

Valuably Unsought: Systems for Digital Serendipity

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Abstract

Contemporary interaction with media is mediated through a plethora of digital systems, conditioning said interaction to the experiences that these systems anticipate and limiting the potential of the medium for surprise and serendipity. Through a literature-review and system analysis, we assert the value of serendipity in our digital interactions, arguing the necessity of a distinction between Natural and Artificial Serendipity, while establishing key areas of action of serendipitous systems: Information Encountering, Experience, Collaboration, Creativity and X. We identify specific systems within each of these key areas, as well as their methods and mechanics for achieving Artificial Serendipity in the Digital Medium.

Keywords

Serendipity, Digital, Information, Experience, Collaboration, Creativity, X.

Introduction

There's an incredible opportunity to create tools that help people move beyond search and social modes of discovery and increase the chances of serendipity. Builders of these tools have a chance not just to gain great fiscal success but to make a positive impact on the world, increasing the range of perspectives and strategies we can bring to bear on complex problems. (Zuckerman, 2014)

The vertiginous adoption of new or digital media as the privileged method for virtually all of our endeavors, from the most mundane to the highly specialized, has resulted in a necessity for the tools and methods used to interact with it to be created, transformed and mutated *in medias res*.

The consequence is that we are unable to foresee the impact that new systems created can have both on our habits interacting with media as well as ourselves as the interactors. Technologies that were created in order to better serve the user and her necessity for timely discovery of relevant information are now being

questioned on their possible effect as personalised echo-chambers and *filter bubbles* (Pariser 2011).

Much effort has been dedicated in the past years, to cater to the user, through data collected of her habits and preferences, online shopping, social media *likes*, and search history. The same, however, cannot be said of an exploration of the user unknowns, of *possible* interests, yet to be discovered. To wit, the medium's capacity to provoke serendipity, be it in the tools and systems used for productivity, for discovering new information, for play or for collaboration.

On Serendipity

Historically, the definition of serendipity is a malleable one, open to interpretation. It has been so since the term was coined by Horace Walpole, in 1754, describing "a particular mix of chance and reasoning" (Merton & Barber, 2004), through examples and anecdotes that did little to strictly define it but rather left it to what Stoskopf referred to as "robust plasticity" (2005).

As it pertains to this research, we refer to Boden's definition of serendipity: "the finding of something valuable without its being specifically sought" (2004, 234).

The particularity of Boden's approach, and contrary to the common understanding of the phenomenon, is that chance and unpredictability aren't a prerequisite for serendipity, that it "need not involve any inherently improbable event" (2004, 235). While the experience of serendipity is seemingly random, unexpected or accidental, it can be the product of a knowingly approach to induce it. As Boden exemplifies: the parents of a child can leave a book open on the table that would help the child solve a particular school problem. From the child's point of view, the event is mere happenstance, a lucky, fortuitous coincidence, even if it was planned by the parents. This approach to serendipity allows, therefore, for procedural, computational and digital systems that, knowingly, attempt at provoking serendipity. With

this approach to serendipity we propose a distinction between serendipity that happens naturally, without any interference, and that which is in any way premeditated.

Natural Serendipity

Natural Serendipity is the common interpretation of serendipity: an elusive, rare phenomenon that is wholly unpredictable and unprovokable. This interpretation is akin to Boden's notion of A/E-randomness (2004, 239), insofar as to be, likewise, indeterministic and, therefore, unfit to be conscientiously explored. In fact, to do so would be negate its very *raison d'être*.¹

Artificial Serendipity

When we consider that serendipity can have some sort of deterministic nature, i.e.: there may exist a commonality of conditions that promote a serendipitous experience, we are now discussing *Artificial Serendipity*, since we are now in the camp that serendipity can be, if not created, possibly induced. It is with this approach that we encompass our research.

From the interactor's stand point, *Artificial Serendipity* can be (and often is indistinguishable from Natural Serendipity. Take, for example, the power-ups from the video-game series *Mario Kart*. These seemingly random items of varying outcome change their probability according to the relative position of the player in the race. The worst you are playing, the better the power-up will be, and vice-versa. The result is what is referred to as *rubber band effect* (a method for dynamic game difficulty balancing), where you are, quite literally in the case of *Mario Kart*, thrown into a better spot in the race. To a player that is unaware of this mechanics, this struck of luck can be considered serendipitous. As such, *Artificial Serendipity* exists from the perspective of the interactor, even if designed.

