

# Your Brain on Facebook: Neuropsychological Associations with Social Versus other Media

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## Abstract

We measured individuals' mental associations between four types of media (books, television, social/Facebook, and general informational web pages) and relevant concepts (Addictive, Story, Interesting, Frivolous, Personal, and Useful) using three different measurements: a Likert scale questionnaire, a speeded Yes/No judgment task, and electrical brain activity. The three measures were designed to capture associations at different levels of mental processing, from very automatic (electrical brain activity) to conscious and reasoned (questionnaire). At more conscious levels of cognitive processing, Facebook was seen as interesting, addictive, and highly personal. Results for the electrical brain activity measure show that Facebook tells less of a story and, surprisingly, is less personal than other forms of media. We discuss differences in results across the three measures and how our findings can inform the design of future social media systems.

## Introduction

Media, in one form or another, have existed for much of recorded history. Books go back thousands of years and have been relatively widespread since the invention of the printing press hundreds of years ago. Television has been available since the 1930s. Social media, in contrast, has been around for less than a decade, and yet in just that relatively short amount of time has exploded in popularity and influence. Facebook already has over 350 million users<sup>1</sup>, and Twitter, which started just three years ago, was

projected to have over 12 million users by the end of 2009<sup>2</sup>. Beyond the initial use of keeping in touch with friends, many businesses, community groups and non-profit groups now use social media for more professional purposes to advertise, recruit sponsors, and share updates. Celebrities and politicians alike are using these tools to communicate with their fans and constituents. For example, the Barack Obama Facebook application and the online social networking group his campaign team created at MyBarackObama.com made history during the American 2008 Presidential Election and some think contributed significantly to his win (Carr, 2008). The power of social networking tools was demonstrated even more recently during the Iranian election protests beginning in June of 2009, when the only real information leaving the country was in the form of text, picture, and video updates by ordinary citizens through online social media.

Given its popularity, power, and breadth of influence, social media is starting to reach levels of usage and social relevance somewhat comparable to the older, more well-established forms of media like books and television. This potential parity raises important questions for researchers in technology, communication, and social behavior as to how people perceive social media on a variety of dimensions and how these perceptions compare with those of other types of media. An important aspect of such comparisons is the kinds of basic associations people have with different forms of media, as these associations can speak to a variety of user factors such as motivations for use, commitment to usage, and attitude towards that form of media. For example, "Is MySpace associated with adolescence and frivolity?" "Is reading a Twitter feed similar or dissimilar to reading a book or magazine article?" "Is connecting with

<sup>1</sup> <http://www.facebook.com/press/info.php?statistics>

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<sup>2</sup> eMarketer. Twitter Tally (April 28, 2009). Retrieved from [www.emarketer.com/Article.aspx?R=1007059](http://www.emarketer.com/Article.aspx?R=1007059).

my friends on Facebook really associated with feelings of intimacy?”

Accurate answers to such questions will serve to help clarify for designers of social media systems exactly where social media stands in the eyes of its users. It can also help them address shortcomings and generally improve social media by incorporating aspects of other media forms that have proven successful. For example, if Twitter is associated with being “confusing,” where as news web pages like CNN.com are seen as “organized,” then perhaps the Twitter interface can be improved by adopting features of a news web page.

Our first goal for this work, then, was to compare relevant associations people have with social media to those they have with comparatively more established media (e.g., do people think Facebook is frivolous compared to books or TV?). This will help us better situate social media within the larger context of media generally and also may identify properties of other media forms that might be leveraged to improve social media.

How should these associations be measured? Here we employed three different measurement methodologies: electroencephalography (EEG) to capture electrical activity in the brain, a forced-choice speeded decision task, and a questionnaire. This multi-method approach allowed us to meet our second goal of examining associations at different levels of cognitive processing, ranging from very automatic to reasoned and effortful, respectively (see Figure 1). Importantly, including the EEG measure allowed us to target our third goal of starting to understand people’s responses to social media at the level of brain activity. To our knowledge, this is the first study to assess social media in terms of the effect on electrical activity in the brain. In addition to serving as a heretofore unused measure for the assessment of social media, we believe this undertaking to be important in the longer term, as one can imagine brain interfaces that serve as feedback or input to social media systems.

