

MATHEMATICAL APPROACH TO STROKES AS AN ATTRACTOR WITHIN COMMUNICATION DYNAMICAL SYSTEM

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Abstract: Transactional Analysis as a personality theory has offered some powerful concepts to explain and improve communication between individuals. On the other hand, positive productive communication among large numbers of people, as a compound set of transactions, as an essential aspect of human survival has not been so well explained. Like the weather and other chaotic processes, group behavior is not easily understood or predicted. It has been long suspected that in large groups of people (organizations, communities, societies), positive communication has a leading role in maintaining the duration and quality of communication.

It is the aim of this paper to relate the mathematics notion of dynamical systems to the compound system of communication. The postulate that strokes, a concept introduced by E. Berne as a way in which people recognize each other, and elaborated by Steiner as a way of exchanging information, is discussed as a concept that introduces stability into the functioning of large groups.

Keywords: communication, strokes, dynamical system, attractor.

Introduction

Strokes are a notion introduced by Eric Berne in 1964 [1,2], in order to better explain the content of transactions between individuals' ego states [14,21,26,27]. The concept of strokes illustrates how and why people communicate and how interpersonal transactions influence personal growth. Strokes are defined by Berne as units of recognition; essential for physical and psychological survival. Strokes can be positive or negative depending on their capacity to generate well-being. We are proposing that two concepts – positive strokes and discounts (negative strokes) - clarify how reality functions within communication.

We have used mathematical theory of dynamical systems to prove several important hypotheses:

First we show that any group of people communicating is a dynamical system.

Second we show that the set of strokes in such dynamical system is an attractor - a stable set that attracts other parts of the system.

Finally, based on the previous two propositions we conclude that the set of strokes in the system is the aspect of communication that lends stability and harmony to the group.

The Relationship between Reality and Communication

Positive Strokes and Reality

Positive strokes may be described as an easy and simple way of sharing personal information, of connecting and feeling love and belonging [3-5]. The exchange of “personal reality” satisfies the general need to confirm reality.

Although strokes reflect reality, they are under influence of socio-cultural conditions, which are most strongly transmitted by parents and secondarily by siblings, relatives, friends, neighbors, coworkers

and so on. Consequently, while not perfectly correlated with reality communication where positive strokes dominate is reality-rich.

Discounts and Reality

Discounts illustrate how reality can be ignored; communication dominated by discounts initiates and establishes a specific and pathological approach to reality. Discounts are negative strokes and may also be defective replacements for positive strokes or “fake psychological food”. Discounts represent communication but they are toxic and while they may prevent the “spinal cord” from “shrivel (ing) up” [1,2], they are not otherwise beneficial to either person.

At the beginning of an exchange of communication transactions it is possible that the people involved accept such “toxic psychological food” because they cannot differentiate between strokes and discounts. But discounting leads to confusion, all the more because of the various possibilities of personal realities and discounting methods [10]. There may be as many types of discounting methods and realities as there are individuals.

Analyzing communication from the point of view of reality we may say that strokes and discounts are the basic elements of communication. In fact, any transaction, regardless of which ego state it is coming from, consists of positive strokes, (henceforth we will refer to positives strokes as simply, strokes) discounts, or both. What is the reason for the frequent occurrence of discounts, as a part of communication? According to Berne’s script theory, people ignore (discount) parts of reality in order to maintain their life scripts and script beliefs. But beside the discounts of reality occurring in individual life scripts, discounting may occur in large groups, because of pervasive cultural influences [6]. In addition, in the early phases of language and communication development children and even grownups cannot effectively detect and defend themselves against discounts.

Nevertheless, the reality principle, with its consistency, is a powerful factor, so that even when being avoided, reality forces even the most extreme discounters into eventual contact with itself.

Different aspects of the “handling” the reality are projected through the person’s views. The more the individual “seals” off reality by ignoring it, the more communication will be distorted.