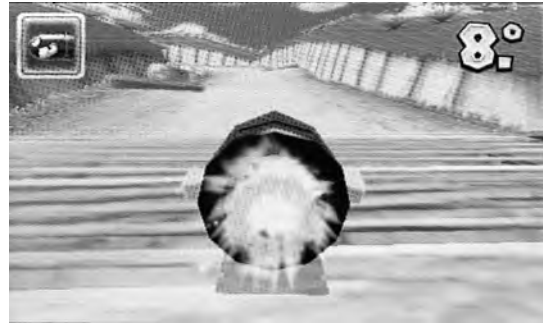


Figure 1. In *Mario Kart 7* (2011), the “Bullet Bill” power-up transforms the player into a racing bullet, propelling her across the track. The duration of this power-up is dependent on how distant the player is from first place.

Serendipitous Systems

Returning to Boden's definition of serendipity, it remains undefined what is or is not “valuable”. Naturally, this is dependent of the intentions of the subject of serendipity. We, have, however, identified a series of domains in which value can take shape: through *Information Encountering, Experience, Collaboration, Creativity* and *X*.

Information Encountering

One of the most common areas of activity of serendipitous systems is in the attempt to provide an answer to how one finds both relevant and surprising information. This necessity became that much pertinent with the commonality of the Digital Medium (Murray, 2012), and its capacity to store virtually infinite amounts of data, where methods that were applied to the physical storage of information, such as the Dewey Decimal System, for example, were now impractical.

Advances in search technology and user profiling solved the problem of information seeking: by knowing something about what we were looking for we were now able to, with a certain degree of accuracy, find what we were looking for. The question then became how do we discover about what we ourselves don't yet know.

Prior to “searching” the web, the verb most often associated with navigating from web page to web page was “surfing”. With search engines we no longer surf, we ferry across the web via algorithmically catered timelines, without much opportunity for chance or side tracks.

¹ Although if considering the universe itself as a computational system — as per the pancomputational argument — Natural Serendipity would be deterministic, if unpredictable.

The software itself that we use to access the World Wide Web is referred to as a “browser”, suggesting a notion of wandering. To browse is to be noncommittal, it is to read superficially, perhaps even randomly. This experience of casually and accidentally discovering information is what Erdelez called *Information Encountering*, a “memorable experience of an unexpected discovery of useful or interesting information” which would occur when one would be looking at a different topic or “carrying on a routine activity” (1999). Here, the unsought “something” referred by Boden is information.

Interactive systems have been created in order to provoke Information Encountering on the Digital Medium. Two of such systems, *StumbleUpon* and *Max*, have distinct approaches:

StumbleUpon’s premise is to enable its users to, as its name indicates, stumble upon interesting websites. Starting with a declaration of the user’s interests, the platform sequentially shows webpages randomly (or pseudorandomly) which it had indexed in its database and categorised according to the user’s preferences. The user can then like or dislike the particular webpage being shown, improving the algorithm. Pressing the “Stumble” button will present a new, randomly selected webpage.

StumbleUpon requires an investment from the user in order to constant improve its algorithm. Furthermore, as the algorithm increases its relevancy, the potential for unexpected webpages, outside of the user’s tastes and preferences, can become greatly diminished.

Max (Campos & Figueiredo, 2002) has no front-end graphical user interface of its own. Instead it records and analysis the user’s browsing history and sends suggestions via email of links that it believes the user will be interested in. In order to deliver not only information that it believes the user will be interested in, but also new information, *Max* also adds to its suggestions alternatives pulled from random profiles, as well as random links. *Max* was able to produce 27.7% of unknown, relevant information, 5% of it being “unknown, unexpected” pages, that sparked a new area of interest, while 6,5% of the results showed “a new and unknown connection between two current domains of interest”. This led to the authors conclusion that “programming for serendipity is possible”.