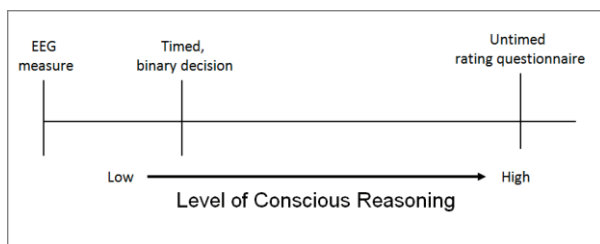


Figure 1: Relative processing level examined by each measure

## Background

### Importance of Automatic Associations

Extensive research in cognition suggests that individuals’ knowledge about the world is organized in memory such that concepts that are related in some way become

“connected” to one another in a mental “network” of knowledge (see Rogers and McClelland, 2004 for a review of network models of cognition). Personal experiences, emotions, and attitudes can also become associated with the pieces of conceptual knowledge in the network. For example, the concept “doctor” is probably connected to thematically related concepts like “nurse,” and “hospital,” but individuals may also connect the concept “doctor” with images of and knowledge about their personal doctor or with negative feelings attached to a memory of being sick. In this way, individuals form a very rich and varied web of conceptual knowledge and personal experience. Navigating though this mental network is a rapid and automatic process, and through this process people are able to construct a meaningful understanding of the world in everyday life.

As one example of how automatic associations impact our lives, extensive evidence from consumer behavior research suggests that the attitudes, emotions and other conceptual associations that consumers form with products are often developed at the subconscious level (e.g., Weilbacher, 2003). These attitudes and associations are activated in memory when a consumer encounters a product, and their decision to purchase it is often driven by these subconscious factors (Bechara and Damasio, 2005). Similar processes are likely at work during the consumption of media. Thus, an examination of subconscious associations as they pertain to social media use should nicely complement existing research using questionnaires and usage data (e.g., Lampe et al., 2006) by providing an understanding of the factors that may motivate user decision making and behavior but are difficult to measure.

### Measuring Automatic Associations Using EEG

In investigating conceptual networks in the mind, cognition researchers have developed many useful tools and methodologies. One particular tool that has grown in prominence over the last decade is measuring event-related brain potentials (ERPs). This technique involves collecting continuous EEG recordings from the scalp and then isolating the electrical brain activity elicited by a particular stimulus (i.e., an “event”). Activity elicited over several trials of stimulus presentation can be averaged together and compared across different conditions in terms of the onset and amplitude of the electrical waveforms (see Luck, 2005 for detailed overview of the ERP technique). The ERP technique is an ideal tool for many research questions because it is not dependent on the participant making a manual response or performing accurately on a task.

A robust and widely-studied ERP effect is known as the N400 incongruity effect. This effect is elicited by a stimulus that is conceptually incongruent with its context. A famous example is the word *bake* in the sentence “The cat will *bake* the food” (Kutas and Hillyard, 1980). When comparing an individual’s electrical brain activity between *bake* in this sentence and the word *eat* in the sentence, “The cat will *eat* the food,” the waveforms will begin to dissociate from one another about 300ms after the italicized word was

presented. The conceptually incongruous word, *bake*, elicits a significantly more negative amplitude compared to the word *eat*, and this difference in activity will peak at about 400ms after the presentation of the word. This more negative amplitude elicited by an incongruent relative to a congruent stimulus peaking at around 400ms has come to be called the N400 incongruity effect. The size of the N400 effect depends on the *degree* of incongruity. For example, consider the sentence, “He likes sugar and cream in his coffee.” Replacing the word *coffee* with the word *juice* would elicit a smaller N400 effect compared to replacing *coffee* with the word *socks* (see Kutas and Federmeier, 2000 for a review of the N400 effect in language).

The N400 incongruity effect has been demonstrated in a variety of different domains and paradigms, such as in videos of real world events that contain incongruous items (Sitnikova et al., 2008) and incorrect answers to simple arithmetic problems (Niedeggen and Rosler, 1999). In our case, we used the ERP technique to measure conceptual associations that exist in an individual’s knowledge network and are automatically activated when the person is exposed to a particular type of media. Specifically, we tested N400 effects elicited by different pairings of media types and concepts (described in detail below).

