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The Dress: Transforming a web viral event into a scientific survey

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ABSTRACT

Background: The Dress picture recently has become a hot topic on the Internet, prompting a debate whether it was black and blue, or white and gold.
Objective: To investigate The Dress color perception in both multiple sclerosis (MS) patients, characterized by frequent visual system impairment with ensuing color vision effects, and general population.
Methods: We developed a questionnaire to record demographics, clinical features, and The Dress color perception, posted on general and MS-specific social networks.
Results: No statistically significant differences were observed in The Dress color perception between MS patients ($n=103$) and general population ($n=441$). Furthermore, white and gold color perception was positively associated with aging in the general population ($p=0.04$), whereas negatively associated with progressive course ($p=0.03$) and longer disease duration ($p<0.001$) in MS patients, independently from patients' age.
Conclusion: The Dress black and blue or white and gold perception might be due to aging in the general population, whereas black and blue perception, despite of aging, might suggest a specific effect of the MS burden (i.e. disease duration and progression) on the visual structures specifically involved in the white and gold perception.

1. Introduction

The use of Social Network Sites (SNS) is becoming dominant among all Internet users, allowing participants to share interests and opinions with social interactions (Alshaikh et al., 2014). Making easy both the acquisition of demographic and clinical self reported data and the submission of questionnaires, SNS may become a power platform for research purposes (Alshaikh et al., 2014; Wiley et al., 2014; Sarker et al., 2015). Indeed, a few studies collected data by using SNS but, so far, none of them specifically included patients with multiple sclerosis (MS) (Alshaikh et al., 2014).

It is worth noting that SNS are also the main responsible for web viral event development and diffusion. In particular, web viral events, defined as an "activity, concept, catchphrase or media spreading through the Internet" (Wikipedia. Internet meme [Accessed January 15, 2016], Available From: ⟨http://en.wikipedia.org/wiki/Internet_meme⟩), may trigger a scientific interpretation of rapidly spreading phenomena.

A noticeable example is the photograph of a dress, becoming a web viral event in February-March 2015, immediately after being posted on the SNS Tumblr. An enormous debate started, as the Internet population disputed whether The Dress was black and blue, or white and gold. The image prompted an "existential crisis" over the nature of sight and reality, enhancing discussions on color vision among various social platform users (Wikipedia. The dress (viral phenomenon) [Accessed January 15, 2016]. Available From: ⟨http://en.wikipedia.org/wiki/The_dress_%28viral_phenomenon%29⟩). Intriguingly, different studies showed that the color perception of The Dress can be determined by modifying specific properties of the picture, such as illumination and reflectance (Gegenfurtner et al., 2015; Lafer-Sousa et al., 2015; Winkler et al., 2015; Brainard and Hurlbert, 2015), and, thus, supported the hypothesis that differences in color perception might be associated with those mechanisms normally involved in stabilizing object color (Brainard and Hurlbert, 2015). On the other hand, Schlaffke and colleagues showed higher brain activation at functional magnetic resonance imaging among subjects reporting The Dress being white and gold, compared to black and blue, suggesting that cognitive function can also contribute in color vision (Schlaffke et al., 2015).

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However, pathological factors influencing the vision of The Dress with a specific color combination have never been investigated. Indeed, for instance, older subjects have relatively impaired color vision, possibly because of both changes in neural and retinal processes (Downie et al., 2014). Furthermore, color vision deteriorates early in many conditions affecting the retina or optic nerve, such as diabetes (Wolff et al., 2014), or MS (Martínez-Lapiscina et al., 2014). In particular, 30% of MS patients suffer from visual impairment, and 70% present abnormal conduction of optical pathways, as explored by visual evoked potentials (Martínez-Lapiscina et al., 2014; Hickman et al., 2014).

Therefore, the present study applied a MS-dedicated SNS in order to investigate the scientific background of The Dress, a web viral event with noticeable biomedical interest concerning mechanisms of color perception. To be more precise, the present investigation aimed at: 1) assessing the feasibility of a scientific survey with a SNS both in MS patients and in the general population; 2) investigating The Dress web viral event by evaluating the prevalence of black and blue, or white and gold vision; and 3) the presence of demographic, environmental and clinical factors possibly influencing a specific perception of The Dress.

2. Methods

2.1. Study design

The study was performed in accordance with good clinical practice and the Declaration of Helsinki. All participants consented to the use of recorded questionnaires for scientific purposes on aggregate level.

A questionnaire was performed by using Google Forms and was available on-line on a public page of the domain www.smsocialnetwork.com in English and Italian language from 16th to 25th March 2015. Aggregated and non-aggregated, English and Italian anonymous results have been automatically collected using Google Sheets and subsequently arranged for statistical analyses.

The first part of the questionnaire investigated the perceived color of The Dress (black and blue, or white and gold) (Fig. 1), the preferred device (smartphone, computer, or tablet), the place where the participant was located (inside, or outside), and the time of the day (morning, afternoon, or night), with specific regard to the moment the participant was filling out the questionnaire. Subsequently, the following personal records were collected: age, gender, educational level (primary school, high school, university), hand dominance (right, left, ambidextrous), place of birth (categorized according to large geographical areas: Italy, Europe, non European countries), daily medication use (open question), visual disturbances, and use of glasses (asking to report the visual defect). The two latter questions were grouped to form a subpopulation of subjects presenting ophthalmological conditions. Furthermore, considering current medications, subjects undergoing treatment for diabetes were recorded (Wolff et al., 2014).

Subjects reporting to have MS were also asked for the year of symptom onset (disease duration was subsequently calculated), the clinical phenotype (relapsing-remitting or progressive), the occurrence of optic neuritis or diplopia. In the original version of the questionnaire, each question was integrated with a short explanation of the medical terms in order to be easily accessible to all participants.

2.2. Data collection

In order to recruit MS patients, the questionnaire was advertised on SMsocialnetwork (www.smsocialnetwork.com), an Italian web community where people with MS can exchange information monitored by a doctor (Lavorgna L, De Stefano M, Buonanno D, Eboli S, Gallo A, Bonavita S, et al. Social Media and Multiple Sclerosis: An Italian Experience. Neurology. 2014;82(10): S49.004.). SMsocialnetwork was born in 2012 with the scientific advice of neurologists and psychologists of the MS Center at the Second University of Naples (Italy), and is composed by a public wall where users can read, write, post or comment, getting in touch with other users. In addition, there is the possibility of having a private user profile, chatting with one or more users, joining discussion groups on specific topics, or viewing public information media on MS (i.e. videos). SMsocialnetwork accounted 1082 registered users at the time of the study start.

Fig. 1. The Dress. The Dress became a web viral event in February–March 2015, prompting a large debate whether it was black and blue, or white and gold (it is suggested to be seen on informatics device). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

The questionnaire was advertised among the general population by using different social networks (i.e. Facebook, Google+ or Twitter).

2.3. Indicators of data collection

Indicators of data collection were calculated for the MS population, in order to test the feasibility of a scientific survey by using SMsocialnetwork. In particular, as previously suggested (Alshaikh et al., 2014), the following indicators were recorded:

1. Response rate (defined as the number of participants who completed the questionnaire, divided by the total number of participants who were asked to participate);
2. Cost (the cost of the informatics technical support for the survey conduction and for the data extraction was calculated, and the cost per recruited participant was subsequently calculated);