While *StumbleUpon* requires engagement and constant feedback to improve the algorithm. *Max* is passive and presents its recommendations at a later date, not forcing the user to act immediately on a suggested

webpage. In *StumbleUpon*, you are taken webpages after webpage, with minimal control. In *Max* you choose which suggestion you wish to explore.

Another approach to Information Encountering is Thudt, Hinrichs, & Carpendale (2012)’s *Bohemian Bookshelf*, recreating the feeling of wandering through a physical library or bookstore in a digital catalogue, while taking advantage of the opportunities that the Digital Medium allows, as a way to “support serendipitous discoveries through information visualisation”.

It defined six design goals for serendipity through information visualisation, which represented in the *Bohemian Bookshelf*’s graphical user interface, through five distinct representations for the digital catalogue, all accessible simultaneously (Thudt et al., 2012).

This approach can also be observed in *StackLife*, a visual navigation for The Harvard Library System.

Designed in order to “help users explore topics, find the next works they need, and help others in their own explorations”, *StackLife* (formerly *ShelfLife*) uses the visual representation of the book as a metaphor for its metadata: horizontal lines tells how old the book is, vertical lines the number of pages (this directly relates to the book’s physical form), while its color (*StackLife* uses only shades of blue) represents how popular the book is: the darker the shade the more times its metadata has been downloaded.

Selecting the book sends the user to a “Subject Stack”: a new vertical stack that group books within a genre or theme. We also get access to “Community Stacks” — stacks that are user-generated — as well as tags associated with a particular book.

While both the *Bohemian Bookshelf* and *StackLife* use the concept of thematic grouping of information, *DEVONthink* — a macOS programme by *DEVONtechnologies* — provides the same functionality for information discovery, although with a different approach to user interface. Relinquishing analogies to the physical world, the programme uses the paradigms of the OS for representing documents, be them books or other pieces of information. These documents are organised in a similar way as one organises documents in the Finder — the file manager and graphical user interface shell used on Macintosh operating systems

— through hierarchies of files, folders and tags. However, it has a unique functionality that displays related information, one that author Steven Berlin Johnson in *Where Good Ideas Come From* claims

to “foster private serendipity”² (Johnson, 2010). This functionality, called “See Also & Classify” analyses the content of an open document and searches *DEVONthink*’s database for similar documents, organised by “Score”. The metrics used for this score level aren’t clear, however it appears that it is based on common keywords between the documents.³ The stronger the score, the more common words the documents share between them.⁴

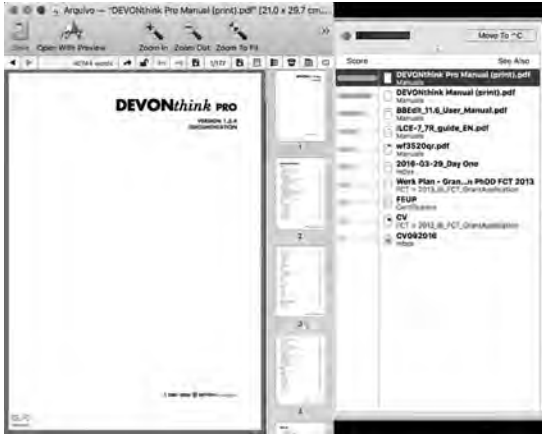


Figure 2. *DEVONthink*’s “See Also & Classify” functionality

Doodlebuzz, a project by Brendan Dawes, approaches information encountering through an interactive visualisation of the news, helping the user to “bump into connected articles and topics” and “find things you didn’t know you were looking for”. The user initiates interaction by typing a keyword, similarly to how one would in a search engine, afterwards the user is prompted to draw (or “doodle”) a line in the screen. Results related to the initial query are presented across this line, which the user can expand (by drawing a connected line) to

² Detailed information on how the author uses *DEVONthink* to cultivate serendipity can be found on his website: <http://www.stevenberlinjohnson.com/movabletype/archives/000230.html> (accessed December 1, 2016).

³ The same concept is also used in another product by DEVONtechnologies — *DEVONagent* — aimed at online searches.

