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Relation between Chaos Theory and Peer support in Mental Illness: Wisdom in the "Serenity prayer" embodies the peer support effect and ability to sense behavioral changes through continuous covariation

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Abstract: Peer support is an effective communication strategy for individuals with serious mental illnesses. This study investigated the relationships among these individuals, supporters, and trained professionals and identified conditions necessary to avoid communication error, within the framework of chaos theory. Chaotic phenomena require continuous covariation and tend to exist in either of two states: 1) converging fixed state, which underlies social rules and present science and is often misunderstood by professionals as completely fixed, non-converging state; 2) chaotic state, which characterizes individual freedom. Outside social rules, individuals exist in expanded chaotic states. Individuals with severe mental illnesses may sense the difference between their own and a professional's thought processes. Conversely, supporter–individual relationships can become continuously covariant. Individuals' changing behavior is subject to the butterfly effect, and supporter–individual relationships may positively develop or descend into further confusion.

Thus, the supporter's recovery experiment and professional's continuous support are important.Inspired by the "Serenity Prayer," two important factors in achieving favorable outcomes were identified: the peer support effect and a professional's or supporter's ability to sense the direction of individual's behavioral changes.

Keywords: peer support, chaos theory, recovery experiment, psychological social worker, butterfly effect.

Introduction

Peer support is an effective communication strategy for individuals with serious mental illnesses. Although the reason for this effectiveness has been theoretically investigated (Salzer & Shear, 2002; Solomon, 2004), the lack of any mathematical understanding hinders attempts to provide error-free services because the conditions of the problem cannot be clarified. Therefore, individuals with mental illnesses may become confused by their peer support services.

This report explains the relationships among professionals, peer supporters, and individuals in terms of chaos theory.

Individuals sometimes view their professionals as antagonists and misunderstand their verbal output, thereby leading to the burnout syndrome. To alleviate the difficulties faced by professionals in this situation, we sought answers in the "Wisdom" phrase of the "Serenity Prayer." The "Wisdom" was identified as the peer support effect and behavioral changes sensed through the continuously covariant relationship between an individual and professional.

The direction of behavioral change is essential in patient support. The important factors that determine this direction are the recovery support system and contact with professionals.

METHODS

Explanation of Chaos Theory

Definition of peer supporter

Examples of specially designated peer positions are peer companions, peer advocates, consumer case managers, peer specialists, and peer counselors (Solomon, 2004). In this report, these individuals are collectively referred to as peer supporters.

Definition of chaos theory

Chaos theory is defined in the "Relation of Chaos Equation to the Schedule for the Evaluation of Individual Quality of Life-Direct Weighting Method" (Yanagisawa, 2014).

Relationship between continuous covariation and chaos theory

Continuous covariation is related to chaos theory in the "Association of Evolutionary Topics related to God and Chaos Theory" (Yanagisawa, 2015). The basic concepts are outlined below.

A representative chaotic equation is given by

$$Y(n+1) = p[1 - Y(n)]Y(n) \quad (1)$$

As the parameter p changes from 3.0 to 3.56995 (called the Feigenbaum (1978) point), the number of fixed points in Equation 1 evolves from 1 to 2 and eventually to 4. Below the Feigenbaum point, the solution Y (n) converges; above the Feigenbaum point, it splits into a localized state and a proliferating chaotic state. The solution does not converge in the chaotic state. By the above reasoning, Equation 1 can be re-expressed as Equations 2 and 3:

$$Z(n) = p[1 - Y(n)]Y(n) \quad (2)$$

$$Y(n+1) = Z(n) \quad (3)$$

Since the calculations in Equations 2 and 3 are alternately repeated, the solutions to Z (n) and Y (n) create an ordered spiral chaos state. Once Y (n) is determined, Y (n + 1) changes according to Equation 1. However, once Y (n + 1) moves to the position of

