Nonlinear Dynamics in Work Groups with Bion’s Basic Assumptions

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RUNNING HEAD: [Bion’s basic assumptions in work groups]

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Abstract: According to several authors Bion's contribution has been a landmark in the thought and conceptualization of the unconscious functioning of human beings in groups. We provide a mathematical model of group behavior in which heterogeneous members may behave as if shared to different degrees what in Bion's theory is a common basic assumption. Our formalization combines both individual characteristics and group dynamics. By this formalization we analyze the group dynamics as the result of the individual dynamics of the members and prove that, under some conditions, each individual reproduces the group dynamics in a different scale. In particular, we provide an example in which the chaotic behavior of the group is reflected in each member.

KEYWORDS: basic assumption; complex dynamics chaos; group dynamics; Wilfred Bion
INTRODUCTION

According to the literature, groups, rather than individuals, are the fundamental unit of work in modern organizations. In fact, routine work and on-going work are often organized in formal and also informal organizational subunits. Also nonroutine work and new activities are accomplished through teams, committees, or ad hoc work groups. Therefore, groups and group behavior are consequential for organizational performance and for individual group members. Also in groups individuals have the opportunity to engage in face-to-face interactions more regularly than at the organizational level. Since often in organizations several different subunits may interact, it is rather natural to think of organizations as complex systems. Several authors have explored the vast potential for complexity theory to inform and transform research in organization studies. Morel and Ramanujam (1999) illustrate how organization theory can benefit from the advances in complexity theory when this is done relying on mathematically proven or computationally justified facts; this way, some of the pitfalls illustrated in Kellert (2008) are likely to be avoided and the complexity metaphor can be quite powerful. Among nonlinear systems, organization theory has devoted a lot of interest to chaos theory (Thietart & Forgues, 1995). On the other hand, Dooley and Van de Ven (1999) challenge researchers to extend their focus beyond a discussion about the implications of chaos, in order to seek out organization-specific generative models that can explain how chaotic behavior comes about in the first place. Finally, for a recent analysis of how complexity science has been used to study organizations the reader may refer to Dooley (2009).

While, as we have seen, several contributions explore organizational complexity, fewer explore group complexity. Among the others, Arrow, McGrath, and Berdahl (2000) consider the complexity of small groups; more specifically, Fuhriman and Burlingame (1994) use chaos
theory to analyze processes in small groups. Guastello (2009, 2010) uses the nonlinear dynamical system perspective to analyze important aspects of teams and groups behavior. Finally, Dal Forno and Merlone (2010) show how complex behavior can arise in supervised work groups. Nevertheless, several other aspects of group complexity need to be explored as it may reflect in the whole organization.

The organizational literature often dismisses the psychoanalytical aspects which govern groups and organizations. For example, although group behavior is a central topic in most Organizational Behavior and Industrial-Organizational textbooks (see for instance Aamodt, 2004; Robbins & Judge, 2009), most of them ignores psychoanalytical approaches to group behavior. There may be different reasons for this, for example according to Cilliers & Koortzen (2000) “...this is because I-O psychology traditionally functions from a rational and economical view towards work, with its assumption that a person works to earn money and to satisfy the need for material possessions” (p. 59). Nevertheless, recently other aspects such as irrationality and the unconscious processes have been taken into account by a number of business scholars who explored the psychology of executives (Coutu, 2004). Therefore, in order to pursue a better understanding of group behavior, it is necessary to give proper consideration also to the unconscious aspects. Several authors such as Jaques (1970), Hirschhorn (1988), and Kets de Vries (2006) explore the psychodynamic aspects of the organizational life. This approach is central to conceptual framework used by practitioners at the Tavistock Institute of Human Relations in the UK and the A.K. Rice Institute in the US. It is important to stress how the approach of the Tavistock Institute of Human Relations uses both the work of Wilfred Bion on groups and the open system theory (Roberts, 1994). Furthermore, according to Obholzer, in institutional processes an “awareness of underlying anxieties and fantasies enable us to manage
ourselves and our systems in such a way as to make improved use of resources, both psychological and physical” (Obholzer, 1994, p.169). Recently, Styhre (2008) has provided a Lacanian perspective to analyze how used documents are used in management control. Morgan (1997) shows how using perspectives coming from other disciplines can provide interesting insights and, when the pitfalls in this process are avoided, some broader lessons can be learned from cross-disciplinary borrowing as suggested by Kellert (2008).