## Study

### Methods

Participants completed two tasks. In the first task, henceforth called the Decision Task, participants were shown images of media items on a computer screen (e.g., a screenshot of the CNN.com homepage), each of which was followed by a concept word (e.g., “Interesting”). This was a speeded, forced decision task in which participants had to respond “Yes” or “No,” within a three second time window, as to whether or not the media item could be described by the word that followed it. EEG activity was recorded during this task. In the second task, henceforth called the Rating Task, participants rated how well the four different categories of media could be described by each of the six concept words on a paper questionnaire.

**Participants** Participants in this study were 16 volunteers (10 male, 6 female) from our company who were recruited via mass e-mail and were compensated for their time with \$15 in dining coupons. Their average age was 29.94 years old ( $SD = 6.32$ ). Each participant completed a pre-study media usage survey on which they estimated their weekly use of the different categories of media. On average, each week our participants reported spending 12.09 hours watching television ( $SD = 8.52$ ), 4.66 hours reading books ( $SD = 2.37$ ), 8.16 hours using general/informational web pages ( $SD = 6.42$ ), and 5.88 hours using Facebook ( $SD = 4.08$ ).

**Stimuli Media Item Images** The four forms of media we compared were books, TV, social/Facebook, and general

informational websites. To ensure that the images of the media items the participants evaluated during the Decision Task were all equally familiar and relevant to the participants, the set of media items that each participant saw during the study was constructed individually and personalized based on the participant’s responses to the pre-study media usage survey (e.g., they saw images of only the TV shows that they reported watching). For each of the four media categories, we constructed 11 representative media images. For the Books category, these images were of book jacket covers or titles; for the TV category, these images were promotional images from shows or freeze frames from an episode of the show; for the General website category, the images were screen shots taken of the web pages; for the social media category, the images were of the Facebook logo and homepage as well as screen shots from the participant’s Facebook profile page (e.g., wall posts, friends list, photo album previews, etc.). All TV show items were entertainment-based (e.g., “Lost,” “The Office”), as were most books (e.g., “Harry Potter”). Most general web pages were news sites like nytimes.com or ESPN.com.

We note here that we chose to use only Facebook to represent the “social media” category for several reasons. In addition to being one of the most popular social networks, based on our participants’ responses to a pre-study questionnaire, Facebook was the most commonly and often-used social networking tool. Also, we did not want to combine Facebook, Twitter, and other forms of social media together into one category, as they may be used for very different reasons and thus have very different conceptual associations from one another.

**Concept Words** We chose to test the concept words Addictive, Story, Interesting, Frivolous, Personal, and Useful (see Table 1 for the definitions of these words used in the study). The choice of these concept words was guided by the concepts tested in the Personal Involvement Inventory (Zaichkowsky, 1985), a long-standing and reliable assessment tool used frequently in advertising research. We also chose these concept words because we believe them relevant to the success of media generally (e.g., Interesting) and to social media specifically (e.g., Personal). The concept words and definitions were pre-tested on several participants (not included in our actual analyses) for clarity. This resulted in minor tweaking of the definitions and changing the word Narrative to Story. Narrative is an important aspect of media like books and TV, but the actual word “narrative” was too confusing in pre-testing.

**Rating Survey** A paper survey was constructed for the purpose of having participants make conscious, reasoned ratings of the media categories on how congruent they were with the six different concepts. Participants were asked to rate on a seven-point Likert scale how well each concept word described each particular media type. For example, “In your opinion, how *interesting* to you are the books that you usually read?” with “1” on the scale representing “Not interesting,” and “7” representing “Very interesting.”

Word	Definition Given to Participants
Addictive	Something that compels you to keep going back to it as often as possible. It quickly and effectively grabs and holds your attention in a way that makes you reluctant to stop interacting with it.
Story	Something that is a meaningful whole, rather than a lot of disconnected parts. It has coherent content that makes sense and tells a story.
Interesting	Something that is intellectually stimulating and sparks your interest. It holds your attention because it is engaging and you become involved with its content.
Frivolous	Something that is unnecessary. It is concerned with things that have little real value or importance.
Personal	Something salient to you personally. It is significantly relevant to your life.
Useful	Something that serves an important purpose or service for you. It would feel like a loss to you to be unable to use this thing.

