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The Predictability of Synchronicity Experience: Results from a Survey of Jungian Analysts

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Abstract

Fibonacci time patterns may predict future synchronicity experiences (SEs) by forecasting nonlinear dynamical interactions. This study examined if there were differences between observed distributions of SEs matching Fibonacci time patterns compared to expected distributions based on chance. An online survey link was e-mailed to a random sample of Jungian analysts drawn from membership lists of the International Association for Analytical Psychology (IAAP). Two experiments tested the hypothesis that Fibonacci algorithms would predict increased SEs compared to chance. The two Fibonacci algorithms studied were a golden section model (GSM) and harmonic model (HM). Participants reported a total of 41 synchronicities. Statistical analysis showed a significant difference ($p < .10$) between observed synchronicity matches and expected frequencies based on chance for the HM algorithm, and no significant difference in matches predicted by the GSM algorithm. Synchronicity dynamics showed a predictability range between ±34 days. The article discusses, among other issues, what these findings might mean for theoretical explanations of synchronicity and clinical practice.

Keywords: dynamical systems, Fibonacci Life Chart Method, golden section model, harmonic model, Jung, synchronicity

1. Introduction

One of the central ideas advanced by Carl Jung (1952) was the concept of meaningful coincidence between outer and inner events. He called this principle *synchronicity*. The concept of synchronicity, explicitly put forward by Jung, refers to an acausal connecting principle. The colloquial term “synchronicity” served as an umbrella for Jung, under which he grouped many paranormal events, including telepathy, precognition, and clairvoyance. Other paranormal phenomena that Jung included under synchronicity were divination (e.g., the I Ching) and astrology (Jung, 1952). People also use words such as superstitious, magical, and supernatural to refer to the disruption of “every day” causal principles, but it is generally understood that these concepts are on theoretical grounds the same (see Lindeman & Svedholm, 2012). In the present investigation, synchronicity experiences (SEs) are understood to refer to the subjective evaluation that coincidences between inner and outer events may not be causally related to one another, but connected by some unknown principle.

Since Jung introduced his theory of synchronicity over 65 years ago (Jung, 1952), theorists have struggled to formulate a theoretical model for this phenomenon. While synchronicity is a term based on chronos, meaning “time,” little attention has so far been paid to understanding the role of time in its analysis (Main, 2018; Yiassemides, 2011). Moreover, although researchers have investigated SEs in relation to dynamical systems theory (Atmanspacher & Fach, 2019), they have not considered the simple Fibonacci sequence in time series models. This is especially surprising given the fact this sequence appears almost everywhere in mathematics, computer science, and nature (Grattan-Guinness, 2002). Jung anticipated the hypothesis that Fibonacci numbers could influence the dynamics of SEs (Jung, 1976). In particular, Jung proposed that Fibonacci numbers were a bridge principle, with Fibonacci numbers bridging mental and physical events and facilitating the transfer of information acausally.

The idea that people can have revelatory experiences of synchronicity has been echoed by several subsequent researchers and thinkers (e.g., Aziz, 1990; Hardy, 1979; Main, 2007; Mansfield, 1995; Sacco, 2016). Does synchronicity manifest as an objective feature of the physical world? The present investigation is a formal test of this proposition. In the current work, the idea is explored that Fibonacci time patterns promote the formation of

SEs. In particular, the hypothesis is tested that people are more likely to report SEs in proximity to Fibonacci time patterns based on their synchronization properties and on the joint dynamics of the brain and the environment.

2. Literature Review

2.1 Synchronization in Complex Systems

Synchronization is a universal phenomenon in nature and society (Pikovsky, Rosenblum, & Kurths, 2001). The term "synchronization" (from the Greek "syn," meaning "together," and "chronos," meaning "time") is used in nonlinear dynamics to mean adjustment of the rhythms of oscillatory processes because of their interaction. Two or more objects are said to be synchronized, or in "synchrony," when there exists a fixed phase relation between them. Self-organized synchronization is a fundamental nonlinear behavior, which can be observed in many systems such as orbital and planetary resonances (Sacco, 2019); fireflies flashing in unison (Buck & Buck, 1976); neural networks (Buzsáki & Draguhn, 2004); coordination dynamics of side-by-side walking (Nessler & Gilliland, 2009); patient and therapist relations (Koole, & Tschacher, 2016); heart cells beating in rhythm (Glass, 2001); and also in quantum systems (Witthaut, Wimberger, Burioni, & Timme, 2017). All these and many other systems have a common feature: they produce rhythms. Also, most of these objects are not isolated from their environment, but interact with other objects, and thus are open systems.

In an open system, both matter and energy are exchanged between the system and its surrounding environment (Prigogine & Stengers, 1984). For example, biological clocks regulate daily and seasonal rhythms by entrainment of environmental signals (e.g., the period of the Earth's rotation, variations of illuminance and temperature), a firefly is influenced by the light emission of the whole population, and different centers of rhythmic brain activity may influence each other. This interaction can be very weak, sometimes barely perceptible, but it often causes a qualitative transition: an object adjusts its rhythm in conformity with the rhythms of other objects. As a result, insects in a population emit acoustic or light pulses with a common rate; birds in a flock flap their wings simultaneously; and patients and therapists synchronize their vocal pitch, bodily movements, and other physiological processes. This adjustment of rhythms due to interaction is the essence of synchronization. Synchronization, therefore, represents a general mechanism of self-organization in complex systems, which, occurs among other nonlinear dynamic features.

2.2 Synchronization and Fibonacci Patterns

How does synchronization occur? Several recent findings point to the Fibonacci numbers and golden ratio as crucial to synchronization. The Fibonacci numbers are the recursive sequence 0, 1, 1, 2, 3, 5, 8, 13, etc. Each Fibonacci number is the sum of the preceding two Fibonacci numbers. Additionally, the mathematics of the Fibonacci sequence and golden ratio (about 1.618) interrelate in that the ratios of the consecutive numbers in the Fibonacci sequence converge on the golden ratio (Livio, 2008). The Fibonacci numbers and golden ratio are found widely in nature. In particular, harmonic proportions related to the golden ratio explain the shape of spiral galaxies (Grattan-Guinness, 2002), orbital periods (Sacco, 2019), pulse frequency of a star (Lindner et al., 2015), gait phases of walking (Iosa et al., 2013), heart function (Yetkin, Sivri, Yalta, & Yetkin, 2013), and also magnetic resonances of atoms (Coldea et al., 2010). In short, the golden ratio is a powerful source of synchronization, and this seems to be the case universally.