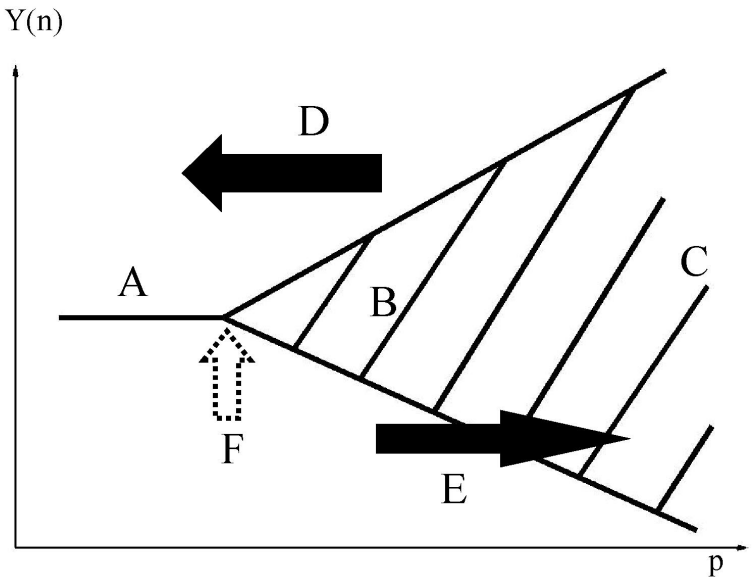

Figure 1: Schema near the Feigenbaum point.
Dotted arrow F indicates Feigenbaum point. Arrows D and E point in directions of stability and confusion, respectively.

Y (*n*) in Equation 1, *Y* (*n* + 2) also changes. Thus, *Y* (*n*) can never settle into its original pre-chaotic value. This relationship indicates that once a variable has changed into another, it cannot return to its original value, and the correlated variable relationship (equivalent to covariation) becomes unsettled. Hence, the covariational relationship between *Y* (*n*) and *Y* (*n* + 1) in Equation 1 may sustain the chaotic state. If the variables are uncorrelated, a chaotic state cannot be established.

Figure 1 is a schema near the Feigenbaum point, showing the converging fixed (region A), localized (region B), and expanded chaotic (region C) states. Each the vertical axis and the horizontal axis are equivalent to "Y (n)" and "*p*" in Equation 1. The mathematics allows complete and converging fixed states, localized and expanded chaotic states, and random states. Continuous covariation is a required condition of chaotic and converging fixed phenomena. No covariation leads to completely fixed or random states.

Relationship between chaos phenomena and covariation

If Equation 3 is void, i.e., if

$$Y(n+1) \neq Z(n), \quad (4)$$

then chaotic phenomena cannot develop because there is no covariation between $Y(n + 1)$ and $Y(n)$. For example, consider

$$Y(n+1) = J, \quad (5)$$

where J is a fixed number. From Equation 5, we have

$$Y(n) = J, \quad (6)$$

and Equations 2 and 6 give

$$Z(n) = p[1 - J]J. \quad (7)$$

In Equation 7, $Z(n)$ is a linear function of p, and the solution is completely fixed.

Butterfly effect in chaotic phenomena

Figure 2 plots $Y(n)$ of Equation 1 with $p = 4.0$ and two initial values, G_1 and H_1, set as 0.160000 and 0.160001, respectively. The solutions $Y(n)$ computed from G_1 and H_1 are denoted $Y_G(n)$ and $Y_H(n)$, respectively. The results under both initial conditions are almost identical up to $n = 16$ but widely diverge for $n > 20$. For the initial value G_1 (H_1), $Y_G(n)$ reaches point G_7 (H_7) through the

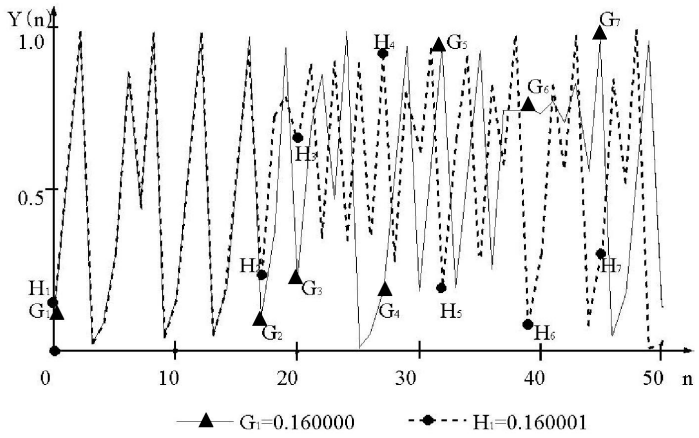

Figure 2: Y (n) calculated by Equation 1 with $p = 0$ and two initial values: $G_1 = Y_G(1) = 0.160000$ (triangles and solid lines) and $H_1 = Y_H(1) = 0.160001$ (circles and dotted lines).

points G_2 (H_2), G_3 (H_3), G_4 (H_4), G_5 (H_5), and G_6 (H_6).

