Amity and Enmity

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Two Archetypes of Social Existence

An Interdisciplinary Study

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Production: Editions à la Carte Zürich

ISBN: 3-908730-29-5

Content

Preamble

The laws of nature existed prior to the creation of all that is. The laws of nature are responsible for either the big bang or whatever else might have brought our solar system into being and as such must be considered immutable. These natural laws determine the behavior of all matter and energy. These laws are in effect daily and in ongoing events, and they may lie dormant in a given realm until the conditions permit them to come into force.

I. Introduction

There is no doubt that all movements and events in the universe, biological, sociological, psychological, or technical, are consistent with the laws of nature. In order to justify the attempt to describe social occurrences and behavioral patterns by means of mathematical-physical models, the subject of this book is the acceptance that everything that takes place or happens, in short that all events, are based on laws of nature; and that this acceptance is inevitable.

Mathematical models can provide us with deeper insight into the laws of our behavior, our actions, and our minds. Physical actions can be observed and very often even measured; but the way our mind is functioning, which is equally subject to the basic natural laws, is still for the most part unknown. A main reason for this is that until today the sciences have demonstrated a strong tendency to consider the operation of these laws in terms of discernible classical physical behavior or - from a religious point of view - of divine order. Attempts to include social and psychological comportment in the realm of mathematical-physical functioning has always encountered resistance and disapproval not only from the point of view of the natural sciences but even more vehemently from the humanities, a fact that necessarily creates a source of conflict about the human value in general and our individual worth in particular.

Whenever human nature is described and examined, be it in philosophy, psychology, sociology, anthropology, in religion, or in the belles letters literature, the presentation is verbal and figurative,

rather than in terms of physical functioning. The methods are descriptive. Nonetheless, over the centuries and through diverse cultures these written records testify that all behavior obeys immutable laws. Not only physical forces such as gravity, electricity, thermodynamics, or quantum physics, absolutely everything seems to be subject to laws that control the processes throughout the universe.

It is the boundaries of our perception that set the limits of the acceptance that everything around us, including ourselves, is a matter of determined actions ruled by laws. The real truth of all operative life lies more deeply than in what can be expressed and described in words, or what can be classified into different doctrines as is done in natural sciences, and more so in the humanities and the arts. The Latin saying *Doctrina multiplex, veritas una* is an inscription on a wall at the University of Rostock in Northern Germany that tells us that there are uncountable doctrines, but only one verity. We believe that nature in its broadest perspective is this one verity that holds true for the existence of all beings and of all that is.

This book, as an attempt to tap the laws of nature as they relate to socio-psychological behavior described mathematically by means of physics, may appear simplistic to some or even most readers. Alternatively, it may be viewed as a first step towards unraveling the tremendous functional entanglement that ensnares us in our daily life. As such, it may help us to gain a better understanding of nature's complexity which is so immense and which has developed over millions or billions of years so that innumerable philosophies, religions, and psychologies have been created and developed to describe this complexity - indeed - each and every faculty from its own perspective.

But there is only one set of laws - *the natural laws* - under which our galaxy and we in it, have to function. It is these laws and with them the world's time-dependent course we will herewith modestly try to indicate and describe in a new comprehensible way. Although our perception is limited, any attempt to touch this, our world, is justified since we are part of it. A remark of Albert Einstein emphasizes our point: *A most fundamental problem, for thousands of years wholly obscured by its complication, is that of motion. All motions we observe in nature, such as a stone thrown into the air, a ship sailing*

on the sea, a cart pushed along the street, are in reality very intricate; [1, page 5].

All the more difficult it is to grasp socio-psychological behavior and put it into a mathematical concept. In the realm of science it is insufficient to provide a qualitative, verbal description, but rather it is essential to make quantification possible, particularly through the use of models and simulation. To design such models is the very purpose of this book.

To throw a stone into the air might serve as an example to underline the difference between the verbal description of a phenomenon and a description of the dynamic functioning of the same action.

A) The verbal description could be as follows: If a stone is thrown into the air, it goes up, makes kind of an arch, and comes back to the ground. The harder it is thrown, the higher up or the further it goes.

B) The functional description, neglecting air resistance, would be expressed with the formula (I-1).

$$h = s \tan\beta - \frac{g}{2} \frac{1}{v_0^2 \cos^2\beta} s^2. \qquad (I-1)$$

In this formula, h is the stone's height above ground which is to be calculated; β is the angle from the ground the stone is thrown with the velocity v_0; g is the gravity constant; and s is the distance the stone travels away from the point where it was thrown. A specific calculation results in the trajectory according to Figure I-1. It appears as a parabola.

As can easily be seen: The functional *B* description is a human construct of an observed daily occurrence, which requires a certain capability in order to understand the process and to describe it with a certain formula. What is contained in the verbal description *A* is merely a simple description of what just happened with or without our functional understanding. Thus *B* makes *A* comprehensible, provided we understand the complexity described here.

Over millions of years the world has developed into such a tremendous edifice that we humans - who came much later into existence - can no longer keep up with understanding the involved complexity. Add to this is that the world's functional intricacy is growing faster than can be comprehended, and it then seems to human beings that in the river of nature, evolutionary streams continue toward higher and higher complexity. Although *Heraklit (550-480 AC)* already stated: *Panta rhei*, which means everything moves, it was not possible at that time to describe movements mathematically. *Laws of Nature* that determine the correlation of interrelated cause-and-effect events remained unknown until the late middle ages when *Leibnitz (1646-1716)* and *Newton (1643-1727)* came up with their superb creation of the infinitesimal calculus.

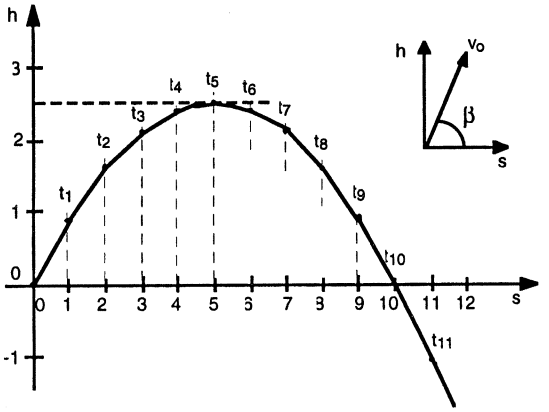

Figure I-1: Trajectory as a parabola.

It has taken us almost 400 years to gain the contemporary capabilities and knowledge to make it possible even to undertake the still modest and prudent approach to investigating social functioning that now might help us to proceed in understanding the world in a more profound sense. By combining physics and mathematics, models can be constructed with which functions can be studied without simultaneous observation of real occurrences. The reasoning that

human behavior in all regards consists of continuous flow of functioning can be contemplated, and such movements can be studied in computer models.

One can argue that such investigations are not necessary for human survival, because people have lived happily from generation to generation for thousands of years but, admittedly, they have also killed each other by the thousands in vicious hate without much thought. The intention of this book is to enlighten the reader about the basic nature of our relationships and ultimately increase our understanding of amity and enmity, friendship and hostility, from the standpoint of deeply rooted *Natural Laws.*

As our model has to serve for socio-psychological investigations, the question can be posed: What is a model? The answer might be: A model is a substitute involving assumptions. A model idealizes the replacement of reality - and therefore is a simplification. A simplified structure facilitates perspective and perception of the uncountable single daily events. But it is important that the main points of the social comportment, which shall be encountered, become evident through the model. This is the objective of this text.

The intention to model socio-psychological functioning must be based on the assumption that everything is matter which functions, that this functioning is compelled to obey the rules of natural laws, and that these laws can be expressed mathematically within reasonable approximations. Indeed, such expressions have their limits. They can only reach as far as our brain is capable of comprehending. By building more complex structure, the complexity of their doing soon grows into involvements beyond our frame of mind. On the other hand, it has to be admitted that the world of nature consists of laws from which there is no escape. It is a challenge to approach such laws.

At the risk of venturing into models of social interaction despite their obvious or supposed impenetrability, deliberation is necessary to reduce oneself to basics in order not to overstretch the demand right at the outset. The mathematical representation is headed toward abstractions that are not easily followed. Therefore, caution has to be exercised in presenting the material.

In the journal „The Sciences", published by „The New York Academy of Sciences", September/October, 1995, Stuart A. Kauffman says in his article *Germinal Velocity: Life is rooted not in blind chance but in mathematical necessity;* (Page 35). The attempt of this treatise is to discover such a necessity.

Friendship and hostility, in an extended meaning of peace and war, consist mainly of two parties, two social units. Such units can consist of either two persons, or two groups of people, or two different religious denominations, or two nations, or even two races. This essay limits itself to two *units* in the form of two persons, also called individuals, or partners. The two partners are called P_1 and P_2.

In an amicable or in a hostile relationship there are two units in an emotional interaction with each other. Two parties have an *attitude,* or an *opinion,* of each other. Attitudes are generated through unconscious imagination and indoctrinated metaphors. Therefore, friendly and hostile metaphors cannot be justified logically - it seems. They are based on irrational justifications. Especially hostile attitudes become inculcated through education in social, racial, and religious prejudices. They are deposited deeply in the unconscious - mainly when the brain is still young, malleable and unaware of its potential or disparagement.