In discounting, the specific personal scripted character of the discounter is manifested [10,26,27]. That causes several types of specific, equally character script-based, reactions by those being discounted:

- Accepting the other’s view and ignoring one’s own - overadaptation;
- Accepting the other’s view and adding one’s own mixtures of discounts-agitation;
- Passivity - not doing anything;
- Competition - responding with a discount of one’s own;
- Psychosomatic reactions (hurting him/herself);
- Violence (hurting others).

All of these responses provide both participants with strokes (recognition) albeit of a negative, toxic, nature. On the other hand, stroke rich-communication (henceforth positive strokes will also be referred to as, simply, strokes) represents an implicit mutual consensus about truth and reality which generates a beneficial, effective and simple process of mutual recognition.

The Attraction of Strokes versus the Attraction of Discounts

How do we make a distinction between stroke-dominated communication and discount-dominated communication in large groups of people? We find clues in the:

1. Duration of communication;
2. Subjective pleasure derived from communication.

Although the above criteria may be checked separately, it is only the fulfillment of both that points to a stroke-dominated communication. That means that if either of the above (duration, subjective pleasure) are not satisfied, then the communication is not dominated by positive strokes.

1. Duration - Participants tend to withdraw from discount dominated communication resulting in shorter duration of communication. Communication in which discounts dominate, involves giving up one's subjective reality in behalf of someone else's subjective reality, or insisting on one's own, in contrast to the other's, with resulting confusion, agitation, or even violence. Such communication creates crossed transactions and creates conflict which tends to curtail the duration of communication.

2. Subjective pleasure - In communication there is an exchange of subjective pleasures, which periodically may or may not occur. Observation of various groups suggests the fluctuation of subjective pleasure among the participants may show whether strokes or discounts dominate communication. In discount-dominated communication, there could be subjective pleasure for only some individuals, while for most of the participants there will not.

In communication where strokes dominate, there is a long duration as well as the subjective feeling that time is running fast, and subjective pleasure for most of the participants. Stroke-rich communication provides satisfaction of the psychological hunger for stimulus, structure and recognition.

Within the organization of societies there are periods of scarcity of strokes. Those are periods of crisis or transition. During such periods some people get used to minimum levels of stroke exchange. In societies "starved" of strokes a discount resembles the stroke the "starved" members of the society hunger for; the usual ways of getting recognition are changed.

When there is a lack of positive strokes, people may choose negative strokes and it is possible for people to be attracted and organized by discounts. People get attracted by discounts while it is originally strokes they search for [5]. Because of that, the attraction of discounts is of short duration and lacking subjective pleasure for the participants.

Research demonstrates that there is a need in people to connect, as well as a need for sensation [9]. A person may have a feeling of lack of success and contact, when he/she is detached from his/her feelings [4]. The greatest sources of strokes in such conditions are where people gather such as in squares, parks, stadiums or concerts.

The attraction of positive strokes is that they provide long-term optimism and confirm the basic hypothesis that people are basically OK.

Study of the process of Strokes' Attraction

We observed the movement of people within a psychiatric section of a hospital. The hospital has a specific internal architecture that corresponds to efficient and economic hospital functioning. Seldom do the architects pay much attention to the people's needs, especially psychological ones, but people nevertheless find the sources of available strokes within the building.

The following example in the psychiatric sector of a hospital is characteristic. Patients of the psychiatric sector do not have to spend their time in bed, and their mobility is not obstructed by their medical condition. So, in such a small space, their movement may be observed and the frequency of their presence in certain places may be measured.

We observed that most of the mornings, time spent was in stroke-rich rooms like the psychiatrists' rooms and the psychologist's room. But, during the late afternoon and early evening, the living room with the TV became a stroke rich area because of the presence of the night shift workers and the patients who often communicated positively with them. This attracted others, so the living room became a region providing

contacts until the evening (Fig.1 a,b,c). This illustrates the fact that strokes attract communication so that, over time, participants are attracted by the stroke source, and gradually strokes dominate over discounts. This provides optimism and trust. As personal responsibility for the communication quality increases by training patients in the exchange of strokes, the awareness of the importance of such a communication also increases, creating a situation where communication will be a source of pleasures instead of discounts.