⁴ The software appears to ignore synonyms and related words. Testing with two documents in the database: one with the word “dog” the other with the word “canine”, neither appeared in each other’s “See Also & Classify”.

see in detail as well as further explore in related topics. This “draw-to-explore system”, according to the author, “creates a chaotic structure that allows for a greater level of serendipity than traditional linear paradigms normally allow for” (Dawes, 2011).

Experience

While not as common as *Information Encountering* but an emergent approach to serendipity on the Digital Medium is *Experience*. This was specifically explored by Tuck Leong (Leong, Vetere, & Howard, 2008) in regards to media consumption, particularly when using the shuffle functionality on an iPod.

Leong’s argument is that the necessity of having to choose what to listen to within a large musical library can be “unpleasant and even paralysing”, particularly when the user doesn’t have a particular preference. As such, by abdicating their ability to choose what to listen to, it can lead to better user experience, an enriched listening experience and even encourage “encounters with serendipity”. Leong defines serendipity “as the meaningful experience of chance encounters”. This can be exemplified in music listening by a surprising sequence of tracks with a common theme that resonates, in some way, with the listener.

Serendipity can also be experienced as the result of good design that enables and empowers the user with the necessary knowledge to carry out a specific task, through the act of experiencing or interacting with a specific system. Take, for instance, the design of level 1-1 of *Super Mario Bros*. Here, the player learns that she has to jump over the enemies, to do otherwise would result in game over. While doing so, the player also learns that if she jumps and hits a box with a question mark, she will earn a coin. The second time she attempts to do this, a *Super Mushroom* comes out from the box instead of a coin, which could be seen as an enemy. At that point, even if the player tries to jump over the *Super Mushroom*, as she did with the enemy, she won’t be able to, resulting in getting hit by the *Mushroom*, which in fact won’t hurt the player, quite the opposite. In the words of *Super Mario Bros*. designer Shigeru Miyamoto “by being hit you become bigger and that makes you feel really happy” (Eurogamer, 2015).

Here, the player is conducted, through clever game design, to understand the difference between an *Goomba* (which hurts the player’s character) and a *Super Mushroom* (which helps the player). To the unaware

player, this could be experienced as serendipity, within Boden's definition.

Similarly, in the 2004 first-person shooter video-game *Half-Life 2*, the player learns that she is able to efficiently kill an enemy zombie with a saw-blade seemingly serendipitously. The player sees herself trapped in a room where the only visible exit is being blocked by blades stuck to the wall. As soon as the player removes one of the blades, a zombie enters into view, compelling the player to "instinctively hit the fire button and wa-pow! You chop the sucker in half!" (Brown, 2015).

Both this and *Super Mario Bros.* method is a more immersive method of teaching the user or player, preventing a break of flow which is key not only while playing but of any other activity.

Collaboration

Tee et al. explored this serendipitous collaboration with digital artefacts through screen sharing (Tee, Greenberg, & Gutwin, 2006) through the implementation of a *Community Bar* — a sidebar peripheral display which aggregates different media items: A *Presence* item that shows a live video stream of a co-worker; a *Chat* item, a multi-person public conversation; *Stickies*, which contain text postings from one individual to the group as well as *Photo* and *Web* items through which users are able to share photos or webpages

— Tee et al. attempted to increase artefact awareness, the "easy awareness of the documents, objects, and tools that other people are using." Through their initial experiences, they reported "serendipitous and opportunistic" interactions, where users would begin to collaborate together on a specific document simply by being aware of its presence, as well as engage in spontaneous conversations triggered by, i.e.: observing another's desktop background.

Similarly exploring serendipitous collaboration in the workplace, Philip Jeffrey developed *Forum Contact Space* (Jeffrey, 2000), a "networked, virtual world with three-dimensional avatar representation." With *The Forum*, Jeffrey intended to explore if chance encounters that occurred within a physical workspace could be reproduced in a virtual one. *The Forum* consisted of two different shared spaces, one for "hanging out" (*Forum Contact Space*) and one for synchronous meetings with the aid of audioconferencing technologies (*Forum Meeting Space*). Preliminary findings reported the possibility for chance encounters within the *Contact*

Space, triggering their memory or enabling them to interact with someone who they otherwise wouldn't without the *Contact Space*.

