# The Chance of Serendipity

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**Abstract.** Serendipity is often defined as fortuitous, accidental, a chance encounter, an unexpected event or a stroke of luck mixed with insight. This suggests that serendipity is, to a great extent, improbable and that, while one can plan or even design for serendipity, serendipity can be considered, as a whole, an indeterministic event. This research (part of an ongoing work on the design of serendipity in the digital medium) argues that serendipity can, in fact, be planned and even expected from the point of view of the designer, while remaining apparently unpredictable from the point of view of the serendipist. With that in consideration, we propose a distinction between Natural and Artificial Serendipity.
While both deterministic, the former is absolutely unpredictable while the latter is relatively unpredictable. We finalise by identifying relevant frameworks that have tackled the issue of designing for serendipity, as a starting point to our own work: the development of a framework for designing serendipity in the digital medium.

## 1 INTRODUCTION

Serendipity was born from Horace Walpole's combination of accident and sagacity [9], of the interplay between a seemingly chance event and the capacity and availability of an observer to derive meaning from that event. While throughout the understanding, definitions, and interpretations of the idea of serendipity have attributed different weights in the balance of this interplay, the core concept remains.

The experience of serendipity starts, in effect, with a trigger, a change in the world that grabs the attention of an observer.

But while this trigger appears random, does it mean that serendipity is absolutely indeterminable? Do these triggers need to be the result of chaos and chance alone, or are we able to plan for serendipity?

Both Merton and Boden suggest the notion that serendipity need not be the result of pure chance, as the key element to it is that serendipity is "unanticipated" [9] or, in the words of Boden: "Although serendipity is sometimes due to coincidence, they are not the same thing. For serendipity need not involve any inherently improbable event" [3].

Boden dissociates serendipity from coincidence, alluding to the idea that the former can be, in some fashion, determined, by not being, necessarily, an "improbable event". The events that lead to serendipity may be constructed and provoked, as what it is required is that the experience of it be unexpected and unanticipated. If the experience is read by who is experiencing it as random or accidental, even if it is not, it still remains serendipity.

This was illustrated by giving as example the parents of a child leaving a book open on the table that would help the child solve a particular school problem. The child would find the book that would nudge her towards the answer, seemingly serendipitously, towards the required answer.

From the child's point of view, the event is mere happenstance, a lucky, fortuitous coincidence, even if it was planned by the parents. While serendipity is not guaranteed—the child may not notice the book or ignore it, failing to make the necessary mental connections or not being in a stake of *prepared mind*—the potential for serendipity remains.

With this in mind, we are able to argue that there is an opportunity for planned serendipity. This, however, begets a distinction between what we are referring to as Natural and Artificial serendipity.

## 2 NATURAL AND ARTIFICIAL SERENDIPITY

Considering that the distinguishable factor of serendipity is not its *accidentality*, but its unpredictability,[3] from the standpoint of the serendipist, Natural Serendipity—meaning the serendipity that occurs naturally in the world—is absolutely unpredictable, as the number of factors and variables that create it are impossible (at least for now), to calculate.

This, however, does not mean that it is indeterminable. One can argue—and the pancomputational concept does—that the universe itself can be considered a computational system and as such it is, by definition, deterministic [10]. What distinguishes physical from artificial computation is not their deterministic or nondeterministic nature, but the complexity of the computation itself, as the natural world implies an unforeseeable number of variables that prevent the states of computation from being wholly replicable, making them unpredictable [5].

As such, we can consider natural serendipity—as a phenomenon experienced by humans—as deterministic, if unpredictable in practice, as we are unable to foresee the results. However, when considering serendipity as the result of artificial interactions—meaning those that were the product of human design—the conditions that lead to serendipity can be, to some extent, reproducible and, as such, are capable of being designed as well.

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[3] Throughout the literature, serendipity has been described as unforeseen, unexpected [7], unplanned [2] and so on. While apparently attempting to represent the same core concept, the term selected to define serendipity has an implicit connotation, as argued by Björneborn on the differences between saying unexpected versus unplanned: "Saying 'unexpected' or 'unplanned' when defining serendipity makes a difference, as unexpected events always are unplanned, but unplanned events are not always unexpected given the situation" [2].
We, therefore, choose unpredictable, as it accommodates all natural serendipity, as well as all artificial serendipity from the serendipist standpoint. As argued by Boden "both serendipity and coincidence […] are in practice unpredictable." [3]

Artificial serendipity is one where an agent (natural or artificial) is able to create the necessary conditions for serendipity to occur. This agent (or designer, if you will) can create experiences that *feel* serendipitous, even if they are the result of careful planning. In the words of Björneborn: "serendipity may thus be intended by designers, but must always be unplanned by users." [2]

To be recognised as serendipity, the process needs to be experienced by a secondary agent: human or computer, that is blind to the process. This blindness creates the necessary experience here defined as serendipity.