In the last fifteen years several applications of nonlinear dynamics to psychoanalysis have appeared. In fact, according to Seligman, chaos theory and complex systems theory share with psychoanalysis an interest in pattern and instability/stability over time (2005, p.286). On the other hand, Levin (2000) remarks that chaos theory offers a unique perspective which may improve our understanding of learning, development, and psychopathology. Finally, Besser, Priel, Flett, and Wiznitzer (2007) provide an empirical exploration of nonlinear relations between personality and depression.

The main goal of this paper is to formalize some psychological aspects of group behavior in a simplified mathematical model to observe under what conditions the group and the individuals influence reciprocally. As Monge (1990) states:

Mathematics contains a reservoir of concepts and a framework for analysis that can increase the precision and rigor of conceptual and empirical work. These tools permit the scholar to examine the implications of different dynamic formulations and thereby explore the process ramifications of the theory in ways that are more difficult at the verbal level. (Monge, 1990, p. 407)

In particular, we use chaos theory and properties of nonlinear dynamics to suggest a different
approach in order to understand how members in a work group interact. We do not use nonlinear system only as a metaphor rather, as Morel and Ramanujam (1999) advocate, ground our approach on a mathematical model. In order to develop it introducing some unconscious aspects of group behavior, we consider some contributions from the work of Wilfred Bion. In fact, according to Stokes (1994), Bion provided some of the major contributions to the understanding of unconscious process in groups. His contributions have provided useful tools of analysis and interpretation to organization consultants (Moxnes, 1998). Furthermore, several other authors have continued to develop Bion's thinking about groups; among the others we mention the contributions by Turquet (1974), Rice (1969) and Lawrence, Bain, and Gould (1996). Finally, using Bion's theories in a mathematical model of group behavior seems quite appropriate given the importance Bion gave to mathematics in his theorization1.

Considering Thorngate's (1976) postulate of commensurate complexity, our model is situated in the area between simplicity and generality at the cost of sacrificing accuracy. In fact, according to this postulate, it is impossible for a theory of social behavior to be at the same time general, accurate and simple. Therefore, using Weick's terminology about the inevitable tradeoffs in inquiry -the well known GAS model (Weick, 1969)- our approach can be situated as a *ten o'clock research*.

The structure of the paper is the following. First we discuss some important topics in the Organizational Behavior and Industrial-Organizational literature about groups; in particular, how the size of the group affects the interaction between members. Then we present some of the contributions Bion gave to the unconscious aspects of group behavior considering some important concepts such as the basic assumptions and valency. The mathematical model is described and some results are provided. The following section is devoted to some examples of
group dynamics which show how individual and group behavior influence each other. Finally, in the last section we discuss our results, and examine some future lines of research.

**THE GROUP BEHAVIOR IN ORGANIZATIONS**

As we mentioned in the Introduction, groups and groups behavior are a central topic in most Organizational Behavior and Industrial-Organizational textbooks. Among the reasons for the importance of this topic is the fact that common to all the enterprises and organizations is the deployment of human resources. Furthermore, it is well known that human beings do not exist simply as individuals rather, they interact in groups. In fact, most employees belong to some work group, and organizations often establish groups to accomplish important tasks (Jex, 2002). Groups include joint activities that either focus on a specific task or concern the interpersonal relations between members.

Groups of different size have different patterns of behavior. According to Aamodt (2004) groups perform best when group's size is small. In fact, one variable which affects group's performance is the communication structure or network. For example, Shaw (1964) considers and compares centralized and decentralized communication networks. In groups which adopt centralized communication networks, communication tends to flow from one source to all the group members (Jex, 2002). By contrast, with a decentralized communication network, communication flows freely within the group. One of the drawbacks of decentralized communication networks is that the flow of information increases exponentially with the size of the group, therefore there are limits on the number of members that allows this communication structure network to be effective. According to Obholzer (1994) “any group numbering more than about twelve individuals is ineffective as a work group, incapable of useful debate and
effective decision-making” (p. 169). In terms of size, Miller & Rice (1967) consider groups of about up to twelve members, which have the essential characteristics of the small face-to-face group, and larger groups which tend to split into subgroups. Therefore, in the following we will consider only small groups which allow for face-to-face interactions among members.

Besides the important aspects about groups which are central in the Organizational Behavior and Industrial-Organizational literature we want to consider some psychological aspects which are usually neglected. In particular, we propose some of the contributions Bion gave to the study of group dynamics in Bion (1961) considering the unconscious functioning of human beings in groups.