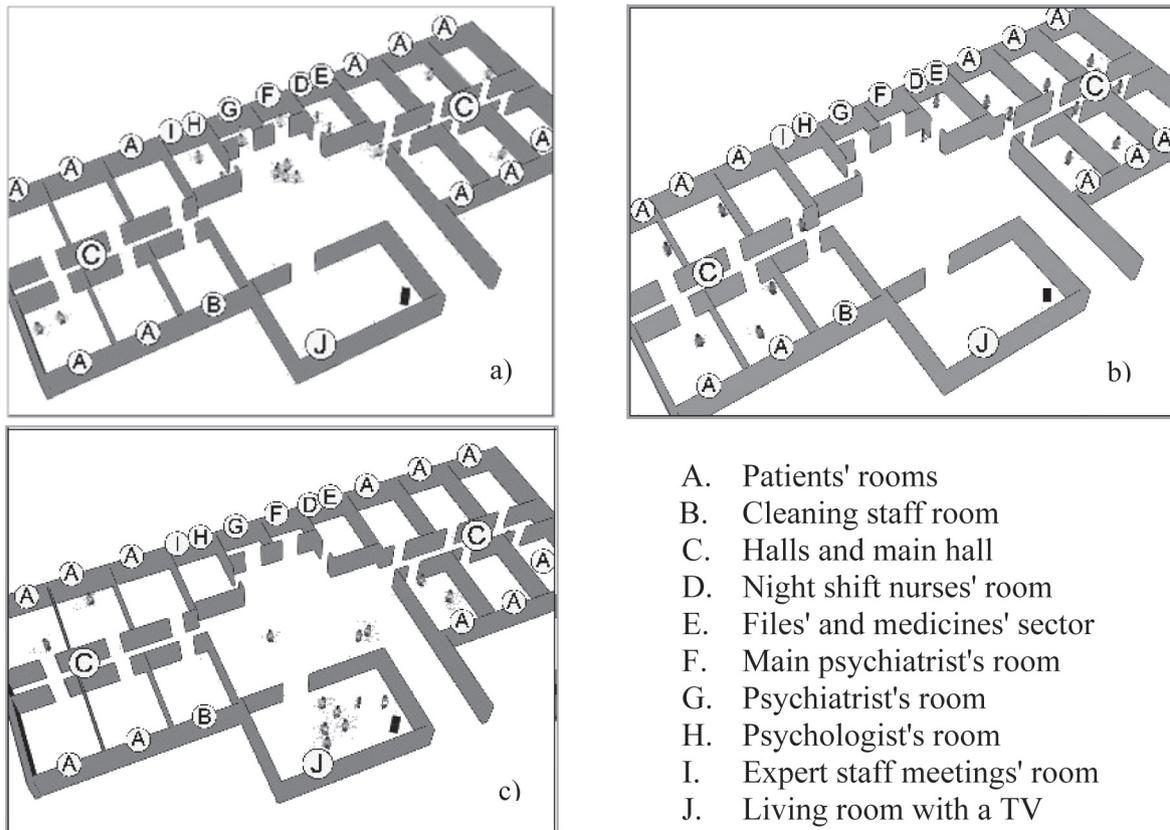


Figure 1. a) Patients' movements situation 1, which takes place from 9am till 4pm; b) Patients' movements situation 2, which takes place from 4pm till 6:30pm; c) Patients' movements situation 3, which takes place from 6:30pm till 9:30pm

Observation of patient movement in the psychiatric ward seems to corroborate the hypothesis that strokes create and attract strokes. Let us now look at this proposition from a mathematical perspective.

Mathematical Analysis

Introduction to the Mathematical Analysis

Up to this point of the text, we have set a hypothesis that in large groups, strokes are those specific parts of the communication within the groups that provide and improve its quality and duration. The mathematical section that follows is intended to serve as support to such a hypothesis with mathematical proofs of the same claim.