Neurobiological research has also demonstrated the role of the golden ratio in synchronization of brain waves (Pletzer, Kerschbaum, & Klimesch, 2010; Roopun et al., 2008a, 2008b). The human brain has about 100 billion neurons that interact to form unique patterns of interconnection, called neural assemblies. The communication between neural assemblies must somehow be integrated to yield coherent patterns of thoughts, feelings, and behaviors. This neural integration is achieved by the synchrony of neural assemblies (Varela, Lascaux, Rodriguez, & Martinerie, 2001). In particular, activated neural assemblies are characterized by naturally occurring rhythmic electrical oscillations (Herrmann et al., 2016). Since these oscillations modulate electrical, inhibitory, and excitatory connections, neural assemblies communicate most effectively when their oscillations are synchronized (Atasoy, Deco, Kringelbach, & Pearson, 2017). Research has found that oscillatory rhythms based on the golden ratio help facilitate neural synchrony (Pletzer et al., 2010; Roopun et al., 2008a, 2008b). Thus, the golden ratio appears to play a crucial role in coordinating human brain dynamics.

2.3 Do Fibonacci Time Patterns Predict Synchronicity?

One might consider SEs as strictly an inner, intrapsychic process, with little bearing on objective reality (Colman, 2011). However, Jung (1952) argued that one should not ignore the strong archetypal aspects of SEs. Clinical experience led Jung to the view that SEs are not strictly internal processes, but have substantial implications for the "psychoid" nature of archetypes as the bridge between the physical and the psychological, that is, between physics and psychology. He suggested that the structuring principals of the mind relate to the structuring principles of the outer world. Thus, an intrapsychic process such as synchronicity might have important objective implications. The archetypal importance of numbers that Jung and von Franz established has generally either not been recognized or not emphasized (von Franz, 1974). In keeping with Jung's important original suggestion on the Fibonacci numbers as an explanatory framework of synchronicity (Jung, 1976), only recently were the Fibonacci numbers harnessed in the form of a testable model of SEs (Sacco, 2016, 2018).

The crux of Sacco's (2016, 2018) theory is that the Fibonacci numbers can be used to formulate a fractal time series model for predicting synchronization dynamics between the brain and environment. This modeling approach is termed Fibonacci Life Chart Method (FLCM). The FLCM draws on nonlinear dynamical systems theory, which deals with systems that exhibit complex, random-looking behavior, and has affected almost every field of science in the last 40 years. The emphasis of the FLCM model is on complex, multilevel, and multi-temporal connectivity, which give rise to the self-organization of macroscopic patterns as a whole. These patterns can be characterized as fractals, as they correlate at different time scales. The brain is fundamentally nonlinear and fractal (Kitzbichler, Smith, Christensen, & Bullmore, 2009), and tiny differences can have drastic effects. Such dynamics are thought to be vital for efficient information processing and thus enable neurons to code for rapid temporal shifts in the environment and to make rapid adjustments at fractal time scales.

Two models based on the FLCM were developed to predict the time series dynamics of SEs: the golden section model (GSM: Sacco, 2016) and the harmonic model (HM: Sacco, 2018). The two models explain SEs as a fractal scaling relation between the brain and the environment. The GSM is based on golden ratio interval divisions. The simplest examples of fractals are structures based on the golden ratio. Therefore, the GSM suggests that when people experience synchronicity events, the time series data for brain/mind dynamics will reveal a fractal structure based on golden ratio intervals. The HM refers to the symmetry and periodicity of a standing wave resonance pattern to explain synchronicity events in terms of Fibonacci harmonics. Both the GSM and HM are iterative functions composed of past values of the system inputs and outputs. To start iteration, an initial condition is needed, and for the GSM and HM algorithms, the initial condition is the individual birthdate.

2.4 Synchronicity in Clinical Practice

According to a recent survey, 44% of a sample of 226 therapists reported SEs in the therapeutic setting, and 67% felt that SEs could be useful for therapy (Roxburgh, Ridgway, & Roe, 2016). Clinically, SEs seem to cluster around periods of emotional intensity or major life transitions, such as births, deaths, and marriage (Beitman, Celebi, & Coleman, 2009). Unfortunately, research with clients who have disclosed SEs in therapy sessions has found that they often report not being listened to, accepted, or understood (Roxburgh & Evenden, 2016). Of particular relevance is that these experiences come as a shock to therapists and challenge their worldviews (Roxburgh & Evenden, 2016). Hence, there is a need to provide accurate and reliable information about SEs for mental health professionals.

Despite SEs appearing to be common in the general population, and a proportion of individuals seeking support for such experiences, little is known about the nature and origins of SEs. To date, most studies have been descriptive rather than explanatory. While research has tended to be exploratory, Sacco (2016, 2018) proposed predictive theories concerning the factors underlying distributions of synchronicity events. As such, the current study aimed to evaluate the proposed potential mechanisms by which synchronicity events could occur.

2.5 The Present Study

The basis of this study was to explore the relationship between Fibonacci time patterns and frequency of SEs, with the goal of determining if Fibonacci time patterns do, in fact, interact with SEs on a dynamical level. To explore these issues, this study surveyed Jungian analysts trained in the psychological approach of C. G. Jung. This sample was chosen because these practitioners are more likely to be familiar with the construct of synchronicity, which has been the most visible aspect of Jungian psychology. Two Fibonacci algorithms were studied: a golden section model (GSM) and harmonic model (HM). The GSM and HM algorithms forecast Fibonacci time patterns based on a person's birthdate (Sacco, 2016, 2018). Calendar dates generated by the two algorithms were used as an index for match rates of SEs. Therefore, this pilot study was undertaken to test the following question and respective hypothesis as well as to obtain data that can be used to generate hypotheses for future studies with larger sample sizes: Do the GSM and HM algorithms predict a significantly higher proportion of SEs? It is hypothesized that both algorithms will predict a higher proportion of SEs compared to chance. The basis for this hypothesis is that both algorithms are likely to forecast synchronization dynamics between the brain and the environment.