**THE BASIC ASSUMPTIONS**

In this section we summarize the framework Bion developed for analyzing some of the irrational features of unconscious group life. The interested reader may also refer to Stokes (1994) and to the original work by Bion (1961).

In Bion's analysis there are two main distinct tendencies in the life of a group. The first one is the tendency to work on the primary task, or the so called W group or *work-group mentality* (Stokes, 1994). In work-group mentality, all the members are intent on carrying out a specific task and assess their effectiveness in doing it. Using Bion's words “if the individual sticks to his task, if he co-operates with other individuals in letting them fulfill their tasks, then all will be well. In my terminology this would be the equivalent of saying that if the W group were the only component in the mental life of the group, then there would be no difficulty” (p.129). By contrast, there is a second, often unconscious tendency to avoid working on the primary task. Bion named the latter *basic assumption mentality*. According to Stokes (1994)
“these opposing tendencies can be thought of as the wish to face and work with reality, and the wish to evade it when it is painful or causes psychological conflict within or between group members” (p.20). For example, Sokol (1994) describes a situation in which a basic assumption may be manifested as reactions to a new technology.

Bion (1968) identified three basic assumptions, each characterized by a particular complex of feelings, thoughts and behavior; namely Dependency, Fight/flight, and Pairing.

**Dependency**

In a group dominated by the basic assumption of Dependency (baD) members behave as if the primary task is solely to provide for the satisfaction of their needs and wishes. In such a group, in the same way as a child, members unconsciously experience dependency from an imaginative parental figure or system. Because their needs are not met, members experience frustration, helplessness, powerlessness, and dis-empowerment. This kind of defense against anxiety can also be interpreted as a manipulation of authority out of its role, according to the fantasy² that then the group will be safe/cared for (Cilliers & Koortzen, 2000). The leader becomes a focus for a pathological form of dependency which inhibits development and growth. Furthermore, provided the illusion that the leader contains the solution can be sustained, he or she may be absent or even dead.

**Fight/flight**

Basic assumption of Fight/flight (baF) is based on the collective and unconscious belief that there is an enemy or a danger which should either be attacked or fled from. In this case either fight or flight are indifferently and unconsciously used as defense mechanism against anxiety. Fight/flight provides a spurious sense of togetherness and, at the same time, serves to avoid facing the difficulties of the primary task. Fight reactions would include aggression against
the self, peers or authority itself. According to Cilliers and Koortzen (2000), when aggression is directed against peers it may include envy, jealousy, competition, elimination, boycotting, sibling rivalry, fighting for a position in the group, and privileged relationships with authority figures. On the other hand, flight reactions may manifest physically, for example, in avoidance of others, being ill, or resignation, and, psychologically, they would include the defense mechanisms such as avoidance of threatening situations and emotions, rationalization, and intellectualization.

**Pairing**

When a group is dominated by the basic assumption of Pairing (baP) there is a collective and unconscious belief that, whatever the actual problems and needs of the group, they will be solved and cared for by a future event. The focus of the group is entirely on the future, but only as a defense against the difficulties of the present. In this case, in order to cope with alienation, anxiety, and loneliness, the individual or group tries to pair with perceived powerful subgroups or individuals. The group behaves as if coupling or pairing between members within the group, or between a member of the group and some external person or entity, will bring about salvation. Furthermore, the group does not work practically towards the future, rather it is only interested in sustaining a vague sense of hope as a way of its current state of difficulties.

While these assumptions are contrasted to the W group, according to some authors, under some conditions, they may facilitate task performance, see Schneider (1987).

Another important concept in Bion's contribution is the innate tendency of individuals to respond to group pressures in their own specific way. According to Bion (1961 p. 116), *valency* is the capacity for spontaneous instinctive co-operation in the basic assumptions. When this capacity is great Bion speaks of a high valency, while, according to Stokes (1994), valency for
one basic assumption rather another may determine how individuals are drawn to one particular profession or another. In fact, according to what Bion calls the *sophisticated use of basic assumption mentality*, a group may mobilize the emotions of one basic assumption in the constructive pursuit of the primary task of some particular profession.

Finally, Bion (1961) identified some specialized work groups which are prone to stimulate the activity of a basic assumption. They are respectively the Church as it concerns the basic assumption of Dependency, the Army for the Fight/flight basic assumption and the aristocracy for the Pairing basic assumption. For a deeper discussion on the specialized work groups and a comparison to other authors' view on group phenomena the interested reader may refer to the original work by Bion (1961, pp.129-137 and pp.166-185).