Symbols

Let us establish the symbols we will use in our proofs for denoting various terms:

- SS - set of strokes;
- GP - group of people;
- S_A^B - stroke that a subgroup A of GP gives to a subgroup B of GP ;
- D_A^B - discount that a subgroup A of GP gives to a subgroup B of GP ;

- T_A^B - transaction from A to B ;
- $s(n)$ - number of all possible “stroke events” within group of n people;
- \wedge - universal joining symbol that stands for “and”;
- C_n^k - number of all combinations of k elements out of n elements;
- CDS - communication dynamical system;
- M -Groups – mathematical groups.

The Stroke Number Formula

Here we show how we can calculate the number of all possible “stroke events” (regardless of their content) in a group of n people. In our research, the most important thing that this calculation provides us with is that, no matter how big the number of people in a group might be, the number of stroke events or other communication units events is always finite.

To get a clearer picture, let us observe what we mean by stroke events, by visualizing few of the possible situations, where the “circled” members are the ones giving strokes (Fig. 2):

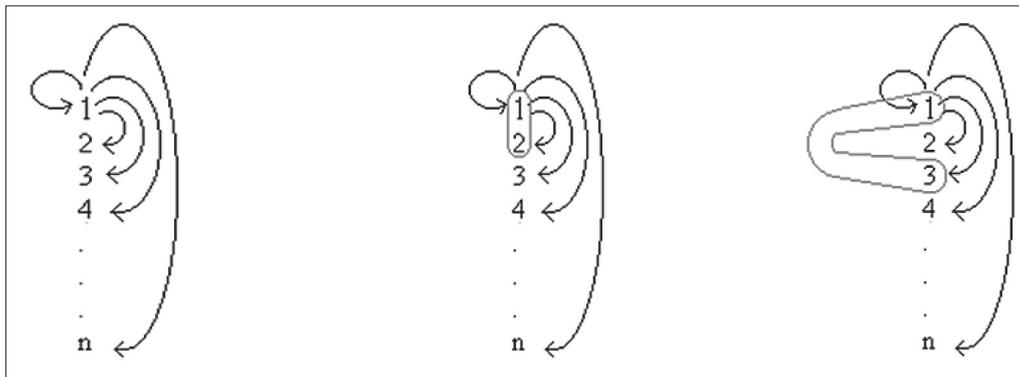


Figure 2. Visual review of some possible situations of stroke events

We obtain the total possible number of strokes events $s(n)$ as follows:

$$\begin{aligned}
 s(n) &= C_n^1 C_n^1 + C_n^1 C_n^2 + C_n^1 C_n^3 + \dots + C_n^1 C_n^n + \\
 &+ C_n^2 C_n^1 + C_n^2 C_n^2 + C_n^2 C_n^3 + \dots + C_n^2 C_n^n + \\
 &+ C_n^3 C_n^1 + C_n^3 C_n^2 + C_n^3 C_n^3 + \dots + C_n^3 C_n^n + \\
 &+ \dots + C_n^n C_n^1 + C_n^n C_n^2 + C_n^n C_n^3 + \dots + C_n^n C_n^n = \\
 &= C_n^1 (C_n^1 + C_n^2 + C_n^3 + \dots + C_n^n) + C_n^2 (C_n^1 + C_n^2 + C_n^3 + \dots + C_n^n) + \\
 &+ C_n^3 (C_n^1 + C_n^2 + C_n^3 + \dots + C_n^n) + \dots + C_n^n (C_n^1 + C_n^2 + C_n^3 + \dots + C_n^n) = \\
 &= (C_n^1 + C_n^2 + C_n^3 + \dots + C_n^n)^2 = \\
 &= (C_n^0 - C_n^0 + C_n^1 + C_n^2 + C_n^3 + \dots + C_n^n)^2 = \\
 &= (C_n^0 + C_n^1 + C_n^2 + C_n^3 + \dots + C_n^n)^2 - 2C_n^0 (C_n^0 + C_n^1 + C_n^2 + C_n^3 + \dots + C_n^n) + (C_n^0)^2 = \\
 &= (1+1)^n)^2 - 2C_n^0 (1+1)^n + 1^2 = \\
 &= 2^{2n} - 2^{n+1} + 1 = \\
 &= (2^n - 1)^2.
 \end{aligned}$$

Therefore, for a group of n people, $s(n) = (2^n - 1)^2$.