3. Method

3.1 Participants

The present study recruited Jungian analysts who were members of the IAAP to participate in a short survey. This study was conducted from February 1, 2018 to March 1, 2018. E-mail lists were obtained for all practicing Jungian analysts from the therapist directory of each group member website (see Appendix). If this information was not available, the next website was chosen. These Jungian analysts were e-mailed with the survey link included. Since membership of the IAAP requires extensive training of multiple years of both practical and theoretical aspects of Jungian psychology, the Jungian analysts can be seen as experts in such areas as the psychology of the unconscious, dream interpretation, and synchronicity. Each analyst was asked if they had personally experienced synchronicity in their personal lives or clinical practice and to report the exact date of the synchronicity (up to five synchronicities), including the level of meaningfulness (rated from 1 to 10), and the emotion associated with the synchronicity. Additionally, basic demographic data were collected.

3.2 The GSM

The GSM (Sacco, 2016, 2018) algorithm is based on characteristics of the essential fractal nature of the golden ratio. The GSM algorithm is implemented in Microsoft Excel and comprises two steps. The first is the calculation of 21 primary intervals where each number in the Fibonacci sequence is multiplied by 24 hours (using the rotation of the Earth as a uniform time scale) and added to an individual birthdate up to the average life expectancy, which is currently 78.6 years in the United States (Centers for Disease Control and Prevention, 2017). Then, in the next step, nine of the primary intervals are used to obtain secondary and tertiary intervals by multiplying by the golden ratio and/or the square roots of the golden ratio (see Sacco, 2016). The procedure can be extended to quaternary or even higher-order levels. In the present study, six higher-order levels were found to be appropriate for model comparison. Further, secondary and higher intervals were multiplied only by the golden ratio (1.618 and 0.618). This procedure resulted in 299 unique calendar dates from the birthdate up to age 78.51, and 116 calendar dates with regard to the age range of the sample.

The GSM time series data are of interest since they can be interpreted as *chaotic attractors*. An attractor is a point or set of points that the system settles toward overtime. Three basic types of attractors are distinguished: *fixed-point*, *periodic*, and *chaotic* (Thelen & Smith, 1994). A chaotic attractor, also known as a strange attractor, is an attracting set of states in a complex dynamical system's state space that shows sensitivity to initial conditions. Because of this property, small perturbations are amplified. Chaotic attractors are also markedly patterned having fixed geometric structures, such as Feigenbaum scaling and Fibonacci order (Linage, Montoya, Sarmiento, Showalter, & Parmananda, 2006), even though the trajectories moving within them appear unpredictable. Accordingly, the chaotic attractor's geometric shape is the order underlying the apparent chaos. Also, chaotic attractors are fractals; that is, some cross-section of them reveals a similar structure on all scales. If fractal dynamics like those of the GSM time series data forecast chaotic attractors and SEs, then the GSM should predict a higher proportion of SEs. However, if there is no relationship between the GSM and SEs, the results would imply that the GSM time series data do not influence SEs.

3.3 The HM

The HM (Sacco, 2018) algorithm is based on the principle of standing wave resonance. The HM time series data also results from two steps: the first is the same as the GSM, and the second comprises generating a standing wave field of nodes and antinodes identified by nine of the primary intervals. All the calendar calculations are generated in Microsoft Excel. A crucial feature of the HM is the cyclic pattern of primary intervals, with periods of 1.67, 2.70, 4.37, 7.08, 11.45, 18.53, 29.99, 48.52, and 78.51 years. The primary intervals form part of a harmonic system, as harmonics have a periodic series of cycles repeating in a sinusoidal fashion. The HM algorithm generated 250 unique calendar dates from the birthdate up to age 78.51, and 148 calendar dates with regard to the age range of the sample.

In general, resonance is related to periodic attractors, but it can be more complex as well (Broer & Vegter, 2013). If periodic attractors like those of the HM time series data influence SEs, then the HM should predict a higher proportion of SEs. Notably, it has been found that the golden ratio causes neurons to oscillate and synchronize dynamically, as is characteristic of bands of EEG signals generated by the neural matter (Pletzer et al., 2010; Roopun et al., 2008a, 2008b). Hence, the HM time series data could establish whether or not SEs correlate with periodic attractors in neural networks.

3.4 Procedure

An online questionnaire survey was conducted from February 1 to March 1 in 2018 using Google Survey (Google, Inc., Mountainview, CA). Participants were sent an e-mail inviting them to take part in an online survey designed to investigate the relationship between synchronicity experiences and chronological age. The survey was distributed by MailChimp to each e-mail address. To encourage responses, a reminder e-mail was sent after two weeks. Open and click rates, and several other metrics were tracked using MailChimp software. The e-mail included an explicit reminder of the importance of accurate reporting and stated that, as the results would be used for statistical purposes, they were required to remember the exact date (month, day, and year) of their synchronicity, and contained a link to the online questionnaire. Participants were not asked to give their names; only an email address was requested for contact purposes. Synchronicity was defined in the survey using the same definition used in other surveys (Roxburgh et al., 2016). Synchronicity was defined as "a psychologically meaningful connection between an inner event (such as a thought, vision or feeling) and one or more external events occurring simultaneously" (Roxburgh et al., 2016, p. 44). To help familiarize participants with the concept of synchronicity Jung's classic example of the golden scarab in the therapeutic setting was described.

When participants opened the survey link, they were taken to the first part of the questionnaire which contained a description of the study. Participants in this study provided consent, checking a consent box affirming they read the information about the study and consent form. Participants were informed that answers would be stored anonymously and that they could withdraw from the survey at any time. After obtaining biographical information (age, gender, education, and length of time practicing), the first question asked participants whether they had experienced a synchronicity event. They were then asked to describe the exact date of their synchronicity experience. All participants were asked to rate the meaningfulness of their synchronicity experience on a scale of 1 (*not at all meaningful*) to 10 (*extremely meaningful*). Also, participants were asked to assess the valence of emotional states associated with each synchronicity (*anticipation, fear, joy, other, sadness, surprise, trust*). They were given space on the questionnaire to provide up to five synchronicities.

After the survey period ended the results were downloaded from the Google Survey server into Excel spreadsheets (Microsoft Corporation, Redmond, WA, USA) and the survey was closed to further participation. Finally, the encoding of data was cross-checked several times for accuracy purposes.