**THE MATHEMATICAL MODEL**

We are interested to see how basic assumptions and valency in groups affect the group behavior when facing a primary task. As Diamond (1991) observes, Bion considers every work group as “comprised of at least two groups-the explicit task group and the implicit basic assumption group. Multiple and diverse basic assumption groups [...] may exist in large organizations” (cited by Diamond, 1990, p.516). To keep things simple here we assume all the basic assumption as non-distinguishable and therefore we consider only one single assumption to be contrasted to the $W$ group. Since we focus on small groups this simplification does not contrast with the existence of more basic assumptions in the whole organization.

Member $i$’s state at time $t$ is denoted as $x_i \in [0,1]$ where $x_i = 0$ indicates that the individual is working on the primary task, i.e., the basic assumption is absent, while $x_i = 1$ indicates that the agent is dominated by the basic assumption and, consequently, has lost its
ability to work on the primary task. Values between these two extreme values indicate situations in which some of the capacity to work on the primary task is left. Member $i$’s valency for the basic assumption is described by the scalar $\lambda_i \in [0, \Lambda]$ with $\Lambda \in \mathbb{R}_+$. Therefore, vector $x = (x_1, x_2, \ldots, x_n) \in [0, 1]^n$ summarizes the state of each member of the group of size $n$.

Since each individual is a member of the group, they individually give their contribution to the state of the system, even if to a small extent. Therefore, we assume the state $X$ of the system is given by a function that takes into account every single value $x_i$ in a given manner that depends on its shape. That is, we define the *state of the system* $X = g(x)$ where $g : [0, 1]^n \to \mathbb{R}$ is an internal aggregation function such that:

$$\min x_i \leq g(x) \leq \max x_i \quad (1)$$

for all $x \in [0, 1]^n$ (see for example Marichal, 2009). This way also the system state belongs to $[0,1]$ dependently on the individual contributions. The aggregation functions are widely used in many disciplines such as Statistics, Economics, Finance, and Computer Science (see for example Grabisch, Marichal, Mesiar, & Pap, 2009) and in our opinion may also well describe situations like the one we are considering.

Classic aggregation functions are, for instance, means. If we assume that all the individuals in a group have the same identical state (even if this may be not a realistic assumption) then we have a good reason to expect that the system also has the same state: if $x_1 = \ldots = x_n = x$ then $X = g(x) = x$. This means that the aggregation of the individual contributions to the state group satisfies the *consistency property* of means.

Finally, we assume that each member $i$ updates his/her state $x_i$ in discrete times
depending on his/her valency $\lambda_i$ -i.e., his/her capacity for spontaneous instinctive co-operation in the basic assumption- and the current state of the group $X$. The dynamics can be described as

$$x'_i = f_i(\lambda_i, X) \quad (2)$$

Among the properties of means there is homogeneity; in our case this property is quite important since if the aggregation function is homogeneous then we can prove the following proposition.

**Proposition 1** When the group state function is such that $g(kx) = kg(x) \ \forall k \in \mathbb{R}$, and the individual updating maps $f_i$ are identical for all the members and have the special form

$$f(\lambda_i, X) = \lambda_i F(X), \quad (3)$$

then the group dynamics replicates the dynamics of a single individual with valency equal to $g(\lambda_1, \lambda_2, \ldots, \lambda_n)$. Furthermore, each member follows the group dynamics proportionally to its valency.

**Proof** As the dynamics is

$$\begin{cases}
  x'_1 = \lambda_1 F(X) \\
  x'_2 = \lambda_2 F(X) \\
  \vdots \\
  x'_n = \lambda_n F(X)
\end{cases}$$

and

$$X = g(x)$$

it follows that
\[ X' = g(x'_1, x'_2, \ldots, x'_n) = \]
\[ = g(\lambda_1F(X), \lambda_2F(X), \ldots, \lambda_nF(X)) = \]
\[ = F(X)g(\lambda_1, \lambda_2, \ldots, \lambda_n), \]
therefore
\[ X' = g(\lambda_1, \lambda_2, \ldots, \lambda_n)F(X) \]

Condition (3) implies that, while all individuals are synchronized to the same qualitative behavior, their individual valency determines how this behavior is amplified. Therefore, the proposition shows that, in this case, the qualitative behavior of the group and its members are the same even if each member keeps its own valency.

