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## Serendipity



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### Abstract

Serendipity is a fortuitous accident; the exploitation of luck by a prepared mind. It is a framework for understanding how luck becomes actualized through human activity. It is widely studied across domains as varied as philosophy, information studies, and innovation research and is most often cast as having a role in the uncovering or generation of new ideas by provoking insight through unintended and unplanned bisociation. Serendipity has been credited as a key component of various inventions, creative inspiration, or unlikely yet fortunate happenings with varying degrees of engagement with its relational ontology. It is thus an integral part of any understanding of the possible because it provides a bridge from the possible to the actual. This entry will define the key types of serendipity and the models which can be used to understand it before examining the evidence suggesting there are differences in personality and environments that may be more facilitative of serendipitous occurrences.

### Keywords

Serendipity · Accident · Luck · Problem-solving

When we consider the possible (i.e., what could be and what could have been), it is rare that we do so without invoking luck. In lay terms, luck is often the magic ingredient that bridges the possible and the actual: the element beyond human control that allows the potential possibles to become concrete actuals. This applies when we consider possible pasts as well as possible futures. We wish people luck when they set off to pursue an unknown possible, and we will often assign luck a significant role in shaping the present from the many possible paths that could have been taken. Any model of our understanding of uncertainty and possibility would be poorer without a consideration of the role of luck. However, luck is by its nature arbitrary and unreliable; it resists theorizing or empirical investigations (de Rond 2014). Moreover, it is inert until it is enacted. Perhaps a better conception of the role of chance relies on both contingent luck and personal attributes (e.g., Austin 1979). It is here that the framework of serendipity is useful to understand this emergent interaction. Serendipity is closely related to luck and in the popular lay understanding is used synonymously with no more than good fortune, but a more precise definition is a mixture

of both “accident” and “sagacity”. This addresses the arbitrary element of luck. Rather than being simply random happenstance, serendipity becomes a form of transactional luck; a relational phenomenon emerging from a person, a time, and a place.

## Definition

The word serendipity was coined by Horace Walpole in his report of the story *The Three Princes of Serendip* where the princes made “discoveries by accident and sagacity.”<sup>1</sup> It has fallen in and out of fashion since 1754 but in 2000 was voted the UK’s favorite word (Ezard 2000). While Walpole coined the word, he obviously did not invent the concept. Furthermore, a pure definition is still elusive, and the boundaries of serendipity are somewhat elastic. This is exacerbated by the story of the three princes that Walpole used to illustrate the new word. This story arguably does not actually reflect his own definition, that is, “making discoveries, by accident and sagacity, of things which they were not in quest of” (cited in Merton and Barber 2004, p. 2), rather the princes’ discoveries could be more clearly put down to a form of intelligent abductive reasoning. Merton and Barber (2004) suggest this word has subsequently functioned as a cipher, allowing writers the opportunity to rewrite definitions to reflect their own preconceptions. However, despite the lack of clarity, the various definitions found in the literature converge on a fundamentally relational concept. There are normally three integral facets: environmental, personal, and temporal. Serendipity involves the right person in the right place and, crucially, is conceived of as a process operating on different timescales rather than a single occurrence. Finally, serendipity is only serendipity if it is recognized as such (Copeland 2017; de Rond 2014; McCay-Peet et al. 2015).

Indeed, from its inception serendipity has been seen as this combination of luck and personal properties. From Walpole to Louis Pasteur’s “le hazard ne favorise que les esprits préparés” (cited in Van Andel 1994, p. 163), writers on serendipity emphasize its dual nature with varying degrees of poeticism. Shulman (2004, p. xiv) suggests it is “a process hovering ambiguously between the [...] incisive mind and the wheel of fortune,” and Copeland (2017, p. 1) describes it as being “at the intersection of chance and wisdom”. In all definitions, the serendipitous process emerges from an interplay of external and internal factors, and, crucially, both are necessary. Material and social worlds are dynamically entwined and produce a rich array of possible perceptions and action affordances. The fortuitous and felicitous qualities of some of these possibilities are the main study of serendipity.