Table 1: Concept words and definitions

**Design** This study's two factors were Concept Word and Media Type, a 6 x 4 design with twenty-four conditions created by the pairing of each of the six concept words with each of the four media types. However, for all measures, each concept word was examined separately, with the different types of media compared to one another in their degree of association with each concept word rather than across the different concept words. In the Decision Task, each of the 11 media items from each media category was paired twice with each concept word, leading to 22 trials per participant per condition and a total of 528 trials.

**Procedure** Upon arriving for the study, participants were first orientated with the EEG equipment and recording procedures. They were then given a brief overview of the experimental tasks and were asked to read detailed task instructions while the experimenter set up the EEG recording equipment. In these instructions, the concept words were defined and the participants were asked to look through their personalized set of media images to ensure that they were indeed familiar with the media represented in the images and would be able to recognize them in a brief presentation. Participants first completed the Decision Task, followed immediately by the Rating Task. Participants were shown some sample trials (with words and images unrelated to the study) in order to prepare them for the Decision Task. During this task, participants wore



Figure 2: Experimental set up.

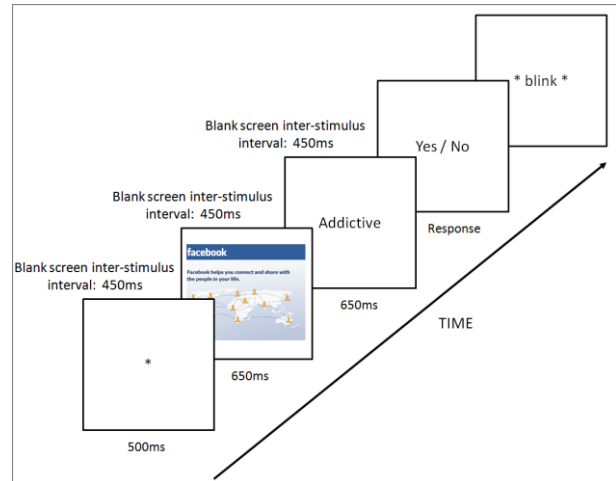


Figure 3: Example trial.

an electrode cap and sat in front of a computer screen and keyboard (see Figure 2).

Each trial in the Decision Task consisted of a fixation asterisk, a media image, and a concept word presented in sequence alone in the center of the screen (see Figure 3). Participants made their "Yes/No" decision during the decision screen, which was displayed until a response was made or until the three second window had expired. The order of the media item and concept word pairings was randomized, and the hands used to respond "Yes" and "No" were counterbalanced across participants. Because each trial only took a few seconds to complete, the duration of the 528 trials was approximately 35 minutes. Participants were also given three equally-spaced breaks during the study, making the total duration of the Decision Task about 45 minutes.

The "Yes/No" responses that participants made during the task were recorded for each trial. EEG activity was

recorded continuously for the duration of the task, but the EEG signal of interest was that elicited by the concept word following the media item image. After participants completed the Decision Task, they were asked to complete the Rating Task, wherein they responded to each question by circling a number on the one-to-seven rating scale to indicate the degree to which they thought a given concept word could describe the four categories of media.

**EEG Acquisition and Processing** Continuous EEG data were acquired using a BioSemi Active Two system with a 32-channel electrode cap montage arranged according to the International 10-20 system. Participants wore the cap on their heads, and additional electrodes were attached with one underneath the left eye and one on the side of the right eye to measure eye blinks and vertical and horizontal eye movement, respectively. Participants were asked to control blinking such that they blinked during the “blink” screen following the presentation of the image and concept word (see Figure 3) in order to reduce artifact in our data from eye muscle activity, which can mask EEG signals.

Incoming electrical signals recorded from the scalp were referenced to an additional electrode placed on the mastoid bone behind the left ear, sampled at 256Hz, and bandpass filtered post-recording between .01 and 45 Hz. We established epochs for analysis around the presentation of the concept words within this continuous EEG signal. Each epoch was from -200ms before the presentation of the word to 800ms after. Event epochs that contained artifact from blinks, eye movement, or other major muscle movement (approximately 17% across participants) were rejected prior to analysis. All major EEG signal processing was conducted using MATLAB’s EEGLAB toolbox (Delorme and Makeig, 2004).