Before two units can be joined together to create a dualism - be this as an agreement or as an antagonism - a unit has to be defined and structured, and its functioning must be explained. The description has to be such that the unit can be mathematically modeled, put into the computer, and the calculations be performed with the model. After that is done, two such units are brought into mutual interaction. The units will exchange unconscious information between each other in a continuous manner.

A mathematical model has to be able to first show the dominant characteristics before more subtle details can be brought to light. Concerning the main purpose of the essay, two distinctive notions have to emerge: *amicable* and *hostile* behavior. Preceding the explanation of the findings, some plausible results, shall already be mentioned:

Consensual behavior is characterized by an increase in the self-realization of both partners. Self-realization means survival. It is the very act of existing, and as such the prime law of nature. Through consensual behavior the partners help each other unconsciously in their existence. Their quality of life augments. Both partners' self-realization becomes larger than they were without the relationship, i.e., if both partners existed autonomously, without the togetherness. The model will demonstrate this fact. In short: A consensual relationship is mutual help.

Hostile behavior, on the other hand, is characterized by a decrease in the self-realization of both partners. An enemy is out to damage the life of his opponent. Each one's intention is to harm the other. The model illustrates that self-realization in the case of pugnacious comportment become smaller than it were without this relationship. In short: A hostile relationship is equivalent to mutual damage. The surprising fact is that consent results in little help, and hostility causes tremendous damage. Help builds up slowly, whereas harm is rapid. In other words, amity is slow, but enmity is fast.

If there is a lack of regard for each other and also no state of hostility, the two partners are called per definitio to be in an autonomous state. This is the starting position for the investigation: the description of the social unit (or the individual). Later, in one direction friendship will be built up, in the opposite direction, hostility comes into play.

Consent and hostility can be minor or strong. This parameter of intensity will be emphasized. The astonishing result is that with equal intensity of consent and of hostility, the mutual harm due to hostility will be a multiple of mutual help coming from consent.

Further parameters will play an eminent role on the outcome of the concept. Such parameters will be: the willpower or volition of each partner he exerts to realize himself, the pattern of motion with which he acts as an autonomous individual, the pattern of motion of the dualism, and disturbances entering the dualism from the greater environment. How such a disturbance affects one partner and how it affects the other partner via the directly disturbed partner is of great interest.

The expression "....he exerts to realize himself" is somewhat a triviality, because every being can only realize himself. One can help another being, but not realize him.

The term speed of action - or pattern of motion - has to be mentioned at this point. The partners P_1 and P_2 have their individual speed of acting as autonomous beings. The amicable dualism as well as the hostile one will have their own specific speed, the speed of the partnership in interaction. They are considered as an entity with their own pattern of motion. If P_1 and P_2 have their speed of acting, say $v_1 = v_2$, both as autonomous individuals, then the amicable dualism, involving P_1 and P_2 as a social system of concord, will have its own speed of acting, say v_3; and the hostile dualism, involving P_1 and P_2 as a social entity, will have its own speed as well. This shall be v_4. Then the findings are that v_4 is much greater than v_3. Enmity acts much faster than amity. And it will be found that - as a general statement - v_3 is lower than v_1 and v_2, i.e., consent is slower acting than its components; and that v_4 is as fast as v_1 and v_2. Hostility is as fast as its components. These are indeed, only rough, preliminary statements.

Many notions, many terms, and many definitions will be repeated throughout the essay. This repetition is done with the belief that the ideas are very new to the reader and repetition can be a valuable help; *repetitio est mater studiorum* - repetition is the mother of wisdom.

Some final remarks to this introduction:

a) In history, for the description of human behavior, mathematics has scarcely been used. In sports you find one of the few exceptions where speed or weight are measured and recorded in terms of statistics. Natural laws, which were put down through mathematics, are almost exclusively formed for a world outside the human being. The human being rejects being put into formulas – with the exception of statistics that do not hurt anybody's psyche. Statistics are expressed on neutral grounds.

b) The mathematically formulated pure technical world is expressed for movements from point A to point B, where there is a cause at point A and its effect is calculated at point B. Social situations also are cause and effect relationship, but compared with the technical world,

each effect is in turn a new cause for a further effect, and this goes on in a continuum. Such continuity is the red thread through the book. Everything is a continuous, never-ending cause-effect-cause relationship. All actions happen in closed, circular loops. Thus, the novelty here is *loop-thinking*.

c) The step from the verbal description of the stone thrown in the air and the correct mathematical representation of the physical phenomenon illustrates the difficulty that is encountered when attempting to transform psychological-social aspects and concepts into formal mathematical descriptions. Care must be taken to define the terms of analogy and ensure they have a credible correlation with the phenomena to be described. Because we are born to magical thought and not to mathematics of reality, this undertaking entails, therefore, a certain rethinking of the functioning of life. This new thinking is *interacting loops in continuity.*

As English is not the author's native tongue and as it turned out to be extremely difficult to find a person familiar with the material to be presented herein who could straighten out incorrect or awkward syntax constructions, the reader is asked to pardon any context that lacks proper grammar. Interacting loop-thinking is one of the more demanding topics in the sciences not only for editors but often also for physicists, although mathematics is on the elementary side. Incidentally: *loop-thinking* - as it turns out - be rather called *loop-calculating.*

II. The Social Unit; the Individual

The social unit is the foundation stone for building social conglomerates. Its description has to be, therefore, rather refined and detailed. The structure for the unit's behavioral representation is given with Figure II-1. For the term *individual*, the pronoun *he* will be used, whereas the pronoun *it* stands for the expression *social unit*, or just *unit*.

Before tackling the investigation, some major findings are listed:

a) An individual's goal is predominantly his self-realization. Whatever an individual does, mentally and physically, he is always in the state of realizing himself. To exist means to realize one's self continuously.

b) The less an individual's willpower is with which he strives to realize himself, i.e., the less his endeavor is to reach his goal, the less well he can attain this goal. The term willpower is synonymous with drive or volition.

c) The more an individual procrastinates over an action, the less he can exert his willpower with which he can strive toward his goal.

d) The less his willpower is, the easier he can become disturbed and either driven away from his goal - or brought closer to it. He comes closer to his goal if the disturbance is goal oriented, i.e., positive. Although the word disturbance has generally a negative meaning, it also can mean help. This is the case when the disturbance pushes the individual in the same direction as he is headed toward. This topic willpower is explained in much more detail in Section IV-2.

e) Excessive willpower drives the individual beyond the limit of homeostasis, i.e., beyond the limit of biological stability. He then loses the state of his equilibrium and is no longer able to realize himself.

f) The swiftness of the unit's action and the synergic connection with the unit's willpower are considered to be the intelligence of the unit. Thus, a rudimentary term for intelligence is coined. An extended version of this term is added in Appendix IV. The swiftness of action is also called the pattern of motion.

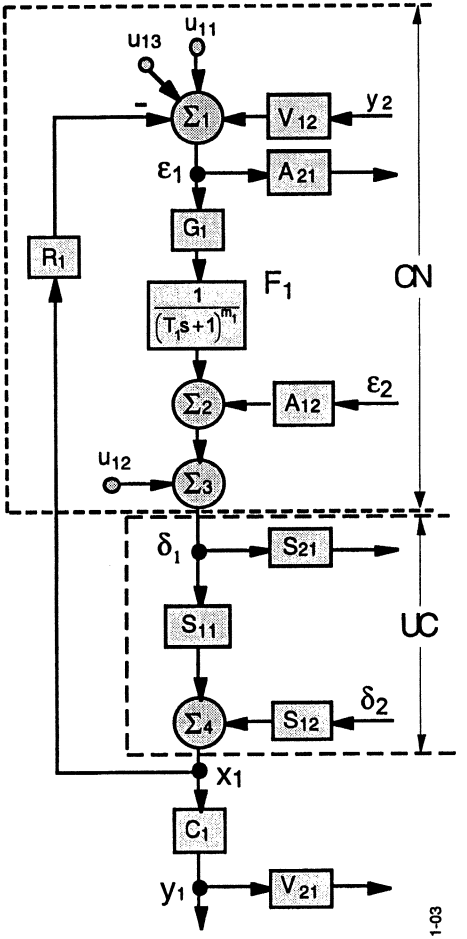

Figure II-1: Structure of the unit P_1.

The reflections given herein are not limited to the social behavior of human beings. They can be applied to any unit of species that strives toward its self–realization; and, no doubt, all beings do that: humans,

animals, insects, plants, or even bacteria. We know that a living being is extremely complex. Therefore the following three postulates can indicate only a very limited but necessary frame of the unit's description.

Postulate 1: Characteristics of functional social behavior that are to be modeled mathematically must be reflected in daily psycho–social behavior in an abundant amount in order to guarantee the evidence of the model.