3.5 Statistical Analysis

Statistical analysis of the data was performed using Microsoft Excel (version 2013; Microsoft, Redmond, WA) and GraphPad Prism version 7.00 for Windows (GraphPad Software, San Diego, California, USA). Microsoft Excel was used to generate descriptive statistics while GraphPad Prism was used to generate inferential statistics.

Empirical data associated with exact dates of synchronicity were compared to GSM and HM algorithm predicted dates. First, the GSM and HM algorithms were run in Microsoft Excel for each birthday in the data set. All calendar dates generated by the algorithms falling 182.5 days (6 months) before/after the date of the corresponding synchronicity were identified using the Excel conditional formula and then were recorded in separate files. These observed dates were compared to the number of full days between synchronicity dates by subtracting the two dates using the Excel calculator. If there was a difference between algorithm dates and synchronicity dates a remaining timing offset was observed and is denoted as the *synchronization range*. The statistical analysis was based in terms of assigning interval bounds for the synchronization range, which is approximately the probable error for the range considered. These interval bounds were derived from five Fibonacci numbers 13, 21, 34, 55, and 89. For the match rate, a score of 0 represented no match between the observed date falling ±13, ±21, ±34, ±55, or ±89 calendar days within the synchronicity date, and a score of 1 represented a match between the observed date falling ±13, ±21, ±34, ±55, or ±89 calendar days within the synchronicity date. Only unique matches for each algorithm were recorded. Thus, if an algorithm produced more than one observed date matching the corresponding synchronicity, that match was only scored once. The counts were automatically summed and converted into a percentage.

The expected distribution was calculated by assuming a random spatial distribution of synchronicity matches. The expected distribution was the proportion of the total calendar days falling ±13, ±21, ±34, ±55, or ±89 within the GSM and HM algorithm dates given the age range of the sample (see Table 1 and Table 2). These models provided a means of accurately calculating the expected distribution. The fit of the data to the expected distributions was evaluated using a chi-square goodness-of-fit statistic (Siegel, 1956). For all tests, values of $p \leq .10$ were considered statistically significant. This relatively liberal cutoff of the *p*-value was chosen due to the small sample size that may have a risk of Type 2 error with a lower cutoff.

Table 1. Expected distribution for GSM ages 23.25 to 72.49 (N = 116).

Interval	Dates	Duplicate	Unique	Total range	% of Total
±13 days	3,016	26	2,990	17,973	16.64%
±21 days	4,872	105	4,767	17,973	26.52%
±34 days	7,888	464	7,424	17,973	41.31%
±55 days	12,760	1,965	10,795	17,973	60.06%
±89 days	20,648	6,405	14,243	17,973	79.25%

Table 2. Expected distribution for HM ages 23.25 to 72.49 (N = 148).

Interval	Dates	Duplicate	Unique	Total range	% of Total
±13 days	3,848	130	3,718	17,973	20.69%
±21 days	6,216	478	5,738	17,973	31.93%
±34 days	10,064	1,435	8,629	17,973	48.01%
±55 days	16,280	3,852	12,428	17,973	69.15%
±89 days	26,344	10,001	16,343	17,973	90.93%

4. Results

4.1 Response Rates and Characteristics of Sample

Multiple measurements were employed in this 1-month experiment. Measurements included open rate, click rate (or click-through rate), and response rate. Of the 1244 e-mail invitations that were sent, 53 were undeliverable. Of the remainder 1191 successful deliveries, overall across the 1-month period, there were 729 unique openings or viewings, giving an open rate of 61.21%. Of the 729 analysts who opened the e-mail invitation, there were 77 unique clicks on the survey link, giving a click rate of 6.46%. Of those who clicked on the survey link, there were 18 completed responses, giving a response rate of 1.51%. In total, participants reported 41 synchronicities.

Of the 18 participants, demographic results show that most respondents were female (83%), White/Caucasian/European (89%), and spiritual but not religious (56%). Participants ranged in age from 32.38 to 72.53 years old and had an average age of 58.90 (*Median* = 61.3; *SD* = 9.31). The age at the time of synchronicity ranged from 23.25 to 72.49 and had an average age of 52.35 years. The frequency distribution of age at the time of synchronicity is shown in Fig. 1. As shown in Fig. 1, age 49 shows a significant peak in that 19.5% of the reported synchronicities occurred at this age. This age had the highest reporting level compared to the other ages. Of the 41 synchronicities, 23 (56%) were rated 10 out of 10 on the meaningfulness scale indicating profoundly meaningful synchronicity experiences (Fig. 2). The two most cited emotions were surprise and trust (66% of the Sample).

Table 3. Description of sample characteristics

Variable	*n*	*%*
All	18	100.00
Gender		
Female	15	83.3%
Male	3	16.7%
Race/ethnicity		
Latino	1	5.6%
White	16	88.9%
Other	1	5.6%
Age (years)		
30–44	1	5.6%
45–59	7	38.9%
60–74	10	55.6%
Marital status		
Divorced	4	22.2%
Engaged	1	5.6%
Married	13	72.2%
Education		
Doctoral degree	5	27.8%
Master's degree	9	50.0%
Professional degree	4	22.2%
Years in practice		
One year or less	1	5.6%
2–4 years	5	27.8%
5–9 years	3	16.7%
10+ years	7	38.9%
Not specified	2	11.1%
Religious background		
Buddhist	1	5.6%
Christian	3	16.7%
Jewish	3	16.7%
Spiritual but not Religious	10	55.6%
None/Atheist	1	5.6%
Country		
America	5	27.8%
Brazil	3	16.7%
Canada	2	11.1%
Czech Republic	1	5.6%
Denmark	1	5.6%
France	1	5.6%
UK	3	16.7%
Not specified	2	11.1%