## Results

As previously mentioned, the association between each media category and the concept words was analyzed independently for each concept word. In the following subsections we present these comparisons separately for each of the three measurements used.

**Media Rating Questionnaire** Participants’ subjective, seven-point scale ratings of how well they thought each concept word described the different media categories were averaged across participants (Figure 4). For all conditions a lower average score indicates lower agreement that a particular concept word can be used to describe a particular type of media (e.g., the rating of about “2” indicates that general/informational web pages as a whole are not very personal) and vice-versa for higher scores. For each concept word, we ran a four-way, repeated-measures ANOVA<sup>3</sup>, with post-hoc, pairwise comparisons<sup>4</sup>, to test for

3 In all reported ANOVA analyses in all Results subsections, a Greenhouse-Geisser significance correction for violations of sphericity was used when necessary

4 For all reported pairwise comparisons, a Bonferroni correction for significance was used.

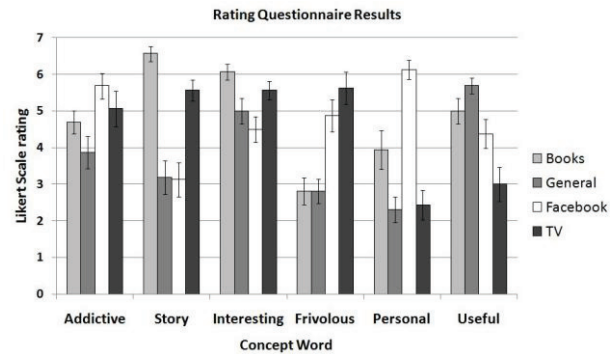


Figure 4: Results of rating questionnaire completed by participants following the Decision Task.

a main effect of Media Type on rating. All main effects for Media Type within each Concept Word were significant (all  $p$  values  $< .01$ ).

In terms of specific comparisons between Facebook and the other forms of media, first Facebook was rated as significantly more personal than all other forms of media (versus Books,  $p < .01$ ; versus General,  $p < .01$ ; versus TV,  $p < .001$ ). It was also rated as significantly more addictive ( $p < .05$ ) but less useful ( $p < .05$ ) than general informational web pages. Participants saw Facebook as more frivolous than both general web pages ( $p < .01$ ) and books ( $p < .05$ ), and less interesting than books ( $p < .01$ ). Lastly, Facebook was rated as telling less of a story than books ( $p < .001$ ) and TV ( $p < .01$ ).

Overall, at the most reasoned cognitive level, participants appear to perceive Facebook as a very personal tool that they feel compelled to use frequently. However, similarly to TV, Facebook is seen as a rather frivolous use of one’s time. Furthermore, users do not feel that they can gain as much useful information from Facebook as they can from other media forms like books, whose content is seen as more cohesive and coherent compared to Facebook.

**Speded Decision Responses** Represented in Figure 5 is the overall distribution of total “Yes” and “No” responses in each condition during the Decision Task. To analyze the frequency with which participants agreed that the concept word could describe the media represented by the preceding images, we calculated the “percent agreement” for each

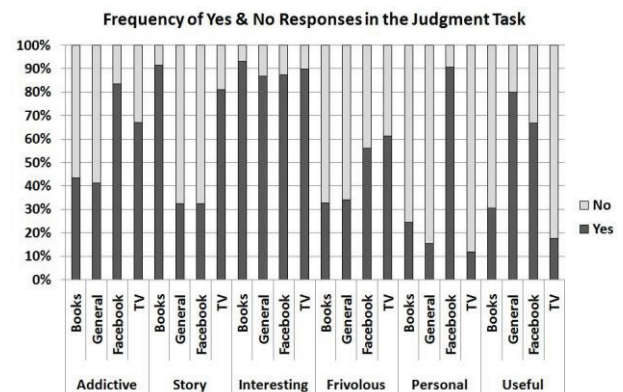


Figure 5: Percent agreement that each media category can be described by each particular concept word.

participant. We defined this as the number of times each participant responded “Yes” for a given media type—concept word condition divided by the number of total responses he or she made for that condition (recall that the response screen timed out after three seconds).