Postulate 2: The qualities of social systems are evaluated on the basis of comparison. There are no absolute and thus, no measurable standards or values. *It is differences that matter in the competitive struggle to survive;* [2, pages 9, 10].

Postulate 3: The complexity of social life is of such an enormous degree that statements can be made only on the grounds of restricted assumptions and simplifications. Parameters which constitute the unit and which are of major importance must be emphasized (*mis en évidence)*; parameters of minor importance must be neglected.

The unit P_1 in Figure II-1 is composed of the following features from (a) to (p). After the elaboration of these features, the concise captions of Figure II-1 are listed.

(a) The structure is characterized by the fact that the unit has the prime goal u_{11} toward which it strives in a continuous manner. This goal is the unit's self–realization because whatever a unit does, it wants to realize itself. As mentioned above, in the present context a unit can be an individual person, a one–goal oriented group of several people, a whole nation which pursues its national goal and thus, the realization of its existence, or finally the union of several nations in the form of an alliance with a common goal. For any unit, self–realization is a *conditio sine qua non* for survival. However, our concern is the human being, the individual.

Because the goal is defined as self–realization, the goal does not have an ethical value; it is value–neutral. To show that ethical values cannot be numerically, i.e., mathematically expressed, the following example might serve: Substantial killing by a soldier done to an enemy in a

war earns medal and honor; but one more person killed intentionally by the soldier after the peace-treaty has been signed results in anathema and jail or execution. Ethical meaning and value are determined by the relationships of the individuals within a system. In a system of relations the individual is no longer autonomous!

(b) The individual has a certain willpower G_1 to realize himself, or in other words, a capability to strive toward his goal. This term *willpower* can also be called volition. For any term used here, a thesaurus gives a list of similar or related expressions.

(c) The individual's action over time is expressed as dynamics, i.e., he has a particular speed or retention of action, or procrastination. The dynamics can be called the individual's pattern of motion. (A functional term may have many different verbal expressions depending on the way it is interpreted - either by friend or by enemy). The model's dynamics is - for the time being - represented with the transfer function symbol F_1. A detailed explanation will follow; (see Section IV-3).

(d) The swiftness of action in a synergic coalition with volition can be set equal to the intelligence of the individual, because the faster an individual is able to approach his goal and the greater his willpower, the closer he is brought to that goal and the more intelligent the individual is considered to be. It will be shown that dynamics and willpower are intrinsically interrelated as a *Natural Law. The characteristic of behavior, as biologists use the term, is that it is fast;* [2, pages 9, 10]. Speed and power are considered to be the two main parameters in all domains of evolution. They are the domineering public interest.

Many symbols used herein are taken from the nomenclature of automatic controls in the technical realm. One such term is *transfer function.* It means that a variable is transferred from one state to another. However, this fact, using technical terms, is not of importance. Rather, it can be said that being able to use such symbols from a pure technical discipline in the social realm, a similarity of relations is demonstrated. The technical world consists of matter (and energy) which functions, and so do the biological and also the social worlds. *A line of thoughts developed in one branch of science can*

very often be applied to the description of events (in another science) apparently quite different in character; [1, page 35].

The term intelligence is restricted herein to the autonomous individual, i.e., the individual is purely on his own, without any interrelation yet. There is - when intelligence is defined - no dependency from, or interaction with other individuals. In a situation of interaction with other individuals in a social context, the term intelligence becomes more complex. If, e.g., the individual P_1 has to cooperate entirely with an aggressively disposed partner P_2, who exerts a greater degree of willpower than P_1, then P_1's intelligence cannot have an effect. P_1's goal attainment can become minimized, perhaps to an amount not large enough to guarantee survival, or even to zero, i.e., to immediate death. This fact becomes obvious in Chapter VI.

(e) The individual's point to point attainment over time, called $x_1(t)$, is partially recognizable by the environment, i.e., how the individual behaves in order to come closer to his goal can partially be observed by the neighbors, although the neighborhood does not know, and cannot perceive the individual's goal. The goal, as the self–realization is within the individual, it is a part of the individual. The fraction of the observable, this is $y_1(t)$ of $x_1(t)$, is determined by the factor C_1. C_1 is always smaller than 1, unless the surrounding neighbors see or assume to see more than what exists. - A joke may indicate that it can easily happen that C_1 is larger than 1 or 100%. A woman (or a man) said to another woman: "I cannot go into all the details now. I already told you more than what I heard." Or the Latin saying: *Fama crescit eundo* - The rumor grows whilst it spreads; *Vergil, Aeneide 4, 175.* - The variables x_1 and y_1 are functions of time and should be written as $x_1(t)$ and $y_1(t)$. For easy reading, however, the denotation of time, (t), is mainly dropped.

(f) The individual is formed as a loop. A loop's configuration provides self–control. The individual as a loop knows (or feels) at any instant his proximity concerning his goal. Self–control is realized with the *negative feedback* signal, $-x_1$ (assuming that R_1 in Figure II-1 is 1), which is *added* to the goal u_{11}, i.e., $u_{11}+(-x_1) = u_{11}-x_1 = \varepsilon_1$. The variable ε_1 is called the *error* signal. This ε_1 is the amount that is not achieved yet when a goal seeking process is under way. This variable

ε_1 will be recognized and enforced by the factor G_1 (the willpower) in order to reduce ε_1 eventually to a minimum. The larger ε_1 and the greater G_1 are, the harder the individual (the loop) works toward his goal u_{11}. The explanation, how G_1 enforces a reduction of the error ε_1 follows further down. It must be emphasized that we are headed toward *loop-thinking* that cannot be perceived as a point-to-point reflection, as what we are indeed doing at the moment. As x_1 is a function of time, so indeed, ε_1 is time dependent as well: $\varepsilon_1(t)$.

(g) In addition to the willpower G_1 and the pattern of motion F_1, a third component for the composition of the syndrome *intelligence* could be taken into the structure of the loop, the derivative of the error signal ε_1, i.e., the term $d\varepsilon_1(t)/dt$. This derivative signal is similar to the psychological term *anticipation*. With a factor C_a this anticipatory term could be added to the willpower G_1, the term $G_1\varepsilon_1(t)$. The term intelligence would mathematically become the formula (II-1)

$$G_1\left[\varepsilon_1(t)+C_a\frac{d\varepsilon_1(t)}{dt}\right], \qquad (II-1)$$

or in the Laplace-form (II-2),

$$G_1\left[1+C_a s\right]\varepsilon_1. \qquad (II-2)$$

However, for simplicity this term will be provisionally neglected although it is of utmost importance. It will be mentioned in Chapter VII and elaborated further in Appendix IV.

(h) The individual's endeavor is to come continuously closer to his goal, although disturbances u_{12} and u_{13} act constantly and at random. However, x_1 tends to deviate from u_{11}. The effect of disturbances has to be recognized by the individual in order to account for the deviation with respect to his goal. Disturbances originate in the individual's environment or through the interrelation with other

individuals if the individual is part of a larger social system; or they can come from inside the individual himself. In short: disturbances can be exogenous or endogenous. Disturbances are not predictable, but it is assumed herein that they are not of such a magnitude that the individual's action becomes paralyzed. Disturbances have an effect on x_1, and they can enter the individual at several locations of the loop, in the individual's consciousness (CN) via his five senses, and in his unconscious (UC). The model in Figure II-1, shows two locations only, both within the individual's consciousness.

(i) The individual consists of a conscious part (CN) and an unconscious part (UC), and he has conscious and unconscious interrelations with other individuals. The unconscious in our brain is supposed to be a full world of its own compared to the outer world we perceive with our senses. It is this unconscious in which the attitude of friendliness or hate toward partners is stored and out of which the attitude acts. It is in this unconscious relationship, the informations $S_{21}\delta_1$ and $S_{12}\delta_2$, where the mutual attitude exchange two individuals have toward each other is symbolized. The other two bilateral interacting signals, $V_{12}y_2$ and $V_{21}y_1$, and $A_{12}\varepsilon_2$ and $A_{21}\varepsilon_1$, are conscious communication signals.

Attitude, our main point to be considered in this essay, is considered to be an unconscious, archetypical feature, an *imperative of nature*, and it serves to recognize the living partner as friend or enemy. Conscious communication, on the other hand, happens via our five senses: sight, hearing, touch, smell, and taste, and also via physical, muscular actions. (The two terms, interrelation and interaction are synonymously used.) Interrelations come into play as soon as the individual begins to interact. V_{12} and V_{21} signify the visual interaction magnitudes; the mutual observation of each other's doing. A_{12} and A_{21} represent the amount of physical action transferred in the form of talking, writing, fighting, etc.