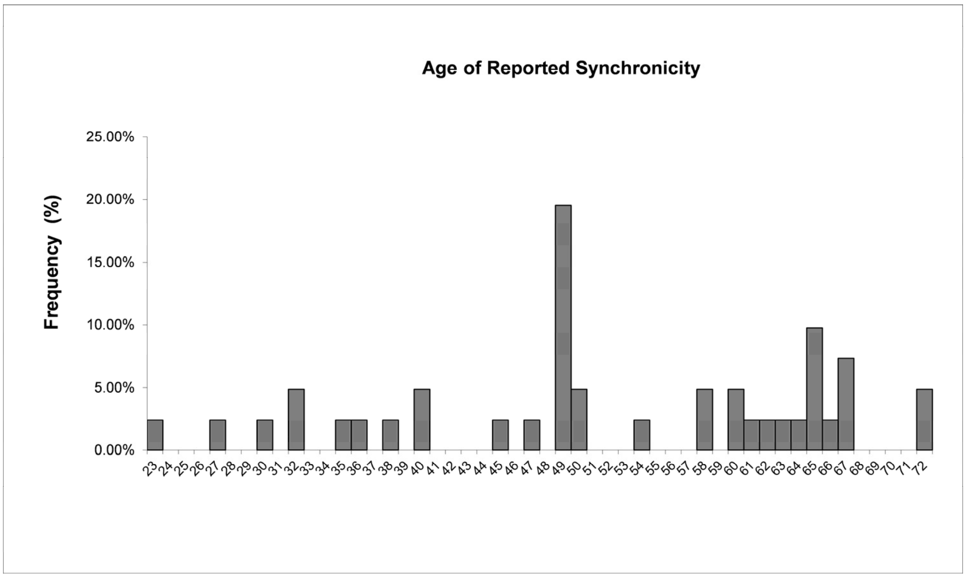

Figure 1. Distribution of synchronicity experience (relative frequency) as a function of age at the time of experience summarized for ages 23.25 to 72.49.

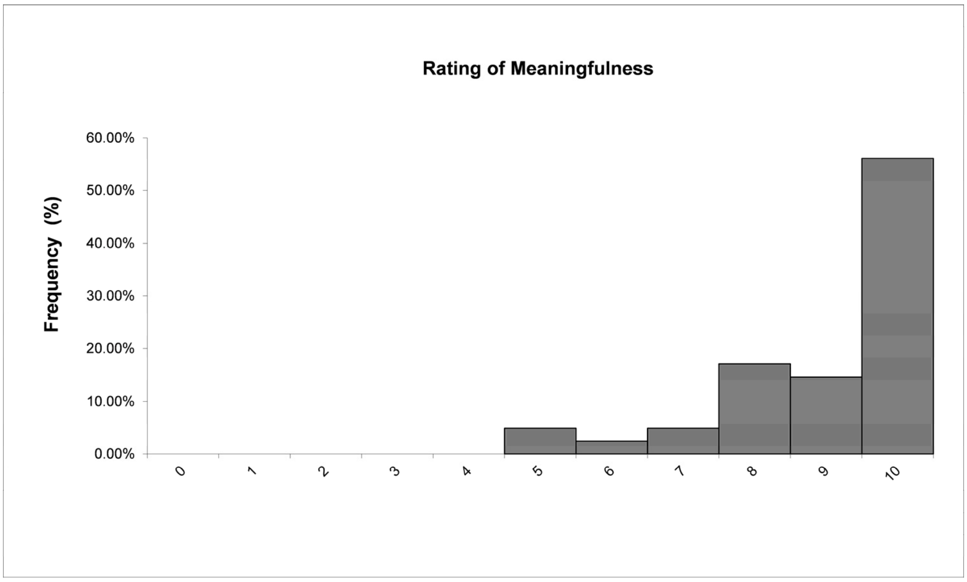

Figure 2. Distribution of meaningfulness rating (relative frequency) associated with synchronicity experience.

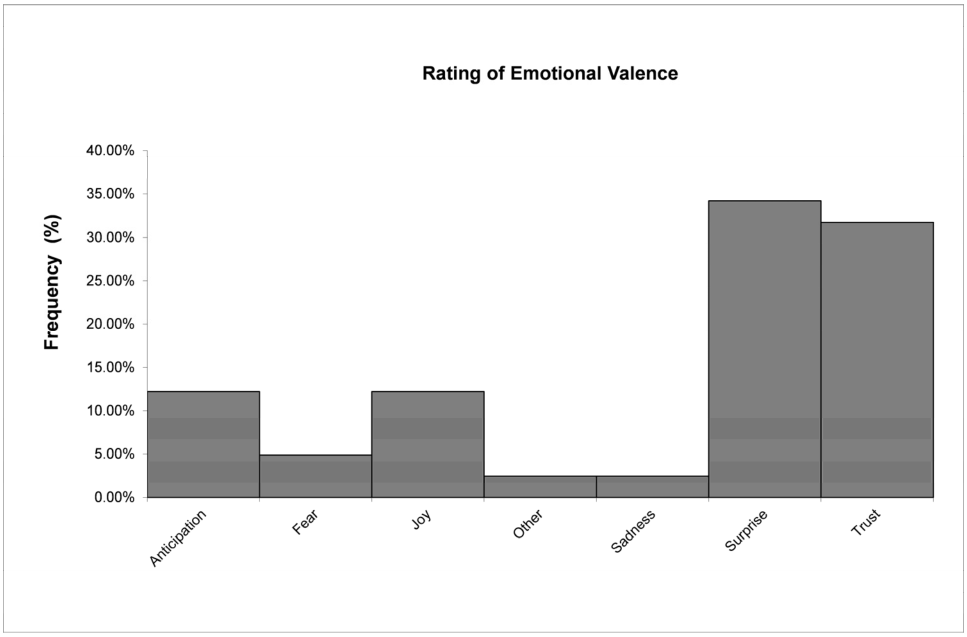

Figure 3. Distribution of emotional valence (relative frequency) associated with synchronicity experience.

4.2 GSM as a Predictor of Synchronicity Experience

The first experiment was designed to test if the GSM algorithm (Sacco, 2016) would predict increased SEs compared to chance. It was expected that the GSM algorithm would predict a higher proportion of SEs within 13, 21, 34, 55, or 89 calendar days compared to chance. Participant birth dates were entered into the GSM algorithm individually. The results from GSM individual simulations of the 18 participant birthdays, produced a total of 91 unique calendar dates 182.5 days before/after a synchronicity date in 40 out of the 41 available synchronicities. In one case, the GSM algorithm produced no calendar dates 182.5 days before/after a synchronicity date and was treated as an exclude case.