Artificial serendipity is therefore relatively unpredictable, as it is experienced as unpredictable from the one experiencing it. This is already common practice in video game design, as, through planned and considered design, user observation and testing, the player can naturally and gradually discover how to play the game, and be empowered to do so, without knowing that she's being taught how.

| Natural Serendipity | Artificial Serendipity |
|---|---|
| Absolutely unpredictable | Relatively unpredictable |
| Unforeseeable | Foreseeable |
| Extemporaneous | Designed |

**Table 1**: Distinctions between Natural and Artificial serendipity.

While the experience of serendipity isn't guaranteed (just as a game designer cannot guarantee that the player truly learns gameplay mechanics) systems can be designed in order make serendipity emergent.

This is the case with the parents in Boden's example: acting as agents, they could predict that the child would experience a moment of serendipity, while the child could not. While serendipity was never guaranteed for the reasons discussed previously, meaning that, at this moment, we maybe be unable to design serendipity, we are able to design *for* serendipity [4].

## 3 DESIGNING FOR SERENDIPITY

Serendipity's apparently fickle nature notwithstanding, we have identified a number of attempts for the design of framework and models that aim towards provoking it in both the digital and the analogue mediums. These previous attempts have informed our own.

During the course of this research we identified some of these attempts that may be pertinent to our work. Of these, we believe that MacCay-Peet and Tom's factors for serendipity within digital environments, and Björneborn three key-affordances for serendipity are the most relevant,[4] and we've used it as a starting point for our own approach to designing for serendipity.

Starting with an earlier work by Björneborn where he identified 10 factors for serendipity in public libraries, MacCay-Peet and Toms conducted an empirical study that aimed at exploring the application of Björneborn's factors to digital environments [8]. In their analysis they propose that, and in the context of digital environments, they observed relevancy in five factors from the original ten: *enabled connections*, *encountered unexpected*, *presented variety*, *triggered divergence*, and *induced curiosity*. These factors established the core concepts that led to the identified heuristics in our framework for serendipity (while most are found throughout all six heuristics, some are more closely related than others).

By *enabled connections*, MacCay-Peet and Toms refer to the events in which the information system would encourage the finding of "an unexpected piece of information" that would encourage connections or bisociations [6] with underlying questions or problems.

Through *encountered unexpected,* a system would permit *rich diversity* and *cross contacts* dimensions [1], encouraging findings outside those anticipated by the user, of "unexpected topics or content" that the user wouldn't, otherwise, encounter.

*Presented variety* relates to systems allowing for a diversity of divergent information and content that would enable "interesting juxtapositions [that] may not only support serendipity, but potentially prime for it", while facilitating "varied or diverse behaviours such as exploration and browsing" [8].

*Triggered divergence* describes the situations where a system "in some way sparked or triggered their attention and initiated divergent thinking and behaviour", based on Björneborn's dimensions of *striking contrasts* and *pointers* [1].

The final factor, *induced curiosity*, relates "to the inducement of deeper exploration or consideration of information encountered and curiosity-teasing triggers" [8]. In this factor, MacCay-Peet and Toms highlight the role the human factors play in the experience, such as "be curious about what is being displayed and become actively engaged" and not being a "passive observer" [8]. These human factors will be further explored on our own framework in Part II.

Building upon his original 10 factors and MacCay-Peet and Tom's empirical study, Björneborn [2] proposes three key affordances for serendipity, consisting of *diversifiability:* the capacity of an environment to allow a diversity of contents and easily permit the exchange and combination of content; *traversability:* the capacity of a particular environment to be easily traversed, allowing for exploration; and lastly *sensoriability:* the quality of an object or environment of being perceived by the senses, and the richness of stimuli that are able to be sensed. These three factors cover a series of sub-affordances, dealing with different aspects of implementations of each affordance [2].

Taking into consideration these approaches for designing systems that promote and afford serendipity, and considering the context of interaction design and the digital medium, we are now able to consider the different factors, methods, and mechanics that allows for the design of interactive systems towards serendipity.

As such, we propose a framework for serendipity, which consists of three vectors that, through its interplay, approach the different components of the design of serendipitous systems, namely: *Human Activities*, which define the overall objective of a particular system, *Human Factors*, which describe and identify both the intrinsic human qualities and factors that influence the

[4] Björneborn's study was published nearing the end of our own research. However, we found that there was a great degree of confluence between our developed framework and Björneborn's findings. As such, we considered pertinent to articulate, when relevant, his findings into our work developed framework.

possibility of serendipity, as well as the possible preoccupations, engagements, and dynamics of the interaction with the systems, and lastly the *Heuristics*, which are rules of thumb that describe the possible implementations of distinct methods and design patterns that enable and encourage serendipity in user interaction.