We again conducted four-way, repeated-measures ANOVAs with pairwise comparisons on this percent agreement measure. The factor of interest was Media Type, and its main effect on percent agreement was highly significant for all concept words ( $p < .001$  for Addictive, Story, Personal Useful;  $p < .01$  for Frivolous) except for Interesting ( $p = ns$ ). In terms of the specific comparisons between Facebook and other media forms, according to this measure, despite telling less of a story than both Books ( $p < .01$ ) and TV ( $p < .05$ ), Facebook was more useful than both of those media forms ( $p < .05$  for Books,  $p < .01$  for TV). Facebook was more addictive than both books ( $p < .05$ ) and General Websites ( $p > .01$ ) and was much more personal than all the other media forms (all  $p$  values  $< .001$ ).

Thus, when forced to make a rapid, binary decision, participants tended to agree that Facebook is very addictive (comparable to TV), extremely personal, and also quite useful. These decisions were consistent with the Rating Task responses, with the exception that Facebook was relatively more Useful on this measure.

**EEG Analyses** EEG signals were analyzed according to an ERP paradigm. Electrical brain activity corresponding to all epochs in a given condition was averaged together for each participant’s data. To test for N400 effects, the mean voltage values for the time window between 325ms and 475ms<sup>5</sup> after stimulus presentation were calculated. The following electrodes Fp1, Fp2, AF3, & AF4 in the far-

frontal positions on the head were excluded from analyses because there tended to be more data artifacts than in other electrode sites due to forehead movement, and because they are not located in the central/parietal region where the N400 effect is typically strongest (Kutas & Federmeier, 2000). See Figure 6 for mean amplitudes for the midline electrodes. Because these electrode positions showed the strongest effects, consistent with previous work on the N400 effect (Kutas and Federmeier, 2000), we’ve chosen to illustrate only the means across the midline sites for all of the different conditions for the sake of brevity and simplicity.

For each concept word, to test for a main effect of Media Type on EEG activity, and to determine how this effect was distributed across the scalp, the data from the remaining 28 electrodes were grouped according to position and analyzed using three repeated measures ANOVAs, performed separately on the data from each concept word. One was a 4 (Media Category) x 4 (Midline electrode position) analysis, the second was a 4 (Media Category) x 2 (Hemisphere) x 7 (Lateral electrode position) analysis, and the third was a 4 (Media Category) x 2 (Hemisphere) x 5 (Peripheral electrode position) analysis. Pairwise comparisons were also conducted for each of these three ANOVAs for each concept word. Additionally, we conducted planned comparisons of the mean amplitude for Facebook to the average of the other three conditions.

Significant main effects were found for the concept words Story and Personal. No significant effects were observed for the other four concept words. There was a significant main effect of Media Type on N400 amplitude for the concept word Story at the midline ( $p < .001$ ), lateral ( $p < .01$ ), and peripheral ( $p < .01$ ) electrode sites. Pairwise comparisons for the Story concept revealed that the Facebook condition had a significantly higher amplitude than both the Books ( $p < .01$ ) and the TV ( $p < .01$ ) conditions at midline, lateral ( $p < .05$  for Books;  $p < .01$  for TV), and peripheral ( $p < .01$  for Books and TV) sites, indicating that relative to one another Books and TV are perceived as telling a coherent story whereas the content of Facebook is not.

The effect of media type was also significant for the concept word Personal at the midline ( $p < .001$ ), lateral  $p < .05$ , and peripheral ( $p < .05$ ) electrode sites. Pairwise comparisons revealed that Facebook had a significantly higher amplitude than Books at midline ( $p < .01$ ) and peripheral ( $p < .05$ ) sites, indicating that Books were seen as being more associated with the concept of Personal when compared to Facebook. This is the exact opposite of what was found in the rating questionnaire and speeded decision responses, wherein Facebook was rated as significantly more personal than Books. This disagreement between the measures is addressed in the discussion section.