It is this relational nature that differentiates it from random chance and mere accident (Foster and Ellis 2014). de Rond writes to “equate serendipity to chance is to unravel but part of a far more promising plot” (de Rond 2014, p. 342). Schulmann exemplifies its relational and temporal nature in his introduction to Merton and Barber (2004) with the tale of Robert Barber being drawn to the word serendipity while reading the dictionary looking for another word. This tale is only complete when we realize that he came across the word several months previously and yet did not pick up on its properties. It was only when Barber was attuned to the concept and open to exploring its implications that it became important to him. A prepared mind is not constant, rather it is temporally contingent. Luck is useless without the right person (or organization) at the right time to capitalize on it (Cunha et al. 2015). A person cannot create serendipity on her own and neither can an environment, however full of potential it may be. Serendipity, then, is contingent on the interaction between the environment and the person and thus requires a truly systemic way of regarding human behavior.

<sup>1</sup>For a summary of the most cited story from *The Three Princes of Serendip*, see Van Andel (1994, p. 632).

## Types of Serendipity

While it has been widely acknowledged in passing, serendipity has yet to be the focus of a mature and systematic research program which characterizes other fundamental concepts such as creativity. While there has been a steady increase in research over recent years, there is a somewhat disjointed theorizing about serendipity; there are almost as many types of serendipity as models describing them (Van Andel describes 17 serendipity patterns drawn from his extensive collection), and serendipity as represented in the research literature is heterogeneous and fluid. This is in part an inherent characteristic of the concept: it arises from an unplanned interaction between person and environment and will, therefore, be inconsistent and complex. It seems unlikely that a phenomenon which is more often used as a dumping ground for uncertainties and which is inherently unpredictable would yield a clear definition.

However, there is a general consensus converging on four basic types of this multifaceted phenomenon. They have most recently been categorized by Yaqub (2018) using the names of prominent serendipity theorists in relation to scientific discoveries, and the categories he proposes broadly reflect those addressed by other writers such as de Rond (2014). These four types vary along the dimensions of the purpose of search undertaken and the nature of the eventual solution: A search can either be planned or unplanned and can yield the solution to the existing problem or a novel one.

First is pure Walpolian serendipity, in which investigators searching in one problem space make a discovery in a different problem space. Yaqub gives the example of the discovery that *sildenafil citrate*, which was being trialled as a cure for angina, also worked as a cure for erectile dysfunction. Second, a targeted search which finds the solution in the same problem space but through an unexpected route. This is described by Yaqub as Mertonian serendipity. de Rond exemplifies this sort of serendipity by the steps that led Watson and Crick to identify the double helix. External triggers (both people and things) enabled

them to solve the original problem but in a serendipitous manner. This type of serendipity is sometimes referred to as pseudoserendipity (Roberts 1989) to distinguish it from pure unsought findings. However, it has been recently argued that if we shift the focus from the problem solution to the problem as being the method of solving the original problem, then this distinction between pure and pseudoserendipity is less clear (Arfini et al. 2018).

Third is finding the solution of a pre-existing problem when there is no particular aim to solve any one problem (Bushian serendipity). Yaqub gives the example of Wells who noticed a man who had injured his leg while under the influence of laughing gas and who felt no pain, an observation which triggered the use of laughing gas as an anesthetic. Finally, an untargeted research program may lead to an accidental discovery which only becomes realized in the future. In this case, neither the problem nor the solution exists at the moment of discovery. This is Yaqub's Stephanian serendipity, and he illustrates this with the example of Benedictus who discovered that a chemical mix resulted in a thin layer over the glass in a flask stopping it from shattering. This accidental discovery later became the basis for safety glass.