**SOME EXAMPLES OF GROUP DYNAMICS**

In order to appreciate the importance of condition (3), in this section we present two dynamics that well illustrate how the group, depending on this condition may behave as a single individual. While for both dynamics we consider an homogeneous aggregation function, condition (3) holds only for the first one.

An example of updating map, such that \( f(\lambda_i, X) = \lambda_iF(X) \) holds, is the logistic map:
\[ x' = \lambda x(1 - x), \text{ with } \lambda \in [0, 4] \]. This map is not only a dynamics which has been thoroughly studied (see for example Devaney, 1989), but is appropriate in our case as we assume the basic assumption to be bounded. In fact, when \( \lambda \in [0,4] \) the logistic map assumes values in the interval \([0,1]\) which describes how the basic assumption is present.
The use of the logistic map is quite common in the relevant literature. For example, Polley (1997) used the logistic map when analyzing turbulence in organizations in order to illustrate a system with a variety of changes in the attractor. Applications of the logistic in psychology can be found in Nowak, Vallacher, and Zochowski (2005) and Nowak and Vallacher (1998). In particular, the logistic map has been used in Nowak, Zochowski, Borkowsky, and Vallacher (1997) to model the partners synchronization in close relationships. Neuringer and Voss (1993) proposed to model humans as nonlinear deterministic dynamical systems and considered the logistic map in their experiments. Finally, Guastello (2001) used the logistic map to model situations with interaction between individuals and groups with bursts of high and low levels of idea production. Since in our model we consider interactions between individuals and groups with different levels of basic assumption, the logistic map is an adequate choice. Here, we briefly recall that in the logistic map for $\lambda \leq 1$ the orbits converge to the fixed point $x = 0$. Then, for $1 < \lambda < 3$ the dynamics is still very simple as orbits are attracted to the fixed point $x = (\lambda - 1)/\lambda$. When $\lambda = 3$ there is a first period-doubling bifurcation; as $\lambda$ increases the cycle type changes via a succession of period doubling bifurcations; in Rasband (1990, p.23) the interested reader may find a table with the cycle type and value of $\lambda$ for which the bifurcations occur. When parameter $\lambda$ increases further the map becomes chaotic. In fact, it is well known that at the accumulation point, periodicity gives way to chaos; this occurs for $\lambda > 3.5699$, see for example Devaney (1989). Furthermore, it must be noted that in the middle of the complexity, windows with regular periods like 3 or 7 and period-doubling cascades appear. In Fig. 1 we represent the bifurcation diagram of the logistic map; for a brief description of this map the reader may refer to Ott (1993). In our model these different dynamics can be interpreted as follows. When the orbit converges to the fixed point $x = 0$ individuals are working
on the primary task and the basic assumption is absent. Then the basic assumption is present at level \( x = (\lambda - 1)/\lambda \). When \( \lambda = 3 \) the basic assumption level starts to oscillate at two different values. Finally, when \( \lambda \) is large enough, the level of basic assumption follows a chaotic orbit.

Example 1

Consider a 10-member group \((i = 1, 2, \ldots, 10)\). Assume that the updating map is the logistic and the aggregation function is the arithmetic mean; in this case the dynamics is

\[
x' = L(x) = \begin{cases} 
  x'_1 = \lambda_1 x(1 - x) \\
  x'_2 = \lambda_2 x(1 - x) \\
  \vdots \\
  x'_{10} = \lambda_{10} x(1 - x)
\end{cases} \tag{4}
\]

and the state of the system is

\[
X = \frac{x_1 + x_2 + \cdots + x_{10}}{10} \tag{5}
\]

Let the valency be \( \lambda_i = 4 \) for all members but individuals \( i = 1, 2 \), whose valencies are respectively \( \lambda_1 \in [0, 4] \) and \( \lambda_2 = .9 \). Since in our model the individual state represents how much each individual is in the basic assumption, when his state is zero it means the individual is working on the primary task; furthermore, two-period cycles mean that the individual oscillates between different levels of basic assumption. This oscillating behaviors are consistent to the literature. For example, in a case study analyzed in Stein (1990) basic assumptions appear intermittently. Finally, chaotic orbits mean that the individual exhibits irregular, unpredictable behavior. Consider first the case with each member behaving as an individual rather than as a group member. According to the above discussion about the orbits of the logistic map, individual
2 would converge to state $x_2 = 0$, i.e., to the primary task. Individuals 3 to 10 would behave chaotically because their valency is larger than the accumulation point, and individual 1 would behave according to his actual valency. Yet, when each individual is a member of the group, their behavior changes. In fact, as shown by the bifurcation diagrams in Fig. 2 and 3, all the individual's behaviors are now synchronized (same qualitative shape) with different amplitudes of basic assumption level due to their different valencies. This is consistent to the fact that when individual come together in a group, they behave as if they were acting on the basis of a shared basic assumption (Post, 1990). In particular, since the aggregation function here is the arithmetic mean, the average valency is