To test the hypothesis that the GSM will predict a higher frequency of SEs compared to chance GSM calendar dates were grouped into ±13 days, ±21 days, ±34 days, ±55 days, and ±89 days unique match scenarios with all five scenarios compared to the proximity of the corresponding synchronicity dates. Pearson goodness-of-fit chi-square analyses revealed no significant patterns of difference in synchronicity matches compared to the expected distribution ($p > .10$). Contrary to the hypotheses, the results show that dates generated by the GSM algorithm are not related to the proximity of SEs. See Table 4 for matches and chi-square data.

Table 4. Chi-Square Results for Synchronicity Matches ($N = 40$).

Range	O	%	E	%	χ^2	df	p
±13 days	7	17.50	6.66	16.64	0.02	1	0.8853
±21 days	11	27.50	10.61	26.52	0.02	1	0.8889
±34 days	16	40.00	16.52	41.31	0.03	1	0.8674
±55 days	23	57.50	24.02	60.06	0.11	1	0.7419
±89 days	30	75.00	31.70	79.25	0.44	1	0.5074

Note. O = observed matches; E = expected matches; % = percent of total ($N = 40$)

4.3 HM as a Predictor of Synchronicity Experience

The second experiment was designed to test if the HM algorithm (Sacco, 2018) would predict increased SEs compared to chance. It was expected that the HM algorithm would predict a higher proportion of SEs within 13, 21, 34, 55, or 89 calendar days compared to chance. Participant birth dates were entered into the HM algorithm individually. The results from HM individual simulations of the 18 participant birthdays, produced a total of 120 unique calendar dates 182.5 days before/after a synchronicity date in 41 out of the 41 available synchronicities.

To test the hypothesis that the HM will predict a higher frequency of SEs compared to chance HM calendar dates were grouped into ±13 days, ±21 days, ±34 days, ±55 days, and ±89 days unique match scenarios with all five scenarios compared to the proximity of the corresponding synchronicity dates. The number of unique matches was compared with the expected distribution. Several Pearson chi-square goodness-of-fit analyses were conducted to compare observed and expected matches.

Results showed support for the hypothesis that the HM algorithm is a predictor of SEs. For the ±13, ±21, ±55, and ±89 day match categories, the results were not statistically significant when compared against chance performance ($p > .10$). For the ±34 day match category the results were statistically significant when compared against chance performance ($p < .10$) with a medium effect size ($r = .26$). See Table 5 for matches and chi-square data.

Table 5. Chi-Square Results for Synchronicity Matches ($N = 41$).

Range	O	%	E	%	χ^2	df	p
±13 days	8	19.51	8.48	20.69	0.03	1	0.8532
±21 days	16	39.02	13.09	31.93	0.95	1	0.3296
±34 days	25	60.98	19.68	48.01	2.77	1	0.0963
±55 days	32	78.05	28.35	69.15	1.52	1	0.2172
±89 days	39	95.12	37.28	90.93	0.88	1	0.3497

Note. O = observed matches; E = expected matches; % = percent of total ($N = 41$)

5. Discussion

The present research sought to explore the role of Fibonacci time patterns in the prediction of SEs. Two Fibonacci algorithms were predicted to forecast a higher proportion of SEs compared to chance. Both algorithms reflect the same mathematical principles vis-à-vis dynamical systems theory—nonlinear time series models and attractors. As a result, they permit measurement analysis of chaotic attractor morphology. Consequently, GSM (Experiment 1) and HM (Experiment 2) algorithms were predicted to be associated with a higher proportion of SEs. This study found both expected and unexpected findings regarding the manifestation of SEs that have the potential to change views on the way people experience synchronicity in their lives.

First, descriptively, a significant proportion of the sample was female (83%). There is no evidence that the sex differences reported in Table 3 are affected by sample bias and considerable evidence they are not. More females than males report paranormal experiences (Castro, Burrows, & Wooffitt, 2014). This confirms other survey data ($N = 634$) that found an 80-20 split (i.e., 81.9% female and 18.1% male) in the report of synchronistic experiences (Coleman, Beitman, & Celebi, 2009). Some suggest the gender differences in paranormal beliefs, practices, and experiences cannot be explained by gender alone, but that these differences are caused by intuitive thinking styles more likely to be associated with women (Castro, Burrows, & Wooffitt, 2014). In this context, phenomenological interpretation, via reflection/introspection, plays a central role in the labeling of experience (Smithies & Stoljar, 2012). Women have also been shown to be better at recalling dates of personally relevant events than men (Skowronski & Thompson, 1990), suggesting that women may reminisce more about events than men, thus creating more vivid memories. Alternatively, gender differences may be a function of the complex interaction between social and cultural factors (e.g., lifestyle, educational level, and cultural beliefs). Thus, environment rather than gender differences may determine reporting of SEs.

Second, this study found non-significant effects that are notable. Compared to chance estimates, the GSM algorithm (Experiment 1) did not differ in the frequency of synchronicity matches across all match categories. Although not supporting the hypothesis, this pattern exemplified an interesting insight relating to dynamical systems: Chaotic attractors based on fixed iteration under the GSM do not forecast a higher proportion of SEs compared to chance. On the other hand, periodic attractors may be more inherent to the emergence of SEs. The logistic map is perhaps the simplest model that exhibits chaotic behavior and is made of a sequence of graphs associated with periodic attractors (Luque, Lacasa, Ballesteros, & Robledo, 2011). These periodic orbits have only one that is attracting because the logistic map has only one critical point. This allows for the possibility that much can be learned about a chaotic system, such as neural dynamics, from its set of periodic orbits (So, Francis, Netoff, Luckman, & Schiff, 1998).

We might also expect that Fibonacci-based periods play an essential role in the dynamics of chaos given the period-doubling aspect of the logistic map results in the appearance of the Fibonacci sequence (Linage, Montoya, Sarmiento, Showalter, & Parmananda, 2006). Periodic attractors are those where, over time, a similar pattern repeats itself like the change in seasons. Periodic oscillation is associated with many biological phenomena, such as heartbeat, respiration, circadian rhythms, and menstrual cycles, but this dynamic tendency also underlies neural networks and essential psychological phenomena including moods, self-evaluation, human behavior, and social interaction (Vallacher & Nowak, 2009). Meanwhile, almost periodic and quasiperiodic motions appear to be more common than periodic phenomena. For example, the dynamics of brain activity is considered a quasiperiodic system of many coupled oscillators with different incommensurable periods of oscillation (Izhikevich, 2007). Quasiperiodic motion is a pattern of recurrence with a component of unpredictability, that is, parameters become periodic up to a small error. Thus, quasiperiodic motion could be considered to be more accordant with reality.

