through socialization processes. [3] Coded meanings of colours are shared connotations of feelings, sensations, atmosphere, thoughts, and moods. [1, 13, 22, 25] It could happen that meanings could vary through historical timeline and different cultures, however more significant differences are widely known and they will be mentioned forward. The vast majority of people are not aware about the effects that colours have on them; neither how this symbolism is used in everyday life and in communication. [23]

Light and colours are also involved in psychological theories. Rorschach developed a psychological test in which colours are an important issue, commonly known as inkblots test. He stated colours remit to emotions, and a more responsive behaviour towards colours indicates a greater affectivity. [15] Jung suggested chromatic experience as different ways of perception and expression, and stated an equivalency between colours and feelings. [16] Phototherapy is a therapy used for depression diagnosis, the patient is exposed to a potent source of light in order to make him/her feel better. It has been proved regions with long non-light periods have higher records of emotional disorders and suicides. [9].

The association between colours and emotions, feelings when we look at them is called Colour

Emotion. Previous research have not found differences among genres; and, from a multicultural point of view several coincidences have been found. [14] Not only emotional response is obtained while looking at colours, physical reaction is also possible. [5]

A first useful distinction of colours is warm-cold categorization. Being "warm" colours from red at one end of the spectrum, to "cold" colours with blue at the other end. See figure 3.
Distinction between warm and cold colours is presented in the early stage of cultures, the Papuan Dani society only has two colours names one for warm and other for cold colours. [12] Warm colours would give a high temperature impression, and imply contact with the environment; meanwhile cold colours would suggest low temperatures and withdrawal. [4] As a perceived impression, warm colours would be seen forward, and cold colours would be seen to step back. [15] It has been found that regardless the colour, the more bright the colour is, the cooler it would be felt. Also, brightest colours are more eye-catcher.

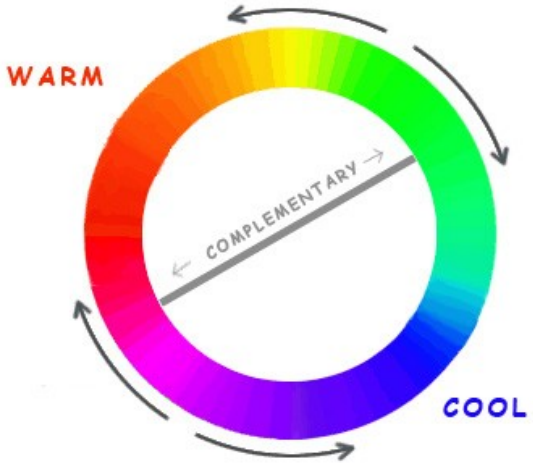

Figure 3. Colour wheel shows warm and cool distinction, and complementarities.

Another distinction is among saturated and desaturated colours. The first ones are associated to enjoyment and fun; the last ones to sadness and languidness.

In addition to the above mentioned, here follows a table which contains different colours and their widely shared meanings, connotations and relations with emotions:

Colour	Meanings, connotations, emotions
Black	Death, unbearable, evil, criminality, hidden aspects, sinister, depression, grief, pain, repression, hopelessness but also sophistication, authority, style. [6, 22] Regarding clothes, black is the colour of mourning in almost all occidental countries, also used as penitence for monks/nuns. [4]
Blue	Cold, peace, depression, sadness, relax, calm, piety, wisdom, introspection, solitude, loneliness, contemplation, distance, infinitude, emotion control; it represents water and the sky. [1, 4,16, 22, 24] Spoils appetite.

Brown	Wood, comfort, ground, earth, substance, physical, worn [4, 24]
Gold	Value, honour, loyalty . [16, 22]
Green	Nature, fertility, fecundity, balance, youth, also water. It induces to tranquility. [4, 22] In western culture, money. During medieval age, brides married wearing green as a manifestation of her fecundity. See figure 4.
Grey	Neutrality, fusion of happiness and sadness. [22]
Orange	Vital force, strength, endurance, social behaviour, warm. [4]
Red	Love, passion, excitement, appetite, health, courage, majesty, hot, danger, blood, weapons, aggressiveness, power, fire, hell. [1, 16, 22] It is the colour bride should wear in China, it means happiness there. See figure 4. [4] Red increases blood pressure, muscle tension and grip strength [5]; unfortunately, mouse and console's pads have no feature that measure pressing.
Violet	Mysticism, royalty, high range. [4]. It is a mourning colour in China. [1]
White	Light, purity, innocence, cleanness, cold. Western bride wears white to represent her chastity. See figure 4. In China it represents Autumn.
Yellow	Seems to stimulate the nervous system, it is linked to intelligence, logical thinking, innovation, spirituality, hope, joy, delicate. [1, 4] It is used to represent the sun that through history is the one that allow life. [23] But, when it is a dingy yellow it would be more likely to cowardice, ruin, shame, illness, decadence. For its brightest version, rage.