$$\bar{\lambda} = \frac{\lambda_1 + \lambda_2 + \sum_{3 \leq i \leq 10} \lambda_i}{10} = \frac{\lambda_1 + 3.29}{10} \geq 3.29$$

(6)

Therefore, even if $\lambda_i$ is arbitrarily close to zero, state $x_i$ does not converge to a fixed point as if individual 1 would act out of the group, but to a cycle as being member of a group dominated by a basic assumption (see Fig. 3 left). Only individuals with valency equal to zero would not follow the group and keep focusing on the primary task. Another important point is that since - as mentioned above - the accumulation point for the logistic map is at $\lambda \approx 3.5699$, in order to have average valency equal to such a value it is necessary that $\lambda_i \approx 2.7995$. But while as an individual his/her state would converge to $x_i \approx 0.6428$, as a member of this group his/her behavior is instead chaotic as the behavior of the rest of the group. So in a group where the valencies are elevated even an individual with a moderate valency -that otherwise would have a predictable behavior- may conform to a chaotic behavior, and the level of basic assumption follows an unpredictable trajectory.
On the other hand, this can be interpreted the other way round, i.e., how the valency of one single individual may influence the whole group dynamics. For example, in a group where the average valency is close to the accumulation point, the valency of a new member joining in can play an important role on the group dynamics, since he/she can bring the group to chaos. Consider an individual with valency $\lambda_i \cong 2.7995$ joining a nine-member group of individuals with common valency larger than about 3.6555, then the group behavior would be chaotic, since

$$\frac{\lambda_i + \sum_{2 \leq i \leq 10} \lambda_i}{10} = \frac{2.7995 + 9 \cdot 3.6555}{10} \cong 3.5699.$$ 

But, if the very same individual were in a group where each member has a valency not larger than about 3.0223, the whole group would converge to a fixed point, since

$$\frac{\lambda_i + \sum_{2 \leq i \leq 10} \lambda_i}{10} = \frac{2.7995 + 9 \cdot 3.0223}{10} \cong 3.0.$$ 

Finally, if the same individual -still with valency $\lambda_i \cong 2.7995$ - joined a nine-member group of individuals with common valency smaller than about 0.8001, then the whole group dynamics would converge to the work-group mentality as

$$\frac{\lambda_i + \sum_{2 \leq i \leq 10} \lambda_i}{10} = \frac{2.7995 + 9 \cdot 0.8001}{10} \cong 1.0.$$ 

This example illustrates how the group behavior depends on the value of the average of the valencies of its members, while each member replicates this behavior according to its own valency. This is another consequence of Proposition 1, and -as we have seen- it has interesting
implications on the group behavior when its composition changes.

**Example 2**

The influence of the group on the state of an individual - as illustrated in this example - does not depend on the special property of the individuals' updating map considered. To this purpose, we provide an example in which the individual updating maps $f_i$ are such that condition (3) does not hold.

Consider a 10 -member group ($i = 1, 2, \ldots, 10$) where the aggregation function is the arithmetic mean as in Example 1. Assume each individual's valency is the level of basic assumption he/she would like the whole group to have. Therefore, we also assume that, when the basic assumption level of the group is lower than this value, he/she increases his/her state to drive the group to the preferred state; on the contrary, when the state is higher, he/she decreases. The behavior we describe can be formalized as a continuous piecewise linear function:

$$x_i' = \begin{cases} \frac{\lambda_i - 1}{\lambda_i} X + 1 & \text{if } X \leq \lambda_i \\ \frac{\lambda_i}{\lambda_i + 1} (X - 1) & \text{if } X > \lambda_i \end{cases}$$

(7)

In this case the dynamics is described by map $T$:
and the state of the system is

$$X = \frac{x_1 + x_2 + \cdots + x_{10}}{10}$$  \hspace{1cm} (9)$$

It is immediate to see that, with this dynamics also, the individual behavior changes when he ceases to be a separated individual and enters a group. In fact, when considering individuals not belonging to groups, it is immediate to prove that, since the iterated map is

$$f^2(λ, x) = f(λ, f(λ, x)) = x \quad \forall x \in [0,1],$$  \hspace{1cm} (10)$$

with initial condition \( x = λ \) the orbit is a fixed point, otherwise is a 2-period cycle.