(j) Collecting the above notions, a) to i), in a mathematical framework results in a closed functional, self-controlling loop where each effect generates a cause which, in turn, results in a new effect. The model is structured in such a way that the individual can become unstable, either because of too high of a level of exerted willpower and/or

because of an excessively sluggish information transfer within himself; e.g., a too long delayed forward control- or feedback-signal. Both, delay and willpower, can create an overreaction - as will be explained later. An unstable individual, or organization, is no longer able to behave in a goal-oriented manner. It is, therefore, indispensable that the individual (as well as communicating systems of several individuals) remain in a stable state during a goal seeking process. In biology, the stability is called *homeostasis*. Any dynamic system of any size and complexity has to be homeostatic, i.e., has to simultaneously head continuously toward his goal (or goals, if the system consists of more than one individual and has more than one goal) and to fight the effect of disturbances.

For the purpose of the investigation of specific social situations it is necessary to simplify accordingly the rather complex structure of Figure II-1. A reduction in the number of parameters that constitute a single unit is an irrevocable condition necessary to remain within a comprehensible frame. In order to avoid *the tyranny of complexity* - with which nature confronts us - simplifications are unavoidable.

(k) Within the framework of our notions and simplifications it will be seen that $x_1(t)$ never reaches the desired value u_{11} in full, i.e., to 100%, unless G_1 is infinitely large (∞). This is a plausible fact in life because, firstly, there are always disturbances acting to drive x_1 away from u_{11}, and secondly, one always demands more from the environment than what one already has and what the environment can give. The model takes care of these circumstances: You never get everything you are longing for!

In short, an individual has to fulfill two tasks:

α) To strive toward his goal self-realization u_{11},

β) To fight the effect of disturbances u_{12}.

The simultaneous fulfillment of α and β requires a constant return of information, the internal feedback signal. Indeed, a third task, the main focus of the book, will follow later, about interaction with a second individual.

(l) Although the error ε_1 varies as a function of time, for simplicity to begin with we consider end states only, states after a goal was set and a final attainment is achieved, and also after there are no longer any disturbances. Such a state is called steady state (or *flux equilibria*). Such a steady end flux is an approximation of reality because no system ever comes to an absolutely final state as will be shown further down. It has to be emphasized that a system, a loop, does not stand still once it reaches its steady state. The functioning continues in order to maintain this state and to fend off entering disturbances.

(m) Some more words about the loop, point f). Our partner P_1 is capable of continuously measuring how far off he still is from his goal u_{11}. He does that by subtracting x_1 from u_{11} in the summing point $\Sigma 1$. $\Sigma 1$ serves as comparison of the two signals u_{11} and x_1. The variable x_1, negatively taken, produces self-reflection or self-control, or awareness of one's own doing. - We dare to say: *self-control over time* forms the *consciousness*. From such a standpoint - self-control over time - every living being and any part of a being that has self-control has its own consciousness. In history there have been many attempts to define consciousness in a way similar to the way objects are normally described; and these descriptions have failed. Why is that so? Our point of view is that this failure must occur because we cannot see time - which we need to define consciousness. We are in the time, enclosed in it and traveling along with it. Therefore there is no way to define either time or consciousness. A makeshift analogy might be sitting in a plane. We cannot see the plane because we are in it and form an entity with it. We do not know where the plane is going, and how fast it is going. We cannot go outside of it, or outside of time, and look at it in order to describe it. Therefore we believe that awareness continuously multiplied with time provides us with what we call consciousness. With this viewpoint in mind any structure, whatsoever, with a goal and with self-control has consciousness. But it is only the human being who shall have this highly evolved feature. Not animals and plants and insects must have the exaggerated self-evaluation of humans!

(n) Figure II-1 shows two very different disturbance signals, u_{12} and u_{13}. The signal u_{13} is a disturbance that acts with the same effect as the goal u_{11} (for simplicity later on u_{11} and u_{13} are given the same

versa. The partners observe each other via the signals y_1 and y_2 and their transfer factors V_{12} and V_{21}. We call these two channels $V_{21}y_1$ and $V_{12}y_2$ *soft information exchange*. There is no exchange of words or shouting, just watching and listening - or observing each other.

p3) There is mutual *hard information exchange* via the signals ε_1 and ε_2 and their transfer factors A_{12} and A_{21}. The information exchange via these channels $A_{12}\varepsilon_1$ and $A_{21}\varepsilon_2$ can be through discussing, haggling, negotiating, or fighting. See also Appendix III.

It is a well-established fact that the unconscious information content in a human being is vastly more effective than the conscious part of the brain. Therefore, unconscious behavior has to be given much more weight when compared to the conscious operations. It is the attitude, embedded in the unconscious, which provides friendship and consent and which is responsible for animosity and hate, passion and affection. It is the unconscious that enables us to survive. Our emphasis is therefore predominantly on attitude.

To emphasize: Information which is transferred from one unit to the other can be changed in magnitude by the receiver unit; reduced, belittled, exaggerated - or its meaning can be reversed. The agent that does the transforming is called the *transfer or intensity function*. Thus, the transfer functions in Figure II-1 are:

S_{12} and S_{21} for attitude, or unconscious information exchange;
V_{12} and V_{21} for soft conscious exchange, i.e., observation of each other;
A_{12} and A_{21} for hard conscious exchange, i.e., dealing with each other physically in a hard manner.

The index $(_{12})$ of the transfer functions means that the information goes to partner P_1 and comes from partner P_2. The index $(_{21})$ means correspondingly that the information goes to partner P_2 and comes from Partner P_1. The reading is: goes to, comes from.

The partners' own unconscious transfer functions are called S_{11} and S_{22}, respectively. These values will later be set to the magnitude 1,

because they are identical to themselves and set as equal ($S_{11} = S_{22} = 1$). This seems to be another (tremendous) simplification. Its vague justification will be provided later. For the evolvement of the model of the unconscious again, see Appendix III.

It has already been mentioned that there are no absolute and no measurable values in the realm of sociology (except in statistics). Comparison is the only means of evaluating systems. As an example, one system can behave faster than another one, or one system exerts more willpower than another. Nevertheless, the computer needs numerical values in order to calculate. The interpretation, however, depends upon comparison of the calculated results. *Argumenta non numeranda, sed ponderanda sunt.* Arguments have to be weighted, not numerically counted.

The transfer functions S_{12}, S_{21}, V_{12}, V_{21}, A_{12}, and A_{21} can be provided with a time delay. But this essay does not consider this circumstance (with one exception, Chapter IX). These six magnitudes are simply modification factors of the signals they transfer.

If a partner does not properly realize his attainment x_1, if he under- or overvalues it, the feedback factor R_1 does not have the magnitude 1. R_1 then can be smaller or larger than 1. The error signal from $\Sigma 1$ would be $\varepsilon_1 = u_{11}-R_1x_1$ with $R_1 \neq 1$. For simplification of the further treatment, R_1 shall be 1, taken negatively, and thus, $\varepsilon_1 = u_{11}-x_1$ (u_{13} and $V_{12}y_2$ both being zero). For $R_1 > 1$ and < 1, see [3].

Such simplifications, as mentioned up to now, are helpful for understanding the model. Nevertheless, one has to keep in mind that the model can be structured to a much higher complexity. Life always has many more facets then one can take into account. And a verity to keep in mind: *An identity cannot perceive itself.* No entity - and so no being - knows itself fully. We have to live with fragmental knowledge of ourselves.

To the above statement, that an identity cannot perceive itself, the following remark may serve. A wooden match as an entity cannot perceive itself, namely as a match in its completeness. A match does

not know that it is a match. But the machine that produces matches fully automatically (after it is fed with the necessary material and energy) knows what a match is, because it makes them. But the machine as an entity itself does not know itself. It is the engineer who designed and made the machine. So, he knows what the machine is in its entirety. Now the engineer, as the next higher entity, cannot perceive himself. It needs the mightiness of a *God-Nature* who made, who created the engineer, and who knows what the human being is in his entirety. This short parable indicates the tremendous increase of complexity from a match to the matchmaking machine, from this machine to the human being, and from the human being to **God-***Universe.*

(We think that if a person starts to communicate with *his* God, he communicates consciously with his God-symbol embedded in his unconscious. Therefore, praying can help the praying person because he consciously sends information into his unconscious and gets information back from it. Whether praying information can be transposed to an object outside the prayer to which the prayer prays for – is not known, but we assume that it might be not impossible. The world is composed of a complexity still unknown and a complexity that will never be known.)

Figure II-1 is a loop of an automatic control structure. Each effect in it immediately creates a new cause for further effects. Such a loop works without interruption as long as it receives the necessary energy - and as long as it is alive. It continuously controls its attainment x_1 and compares it with what it wants to achieve, with u_{11}, - and it continues to strive to make ε_1 as small as possible. Technically, x_1 is called the controlled variable, u_{11} is called the set point; the goal which is set. The captions in Figure II-1 provide further information. It is essential to become familiar with the loop's terms and to accept them before proceeding to the dualism.

Captions for Figure II-1:

u_{11}: An individual's prime goal, the individual's self-realization. u_{11} is a reference signal to x_1; u_{11} is continuously remembered. The consciousness for self-realization is always alert.

$S_{12}\delta_2$, $S_{21}\delta_1$: Unconscious, inherent information exchange between units. Transfer signals $S_{12}\delta_2$ and $S_{21}\delta_1$ are of irrational (unconscious) information that flows from P_1 to P_2 and from P_2 to P_1, respectively.