Tanaka et al. developed two systems that would facilitate serendipity applied to cultural production, through collaborative music mixing. With *CC-Remix* — a network-based collaborative music creation system — up to four users in different locations could participate in a process of music collaboration by taking excerpts from existing songs and mixing them together. With *Malleable Mobile Music*, they these concepts and apply it to a mobile environment, using wireless ad-hoc networks and incorporating "subconscious gestures made in the act of listening" such as gripping the device tighter or tapping along with the beat into the actual music creation.

Within the subject of musical creation and collaboration, Bryan-Kinns designed *Daisyphone*, a "novel environment for remote group music improvisation" with the aim to understand how could musical environments be designed to be more "engaging, social and serendipitous" (Bryan-Kinns, 2004).

Starting with the premise that music has lost a fundamental part in our daily lives, being relegated to a "highly stylised activity requiring serious practice, performance, and accuracy", *Daisyphone* is positioned to reintroduce the "everydayness" into music, through remote group music improvisation, through the use of mobile devices (such as smartphones or tablets). To this end, *Daisyphone* adopts a unique interface that distances itself from desktop graphical user interfaces, opting instead to represent music as a circle, with a play head that rotates around, playing the notes underneath it. These notes are placed and removed by the users, by clicking on the small circles. When joining a *Daisyphone* session, a player is given a unique hue that represents her. Different musical sounds can be selected, represented by different shapes, such as square, round, diamond and triangle, which users can select by clicking on the centre of the system. Pitch decreases with distance from the centre and volume is represented by saturation of color. Players are also able to easily add hand-written comments, be it notes or drawings. Through this visually rich and, possibly, "messy" interface, they hope to "encourage exploration, fun, and contextualisation" (Bryan-Kinns, 2004).

Creativity

To experience serendipity is to experience a unique form of creativity that is the result of a specific series of events, combining unexpectedness and insight. Therefore, one experience of serendipity is achieved through the creative process, when systems and methods are used as facilitators for creativity, enable the interactor to overcome creative blocks or generating solutions that would be possible otherwise.

Ancient methods of divination, such as the *I Ching* or cartomancy, while acting as triggers, are possible vehicles for serendipity. In these systems, randomness (in the form of shuffling cards in cartomancy or coin tossing in the *I Ching*) was used to combine symbolic representations of ideas which, together, would create something that could be interpreted as meaningful by the user.

This same concept, devoid of mysticism and directly aimed at the creative practice, can be found in Brian Eno and Peter Schmidt's *Oblique Strategies* (1975), where cards taken randomly offer aids that can be used to break through creative blocks. The aphorism printed on these cards are often vague and abstract and it's up to the user to interpret them in a way that can be applied to their own work.

These systems, while analogue, have a procedural nature to them, while making use of randomness as the underlying mechanic. In digital environments, randomness can be used both as a trigger for creativity and a creative process in and of itself, as in the case of generative systems. The impact of these systems and their relationship with serendipity will be the subject of future work.

X

By *X* — the mathematical variable that represents the unknown — we consider the systems that provoke serendipity through unfamiliarity and unexpectedness, confronting the interactor with something that challenges conventions and require a reframing of expectations, such as with Anthony Dunne's user *un*friendliness, a design intention that purposefully distances itself from the user-friendly norm:

In design, the main aim of interactivity has become user-friendliness. Although this ideal is accepted in the workplace as improving productivity and efficiency, its main assumption, that the way to humanize technology is to close the gap between people and machines by designing "transparent" interfaces, is problematic, particularly as this view of interactivity has spread to

less utilitarian areas of our lives (Dunne, 2005, p. 21).

Naturally, user-friendliness is a necessity, particularly in the case of user-tool interactions, however, not all interactive artefacts need to be designed in this fashion, as there are experiences to be explored by consciously and purposefully designing unfriendly interactive systems that break with common best practices.

Dunne's consequences of generalised user-friendliness are similar to what Wilson and Sicart refer to as "player narcissism", an "extreme but inevitable consequence of user-centred design practices that subordinate all design concerns to the satisfaction of an ideal player's desires and demands." (2010) They argue that there is a necessity to break conventions and to draw attention to the dialogue between player and designer, through what they refer to as "Abusive Game Design". This concept can be observed in the flash game *Unfair Mario* (2013), a re-interpretation of *Super Mario World* (1990).