A group in which all the members share the same valency (say \( λ_{\text{com}} \)) has the same dynamics of a single individual, i.e., in most of cases, a 2-period cycle, that is, the basic assumption level oscillates between two levels. On the contrary, when an individual, let us say individual 1, has a valency sufficiently different from that of the group, then the group dynamics may be different. This is illustrated in Fig. 4 where the parameter plane \((λ_i, λ_{\text{com}})\) is covered by
regions of different colors, each characterized by a different period as indicated by numbers.

This figure is obtained making both parameters $\lambda_i$ and $\lambda_{com}$ to vary in the interval $[0,1]$. Here the behaviors are symmetrical for $\lambda_{com}$ values respectively smaller and larger than .5. In fact, consider first $\lambda_{com} < .5$.

When the valency of individual 1 is small there are 2-period cycles, while for larger values of $\lambda_i$ there is a fixed point. This can be observed considering the fact that when $\lambda_i \leq \lambda_{com}$ the group behaves as if all the members had the same valency, that is, as 10 homogeneous individuals. On the contrary, when $\lambda_i > \lambda_{com}$ the different valency makes the group behave differently and converge to a fixed point. The opposite can be observed for $\lambda_{com} > .5$.

This bifurcation can be observed more clearly in Fig. 5 which gives the asymptotic behavior of the state variables $X$, $x_1$ and $x_2$ (diagram respectively on the left, centre, and right) as parameter $\lambda_{com}$ is fixed at the value 0.25 (as indicated by the oriented horizontal line in Fig. 4), whereas the parameter $\lambda_i$ increases from 0.0 to 1.0. In this analysis we consider individual 2 as a representative of the pre-existent group. All three behaviors are similar, but it should be observed that for individual 1, while at beginning the amplitude of the cycle increases with the valency, later on it qualitatively follows the same pattern of the rest of the group: the cycle reduces and the trajectory becomes a fixed point. On the contrary, the group -and therefore individual 2 - are cycling from the beginning with amplitude decreasing up to become a fixed point. In fact, when individual 1 valency is 0 his/her behavior is independent from the rest of the group. In this case, while individual 1 is working on the primary tasks, the other members
have a 2-period oscillation.

The change of behavior we observed in Fig. 4 and 5 is not abrupt, rather there are interesting changes in the amplitude of oscillations as it can be observed in Fig. 6. These bifurcation diagrams are enlargements of those showed in Fig. 5 and give the asymptotic behavior of the state variables $X$, $x_1$ and $x_2$ respectively as parameter $\lambda_{com}$ is fixed at the value 0.25, whereas the parameter $\lambda_i$ increases from 0.22 to 0.27. Here we can observe that, as $\lambda_i$ increases, the amplitude of oscillations does not reduce monotonically, rather there is a sudden widening of the cycle just before its vanishing.

Finally, we could see -also for this example- that when the group follows a 2-period cycle all the non-zero valency members have the same qualitative behavior, shared by the entire group. Therefore, also in this case, the only way for a member of a group not to conform to the group behavior is to have valency equal to 0.

**CONCLUSION**

The simple model we have presented describes some aspects of group dynamics when the work-group mentality and a basic assumption mentality are taken into consideration. In particular, the two examples we have considered show how the group dynamics influences individual behaviors and vice versa how a single member may influence the entire group behavior. Even if these two dynamics are quite different some aspects are in common. For
example, it is possible to see how different groups influence the behavior of a single individual with a given valency. In this sense the resulting group dynamics is the combination of each member's valency. Furthermore, in both cases the individual dynamics qualitatively reproduces the one of the group.

Nevertheless there are some important differences. Firstly, only with the first dynamics this similitude in behavior goes beyond being just qualitative. In fact, in this case each member follows the group dynamics proportionally to its valency as we have proved. Secondly, the first dynamics is characterized by allowing also for chaotic behavior while in the second one we could observe at most 2-period cycles.