Of course, actual examples of discovery and innovation are rarely able to be neatly parcelled, and the boundaries between these categories are fluid. What is important to note is the unexpectedness of the discovery across all four categories. Whether the actual discovery or the method used to reach that discovery, serendipity involves unanticipated and unplanned actions. As Copeland (2017) argues, it is impossible to announce in advance that there is going to be a serendipitous moment; by its very nature, serendipity is unplanned and unexpected. It is also iterative: recognition of serendipity leads to changed behavior which consolidates the serendipity (McCay-Peet and Toms 2015). This unexpected nature points to an uncovering through chance of other, unconsidered possibilities.

Serendipity taxonomies classify serendipity not solely in terms of the event trigger, but in relation to the preceding events and the activities of the person. Serendipity is thus temporally

relational – it is contingent on past and future categorization and varies according to these. The same event, if it solves a problem already posed, is considered to be a different sort of serendipity than when it suggests a solution to a non-posed problem. In other words, the same event would be categorized differently depending on the program of problem-solving that had led up to it and is therefore also contingent on human interpretation. The instability of serendipity as a concept is a reflection of two things: its enmeshed and entangled nature and the methodology which means it is only seen retrospectively.

### Serendipity as a Process

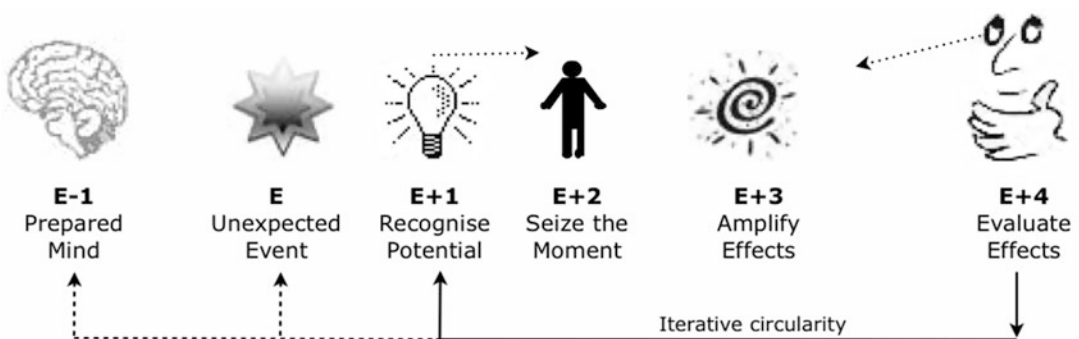
Van Andel (1994) emphasizes this temporal nature of serendipity suggesting that Columbus's discovery of the New World was only considered serendipitous when it was realized that he had not landed in India. This illustrates an additional complexity from which serendipity suffers: It needs to be recognized as serendipitous to “count” even when exactly the same actions and discoveries might not be considered serendipitous by another. This recognition has to come after the event because it is impossible for it to come prior to it. Indeed, it may also change depending on the vantage point in the post event timeline. In this way, it suffers from some of the complexities inherent to creativity where linking creativity with social value accords it an unstable ontology (e.g., Weisberg 2010). It is, therefore, not clear

whether serendipity can exist outside of people's understanding of it. And it is, therefore, doubly dependent on people – both at time of the event and in making sense of the event afterward.

Lawley and Tompkins' (2008) model (Fig. 1) focuses on this temporal aspect of serendipity and explicitly refers to a serendipitous process rather than a single moment. They make a distinction between synchronicity, where two events happen simultaneously, and serendipity, which may arise from synchronicity or from ordinary events. Within their model all six stages have to occur for an event to be considered serendipitous, and serendipity therefore only occurs post hoc, in the state when it is evaluated by the person experiencing serendipity.