$V_{12}y_2$, $V_{21}y_1$: Transmitting to and receiving conscious information from a second individual by observing, listening in on, or spying on. We call those signals *soft communication.*

$A_{12}\varepsilon_2$, $A_{21}\varepsilon_1$: Conscious interaction:
a) an interaction directed toward adaptation to a second individual, or
b) criticism of inability to adapt, with the result of either mutual help or rather mutual harm. It is *hard communication.*

ε_1: Difference between the totality of the intended goal self-realization, and, e.g., incipient damage (u_{13}) along with the exchanged information (see $V_{12}y_2$) and the individual's degree of perception of goal attainment ($-R_1x_1$). That is: $\varepsilon_1 = u_{11}-R_1x_1+V_{12}y_2+u_{13}$.

G_1: Willpower to attain self-realization. Technically oriented readers may object to calling G_1 willpower. In the structure, Figure II-1, G_1 is merely a factor that increases ε_1 proportionally. Power, on the other hand, has the dimension *energy per time.* The term power in a thesaurus is even more vague than our word-risk *will.* To name just a few: -- determination, drive, firmness, purpose, resolution, self-control, self-discipline, single-mindedness. And for power one can find -- ability, capacity, competence, potential, energy, forces, intensity, might, strength. And volition can be seen as -- determination, free will, purpose, and resolution.

In the humanities words cannot be defined in the same way that is required for calculation in engineering. Every so often terms in the humanities suffer from a lack of clarity although their meaning seems to be clear.

T_1 & m_1: Individual's reaction time (delay of reaction) that can be inherent or performed on purpose - or both.

$S_{11}\delta_1$: Individual's unconscious transfer signal of information in relation to itself. S_{11} can be called the (unconscious) archaic surviving content of the individual.

x_1, or properly $x_1(t)$: The individual's approach to the goal.

x_1/u_{11}: Dimensionless moment-to-moment goal attainment.

C_1: The transfer factor of the momentarily achieved goal x_1 that is released into the public via y_1.

R_1: The individual's degree of perception of goal attainment, i.e., the value sensed by P_1 and operating as the negative feedback signal. R_1 can be smaller, equal, or lager than 1.

CN: Realm of conscious motion.

UC: Totality of unconscious information as held by the prime individual P_1, exchanged with another and held by another individual, P_2.

s: Laplace operator.

All variables within and entering the loop are time dependent. These are ε_1, x_1, δ_1, y_1, ε_2, and δ_2. Indeed, in a more sophisticated consideration, u_{11}, u_{12}, and u_{13} can be time dependent as well. They are, however, considered to be constant.

The following chapter, Chapter III, describes a technical automatic control loop, a temperature control of, say, a room as an analogy to the loop of Figure II-I. It shall help to more easily understand and accept the term *negative* feedback and clear the plus or minus effects of a disturbance, and foremost - help present the functioning of a closed circular loop, requiring *loop-thinking*.

It is absolutely necessary to accept the new facts of Chapter II in order to feel comfortable with the investigation of a dualism. Many of the terms used thus far will become easier to understand for the reader in connection with the following material.

III. An Automatic Temperature Control

Before attacking the main topic, it might be advantageous to look at an installation used nowadays in almost every home: an automatic temperature control system. In daily usage, the term 'negative' for feedback has a negative flavor - especially in circles of sociologists who argue that feedback has to be positive in order to stay in affirmative terms. The description of a technical control system shall clear up this misconception about *positive* feedback. That the feedback signal - as we will see - has to be negative can be considered a matter of definition - although it is a very reasonable, almost compulsory, definition. A technical control loop looks very similar to the loop Figure II-1. In fact, it is the technical terminology and concept of an automatic control loop that originally lead to the structure of Figure II-1. The technical loop, which illustrates a temperature control loop paralleling Figure II-1, is shown in Figure III-1.

Due to the fact that we consider the two Figures II-1 and III-1 comparable, we will switch back and forth between them in the discussion that follows.

In Figure III-1 the term S_{11} signifies a living room that has to be heated and cooled so that the temperature in it changes and then remains constant or at least within acceptable limits after a desired temperature has been set at the thermostat. In the summer when the sun shines on the house, the room needs to be cooled. On rainy days or in the winter when the outside temperature is low, then the room needs to be heated. Such outside signals are a disturbance for the room S_{11}. In technical language the living room is the controlled process. The controlled variable in it is the temperature. This is x_1.

The behavior inside the process S_{11} is the movement of the air molecules that determine the temperature of the burnt fuel, and the structure to be heated is determined by chemical and thermodynamic laws, by laws of nature. In a similar way, the unconscious behavior in a human brain is inherent, it is also dictated by nature. Such imprinted behavioral structure cannot be changed, although its functioning can be influenced by sending conscious information into it. Therefore this parallelism of natural laws in a physical field S_{11} in Figure III-1

and the unconscious of a being S_{11} in Figure II-1 is a beneficial analogy. Similarly, as it is impossible to dictate the laws of nature that exist in the room S_{11}, it is impossible to change the unconscious primal urges in our brain. As the engineer has to adapt to the thermodynamic laws with his technical knowledge, the human being has to adapt to his unconscious by using his rational thinking, his consciousness. We set in parallel the immutable laws of nature in the living room with the laws of the unconscious of a social unit.

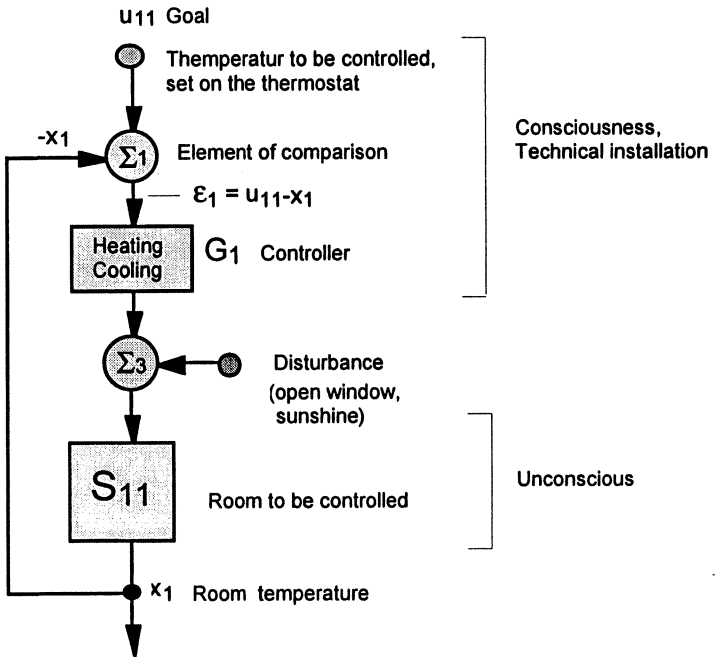

Figure III-1: Temperature control loop; Analog structure of Figure II-1.

The consciousness shown in Figure II-1 is set in parallel with the installation that controls the temperature in S_{11}. This consciousness is manmade. It consists of, firstly, the feedback signal $-x_1$, leading to the thermostat where the desired temperature u_{11} becomes compared with

x_1, namely as $\varepsilon_1 = u_{11}-x_1$, and secondly, of the installed heater/cooler willpower G_1.

Unconscious laws in this part of the brain, in S_{11}, are necessary for the survival of the being. These laws are archaic. For example, xenophobia (dislike of foreigners or people of other religions) serves for the defense of the own territory, or the own culture. The unconscious urge to hate has to be soothed with rational thinking. And similarly, the strong drive and fight for reproduction of the own genus for survival of the own species has to be constrained by social reasoning. Otherwise there is no reasonable togetherness possible but only the naked fight for survival. However, it has already been mentioned that consciousness is almost powerless compared to the unconscious. And that is the crux of the issue of the malady of peace.

The unconscious immutable laws of nature come better to light in Appendix III where a technical dual control system is briefly described. Some time ago, such technical systems indicated to the author the possibility of forming the social structure of a dualism of Figure V-1 in Chapter V.

The paralleled terms *technical--social* in some more detail:

The self-realization goal of human beings, u_{11}, is equal to the setting of the desired temperature on the thermostat. It is the desired temperature, the goal of the control system at that time. The control loop wants to immediately realize this temperature u_{11} in the same way that a human being wants to (has to) realize himself. In order to attain and then, after the loop came close to the desired temperature, to maintain this temperature, we assume that the room S_{11} can be heated and cooled. Cooling would be necessary if the temperature were to overshoot the desired level without control, e.g., in the summer.