For the planned comparison between Facebook and the average of the other three types of media, the two concept words to show a significant difference were the two that also showed significant main effects, Story and Personal. For Personal, this comparison indicated that Facebook was

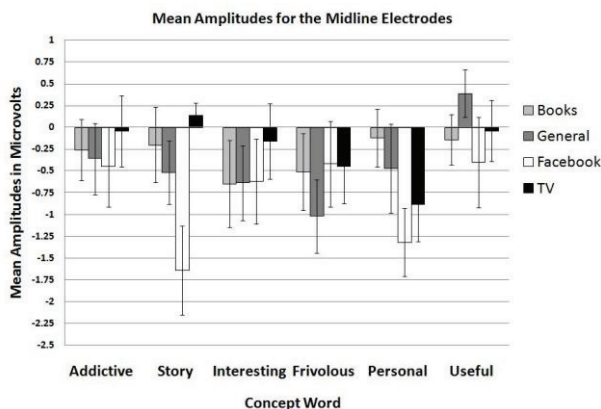


Figure 6: Mean amplitude for electrodes Fz, Cz, Pz, & Oz, which are positioned along the top of the head from front to back. More negative relative amplitude for a concept word indicates less association with a category of media items.

5 Common practice is to establish a 100-200ms time window for analyses around the expected peak of the N400. After testing several time windows, we determined that the effects were strongest here.

significantly<sup>6</sup> less associated with Personal than all of the other types of media at midline ( $p < .01$ ), lateral ( $p < .05$ ), and peripheral ( $p < .05$ ) electrode sites. Also, Facebook was less associated with Story compared to all the other types of media at midline ( $p < .001$ ), lateral ( $p = .001$ ), and peripheral ( $p < .001$ ) electrode sites. Taken together, then, the EEG measure shows that at the level of electrical activity in the brain, Facebook tells less of a story and is less personal than the other forms of media.

Finally, we note that although some of them were only statistical trends, the EEG measure did show many expected effects. For example, general information websites was the most useful and least frivolous media type (see Figure 6). In comparison to word-only ERP studies, our stimuli were “messy” and thus we may need a slightly larger than normal number of trials to achieve significance for all effects. This implies that the effects we did find, such as Facebook measuring as less personal, were fairly robust.

## Discussion

**Facebook versus Other Media** On the whole, Facebook compares quite favorably to forms of media that are considerably more established. On the forced decision task, for example, participants responded that Facebook was as interesting as the other forms of media, was more addictive than books or general web sites, and was the most personal. Facebook was also on par with general websites as being a more useful tool than books and TV. Participants also rated Facebook by far the most personal on the questionnaire and again indicated that it was very addictive. Thus, when people made both “gut reaction” judgments on the Decision Task and thoughtful, reasoned evaluations on the Rating Task, they were relatively consistent with one another and indicate a rather favorable view of social media. On our EEG measure, Facebook was on par with the other media types for four concepts: Interesting, Addictive, Useful, and Frivolous. These results bode well for social media.

Looking closer at the results, the biggest surprise was that Facebook was significantly less associated with Personal than other forms of media when measured by EEG (driven by a very large difference compared to books), while the reverse was true for the other two measures. In essence, people say Facebook is clearly the most personal form of media that we tested, but their brain activity says largely the opposite. One explanation for this discrepancy is that Facebook is personal on the surface, but not at a “deeper” level. Facebook pages are unique to each user and comprised of content from a personalized network of friends and family, so it makes sense that when simply asked people will respond that Facebook, whose mission according to its homepage is to “[help] you connect and share with the people in your life,” is in fact a very personal

type of media. However, it may lack attributes that make it personal at a more automatic level.

Finding ways for social media to attain that deeper level of personal identification may be critical to the continued success and improvement of social media. Potentially we can look to other forms of media, particularly books, which were more associated with Personal on the EEG measure, for guidance on ways to grow social media. Typically an individual’s collection of books or list of favorites is a set of items chosen by the person, so in a sense it is hand crafted and personalized. This personalization affords a degree of self-identification (e.g., “I’m a sci-fi person”). Often the process of building a social network on one’s Facebook page is not as purposeful or personal. This is especially true given friend recommendation engines and techniques for the viral growth of a network. Also, although research shows that the many online connections arise from real-world connections (Lampe et al, 2006), for users with many hundreds of “Facebook friends” it is likely that many “friends” are mere acquaintances born from brief and shallow personal connections. Enabling an option within a person’s network that allows more substantial exchanges with core friends may help in this respect. Also worth recalling is that MySpace and other social networking sites allow for considerably more customization of one’s profile page, at least in terms of look and feel, something Facebook might consider for increasing personalization.