Thus we will call $s(n) = (2^n - 1)^2$ the **stroke number formula**.

Examples:

a. For a “group-dyad” of two people, total number of stroke events is:

$$s(2) = (2^2 - 1)^2 = 3^2 = 9.$$

b. For group of four people, total number of stroke events is:

$$s(4) = (2^4 - 1)^2 = 15^2 = 225.$$

By defining the recognition unit of communication as a stroke, Berne made it possible to quantify the important activity of communication. We have now shown that we can compute the total number of possible stroke events in a group of people.

The Two Steps

The mathematical analysis we undertake consists of the following steps:

Step one: Using mathematical tools, we show that the set of strokes (SS) in any group of people (GP), has certain highly favorable properties that **give SS a fine structure**, which is called an M -group.

Step two: Second we show that communication within any group of people GP is a **dynamical system**, which we call CDS and that SS is the attractor into the CDS.

Step One

Step 1 is divided in showing two substeps:

A. Strokes can be divided into classes (sets) of strokes;

B. Union of classes of strokes has a stable structure (union of two or more sets is defined as a set that consists of all elements of all of the sets).

A. Our first objective here will be to elaborate and analyze the structure of the set of strokes (SS) that are being exchanged in a group of people. Thus, our first substep starts with the construction of a SS in a group of people (GP). We will denote the number of group members as n and we will number them from 1 to n .

Let us introduce the notion of **saturated stroke exchange** (further denoted by S_0), which we define as a closed cycle of strokes' exchange. One may notice that the exchange of strokes is much richer within any TA group than within an average group of people. This can be attributed to the saturation of strokes within the TA group and the process functions as follows: subgroup A of GP gives stroke/s to subgroup B of GP (A and B may have either empty or non-empty intersection. By non-empty we mean that both A and B contain at least one group member.), and then subgroup B gives stroke/s to subgroup A . (We will assume that both A and B accepted the given stroke/s). This would constitute a saturated stroke exchange. Further, giving a self-stroke would also be a saturated stroke exchange (A to A). Any subgroup may consist of only one member. The symbol denoting A giving a stroke to B will be S_A^B . Here, A and B are any non-empty subsets of $N = \{1, 2, 3, \dots, n\}$ - the set of all group members.

We now divide SS - the set of strokes - into classes of strokes related to each other in the following way (we need such a substep to analyze the stroke's stability accurately):

We define the relation “ \approx ” between strokes in the following way: If $A \cap B = C$, $C \neq A$, $C \neq B$ (where the symbol “ \cap ” denotes the intersection of the sets A and B), then $S_A^B \approx S_{A \cap C}^{B \cap C}$.

To explain: Symbol “ \setminus ” in $S_{A \setminus C}^B$ means that we exclude those members which are same both up and down. It is then a new stroke without the saturated stroke exchange within and which is in relation “ \approx ”

with the starting one, according to the relation definition. Then “ \approx ” is an equivalence relation, which means that “ \approx ” divides SS into disjoint classes, which are in fact subsets of SS that do not have same strokes in common. We may then observe the set SS - set of **stroke classes** (groups of “similar” strokes) instead of SS . Further in the text, instead of “stroke class” we will simply say - stroke.