Third, attesting to the validity of the HM algorithm (Experiment 2), this study found significant differences between observed and expected synchronicity matches. These findings support the hypothesis that Fibonacci harmonics play a role in forecasting SEs. The results showed that the relationship between the ±34 calendar days match scenario and the corresponding synchronicity dates was significant ($p < .10$). The p-value of .096 (Table 5) obtained from the HM statistical tests means that the distribution observed in the data has a likelihood of 90.4% not to have been produced by chance. Therefore, the difference observed between the expected distribution is probably significant. These results are interesting for various reasons. For instance, it is possible to better understand SEs by considering the large-scale correlation between the temporal hierarchy of the human brain and the environment (Kiebel, Daunizeau, & Friston, 2008).

The limited predictability range can be explained by the chaotic nature of dynamical systems (Kravtsov & Kadtke, 2012). Another, more fundamental factor, limiting the predictability range may be quantum fluctuations. While chaos theory is deterministic, quantum mechanics is probabilistic—that is, even with exact knowledge of the current situation, it is impossible to predict its future precisely. The fact that quantum mechanics is probabilistic leads to amplitude densities in the state space. Amplitude densities can only compute probabilities, conditional probabilities, and expectations. Therefore, Fibonacci time cycles may raise the probability of SEs by acting as system attractors supporting the probability density function of the system states in the multi-dimensional state space. This highlights the notion of causality referred to as *probabilistic causation* (Illari & Russo, 2014). Several individual difference variables (e.g., gender, age, personality traits, life stress, and beliefs) could moderate the probabilities of a synchronistic event.

Last, and most notably, the findings point to the importance of a 24-hour period as a critical variable. The Waskom-Rose paradigm (Rose, 1991) offered a perspective on human development based on the Fibonacci numbers expressed as 365-day units of time. This was an important step in understanding human development, but it was insufficiently elaborate and overly simplistic. Therefore, a new version of human development was proposed that defined Fibonacci numbers in terms of 24-hour units of time based on the rotation of the Earth around its axis once every 24 hours with respect to the Sun (Sacco, 2013). This method is supported by the 24-repeating number pattern of the Fibonacci numbers (Sacco, 2013), the coupling-induced dynamics of celestial mechanical cycles (Sacco, 2019), the natural doubling time for human embryonic cells approximating 24 hours (Lagarkova, Eremeev, Svetlakov, Rubtsov, & Kiselev, 2010), and the circadian rhythms of virtually all life forms entrained to a 24-hour period.

5.1 Theoretical Implications

The above results have several theoretical implications. First, they add an explanatory mechanism for SEs, which rests on synchronization in complex dynamical systems. Nature provides many examples of rhythmic systems and synchronization phenomena (Pikovsky, Rosenblum, & Kurths, 2001; Strogatz, 2004). In systems composed of multiple interacting components, synchronization is a process in which two independent parts continuously influence each other toward greater entrainment. In the present case, results show that Fibonacci harmonics have a significant effect on the incidence of SEs, thus providing a mechanism by which SEs could result from entrainment of neuronal activity and the environment. By demonstrating a link between Fibonacci harmonics and SEs, the present approach builds on Jung's original description of the Fibonacci sequence as a bridge between mind-matter correspondences within a common framework based on modern nonlinear dynamics. Indeed, this research contributes to the major paradigm shift in contemporary Jungian psychology by evaluating key concepts from the vantage point of complexity science (Atmanspacher & Fach, 2019; Cambray, 2009; Hogenson, 2014;

Sacco, 2016; Saunders & Skar, 2001; Tresan, 1996; Van Eenwyk, 1991).

Second, the present research supports the empirical connection between the golden ratio and the periodic rhythm of brain activity (Pletzer et al., 2010; Roopun et al., 2008a, 2008b). A fundamental characteristic of brain activity is coherent oscillations covering a wide range of frequency bands. Changes in the frequency and amplitude of these oscillations accompany the various states of consciousness (e.g., awake state, REM sleep, and anesthesia). These various mental states associate based on the fundamental principle of harmonic resonance (Atasoy et al., 2017). Furthermore, evidence supports that the classical frequency bands of the EEG in the brain's natural resting state have a ratio between adjacent frequencies of the golden ratio (1.618) (Pletzer et al., 2010). Hence, SEs appear to cluster around the frequencies of standing wave harmonics as predicted by the harmonic model (Sacco, 2018).

Finally, the present findings may indicate the importance of personality as a moderating factor in SEs. For example, Pasciuti (2011) found a potential link between synchronicity detection and the Myers Briggs profile of introversion, intuition, feeling, and perception (INFP). Introversion focuses attention introspectively on one's thoughts, memories, and emotions. Research into the accuracy of introspection has the potential to provide insights regarding the link between attention and consciousness (Smithies & Stoljar, 2012). Openness to experience is another aspect of personality that may be related to SEs and is characterized by receptiveness to new ideas, approaches, and experiences. A study of personality traits found that people high in openness to experience tend to have a greater belief in paranormal phenomena (Smith, Johnson, & Hathaway, 2009).

5.2 Clinical Implications

These findings also have broad implications for clinical practice. Much is known about SEs in terms of their general sense of spiritual meaning (Main, 2007). Among the findings that have emerged from the literature on spirituality, two have particularly important implications for clinical practice. First, spirituality can be a powerful resource for people coping with life's challenges (Exline & Rose, 2013). Second, spirituality can also be a source of difficulties. Such difficulties around spiritual issues involve conflicts, tensions, and strains about spiritual matters (Exline & Rose, 2013). Thus, addressing SEs in clinical practice can make a considerable difference in mental health outcomes. Unfortunately, therapists often feel unprepared and thus uncomfortable addressing SEs, perhaps because they lack training in this area (Roxburgh & Evenden, 2016). If future studies support these findings, then the harmonic model may prove useful in assessments of synchronicity events.