In *Unfair Mario*, the familiar mechanics of the Nintendo series are distorted, inconsistently and unpredictably, throughout the game to the extent that the player is led to distrust any possible outcome. Within the very first moments of the game, the player jumps over a gap, just to have the landing spot collapse resulting in the character's death. This unpredictable behaviour is avowed by the designer through the encrypt message "NOT EVERYTHING IS WHAT IS [sic] SEEMS...", appearing shortly after the start of the game. This warning, as well as the initial hidden traps in apparently safe areas of the game, rapidly condition the player to mistrust everything that follows, such as a message urging the player to pass under a series of blocks which, unsurprisingly, reveal a hidden trap. In order to avoid dying, the player needs to ignore the message passing over the blocks. However, when attempting to do the same with the blocks immediately after, she is surprised to learn that this will result on her death, having, this time, to pass under in order to be able to continue. This happens throughout the game. More so, the game defies good game design practices, particularly in collision detection. A player can be killed by a deadly spike without these clearly and visibly touching the character.



Figure 3. *Unfair Mario*'s attempts at misleading the player

Players of *Unfair Mario* struggle with unpredictability of the game, experiencing moments of joy, of delight, of incredulity that they were able to (eventually) overcome the game. This is a type of agency that results not from a well-designed interaction but from the successful struggle with a frustrating one. It is the end-result of exploring a *defamiliarised* design.

To Shklovsky, *defamiliarisation* was a valuable technique applied by Art as a means to make objects “unfamiliar”, increasing the difficulty and, therefore, length of contemplation and perception of the artistic object, “because the process of perception is an aesthetic end in itself and must be prolonged” (1917).

Through challenging conventions of user-friendly and user-centred design in interactive digital systems, we make them unfamiliar, promoting reflection by the interactor on the experience itself. We are able to see and experience these interactions anew, and reflect on their outcomes, encouraging creative and unexpected, serendipitous, experiences.

The concept of *defamiliarisation* was explored by Helmes et al., with the intent of grabbing the user’s attention and projecting digital abstracts into a physical world, by creating two ambient devices that explored both the potential of *defamiliarisation* in our personal media collections, as well as randomness (specifically choice abdication). These two devices — *Meerkat* and *Tuba* — engaged the user in two distinct fashions and offered distinct methods of interacting with personal media in order to “enable serendipitous presentation of digital content from people’s personal media collections”.

With *Meerkat*, Helmes et al. attempted to grab the

user attention by “pushing content towards the user”. To achieve this, *Meerkat* had the ability to “pop-up” at random moments, while showing a random combination of photos. Featuring an embedded IR sensor, *Meerkat* could sense presence, triggering its action. Furthermore, *Meerkat* was designed as to increase the frequency it activates if it is ignored, while decreasing it if it’s regularly activated, as a means to play with the levels of engagement.

Tuba, on the other hand, requires a deliberate act by the user. The display sits face down, requiring the user to pick it up and turn it. Doing so, would trigger a random presentation from the user’s personal media collection: an image, music, random trivial or a Facebook post.

Helmes et al. reported that the deployment of these devices on user’s familiar contexts, as potential serendipitous devices, created certain expectations that couldn’t be kept by the devices and would even decrease the potential for serendipitous interactions.

Still, the random and unexpected behaviour of these devices created a level of engagement between the users, their personal media and the devices themselves.

Conclusion and Future Work

Having acknowledge a necessity for serendipity in digital interactions, we propose the concept of *Artificial Serendipity*, in contrast to *Natural Serendipity*, as a knowingly, intentional process that can be considered in the development of digital interactive systems.

We have, as well, identified five key areas of action for serendipitous systems: in *Information Encountering*, *Experience*, *Collaboration*, *Creativity* and *X*, as well as observed the individual methods used by these systems towards serendipitous experiences.

We will continue our analysis of these areas and identify the underlining mechanics that are used by the serendipitous systems, in order to provide designers a framework for the creation of artificial serendipity within interactive, computational and digital systems that will allow for a broader range of experiences within the digital medium.

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