To see how we group the strokes, let us get back to example a) mentioned above. By our definition, there are 3 stroke classes: $\{S_1^1, S_2^2, S_2^2\}$, $\{S_1^2, S_1^2, S_2^2\}$, and $\{S_2^1, S_2^2, S_2^1\}$. We notice that, the first class consists of all saturated stroke exchanges (and we will denote it by S_0), and that the other two classes consist of strokes that would be equal among each other if we exclude the saturated cycle from them.

B. The following substep is to show that SS has a fine structure, called mathematical algebraic group, or shortly an **M-group**. We define an “operation \wedge ” in the following way:

$$S_A^B \wedge S_C^D = S_{A \cup C}^{B \cup D}$$

The symbol \wedge is the universal joining symbol and stands for “and”. Here we may refer to it as a **stroke joining**. We actually join the ones who gave strokes (in the lower index), and the ones who received strokes (in the upper index).

To be an M -group, the following four conditions must be satisfied:

i. The result of the stroke joining must be a stroke.

Obviously, it is.

ii. The associative law must be satisfied (meaning it doesn't matter which two out of three strokes are joined first). It is, because by the definition of “ \wedge ”,

$$(S_A^B \wedge S_C^D) \wedge S_E^F = S_{A \cup C}^{B \cup D} \wedge S_E^F = S_{A \cup C \cup E}^{B \cup D \cup F} = S_A^B \wedge S_{C \cup E}^{D \cup F} = S_A^B \wedge (S_C^D \wedge S_E^F).$$

iii. There must exist a neutral element - it is the element that does not change the result under the operation \wedge . Here the neutral element is the saturated class, which was previously denoted by S_0 . Actually, the following condition is satisfied:

$$S_A^B \wedge S_0 = S_0 \wedge S_A^B = S_A^B.$$

iv. There must exist an inverse element - it is the element which gives the result S_0 - the neutral element under the operation \wedge . The following condition is satisfied:

$$S_A^B \wedge S_B^A = S_B^A \wedge S_A^B = S_0.$$

By showing that SS satisfies the above conditions 1-4, we obtain that SS with the joining operation \wedge , is an M -group, which encourages further analyses in terms of stability of the SS structure.

Step Two

One of the issues that are really important to understand is the following question: Why is stability of a set within a dynamical system so important? The greatest and most important difference between a stable and a non-stable set is that a very small change in the starting conditions results with a small change in the final result at the stable set case, and may result with an extremely big change in the final result at the non-stable set case. That strongly encourages us to think of defining a dynamic system, of which SS would be a subset. Being stable enough, SS would be an attractor. In the case of a stable system, there is a certain order within the system, and furthermore, it is very possible to predict the final result.

Step 2 we also divide in two substeps:

A. Communication that involves stroke events is a dynamical system;

B. Strokes as being the attractor of the system provide the stability in any type and level of communication.

Definition of a Dynamical System

Before we get to the precise definition of a dynamical system [7,8], we may intuitively think of it as any natural system that goes through some changes throughout the time – as in human life, the family system, any process within interpersonal relationships, earth’s revolution, atom’s nucleus, and an infinite number of other examples.

Definition: *Dynamical system* on the space X is the triple (X, N, p) , N being the set of all natural numbers plus 0, where $p: X \times N \rightarrow X$ is a mapping that satisfies the following three conditions (axioms):

$$p(x, 0) = x, \forall x \in X \text{ (identity axiom)} \tag{1}$$

$$p(p(x, t_1), t_2) = p(x, t_1 + t_2), \forall x \in X, t_1, t_2 \in N \text{ (M-group axiom)} \tag{2}$$

$$p \text{ is continuous (continuity axiom)} \tag{3}$$

The Communication Dynamical System (CDS)

What’s important for us right now to elaborate, are substeps A and B, which would mean that:

- Communication among people is a dynamical system;

- The stability of the whole system is provided by the set of strokes **SS**;

- **SS** is not only a stable set, but also an attracting set – which means that through time it attracts other parts of the system.