Books are also tangible, and especially for favorite books, readers often have their own copies that can become very personal possessions. This poses an interesting question for development. Beyond mobile phone applications for social media, what might dedicated social media devices look like? How could users personalize the actual device? Commercial devices like the Chumby, which streams internet content, including social media, to a somewhat customizable alarm clock-like device, provide a starting point for thinking about dedicated hardware for social media that users can turn into intimately personal objects.

Probably the most obvious aspect lacking in social media but present in books and television (according to all three measures) is the ability to tell coherent stories. Facebook content does not tell a story, or at least does so in a much more minimal fashion than narrative-driven media like books and television. In order to increase user engagement, incorporating an element of cohesion or context into what is often a cluster of snippets of diverse information might really help people feel they are sharing “life stories” with others. For example, status posts and important events (e.g., birthdays, changes in relationship status) could be placed onto storylines that could be continued over time.

Finally, in terms of comparing the two online media tested, by the questionnaire, we see that not surprisingly Facebook is seen as more addictive, but less useful and more frivolous than informational websites. The results do shift a bit however, when moving toward the more automatic information processing measures. For instance, Facebook was relatively more useful on the decision task,

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6 Given that we didn’t have any explicit hypotheses for these tests, it is important to note that they are significant even with a Bonferroni correction.

and on the EEG measure, while general informational sites are still more useful and less frivolous, the gap with Facebook narrows even further and is no longer statistically significant.

**Different Levels of Processing** The differences observed across the three measures beg the question of which is better or more true. We stress that all three are valid, but each simply targets different aspects of human information processing. As an analogy, research on stereotyping shows preferences for similar others at automatic levels of processing, which can then be overridden at more reasoned processing levels (see Bargh and Chartrand, 1999 for an overview of the effects of automatic information processing). Importantly, both levels of processing can impact judgments. Likewise in this case, all three measures reflect different aspects of people's evaluations of media. When comparing the different measures, the patterns of responses for the rating questionnaire and the speeded decision task are similar to one another but different from the pattern of EEG responses. This suggests that there is something unique happening at the most automatic level of processing that is being measured by EEG but not by the other measures. Thus for cross-measure comparisons, we argue that the EEG measure captures important mental associations that are less studied and not accessible through more traditional research methods yet relevant for future development of social media.

**Limitations** Our study focused on Facebook as a popular representative of social media, and as noted, other social media platforms such as Twitter may yield different patterns of automatic associations. We feel that recommendations supported by our data, such as increasing storytelling aspects of social media, are likely applicable to other social media platforms, but nonetheless we are careful not to over generalize. Also, our participants were largely male, nearly 30 years old, and employees of a technology company. Although this demographic is hardly underrepresented on Facebook, data from other demographics such as teens could look very different. Exploring additional automatic associations with other social media environments, particularly with different user populations, is a terrific direction for future work.

## Conclusion

We compared Facebook, a popular instantiation of social media, with three better-established forms of media in its strength of association with design-relevant concepts, such as Addictive and Useful. We did so using three measures, each of which targeted a different level of human information processing. From the more reasoned processing measures, we saw that Facebook was judged to be addictive, interesting, useful, and highly personal. From our EEG measure, however, Facebook was surprisingly less associated with being personal than other forms of media, particularly books. Less surprising but also important was the weak association between Facebook and telling a story. These EEG findings are important because automatic

associations can significantly influence user decision making and behavior.

Our recommendations for designers of social media are to consider utilizing narrative structure to help make content more coherent and cohesive, and to make tools with more personalized interfaces (including hardware) and social interaction mechanisms that target stronger interpersonal connections. Interestingly, these qualities arguably have been present in other forms of social media. For example, blogging can have a very personal, storytelling-like journal quality, while MySpace and other networks provide more customization in profile pages. Going forward, the trick will be to maintain the success of the currently popular formats (e.g., status updates) while incorporating the best elements of other forms of social and other media.

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