Now in starting the operation of *realization*, it is assumed that the temperature in S_{11} is 16^0C at the time when our goal striving process has to begin. This is x_1 at time zero. At that very moment the desired temperature at the thermostat is moved to a higher level, from 16^0C (0% of u_{11}) to 24^0C (100% of u_{11}). 24^0C is now u_{11}, the goal of the control loop. That means that a higher temperature is required than

exists there at the moment. The actual temperature in S_{11} at time zero, 16^0C, is now fed back to the element of comparison. This is the element $\Sigma 1$. The 16^0C is reached negatively, namely as -16^0C. The $\Sigma 1$-element adds the two values, 24 and -16. The result is $+8^0$C. More heat is needed. This is the starting error ε_1 at time zero. It is 100% of u_{11} when the process of control to establish the goal of 24^0C starts. Eight degrees, $+8^0$C, are required to change from zero-%-level of u_{11}, i.e., from 16^0C, to 100%-level of u_{11}, to 24^0C. The loop's task is to make the $+8^0$C disappear, so that ε_1 returns to zero or at least a minimum at the end-temperature of 24^0C. (Note that the starting temperature at the 0% level is not 0^0C, it is 16^0C.)

Through the feedback set-up, self-control of the loop's behavior is established. Self-control is imperative in order to correct and maintain a continuous flow of goal-oriented operation over time. The loop knows at any instant its temperature in S_{11}. The loop is conscious of its state. It has consciousness. We do not assign consciousness to the human being only! As mentioned, each closed loop with self-control has some form of consciousness, because it knows what it wants and where it stands with what it wants.

It is a matter of a reasonable technical convention, that the incoming signals become added into the $\Sigma 1$-element. Therefore, in order to find the correct temperature difference, the feedback signal has to be negative. The feedback signal becomes negatively added.

In Figure II-1, the error ε_1 will eventually be $u_{11}+u_{13}-R_1x_1+V_{12}y_2$, whereas in Figure III-1 ε_1 is only $u_{11}-x_1$. The temperature loop has only one variable to deal with, the temperature x_1.

Now, as ε_1 is $+8^0$C, the command to the heater G_1 is: Heat! Heating is a positive ε_1, cooling would be a negative ε_1 for G_1.

G_1 is an amplification factor that multiplies the error ε_1 in order to emphasize heating. If G_1 is large, a great amount of fuel per time will be burnt. The willpower of the loop is large. The temperature

increases rapidly. If G_1 is small, then heating is slow. In a human being, we can call G_1 volition, or will, or willpower. The greater the will, the faster the individual wants to reach his goal. In addition, here, the greater the will G_1 the greater is the heating rate. - Note that the error ε_1 becomes *multiplied* by G_1. The error becomes increased within the loop! It is made larger. This increase of the error has a deeper meaning later in the dualism.

It is now a law of nature that the error ε_1 cannot be erased completely. At the very end of the corrective maneuver, to reach 24°C a small error $\Delta\varepsilon_1$ will be left (the sign Δ means a small amount). Although +8°C will be required, a little bit less will be achieved, say, only 23.8°C. This amount will be the steady end-state (until a new requirement at the thermostat, a new goal, for heating or cooling sets in).

Yet another fact occurs: a small G_1, i.e., a small degree of volition results in a larger final $\Delta\varepsilon_1$ then a large G_1. The final error $\Delta\varepsilon_1$ at the end of the process, in which 24°C was the desired objective, could indeed be made almost zero, but it needed a more sophisticated device than just a multiplication factor G_1. With our simple device, only if G_1 were infinitely large could the loop make the rest error $\Delta\varepsilon_1$ zero and the final temperature would then be exactly 24°C. But an infinitely large G_1 is not possible. Everything in life reaches saturation, is finite. However, we have to keep in mind: The larger the factor G_1 is, the better the goal attainment u_{11} will be at the end of trying to reach 24°C, and also the faster it will be reached. One could say, the larger the willpower of the heating process, the better the result. - But due to the state of stability's requirement, the fact is that the larger G_1 will be set, the more the loop is endangered to become unstable. In the case of instability, the loop would hunt in oscillation, and the temperature would go up and down in large and fluctuating cycles, dancing around 24°C. The loop would operate in an undesirable manner. The explanation of the matter of stability, or of homeostasis, will be mentioned some lines further in this chapter.

Already here - a word about the dynamics of the loop will be said: If there is an error in the temperature that is to be corrected (in our case

$+8^0$C), the feedback signal is not allowed to arrive too late after the heating process began. If x_1 arrives too late at $\Sigma 1$, there will be overheating, and the control will run amuck! The more brusque the heating i.e., the stronger the correction endeavor of G_1 is, the faster the feedback signal has to come back to the control point $\Sigma 1$ in order to avoid overheating - and under-cooling when it goes the other way.

For now the statement is: It is *a Law of Nature* that the larger the willpower G_1 is (strong heating), the smaller is the remaining effect $\Delta\varepsilon_1$. And also, if a disturbance signal arrives, e.g., an open window letting cold air flow in, the smaller the remaining effect of a disturbance. Both effects, final goal attainment and the final effect of disturbance, will be shown in Chapter IV. Again here we approach functional thinking - *loop thinking* – that is difficult to perceive with verbal explanations. Loop behavior requires calculating in order to get insight. The dilemma of the didacticism in automatic control is that explaining the theory requires to proceed in a sequence from one point to the next, whereas in a loop everything happens simultaneously.

To summarize: The larger the willpower G_1 of the loop, the smaller the remaining error $\Delta\varepsilon_1$, and the smaller the effect of a disturbance; but the more endangered the stability of the process. And also vice versa: The smaller G_1 is, the larger is the remaining $\Delta\varepsilon_1$, and the larger the effect of a disturbance at the end of the correction, and the less endangered the stability.

These are *Natural Laws*, which cannot be changed. They hold in readiness to function alike throughout the whole galaxy.

Such natural laws are evident not only in the technical realm, but also in social life. Too much power (G_1) creates social instability for the individual (and later for the dualism or even for larger conglomerates of beings). If the goal to be wanted is tried to be attained too closely with too high of a level of volition, the goal can eventually not be attained at all. Life is always a compromise or discrepancy between different opposing conditions.

We will repeat the philosophical remark mentioned before. S_{11} is the physical process, the room in which the temperature has to be maintained as closely as possible despite disturbances. The behavior in the room, namely how the fuel (any specific fuel) turns into heat, is determined by physical-biological laws. Such laws are inherent. They are present since space has come into existence - or even before that. Who knows when space was created! Such laws are, so to speak, passed on from one heating process to the next, from day to day when rooms are built. What contrives heating and cooling is subject to *Natural Laws*. Inevitable we have to obey these laws. This is physics, or in other words, this is reality. Not obeying natural laws is self-destruction. Nature eventually destroys what breaks its laws. In parallel it can be said that S_{11} in Figure II-1 of the social unit is a process installed by nature. The attitude we have, or one's own so-being and so-behaving, is an unconscious constellation. We have to consider the behavior of the unconscious brain as almost sacred. It resists enormously to be changed.

In the human being Figure II-1, the variable x_1, the momentary attainment of self-realization, is a product of three parts, the consciousness, the unconscious, and - later in the essay - the relation of communication between individuals. But only the variable y_1 becomes public. This is the information that can be observed by other individuals. The output x_1 is known only to the social unit P_1 - to him only. In parallel to our temperature control: the control loop knows its temperature x_1 because it has a temperature-measuring device in it and its feedback signal. But if a person (another loop), wants to know the temperature he has to go to the measuring device and read the temperature. In a social case, a second individual P_2 (an interacting loop) does not know x_1. If he wants to know what P_1 is doing he also has to go and observe (read) x_1 via V_1. This *seeking to know* is symbolized by the observation channel $y_1 = V_{21}x_1$.

But allow us to switch back once more to the temperature control. The matter with the term negative feedback is not quite finished yet.

Assuming now that the feedback is positive instead of negative. Then at the time zero the signal $+x_1$ ($+16^0$C) enters the Σ1-element. To the desired 24^0C, 16^0C will be added. This results in the error ε_1 of 40^0C.

The heating element G_1 receives a tremendous order to heat. There will be a huge overheating effect which never ends, which increases more and more if there is no saturation built in (e.g., an alarm). The result can be a heat explosion, a fire. Therefore, the feedback has to be negative by the generalized definition that $\Sigma 1$ is a summing point. Positive feedback results in monotonous instability. Explosions, atomic bombs, are devices with positive feedback.

Assuming that the feedback signal is taking the positive way, as $+x_1$, then the goal u_{11} would have to be changed into a negative amount in order to get the correct difference: $-24^0C+16^0C = -8^0C$. Now -8^0C would have to mean *heat* instead of *cool* - Leaving the goal u_{11} positive, as it simply makes sense, the feedback has to be negative. The notion of a *goal* for a loop is always a positive property.

Another feature has to be mentioned once more, that of oscillatory instability. This is an instability that occurs with a negative feedback, i.e., with a correct negative feedback sign. This instability, however, is less dangerous than the monotonous one, but it also has to be avoided. How does it happen?