All these aspects are quite important as they shed some light on the differences between individual and group behavior and the complexity of group behavior. These themes are quite important for understanding social systems and have been approached by several authors, see for example Galam (2005), Bischi and Merlone (2010), and Arrow et al. (2000). For instance, as it concerns the first example there are interesting implications on group composition -in terms of individual valency- and group behavior. In fact we saw how the valency of one single individual may generate unpredictable behaviors in the group. Finally, one of our results, i.e., the fact that only individual with valency 0 do not follow the group behavior, brings us back to Bion's (1961) own words: “... he can have, in my view, no valency only by ceasing to be, as far as mental function is concern, human” (p.116).

The model we propose is a first step towards understanding these phenomena and there are some limitations. For example, so far the synchronous updating of all group members seems to be a strong assumption. In further research it would be interesting to analyze the changes observed when members update their behavior asynchronously; in fact it seems unlikely for
individuals in groups to follow a common time clock in their internal processes. Also, from a
dynamical point of view, it may be interesting to characterize and interpret in terms of
organizational behavior the changes in the amplitude of oscillations illustrated in Fig. 6.
Furthermore, the model seems to resent on the trade-offs mentioned by Thorngate (1976) and
Weick (1969). Therefore, an interesting challenge is to try to modify the model in order to make
it a more accurate description of the dynamics of a real group at the cost of either generality or
simplicity. Furthermore, since the aggregation functions allow for considering individuals with
different weights, this approach would open a novel perspective to leadership analysis in groups.

Recently, complexity theory has attracted interest as being able to provide insights to
design and manage organizations in today's dynamic environments (e.g., Hatch & Cunliffe,
2006). Several aspects characterize complex dynamical systems and, often, chaos is a recurrent
theme; for example, according to Hatch and Cunliffe (2006), “organization theorists who use
complexity theory suggest that organizations are complex adaptive systems existing on the edge
of chaos” (p. 331). Furthermore, according to Morgan (1997) insights from chaos and
complexity have been used to enrich the understanding of leadership, strategy and the
management of change. In fact, when systems are managed not as mechanical systems, rather in
terms of systems of greater complexity in which people and situations are linked by numerous
nonlinear feedback loops, the usual strategies do not work any longer. Therefore it is quite
important for managers to be able to understand both how individuals are nested into groups
and the psychoanalytical aspects underlying individual behavior in organization (Styhre, 2008).
AKNOWLEDGEMENTS

The authors are grateful to Gian Italo Bischi, Louisa Diana Brunner, Charla Hayden and Matteo Morini for helpful suggestions and to the participants to the 21st Annual International Conference of the Society for Chaos Theory in Psychology & Life Sciences at Chapman University, Orange, CA, August 4-6, 2011, for comments and fruitful discussion. Usual caveats apply.

ENDNOTES

1 For a discussion about the role of mathematics and logic in Bion's theorization, the reader may refer to Skelton (1995) and Mondrzak (2004).

2 Here we do not enter in the debate about using the world “fantasy” instead of the Kleinian term “phantasy”; for a discussion about this point the reader may refer to Vansina (1999).

3 In the following we do not consider the trivial cases in which the initial conditions is either 0 or 1.

REFERENCES


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Fig. 1. Bifurcation diagram of the logistic map with parameter $\lambda \in [0, 4]$ on the horizontal axis and the state variable on the vertical axis.
Fig. 2. Bifurcation diagrams of the basic assumption (ba) of the whole group (left) and of member $i$ (right) with $i \geq 3$, as member 1's valency $\lambda_1$ varies in the interval $[0,4]$ in the ten-member group described in Example 1.
Fig. 3. Bifurcation diagrams of the basic assumption (ba) of member 1 (left) and 2 (right), as member 1's valency $\lambda_1$ varies in the interval $[0,4]$ in the ten-member group described in Example 1.
Fig. 4. Two-dimensional bifurcation diagram in the plane \((\lambda_1, \lambda_{com})\) of the ten-member group described in Example 2. In areas labeled with 1 parameters \((\lambda_1, \lambda_{com})\) drive the group to a fixed point, in areas labeled with 2 they lead to a 2-period cycle.
Fig. 5. Bifurcation diagrams of the basic assumption (ba) of the whole group (left), individual 1 (center) and individual 2 (right) -considered as a representative member of the group- as individual 1's valency $\lambda_1$ varies in the interval $[0, 1]$ in the ten-member group of Example 2.
Fig. 6. Bifurcation diagrams of the basic assumption (ba) of the whole group (left), member 1 (center) and member 2 (right), as member 1's valency $\lambda_i$ varies in the interval $[0.22, 0.27]$ in the ten-member group example described in Example 2.