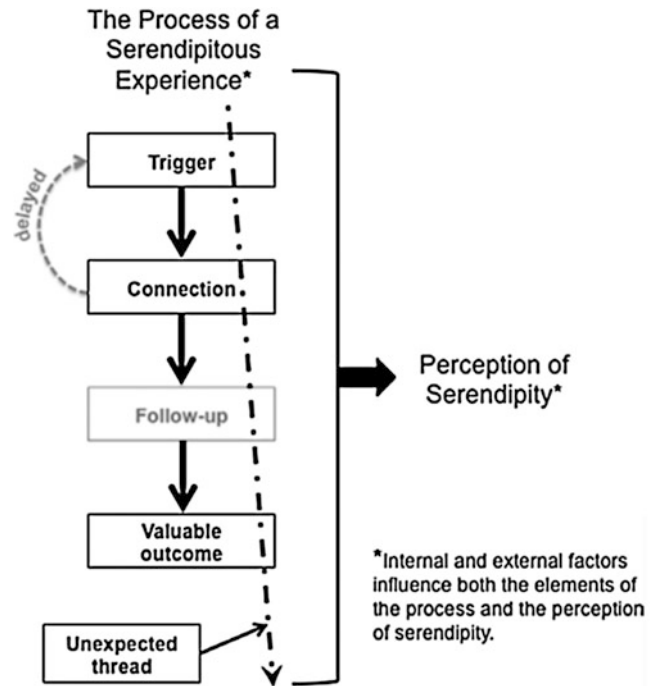
As is clear here, the model refers to a process that wraps around an event. Most of the model is concerned with what happens after the event, and thus the focus is on the role of the person in creating serendipity. The model starts with a “prepared mind” (E-1). Then the event (E) occurs. For E to be considered serendipitous, it must also be recognized as potentially useful, exploited, and then evaluated. However, as Makri and Blandford (2012a) argue, while the focus on the process in this model is important, the actual character of that “unplanned and unexpected event” is left rather unclear. As is common in earlier explorations of serendipity, the focus here is on the person in the model rather than the event itself.

McCay-Peet and Toms' (2015) process model (Fig. 2) has more room for the environment as a trigger for serendipity as part of an overall



**Serendipity, Fig. 1** “Stages of serendipity” taken from Lawley and Tompkins (2008). (Permission granted by the authors)

**Serendipity, Fig. 2** “The process of a serendipitous experience” taken from McCay-Peet and Toms (2015). (Permission granted by the authors)



process. Their model posits an instant phenomenological aspect of serendipity (which parallels the more widely investigated “aha” experience in insight problem-solving, see Danek et al. 2014). However, within an organization for a moment to be serendipitous, it must often be followed up and worked on with varying levels of granularity. This capturing of the moment of serendipity and cementing it is often absent from other models. It is only then that serendipity occurs: both the practical outcome and the feeling that accompanies it are required. Indeed, this model emphasizes the perception of serendipity. It is not enough for all the aspects to come together; there has to be a “feeling” of serendipity to accompany it for the process to be cast as serendipitous.

So we see that serendipity is theorized as emerging from an interaction between a person or people and the environment in which they are located and situated in a timescale. Again, in this model, serendipity only happens when it is recognized as such by the people making the discovery. Without this awareness of serendipity, an event is not categorized as such.

For an event to be serendipitous, the past is important because of both the nature of the narrative framing and the way the mind of the person experiencing serendipity has been “prepared” (Yaqub 2018). Furthermore, because serendipity is often characterized in hindsight, as the end point of a process, the evaluation of the product in that moment is also important. Finally, the future is also key to the recognition of a moment as serendipitous – the evaluation of the happy accident necessarily requires a projection into the future (Copeland 2017).

Just as serendipity is integral to an understanding of what is possible, so the possible is integral to understanding serendipity. The fortuitous aspect of the phenomenon means that it is only serendipitous in relation to the other possibles. The human judgement of the moment can only happen against a backdrop of awareness of other possible outcomes. Serendipity becomes a way of characterizing the path taken which allows for unplanned and unexpected events to play a role in both the possible and the actual.