An information transfer delay will necessarily evolve between the heating order (In Figure III-1 indicated with *heating-cooling* in the block G_1) and the new temperature in the heated room S_{11}. It also takes a while to develop the required heat before it can be recognized by the measuring device in S_{11} and sent back toward $\Sigma 1$. An additional delay can occur in the feedback channel. All these delays can produce an overreaction due to too much delay in the information transfer within the loop. If the whole information transport is too slow, too much fuel is burnt before the proper signal comes back and reaches the control $\Sigma 1$-element: stop heating, it's enough! If too much fuel will be burnt until this happens, a too strong signal for cooling will be produced in return, and this signal can be too large as well. The temperature will hunt, either with permanent or with increasing amplitude heat-cool-heat-cool! The temperature will go up and down without finding a final position. The control loop oscillates! The more delays there are along the forward and the response channel, i.e. the longer it takes to get a feedback signal, the more cautiously the room

has to be heated in order to avoid this hunting action, i.e., the smaller the volition G_1 has to be set. Too much heat-power with the intention of reaching the desired temperature too fast and too accurately produces oscillation, i.e., oscillatory instability.

Similar observations can be made in daily social life. When bringing a pot of water to a boil, firstly if takes a while before the water reaches the boiling point. Secondly, the stronger the heating rate was, the faster the water comes to a boil, but also the more violently it will over boil even if the heating has stopped after boiling started. There is inertia that creates delay and as a consequence boiling over. If boiling over is to be avoided, heating has to be done smoothly and heating has to be stopped or reduced before the water boils.

Changes have to be made cautiously and moderately. Changes that are too drastic and too violent result in instability within a person - and even more so in groups of people. The proper mathematical explanations for stability and instability are beyond the scope of the book.

To complete our heating story, another natural fact has to be mentioned. There is a small amount of positive feedback within which a system still can be stable. However, this fact shall not be treated in any detail herein. Nevertheless, a simple example of a stable positive feedback in nature shall be given. It happens very often in daily life, although unnoticed as such. - If in a hermetically closed vessel of gas, the temperature inside the vessel (e.g., of 100^0C) is increased from outside by a certain amount of heat (by air of e.g., 150^0C), the pressure inside the vessel also increases. When its pressure begins to increase, so does its temperature, and so does its pressure again in turn. Pressure and temperature are in mutual dependency in a positive interrelation inside the closed vessel up to the new temperature (of 150^0C); a positive feedback cycle goes on. This is a fact of the laws of physical nature. But these mutual slow increases - *pressure-temperature---pressure-temperature* - become smaller and smaller, and not larger, until they die out, and the action stops at the new temperature (of 150^0C) on a higher pressure. A new stable position will be attained. If such a process is modeled mathematically and structured as a loop, it will be found that G_1 is smaller than 1 with the

positive feedback $+x_1$ in the loop. The error ε_1 does not become increased by G_1, it becomes reduced because G_1 is smaller than 1. The process calms down.

The next consideration, the quantitative description of the behavior of the social unit, in Chapter IV, is somehow directly related to the behavior of the herein presented temperature control. The explanation in Chapter IV will be satisfactory for the description of our social unit. A more detailed, mathematical treatment of the single loop, or of a person, can be found firstly in Chapter VII and later on in Appendix IV.

IV. The Characteristics of the Social Unit, of the Individual

Three important characteristics of the unit's behavior shall be described in this Chapter IV. The purpose of these characteristics is to render Figure II-1 a credible model of a social unit. In the situation to be demonstrated, the unit is in an autonomous state, i.e., the individual does not have any relation yet with another individual, but he shall become disturbed by a signal u_{12} which comes from the environment - or from inside himself.

The three characteristics are:

a) The end result of the action toward the goal u_{11}, i.e., the final goal attainment, or what is equal, to the steady state;
b) The remaining effect of a disturbance signal u_{12}, also as steady state;
c) The stable areas, i.e., the properties of homeostasis.

Whatever the parameters are to describe an individual, the individual has to remain within a stable area. Only if he is stable, if he is homeostatic, he can behave in a goal-oriented manner and fight the influence of disturbances. Whenever investigating the properties of stability, the pattern of motion comes into play and with motion, time becomes important. As human beings think statically, and as in reality everything happens simultaneously over time, some readers might have difficulties absorbing dynamic terms to begin with. Dynamics is the more elaborated, more difficult part of physics and it only can be described mathematically. In addition, we have to deal with closed loops of which the dynamics is almost enigmatic. The requirement of *loop-thinking* comes into play. And to be correct: loop-thinking means indeed loop-calculating. Loops´ performance cannot be grasped by thinking.

The three characteristics, a), b), and c), are investigated with parameters belonging to different units. Thus, units with different behavior can be compared to each other. Parameter values, it is assumed, shall remain constant during a goal seeking process until a stationary state is reached after a goal was set. (Referring to our

temperature control: after the temperature of 16^0C was set, no remaining disturbance shall occur on the loop's way to the final temperature toward 24^0C).

In the sections to follow, the three graphic representations are:

Figure IV-1: The steady state goal attainment x_1/u_{11} is shown as a function of willpower or volition G_1. Note that x_1 at the end of the process will not be equal to u_{11}, but some small amount less; $\Delta\varepsilon_{1end}$ at steady state.

Figure IV-2: The remaining effect of a disturbance x_1/u_{12} as a function of G_1, and,

Figure IV-5: The limits of stability as a function of G_1 and with patterns of different loop motions.

As the sections IV-1 and IV-2 are concerned with end values, the dynamics, i.e., the pattern of motion, has no effect. Section IV-3 then shows how limits will be set to the volition or willpower, for different patterns of motion.

In order to reach technically oriented readers, some mathematics is included. The non-technical reader may skip formulas and stay with text and figures.

IV-1. The Steady State Goal Attainment

The human being has a willpower to realize himself, G_1. The question is: How much does he achieve with a weak will, how much with a strong will? In other words, how close to u_{11} does x_1 finally come after the goal u_{11} was set? The goal attainment is represented with the expression x_1/u_{11}. This magnitude is dimensionless. But if u_{11} is set to one or to 100%, then x_1 gives directly the attainment, either as a fraction of one or in a % of 100. Figure IV-1 depicts the goal attainment as a function of the willpower G_1. During the whole process, from $x_1/u_{11} = 0$, when the goal was set, to the final achievement, the system parameters u_{11} and G_1 remain unchanged. This definitely does not conform to reality where parameters and the level of the goal can change depending on different life situations. The aim here is to establish basic patterns of social behavior.

Figure IV-1 shows results that go almost without saying. With no willpower, $G_1 = 0$, no information flows through the loop. The loop does nothing; it achieves nothing. *De nihilo nihil*: From nothing, nothing comes. Where there is no will, there is no way. One has to do something in order to achieve something. Functionally, with $G_1 = 0$, the loop is dead. If the willpower G_1 is 1, the individual's attainment is 50% of the desired quantity u_{11}. This is not much yet, although enough for survival if, say, 25% of u_{11} is necessary to stay alive. (Nature does not know anything about social security and does not provide any guarantee for survival!) At the same time this value 50% can serve for a basis of comparison. $G_1 = 1$ might stay for *going easy*. We know that social values, the standard of living, cannot be measured. But comparison is possible. It can be said that an individual with $G_1 = 5$ has five times more willpower to realize himself than an individual with $G_1 = 1$.

The curve indicates that doubling the willpower from 1 to 2 does not double the attainment too. If $G_1 = 1$ the loop achieves 50%, with $G_1 = 2$ it achieves only 17% more, namely 67%, and with $G_1 = 4$, i.e., four times G_1 of 1 the loop reaches only 80% of attainment.

Figure IV-1 indicates that with increasing G_1, the goal attainment x_1/u_{11} increases as well. But the attainment never reaches 100%. There is always a remaining part to be wanted. This is a real life-situation. One

always would like to get more than what one already has. The closed loop in its mathematical-physical functioning behaves just like real life! Another reason that 100% is not possible is – as has already pointed out - the fact that disturbances always show up and try to move x_1 away from its aim u_{11}. Disturbances always act. In order to reduce the effect of disturbances, the loop has to have self-control of what it does and what it achieves. And it is the loop-action with leads to Figure IV-1. It has to be noted that a disturbance as we see it in our model stays on, but *the effect* of the disturbance upon the individual will be fought, has to be reduced and this, indeed, as much as possible. Because each being requires more from the environment - from nature - than nature can give or wants to give, competition, jealousy, and miserliness, can occur and act as disturbances; and they certainly do so.

There is also the phenomenon in real life that G_1 does not necessarily remain constant but can increase during a goal approach. The very old Latin saying expresses this clearly: *Crescit amor nummi quantum ipsa pecunia crescit:* The love for money grows when its quantity grows. The more one has, the more one wants. The New Testament knows this too: Matthew 13:12: *For whosoever hath, to him shall be given, and he shall have more abundance: but whosoever hath not, from him shall be taken away even that he hath.* But for our modest purpose we assume that G_1 and u_{11} remain constant during a goal approach.