A. First, let us do the construction of the communication dynamical system CDS. Here we keep in mind that from aspect of the level of ignoring the reality (generally or partially), any transaction consists of a part which ignores (discounts or grandiosities), a part that corresponds to the reality, or may consist of both. If we denote the transaction by T , and the discount (grandiosity) by D , then we can formally write:

$$T_A^B = D_{A_1}^{B_1} \wedge S_{A_2}^{B_2} .$$

To explain this better, T_A^B means that a group A gives a transaction to a group B , and within that transaction a subgroup A_1 of A gives discounts to a subgroup B_1 of B , and a subgroup A_2 of A gives strokes to a subgroup B_2 of B . Let C be the set of all transactions events. The previously shown M -group property of **SS**, enables us to precisely perform satisfaction of the three above-mentioned axioms. Namely, what might seem “understandable” to conclude, would not be correct or true if **SS** were not an M -group. Just for instance, to be able to complete showing the axioms - particularly axiom (2), we need a concrete order of operating. The associative law that **SS** satisfies (condition 2 for M -group), enables us to choose whatever order we need.

Now, we may finally define the mapping $p: C \times N \rightarrow C$, by putting:

$$p(T_A^B, t) = S_{B_1}^{\{the_first_t_members_of_A_1\}} \wedge S_{A_2}^{B_2} \wedge D_{A_1 \setminus \{the_first_t_members_of_A_1\}}^{B_1}$$

The actual meaning of p is suggesting positive communication with lowering the number of discounts as the communication continues. That is, suggesting a tending of some people answering with strokes to received discounts. We will show that p satisfies the three axioms, which would make the triple $(C, N, p) = CDS$ a dynamical system.

1. $p(T_A^B, 0) = S_{B_1}^{\{the_first_0_members_of_A_1\}} \wedge S_{A_2}^{B_2} \wedge D_{A_1 \setminus \{the_first_0_members_of_A_1\}}^{B_1}$, but the first stroke is no stroke, since it is a formal denotation of a “stroke” given to zero people, and the discount actually stays unchanged, since A_1 and B_1 stay as they were. So we obtain that $p(T_A^B, 0) = S_{A_2}^{B_2} \wedge D_{A_1}^{B_1} = T_A^B$, and by that we completed showing 1).

$$\begin{aligned}
 2. \quad & p(\pi(T_A^B, t_1) t_2) = \\
 & = \pi(S_{B_1}^{\{the_first_t_1_members_ \emptyset _ A_1\}} \wedge S_{A_2}^{B_2} \wedge D_{A_1 \setminus \{the_first_t_1_members_ \emptyset _ A_1\}}^{B_1}, t_2) = \\
 & = S_{B_1}^{\{the_first_t_2_members_ \emptyset _ A_1 \setminus \{the_first_t_1_members\}\}} \wedge S_{B_1}^{\{the_first_t_1_members_ \emptyset _ A_1\}} \wedge S_{A_2}^{B_2} \wedge \\
 & \wedge D_{A_1 \setminus \{the_first_t_1+t_2_members_ \emptyset _ A_1\}}^{B_1} = \\
 & = S_{B_1}^{\{the_first_t_1+t_2_members_ \emptyset _ A_1\}} \wedge S_{A_2}^{B_2} \wedge D_{A_1 \setminus \{the_first_t_1+t_2_members_ \emptyset _ A_1\}}^{B_1} = \\
 & = \pi(S_{A_2}^{B_2} \wedge D_{A_1}^{B_1}, t_1 + t_2) = \\
 & = \pi(T_A^B, t_1 + t_2)
 \end{aligned}$$

Therefore 2) is also satisfied.

3. This axiom is satisfied, because any mapping on discrete space is continuous [19], and so is p , since $C \times N$ is discrete. It is, because the number of stroke events was finite (see Stroke Number Formula), as well as the number of discount events which may be defined analogously.