This result indicates that a tiny change in the initial value leads to significantly different iterative behavior. The initial values G_1 and H_1 can be likened to “no flap of a butterfly wing” and “one flap of a butterfly wing,” respectively. A single flap of a butterfly wing will generate a miniscule airflow but can ultimately lead to hurricanes. This iterative effect is known as the butterfly effect (Lorenz, 1963).

Relating chaos theory to human life

Completely fixed and random states occur in the absence of a continuously covariant relationship and thus do not converge. Converging fixed and chaotic states emerge in chaos theory. A completely fixed state exists at the leftmost point in Region A in Figure 1. The rightmost point in Region C of that figure is a random state. Both points are outside of chaos theory. Completely fixed and converging fixed states are quite different. Similarly, a random state differs from an expanded chaotic state.

Completely fixed phenomena with no convergence are time-invariant (Yanagisawa, 2000, p.56) and thus require no time-dependent factors. An example of a converging fixed phenomenon is the genome. Genes “learn” from the experiences of living creatures (Yanagisawa, 2015). Because genes evolve over time, they share continuously covariant relationships with other temporal phenomena. Genes are not chaotic; rather, they are almost fixed.

In contrast, social rules and current science are localized chaotic phenomena. Individuality is the antithesis of social rules and present science (which demands complete reproducibility). Therefore, individuality is not forgiven in social rules and present science, and people will inevitably change in different environments.

A completely fixed state does not require the so-called five W's and one H, which define how we investigate. The term refers to the interrogatives who, what, when, where, why, and how. Present science demands that the five W's and one H yield a consistent answer, but it also recognizes that the answer changes in the long term. Like social rules, which can change in different environments, science becomes corrected over time. Because scientific phenomena yield different results in different circumstances, science must always evolve by discovery.

A human example of an expanded chaotic state is a hermit with no other human contact. Being inextricably linked to nature, he shares continuously

covariant relationships with natural variables and consequently inhabits a chaotic state. He also has unlimited social freedom because he is detached from all other persons. In the chaotic state, all answers are correct, and which answer is selected will depend on the individual and his environment. To arrive at his answer, the individual evaluates his circumstances through the five W's and one H. However, the range of possible answers is limited in practice. The chaotic state is a random state with no continuous covariation between “anything” and “good.” No person can exist in a completely random state because survival is continuously correlated with excretion and with eating other living plants and animals. Any time-dependent phenomenon shares continuously covariant relationships with other time-dependent phenomena. As such, time-dependent phenomena are predisposed to chaos. Given that “living” is synonymous with continuous covariation, real-life phenomena can be aptly explained by chaos theory.

Relating direction to chaos theory

In chaos theory, the transition point between a fixed and chaotic state is called the Feigenbaum point (see dotted arrow pointing to F in Figure 1). Consequently, at the Feigenbaum point, the system may evolve in either of two directions (solid arrows D and E). If the parameter p in Equation 1 decreases, the system evolves from a chaotic state to a converging fixed state. The human analogy is rearranging one’s thoughts in the convergent direction. On the other hand, if p increases in Equation 1, the system evolves into an expanded chaos state or randomness (confused thinking processes).

Relationship between information and thoughts

Humans are influenced by the information they receive. Thoughts that are arranged and unified will arrive at a fixed answer (Yanagisawa, 2014, 2015). If the received information is irrelevant and random, this correct rearrangement is disturbed, and the individual becomes confused. However, the direction toward chaos or convergence is not entirely determined by information.

Each piece of information is not necessarily associated with a fixed or chaotic state. Chaos arises only if a person is covariantly related to that information. Therefore, the direction is determined by the relationship between a person's thought processes and the information received. Each thought of the person sending or receiving information influences the direction. When the

information sent is limited in range, the direction is selected by the sender. When information is received, the direction is selected by the receiver.

Relating peer support to chaos theory

Relationship between professionals and individuals with serious mental illnesses

The thoughts of professionals such as psychological social workers, who are educated in social rules and present science, occupy a localized chaotic state (see region B of Figure 1). Consequently, professionals may misunderstand social rules and sciences as completely fixed phenomena.

The situation differs for individuals with mental illnesses. When their speech and actions are within the permissible range defined by their society, such individuals will not be regarded as seriously mentally ill because they can control their actions to some extent. Because they are adapting to their society, their thought processes occupy region B in Figure 1. However, if their speech and actions are outside the permissible range, these individuals will be treated as seriously mentally ill. In other words, individuals living the hermit lifestyle can never be treated as mentally ill because they have extricated themselves from society. The thoughts of individuals with severe mental illnesses are unrelated to that individual's society. Therefore, such individuals cannot adapt.