## Individual Differences

Despite evidence that there is a weak link between individual differences and serendipity (McCay-Peet et al. 2015), as discussed above, the majority of serendipity research considers people's role at the center of serendipitous encounters. This is not unreasonable: it is the addition of sagacity which raises serendipity from accident or random chance and, traditionally, this has been the focus of much theorizing. For many writers it is these internal characteristics that provide the element of control of serendipity (Foster and Ford 2003), and, in wider folk psychology, there are personal characteristics that have commonly been associated with "making your own luck." Indeed, de Rond (2014) suggests that the only proper analysis of serendipity is the focus on human agency. He suggests that we should conceive of it as a capability, that of being able to match two disparate events.

Makri and Blandford's (2012a) model, drawn from several interviews with academic researchers, leans heavily on how a person responds to "bisociation" – that is, a new mental connection – which, in their model, can come from the environment or also from a memory. Thus, for Makri and Blandford, serendipity can arise completely internally, and there is a new focus on internal processes. This is also similar to the second half of McClay-Peet and Toms' model which refers to the process of creating a link between the trigger and either (a) a previously conceived problem or (b) a new, unthought of idea which occurs internally. However, this may not only be difficult to identify but also widens the definition beyond the core relational aspect which has defined it thus far.

There have been many attempts to define the internal characteristics that make someone more likely to take advantage of a serendipitous moment. Race and Makri (2016) identify four traits: being curious, observant, alert, and assiduous. Rubin et al. (2011) describe two personality traits emphasized in the literature that allow someone to experience more serendipity: noticing and preparedness. All these characteristics describe a person who is highly attuned to the surrounding environment centering that relationship. Indeed,

Rubin et al. suggest that the noticing aspect of the person is equally shared with the environment which will highlight things that should be noticed so it becomes impossible to unpick which is most salient. This bidirectionality is also stressed by Björneborn (2017), who discusses three key serendipity personal factors (curiosity, mobility, and sensitivity), but, crucially, these are contingent on and inseparable from the external serendipity factors. This reflects the relational and contingent nature of the phenomenon. There is a tendency in psychological research to focus on human factors, but, in serendipity research, it is impossible to separate these from the environmental factors – not only are both of them necessary, but they often interact.

## Environmental Factors

Beyond the individual differences that may dictate whether or not a person takes advantage of serendipity, researchers are becoming increasingly interested in the environments which facilitate serendipity. In the information retrieval literature, serendipity is seen as a by-product of browsing, and the direct nature of internet searching reduces the likelihood of coming across something unplanned (Foster and Ford 2003). Especially in the fields of information encountering, much of the current interest in serendipity stems from a concern that the increasing digitization of information will reduce flexibility and with this the chances for serendipity. However, this is also an area under much debate with others claiming that the open environment of the internet facilitates accidental discovery by allowing more and a wider range of connections (see Race and Makri 2016 for a summary of the debate occasioned by Gup's 1997 essay "The End of Serendipity").

In a complementary paper to their model cited above, McCay-Peet et al. (2015) go into more detail about the aspects of the environments necessary for serendipity. They are particularly interested in the types of trigger in an environment which can precipitate serendipity in information acquisition. Three forms of trigger were extracted from interviews with researchers: (a) verbal, (b)

textual, and (c) visual. The verbal trigger was the most often described, which reminds us that external triggers can be people as well as things – indeed, the authors found the social aspect of serendipity to be readily apparent. The trigger does not need to be immediate (although it can be), and there can often be an incubation delay. The facilitating factors they identify, those within the external environment, all relate to this first stage: an environment must be trigger-rich, highlight the triggers, facilitate recording of the triggers, and encourage the making of connections.

Perhaps the closest examination of serendipitous environments comes from Björneborn (2017, p. 3) who sees serendipity as an affordance or “usage potential.” He identifies three key affordances for serendipity that encompass ten sub-affordances. Although he also identifies personal factors, he is unusual in skimming over these and devoting the majority of his framework to the affordances of diversifiability, traversability, and sensoriability. These all refer to the possibilities engendered by an environment.