5.3 Strengths and Limitations

One strength of the present study is that it provides the first empirical exploration of Fibonacci time patterns in the prediction of synchronicity. Another strength of the study is the medium effect size that was found. Also, all the data was checked for accuracy several times during the study period.

A limitation of the study is the low participation rate of 1.5%. The 41 synchronicities reported by 18 subjects were sufficient for statistical analysis but are not a large sample size. The low participation rate may be explained by the busy work schedule of practitioners and privacy issues. The major reason for the relatively low participation rate (1.5%) in this study compared to other surveys of practitioners including 10.3% (Roxburgh et al., 2016) and 5.9% (Savic-Jabrow, 2010) was the requirement that subjects recall the *exact date* of synchronicity (month, day, year). Requesting only the month and year from participants may have achieved a higher response rate, but would not be precise enough to be useful. Thus, while 61.2% of the sample viewed the e-mail invitation, most of the low click rate and response rate is likely due to the focus on the content within the e-mail and inability to recall the exact date of synchronicity.

The questionnaire was sent unsolicited to practitioners listed on the IAAP member websites via email. While unsolicited postal and internet-based surveys are known for low response rates (Nulty, 2008), it allowed reaching practitioners of different ages, varied regions, and backgrounds. It is not known how many questionnaires were filtered out as spam and thus not received by potential respondents. The survey had an open rate of 61.21% (the percentage of recipients known to have opened the email based on tracking data) and click rate (the percentage of recipients known to have clicked the survey link) of 6.46% across the 1-month period. This compares significantly better than the average open rates and click rates across all industries of 21.80% and 2.62%, as reported by the mailing list provider (MailChimp, 2015). Part of the e-mail delivery success may have been a result of following several best practice rules (Foreman, 2014). Specifically, emails: were sent on weekdays rather than during the weekend, were sent on late mornings rather than late afternoons or evenings, and contained simple and straightforward subject lines.

The present sample comprised practicing Jungian analysts. The participants possessed high levels of academic achievement and a preference for analytical thinking. Therefore, the external validity of the present study involves the issue of generalizability of results beyond the sampled population. Cook and Campbell (1979) made an important distinction between generalizing “to” a well-defined population and generalizing “across” subgroups of a larger population. The first type of external validity involves generalizing research findings to the target population of interest. The second involves conceptual replicability or the extent that results found in a study that used particular subjects and settings would be replicated in different subjects, settings, and times. Moreover, before researchers focus on generalizability, it is important to ensure valid operationalization of constructs (Cook & Campbell, 1979). Accordingly, more attention is needed on conceptual clarity and definitional precision of synchronicity to advance empirical research in the field.

5.4 Recommendations for Future Research

Future studies pertaining to research using questionnaires may consider evaluating ways of enhancing external validity by generalizing to other individuals. This study (e-mail survey) relied on retrospective memory. To further this program of research, future studies should consider longitudinal studies with subjects keeping detailed diaries of their synchronicity experiences over long periods, thus providing a suitable source of memories to be tested later, which could be checked for their accuracy. Developed by Carl Jung, the synchronicity concept also has no empirically validated instrument integrating the several dimensions of synchronicity. This represents a research need. With these factors combined, it is possible to increase internal and external validity in future research.

6. Conclusion

Synchronicity is one of the most widely known terms of Jungian psychology. Although generations of scholars from various fields have found the concept intuitively appealing and interpretively useful, there has been little agreement among theorists how synchronicity might operate, and researchers have had difficulty providing empirically testable models. Indeed, after more than 65 years the theory of synchronicity has remained without empirical validation in the scientific literature (Jung, 1952). In the present investigation, supportive evidence was found that Jungian analysts experience an increased frequency of synchronicity near Fibonacci time cycles, consistent with the notion that the Fibonacci numbers and golden ratio are crucial to synchronization dynamics. This research builds on Jung’s original observations and speculations that the Fibonacci numbers might account for synchronistic events, but the mechanisms have to be elaborated. In future, FLCM can guide intervening generations of researchers in psychology and physics. The present research will also hopefully contribute to a more integrated approach to understanding and addressing synchronicity experiences in psychotherapy.

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Appendix

List of IAAP member associations contacted for synchronicity experiences

Australia

- Australia-New Zealand: The Australian and New Zealand Society of Jungian Analysts

Europe

- Austria: Österreichische Gesellschaft für Analytische Psychologie
- Belgium: Belgische School voor Jungianse Psychoanalyse
- Belgium: Société Belge de Psychologie Analytique
- Czech Republic: N-T Group Česká Asociace Analytických Psychologů, z.s.
- Denmark: Dansk Selskab For Analytisk Psykologi
- Finland-Estonia: Finnish-Estonian Group of Analytical Psychology

- France: Société Française de Psychologie Analytique
- Israel: Israel Institute of Jungian Psychology
- Italy: Centro Italiano di Psicologica Analitica
- Spain: Institut de Psicologia Analítica C.G. Jung de Barcelona
- United Kingdom: Association of Jungian Analysts
- United Kingdom: British Jungian Analytic Association
- United Kingdom: The Guild of Analytical Psychologists
- United Kingdom: The Independent Group of Analytical Psychologists

North America

- Canada: C.G. Jung Foundation of Ontario
- Canada: Western Canadian Association of Jungian Analysts
- United States: Chicago Society of Jungian Analysts
- United States: Dallas Society of Jungian Analysts
- United States: The Inter-Regional Society of Jungian Analysts
- United States: C.G. Jung Study Center of Southern California
- United States: New England Society of Jungian Analysts
- United States: The New Mexico Society of Jungian Analysts
- United States: Jungian Psychoanalytic Association
- United States: New York Association for Analytical Psychology
- United States: North Carolina Society of Jungian Analysts
- United States: The Ohio Valley Association of Jungian Analysts
- United States: Pacific Northwest Society of Jungian Analysts
- United States: Philadelphia Association of Jungian Analysts
- United States: Pittsburgh Society of Jungian Analysts
- United States: Society of Jungian Analysts of Northern California
- United States: C.G. Jung Institute of Seattle
- United States: Jungian Analysts of Washington Association

South America

- Brazil: Associação Junguiana do Brasil
- Brazil: Sociedade Brasileira de Psicologia Analítica