Due to paper length constrains, we shall summarise our proposed framework. Likewise this is underdevelopment and in flux, as such the distinct elements that constitute this framework may be subject to change according to future work

# 4 A FRAMEWORK FOR SERENDIPITY

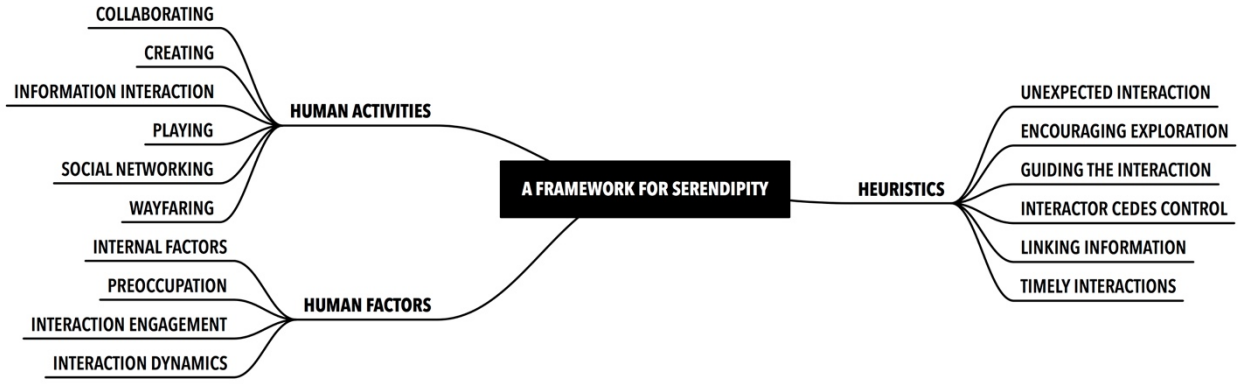


**Figure 1:** Framework for Serendipity: *Human Factors*, *Human Activities*, and *Heuristics*.

Through our proposed framework we are able to provide a basis of analysis of existing systems, as well as enable the design of future ones. When developing for serendipity, designers are able to identify the system's intended activity, which informs the human factors to be encouraged, and what heuristics best to support that activity.

## 4.1 Human Factors

These human factors here represent different mental models, expectations, modes of thought and modes of acting of the interactor that will influence the interaction with a system. In order for a system to provide a serendipitous experience, it needs to accommodate and design towards accentuating the *internal factors* (such as encouraging curiosity in the interactor), identify the relevant *preoccupation* (will the system be utilised with a foreground or a background question), consider the specific *engagement* level (will the system or the interactor that initiates interaction), and encourage the specific *dynamics* within its interface design.

Furthermore, when designing a serendipitous system, should be articulated with the particular human activities that the interactor is engaged with.

While the factors were described separately, they are not, for the most part mutually exclusive. In fact, a particular serendipitous system can be designed in order to take advantage of a number of these factors.

## 4.2 Human Activities

In these activities we have identified the potential for serendipitous experiences, examples of how they are able to encourage serendipity, as well as some potential shortcomings, namely how we encounter information in the digital medium, to how we leverage serendipity in the creation and consumption of artefacts, to how we collaborate and interact, how we travel and play.

The defining factor for the Human Activities of this framework is that they reflect the different *verbs* that are possible in the medium (or which the medium *affords*) while encouraging serendipitous experiences.

While we have mapped the current state of the art in regard to serendipitous experiences, this remains a snapshot of the medium's potential, and as the medium—and the activities it affords—mutates, so does the possible experiences that be had on it. We will continue to identify and map different activities that relate to the serendipitous experience here examined.

## 4.3 Heuristics

These heuristics describe rules of thumb that enable the design of serendipitous systems, described by their distinct mechanics, methods of implementations, or design patterns.

We have identified seven distinct heuristics, namely: 1) *Unexpected Interaction*, where through techniques such as speculative design, defamiliarisation, errors, glitches and interference, designers are able to provoke surprise in an interaction. 2) *Encouraging Exploration* in which a particular system encourage the exploration of an interface by the interactor, which increases the serendipitous potential of a system. 3) *Guiding the Interaction*, where the system plans occurrences that can be perceived as serendipitous by the serendipist, through recommendations, personalisation of an interaction, or through planned events that appear the result of change or the sagacity of the interactor but were, nonetheless, the result of careful design. 4) *Interactor Cedes Control* is an heuristic in which the serendipist is who plans and/or designs the system that leads to the experience of serendipity through releasing control from the interaction, be it through randomisation of information, through automatization or rules-based systems, or through relinquishing control to other

interactors. 5) *Linking Information* describes the different methods of connecting information in an interactive system in order to promote serendipitous discoveries. Lastly, final heuristic 6) *Timely Interactions* the methods in which interactive systems are able to alert the interactor to a particular event at a particular time, provoking the feeling of "the right thing at the right time", often associated with serendipity.

## CONCLUSION

This work begins by challenging the assumption that serendipity is unexpected and, mostly, a product of chance and accident and, therefore, cannot be determined. Considering Boden's differentiation between serendipity and coincidence, we argue a deterministic approach to serendipity, one absolutely-unpredictable in the case of Natural Serendipity and relatively-unpredictable in the case of Artificial Serendipity. As part of our ongoing work in the creation of an interaction design framework for serendipity in the digital medium, we identify grounding work that is relevant for Artificial Serendipity and enables the design for serendipity and informs our own framework for serendipity in the digital medium.

Future work will consist of correlating the frameworks identified with the state of the art of interactive systems that permit serendipitous discoveries on the digital medium and the further development of our own framework.

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