Individuals existing in expanded chaotic states cannot comprehend the words of professionals, who occupy completely or converging fixed states. Because a person senses the nature of the speaker before hearing the speech contents, individuals may perceive that professionals occupy the other side of the expanded chaotic state. For example, no child or unskilled sportsperson can catch a ball pitched at very high speed by a professional pitcher. If they do catch the ball, they may feel uneasy. A professional's words are analogous to high-speed balls. Most likely, they will not be understood by individuals with mental illnesses. A professional's service is effective only in the fixed state, but for individuals with serious mental illnesses, servers, receivers, and thoughts are effective only in the expanded chaotic state. These individuals may not understand that professionals frequently relate their thoughts to their ambient environments. Because continuous covariance is a requirement of chaotic phenomena, it is predisposed to the butterfly effect. In turn, the butterfly effect depends on the numbers of interactions. In the relationships between professionals and individuals, the small butterfly effect cannot be

expected to positively change the behavior of the individuals (Solomon, 2004). Because the individuals can hardly understand the professionals' words, the professionals are likely to experience burnout syndrome (Peterson, 2008).

The expanded chaotic state is distant from a professional's completely or converging fixed state and may be misunderstood by the professional. According to Figure 1, if a person's thought processes occupy regions A and B (the complete fixed state) in the diagram, that person cannot understand thought processes in region C, and vice versa.

Relationship between peer support and covariation

Peer supporters are closer to the expanded chaotic state (region C in Figure 1) than are professionals and thus may be better received by individuals with mental illnesses. Because peer supporters may be regarded as like-minded, individuals may establish immediately covariant relationships with them. An individual with mental illnesses may therefore view a peer supporter as another individual without a fixed state. This situation is advantageous in forging covariant relationships among individuals.

Relating the recovery experiment to the direction of chaos theory

In the event of continuous covariation, the direction of chaos theory is very important. It is hoped that individuals will adapt to social rules; that is, that their thought processes will evolve in the direction of arrow D in Figure 1. This process is called positive behavioral change (Solomon, 2004). The recovery experiment (Davidson, Bellamy, Guy, & Miller, 2012) implies adaptation to social rules, even if incomplete. Because adaptations occupy region B in Figure 1, individuals may achieve the direction of arrow D by establishing covariant relationships with their supporters. If only continuous covariation exists, they may be driven in the opposite direction (arrow E in Figure 1). To elicit positive behavioral changes in an individual with a mental illness, supporters should relate their own recovery experiments. Most importantly, peer supporters should provide definite goals for their clients through peer supporting activities.

Peer supporters are in strong positions to help others by positive feedback and self-affirmation (Solomon, 2004). Such feedback is part of the covariation. Because peer supporters can confirm their own existence through covariant relationships, they can provide conscious support and possibly reduce their own recurrence of serious mental illnesses. However, by supporting

individuals, peer supporters may revert to more confused states. Therefore, peer supporters require the continuous support of professionals with stable mental states (Solomon, 2004).

An answer to the "Serenity Prayer"

In the chaos-theory interpretation, two factors determine the relationships between professionals and individuals: continuous covariance and direction. The "Serenity Prayer" is "O God, give us the Serenity to accept what cannot be changed, Courage to change what should be changed, and Wisdom to distinguish the one from the other" (Niebuhr, 1980). The answer to the "Wisdom" in this prayer would prevent burnout syndrome.

Professionals are socially conditioned to regard the expanded chaotic state as different from their own. If a professional is to achieve a continuously covariant relationship with his client, he must adapt his thinking from its usual fixed state to an expanded chaotic state. "Serenity to accept what cannot be changed" and "Courage to change what should be changed" are an individual's responses to the world. Regarding "Courage," what is changed is the individual's world, whereas what changes is the professional's world. To change an individual's world, a continuously covariant relationship must be established between the professional and the individual. Achieving this objective requires a drastic alteration of the professional's world and may be detrimental to the professional. Moreover, an individual's world may not immediately change in the direction of social adaptation. Therefore, an immediate execution may be erroneous. Although "Serenity" is a better choice than "Courage," the professional requires "Courage" to change the individual's world.

The first hint to the "Wisdom" solution is that peer supporters are more akin to individuals with mental illnesses than are professionals. Individual change requires a continuously covariant relationship between the individual and his supporter or professional.