Table 1. Colours and meanings, connotations, emotions.

Figure 4. Different colours for different brides. Chinese brides wear red for representing happiness, medieval bride wore green for referring her fecundity, western brides wear white to mean purity.

DIGITAL GAMES AND COLOURS

The game industry is so concerned about the technological race that there is little space for thinking of the uses of graphics as an expressive medium. There are thousands of articles about how gorgeous a texture is seen with the newest technological features, but almost none about the intention relaying beneath the use of that texture. Most games artists choose colours intuitively instead of consciously.

When a designer creates, s/he is considering someone will use her/his creation. For this reason, designers need to anticipate the possible users' behaviour, and allow them to interpret easily how to use it. The designers should leave subtle messages that have to respect common codes to allow users an intuitive approach for discovering the world's rules. In digital games visual information is the most use input medium, and colours are useful coded messages. What we mean is that people involved in the design and creation of digital games should be aware that visual information displayed is a rather valuable communication medium; and, a conscious use of colour would allow a more insightful, immersive experience.

Characters

Some considerations have been done regarding colours as codes to create meaningful contexts and characters. [18, 20] But, it would be possible to go further. When a colour is addressed to an item or character, there should be a decision for its selection. It would not be enough just picking two colours and applying them onto the object to make them different. The colour should evoke some characteristic of the item, some clue for the player. This could be applied to landmarks as well, loosing one's bearings is annoying, and when diverse landmarks are alike, they should have an extra piece of information to make them unique, moreover if it could summarize the main characteristics of the place. See figure 5.

Figure 5. Warm and cold colours in Disciples II. Blue for the dwarf from the mountains, and red for the demon from hell, notice his quite bright yellow eyes that refer to his wrath.

Characters should be considered like persons, beings who posses singular characteristics. When we are in the street and watch people walking across, we quickly figure out a profile about how that person is, we collect data from their clothes, haircut, their colours, and other non verbal communication hints. We guess some traits and act accordingly, we proceed in this way daily, and we would do the same while playing. During interaction, we confirm or reject the hypothesis.

Let's analyse some characters. In Hitman 2: Silent Assassin, the player is a professional hired assassin; other characters would not know that he is an assassin until his weapons are seen. He should be formal, sophisticated, "Death is his business". The black of his suit gives him formality, hidden characteristics, criminality, also reminds of death. The details of red in his tie and lining would refer to danger, blood, weapons.
See figures 6.

Figure 6. The clothes of the central character of Hitman 2: Silent Assassin are mainly black, and details of red. Referring to formality, death, danger.

The main character of Half-Life is Gordon Freeman that is the player's character. Although this game is a first person shooter game, and the player does not see his avatar, everybody would recognise Gordon Freeman, and his suit is an essential trait of his. It would be believed that the two colours his suit has are enough to describe him. Freeman was a scientific who worked at a secret laboratory. After an accident, he was involved in shooting. Let's remind grey has a neutral connotation, he had not been involved in shooting, he was a researcher, and grey would allow an easier identification with the character. The orange details would evoke the endurance that Freeman has. See figure 7.

Figure 7. Gordon Freeman is the main character of Half-Life. His suit defined him.

User Interfaces

StarCraft Brood War is a strategy game, players can choose among three races, each of them have specific characteristics. Depending the race chosen, the colour of the interface changes. If Protoss is chosen, the command interface will be yellow, colour associated with intelligence and logical thinking, main attributes of the Protoss. Whereas Zerg race is chosen, the colour of the command interface will be brown, colour related to substance, physical, worn, ground, primitive behaviour; they are like animals, zergs' main attribute is strength, they fight with brute force. Meanwhile humans are chosen, the colour command interface will be grey, this colour is neutral, players are also human, they know which this race characteristics are. Those colours are also use for the building structures of each race. See figure 8.

Figure 8. StarCraft. On top, Protoss and yellow, intelligent race. In the middle, Zerg and brown, substance alike. Bottom, humans and grey… we are what we are.