B. So far, we have shown that there exists a dynamical system of transactions, which we named CDS. In order to show that \mathcal{SS} is attracting set, it would be enough to show that each sequence $\{T_A^B, \pi(T_A^B, t_1) \pi(T_A^B, t_1 + t_2) \pi(T_A^B, t_1 + t_2 + \dots + t_n), \dots\}$, $n \in N$, has a limit that is an element of \mathcal{SS} . Let us analyze the sequence element $\pi(T_A^B, t_1 + t_2 + \dots + t_n)$.

Suppose that the subgroup A_1 of A giving discounts to the subgroup B_1 of B has k members. If $t_1 + t_2 + \dots + t_n < k$, then we obtain:

$$\pi(T_A^B, t_1 + t_2 + \dots + t_n) = S_{B_1}^{\{the_first_t_1+t_2+\dots+t_n_members_ \emptyset _ A_1\}} \wedge S_{A_2}^{B_2} \wedge D_{A_1 \setminus \{the_first_t_1+t_2+\dots+t_n_members_ \emptyset _ A_1\}}^{B_1}$$

which here may be expressed simply as $S_n \wedge D_n$. But if $t_1 + t_2 + \dots + t_n \geq k$, then:

$$\pi(T_A^B, t_1 + t_2 + \dots + t_n) = S_{B_1}^{\{the_first_t_1+t_2+\dots+t_n_members_ \emptyset _ A_1\}} \wedge S_{A_2}^{B_2} \wedge D_{0_members_ \emptyset _ A_1}^{B_1}$$

However, since $D_{0_members_ \emptyset _ A_1}^{B_1}$ is only formal denotation of absence of any discount, and “the first $t_1 + t_2 + \dots + t_n$ members of A_1 ” is in fact the whole group A_1 , in such case we obtain that the element $\pi(T_A^B, t_1 + t_2 + \dots + t_n) = S_{B_1}^{A_1} \wedge S_{A_2}^{B_2} = S_{B_1 \cup A_2}^{A_1 \cup B_2}$. Let us denote it by S_k . Then, the discussed sequence may be written as $\{T_A^B, S_1 \wedge D_1, S_2 \wedge D_2, \dots, S_{k-1} \wedge D_{k-1}, S_k, S_k, S_k, \dots\}$.

The latest unequivocally shows that the element S_k is the sequence limit. It is clear that S_k is an element of \mathcal{SS} .

By that we have shown \mathcal{SS} is global attractor in CDS, because it attracts an arbitrary transaction T_A^B from C . It means that \mathcal{SS} gives stability and harmony to the whole system. \mathcal{SS} being an attractor means that strokes attract other strokes, strokes provoke other strokes, and that strokes attract even transactions that do not contain only strokes. It also means that in time the non-stroke part shrinks, and the stroke part grows.

Conclusions

Our research was directed to answering the question: In large groups, what keeps people in the communication process and what improves communication? From Transactional Analysis theory, we know that strokes maintain the positive quality in communication on an interpersonal level. But what can we conclude when there are large groups of people communicating? In such groups of people, because of the plentitude of interpersonal communications, they may easily seem chaotic and unavailable for precise observation and analysis by a transactional analyst. In theory, it is possible to observe such a process with the same number of transactional analysts as there are interpersonal relationships. But even if that was possible a problem

might occur in their coordinating and their successive reports.

The previous analyses show that in large groups of people (people who don't know each other well or the group is not homogenized) strokes attract people to stroking communication. If we analyze the mapping p , we can conclude that such a process in such a dynamical system can be maintained, if our transactions are rich with strokes, even in cases when the transactions that we receive from other people contain a "non-stroke" part. SS as an attractor constitutes the main influence in the duration of communication and provides the subjective pleasure of it (I'm OK, you're OK, others are OK). When there is communication with rare or no strokes, on the other hand, such groups fall apart relatively quickly because of the lack of an attractor.

From these findings we can see the important beneficial consequences of an environment rich with positive strokes. At a time in which millions of human beings are involved in numerous destructive behaviors, these findings suggest that the promotion of positive strokes among people can be a stabilizing influence in the direction of cooperation and non-violence.

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