Diversifiability refers to the diversity of content in an environment and covers the sub-affordances of diversity, cross-contacts, and incompleteness. An environment high in diversifiability facilitates serendipity because it allows for more accidental bisociations and juxtapositions. The clustering of possibilities in an environment increases the likelihood of one of those possibilities being actualized. Traversability refers to the potential affordances to move and access the diverse content. This covers the four sub-affordances of accessibility, multi-reachability, explorability, and slowness. These are four ways of making use of the topology of a given environment. This emphasizes the relational nature of serendipity: An affordance is only an affordance when it is used. Finally, sensoriability describes the way an environment appeals to all the senses and deals with how the environment can make different resources stand out for different senses. It covers the three sub-affordances of exposure, contrasts, and pointers.

A detailed examination of the environments that facilitate serendipity is possible alongside an understanding that, while personal characteristics

and environmental characteristics may be necessary for serendipity, they are often not sufficient. These serendipitous environments can arise naturally or can be reinforced deliberately by design. Although there appears to be a paradox in planning for serendipity because serendipity arises from the unplanned, environments can be designed to create more opportunities for accidents to arise (Race and Makri 2016). The designers can plan for serendipity, but it is the users who must uncover things in an unplanned manner (Björneborn 2017).

## Methodological Considerations

As we have seen, work on serendipity proceeds from mainly a posteriori position. Serendipity is identified after it has occurred, sometimes even after a significant amount of time has elapsed (Foster and Ellis 2014). The models arise from two different angles: either semi-structured interviews (Erdelez et al. 2016; Makri and Blandford 2012b; McCay-Peet and Toms 2015) or collections of reports of serendipity whether first or third person (Van Andel 1994; Yaqub 2018). There are no models currently that draw their evidence from experimental designs. For example, Yaqub (2018) compiled his taxonomy when given access to Merton’s records of serendipitous events that had been sent to him over the course of his life. Van Andel’s (1994, p. 631) “serendipity patterns” are based on an overview of his “collection of serendipities,” and McCay-Peet and Toms’ (2015) model is based on interviews with 12 Canadian academics and professional researchers.

Methodology and construct conception often form a bidirectional relationship: the operationalization of a concept informs the methodology used, but the reverse can also be true. The methodology used to elucidate a concept will inform our understanding of the ontology of that concept. The dominant methodology that has informed research on serendipity has also informed its emphasis. Serendipity is filtered through a lens of human agency because it is researched by asking people how they experience it. Yet, the theoretical basis of serendipity paints it as a relational

concept, and, as such, both the external triggers and internal dispositions are necessary.

Serendipity is often conceived of as a process, and, indeed, many of the models that exist are process models. Again, models structure our thinking about a concept, often turning messy heteroscalar processes into linear, perhaps iterative, processes with an implied start and end point. The models reviewed here all suggest that serendipity only exists once it is conceived as such, and so they tend to focus on human agency. The process of serendipity is such that it can only occur when human agency is invoked, and, further, it is often proposed that it is necessary for a human to categorize the moment as serendipitous. There is an ever-present tug toward a human-centric model of action, even in a concept such as this one which is, by its very nature, enmeshed and entangled. What is possible in serendipity studies is constrained by the way it is approached.

## Conclusions

Serendipity is a relational concept emerging from the interactions of people and possibilities. It has a transactional logic – luck arises in the environment but becomes serendipity when it is realized by a person. Serendipity is perhaps best conceived as enacted luck. While it is unhelpful to consider the possible and the actual as diametrically opposed or in a linear temporal progression (possible leading inexorably to actual), an understanding of *how* the possible becomes actualized would be incomplete without serendipity; serendipity is the bridge between the two. Furthermore, serendipity can only be understood as existing in relation to other possible pathways, and so an understanding of the possible is also integral to our understanding of serendipity. We cannot categorize something as serendipitous without understanding how it has broadened our understanding of the possible and also how it stands in opposition to the other possibles. In the end, serendipity interacts with the possible to help us understand how we make sense of a messy world.

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