Colours are also used to indicate different options at a glance. It has been mentioned that in Baldur's Gate, when characters are marked a coloured circle appears beneath them. Players would immediately know if the character is friendly, hostile or neutral for the colour of the circle (green, red and blue) [2]. See figures 9, 10.

Figure 9. In Baldur's Gate enemies are easily identified by the red circle under the characters' feet.

Figure 10. In Baldur's Gate friendly characters are easily identified by the green circle beneath them.

In Diablo II, the colour of the bottles in the inventory show what they are for. Red bottles are for health, blue bottles for mana (magical-spiritual concept), and violet bottles are for a combine use (violet is obtained from mixing of red and blue). The same colour cue is used in the command interface. See figures 11, 12.

Figure 11. In Diablo II, inventory's item would be recognize at a glance by its colour.

Figure 12. The command interface of Diablo II uses red and blue to refer to the character's health and mana.

Environmental Colours

Environmental colours should be an important matter, because the player would dive in the emotional atmosphere created. Some artists suggest selecting up to three basic colours for each level, keeping in mind the entire game palette, for evoking particularly emotions. The topography should be integrated to the desired impression. The same happens with objects and characters. [21]

A general impression of the world would be given by how saturated the general palette of the game is. Saturated colours evoke a cheerful world, meanwhile desaturated colours would show a languid environment. See figure 13.

Figure 13. Use of saturated and desaturated colours. The cheerful The Neverhood and the languid Silent Hill 4.

It has been mentioned the importance of the colours for setting a mood of the world the player would immerse in. [21] Let's see two examples that reflexes a sad, lonely world. One of them is Oddworld: Abbe's Exoddus, the plot is about Abbe's race had been enslaved, and he is alone and has to free his kind. During the game, Abbe (player's avatar) goes through several similar levels.

Scenery consists of a greyish-blue rocky foreground and blue background. Those colours refer to depression, sadness, solitude, loneliness, distance. Those are the attributes of the world that Abbe has to struggle with. It should also be noticed the use of the signs' colours: a colour of the palette (bluish) and its complementary (orange). See figure 14.

Figure 14. Oddworld: Abbe's Exoddus. Greyish and blue are used to evoke the solitude and sorrow of the environment.

Wik and The Fable of Souls has several similarities to Oddworld, both have a funny skinny character who is lonely trying to overcome difficulties, and the environments are depressive. The colour palette used in Wik is green-bluish, and brown. It would express a sad, solitude world, with a connotation of substance and worn things. There are some animals during the game: red has been chosen to point out that scorpions are dangerous, their tail is coloured differently from the body. See figure 15, 16.

Figure 15. Wik and The Fable of Souls

Figure 16. The red tails of scorpions are dangerous for Wik.

Bright colours are eye-catcher, eyes cover the distance between the avatar and the brightest areas. In SSX3 artists used lighting sources in order to insinuate the paths players should follow through caves while the avatar is snowboarding. See figure 17. [17]

Figure 17. Navigating inside a cave in SSX3

The prominence use of darks and shadows in games could refer us to primitive instinct, as Jung referred those as unconscious aspects of the mind related to inadaptability and hostility towards society. [6] This is mainly used in first-third person shooter game such as Manhunt, The Suffering; it also works in illegal racing games such as Need for Speed Underground. But it does not happen in Grand Theft Auto: San Andreas (GTA:SA)for example, as we play we do not feel that it were some kind of underworld although gameplay encourages criminal behaviour actions. This contradiction between colourful atmosphere and the instinct, criminal actions performed during gameplay, does not allow a good integration between what is seen and what should be done. This could be related to what has been pointed out about several boys wanted to play GTA just for driving by their houses, and were not interested in stealing cars. [10] Driving and that kind of activity are more related to colourful sceneries as those we can see in GTA. See figure 18.

Figure 18. On top screenshots of The Suffering, rich in use of shadows. At the bottom, GTA SA uses bright colours.

CONCLUSION

We defined colours as a whole process involving physics, physical and psychological procedures. Although there are several works written about colour, emotion, and its meanings, there is little written about its use in digital games, in spite of the vast majority of digital games are mainly visual.

Different parts of the digital games could transmit a meaning by their colours, sceneries, characters, and objects. Like spreading little clues, unconsciously perceived by the players.

There are no right or wrong decisions for choosing colours, but designers of the game industry should be aware about the connotations and feelings attached to them. Consequently, digital games would improve immersion, conveying of information and emotion, and intuitiveness of user interfaces. Overall, a much better player experience.

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