Second, a professional may hope for early results. Delayed changes may be misinterpreted by the professional as no change, causing unnecessary worry.

Third, the professional must avert the individual's negative behavioral changes. The direction of the individual's change must be sensed by the professional through the covariation. The direction is not determined solely by the professional's actions, but it also depends on the individual's choices. Given that peer supporters can forge continuously covariant relationships with the individual, the "Wisdom" in the "Serenity Prayer" combines the

effects of peer support with the ability to sense the direction of the individual's behavioral changes through the continuously covariant relationships.

Results

The effects of peer support on individuals with serious mental illnesses can be explained by chaos theory. Individuals may sense differences in mental processing between professionals and themselves and likely will not understand professionals' words. Therefore, in their attempts to communicate with their clients, professionals are threatened by burnout syndrome. By considering the "Wisdom" phrase in the "Serenity Prayer," we identified two factors that might avert burnout syndrome: the peer support effect and the ability to sense the direction of the client's behavioral changes through continuously covariant relationships.

The effects of recovery experimenters are twofold. First, the recovery experiment may establish a covariant relationship between a peer supporter and an individual experiencing mental illness. Even if the peer supporter provides minimal stimulation, a large behavioral change in the individual is expected due to the butterfly effect. The second effect is adaptation to social rules. If the direction of the individual's change opposes adaptation, the individual becomes more confused. Therefore, peer supporters should relate their own recovery experiments to elicit positive changes in the individual's behavior. By supporting an individual with mental illness, peer supporters may reduce their own recurrence of serious mental illness; on the other hand, without proper support by a professional, they may descend into further confusion. To avoid both of the above errors, peer supporters require continuous support from professionals with fixed mental states.

Discussion

Ideally, individuals with serious mental illnesses will eventually adapt to social rules. However, their illnesses separate them from their fellows and distance them from their professionals.

Judging people by their occupations or titles, as dictated by social rules, is not always correct. The confidence with which people regard an occupation may change in different circumstances. Human trust is acquired through numerous informational exchanges involving the five W's and one H. Because many exchanges induce the butterfly effect, a confirmed large change indicates a good or bad state.

Meeting another person involves many exchanges that are interpreted by the five senses. Therefore, each person senses the nature of the speaker before hearing his or her speech contents. Reportedly, appearance significantly affects how we interpret another person (Rosenham, 1973). In a hospitalization study, eight pseudo-patients were actually normal but were not recognized as such by the ward psychiatrists. On the other hand, one patient with mental illness detected normality in one of the pseudo-patients. Not surprisingly, individuals with mental illnesses can become distanced from their professionals.

Professionals with no experience of mental illness may lack the skills to establish continuously covariant relationships with their clients. Therefore, professionals treating such individuals may suffer from burnout syndrome. The “Wisdom” phrase in the “Serenity Prayer” offers a theoretical solution to the burnout problem: peer support and the ability to sense the direction of behavioral changes in the individual. Although continuously covariant relationships between individuals and professionals are difficult to establish, they are more easily forged between individuals and peer supporters, whose thinking processes are more akin to their own.

There are two problems in peer supporting. One is that peer support modifies the individual's behavior. Wrong choices can drive the individual’s thinking toward further confusion. Because the recovery experimenter has already adapted to social rules, his behavioral changes have been directed along arrow D in Figure 1. A supporter with insufficient understanding of the recovery experiment may confuse other individuals.

The other problem is that, by relating to individuals with mental illness, the supporters themselves may regress. Therefore, it is essential that peer supporters are continuously backed by professionals with stable mental states.

Conclusions

The effects of peer support on individuals with serious mental illnesses can be explained by chaos theory. Individuals with mental illnesses and professionals who adhere to social rules exhibit very different thinking processes. Therefore, clients may not trust their professionals, and the professionals may experience the burnout syndrome. The “Wisdom” phrase of the “Serenity Prayer” inspired two solutions to the burnout problem: peer support effect and the ability to sense the direction of behavioral changes through the continuously covariant relationship between client and professional or peer supporter.

Peer supporters can easily establish continuously covariant relationships with individuals with mental illnesses. Individuals can better relate to recovery experimenters than to professionals and may thus be guided toward social rules. Because peer supporters can confirm their own existence through the covariant relationship, they will consciously contribute to the support. However, professionals with fixed mental states play a vital role in supporting peer supporters who may otherwise revert to confusion or make errors that negatively affect the individual. A positive relationship will likely reduce the recurrence of serious mental illnesses in supporters.

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