An increase of willpower for the purpose of better goal attainment could be achieved by integrating the error signal $\varepsilon_1(t)$ together with its derivative action. The formula (II-1) would change to formula (IV-1).

$$G_1\left[\varepsilon_1(t) + C_a\frac{d\varepsilon_1(t)}{dt} + C_p\int\varepsilon_1(t)dt\right]. \qquad (IV-1)$$

The derivative part in (IV-1), that is

$$G_1C_a\frac{d\varepsilon_1(t)}{dt},$$

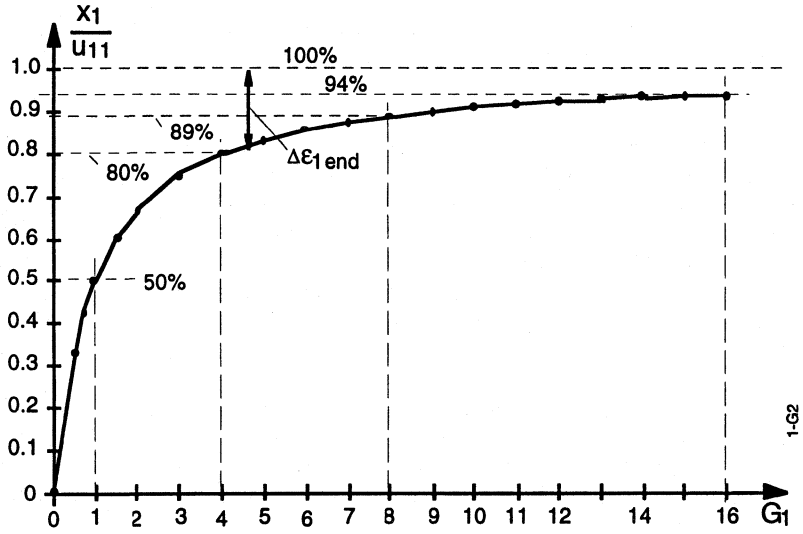

Figure IV-1: Steady state values of attainment x_1/u_{11} as a function of the willpower G_1. The value x_1/u_{11} can be calculated with the expression $G_1/(1+G_1)$. As the data are end-values, the time does not come into play.

would then represent anticipation, i.e., feeling in advance what is coming. The expression $d\varepsilon_1(t)/dt$ is the rate of change of the error ε_1. The integral part in (IV-1), that is

$$G_1 C_p \int \varepsilon_1(t)dt,$$

would provide enforcement or stubbornness. Integration means an increase of the volition over time. The formula (IV-1) has - for the time being - an informative purpose only, namely to indicate that our investigation is a preliminary attempt to demonstrate basics. For specific information about the expression (IV-1), see Appendix IV.

Figure IV-1 reveals more information than the fact that 100% attainment can never be achieved. The higher the attainment the flatter and the more horizontal the curve becomes. That will say that it needs more and more effort to add to good attainment another increment. Every sportsman and every musician knows about this fact quite well. To run 100m in 12 seconds is not too great a task (for men). But to break the world record (which is slightly below 10 seconds) requires not only gigantic effort, but also years of training and the necessary physiological body conditions and mental disposition. A similar situation holds true for a musician. To play the violin reasonably well can be achieved with some good and lasting effort. But to become a Yehudi Menuhin is quite a different problem. The closer the approach to the limit of 100% of the goal in mind, the more effort is required for doing better, for gaining more. The same situation occurs in the technical world. To increase the actual efficiency of, say, a turbo compressor by 1%, the research investigations were tremendous.

The formula used to calculate the curve Figure IV-1 is the simple expression (IV-2):

$$\frac{x_1}{u_{11}} = \frac{G_1}{1+G_1}. \qquad (IV-2)$$

The flattening out of the curve is clearly shown with the derivative of this expression (IV-3):

$$d\frac{\left[\frac{G_1}{1+G_1}\right]}{dt} = \frac{1}{(1+G_1)^2}. \qquad (IV-3)$$

The larger the willpower G_1, the flatter the curve becomes; the derivative tends to zero with growing G_1. Only if G_1 is ∞ the curve becomes horizontal and x_1/u_{11} becomes 100%, or 1 with formula (IV-2), because in this case $\infty/(1+\infty) = 1$. (∞/∞ is an undefined expression.)

The well-known proverb, *Where there's a will, there's a way*, can be slightly reformulated to make it more suitable to the variety of life: *Where there's no will, there's no way;* ($G_1 = 0$, $x_1/u_{11} = 0$). *Where there is some will, there is some way. - Where there is a tremendous will, there is a very rocky way*, the flat curve. But proverbs have to be effective, concise. Most people do not like elaborate explanations of anything.

But we have to pay careful attention to the proverb *Where there is a will, there is a way.* The saying can have unpleasant consequences. When exerting an enormous willpower, one must be extremely cautious. The unit can become unstable and miss its goal completely. This is the case when, for example, the greed for political power of a dictator becomes fanatic. The term instability will make this clear in section IV-3. A Spanish proverb says - concerning accumulations of money: *La codicia rompe el saco;* greed shreds the bag. And politically, overdone willpower stimulates revolutions and wars. The instability disperses.

The curve shown in Figure IV-1 gets its form from the loop concept. The loop concept is necessary for self-control. Self-control is awareness of oneself, of the own being. And awareness over time provides consciousness - to repeat our axiom. This curve, Figure IV-1, should hang - we think - on the wall of every class-room, because especially for young people it can often be frustrating if they do not get twice the success by applying twice the effort.

IV-2. The Effect of a Disturbance

What does a disturbance signal u_{12} bring about, and what can the loop do to prevent the disturbance's influence? An illustration of this is given in Figure IV-2.

The remaining effect of a disturbance with a positive effect, after it penetrated the loop with the value 1 or with 100%, i.e., when it enters with the same positive magnitude as the goal u_{11}, is the mirror image of the goal attainment curve Figure IV-1. It is the curve $+x_1/u_{12}|_{u11=0}$. The image is around the horizontal line at 50% of x_1/u_{11}. It can be said that the effect of a positive disturbance of 100% of u_{11}'s magnitude, $+x_1/u_{12}$, plus goal attainment, x_1/u_{11}, equals 1, illustrated by equation (IV-4), and depicted in Figure IV-2.

$$\frac{x_1}{u_{11}} + \frac{x_1}{u_{12}} = 1 \qquad (IV-4)$$

Goal attainment plus the positive effect of disturbance is summed up 100%. This is correct under the assumption that the weight (or the importance) of both, the goal u_{11} and the disturbance u_{12}, are equal in size and orientation. But under this circumstance the disturbance is help and not a detriment to the goal u_{11}. A disturbance u_{12} in the general meaning is a signal that is not positively u_{11}-related. The signal u_{12} can be help or a detriment, depending on the effect the disturbance has. The effect is what counts. If u_{12} is positive - as it is shown in the equation (IV-4) then it adds to x_1/u_{11}. On the other hand, if u_{12} is negative with reference to u_{11}, it means a detriment. Its effect is deducted from x_1/u_{11}. This is also shown in Figure IV-2. The curve is $-x_1/u_{12}|_{u11=0}$. The general social assumption is that u_{12} works against u_{11} because any disturbance, positive or negative, prevents self-control.

The formula (IV-4) with the willpower G_1 as an intervening measure has the following origin:

Due to the loop concept, x_1/u_{11} becomes $G_1/(1+G_1)$. This expression leads to the curve Figure IV-1, and it is repeated in Figure IV-2. The value x_1/u_{12} becomes $1/(1+G_1)$. This expression is also depicted in Figure IV-2.

It is the above mentioned curve $+x_i/u_{12}|_{u11=0}$. Both expressions added together result in the value 1, shown with formula (IV-4) [presupposed $u_{11} = u_{12} = 1$]. Although the mathematical explanation of these formulae is simple, it is omitted herein. What we have to know is that it is the *loop concept*, the concept of self-control, which leads to the expression (IV-4).

In Figure IV-2 it can be seen that if the volition is nil, the effect of the disturbance on the individual is 100%. The individual becomes the victim of the disturbance (or the beneficiary); x_i/u_{12} becomes ±100%. In addition, the stronger the willpower G_i for self-realization is, less is the influence the disturbing information has. But as the desired goal never can be attained to 100%, so the influence of a disturbance can never be made zero.

The disturbance - this is to be emphasized in our consideration - stays on as an input signal into the loop. But its effect on the individual will be reduced by the willpower G_i. - If, as an example, the neighbor plays his music out through his window into the environment, you can close your window and plug your ears. The music stays on, but the influence on you is reduced. This is possible if you have self-control. Yet, there are many and more severe disturbances than the neighbor's music that interfere with your life expectations! Therefore, one must have strong willpower if one wants to become one's self!

In reality, it is definitely not the case that the weight of the disturbance u_{12} is equal to the weight of the goal u_{11}, although it can come close. For example, in the case of drug use or alcoholism, disturbances can have a tremendous emotional and physical influence. Derangement can even mean more than self-damage, namely self-destruction. This can be the case when the willpower is extremely weak or the weight of the disturbance is greater than the weight of self-realization.

It is very important to realize that the two influences, the goal in mind (u_{11}) and the influence of disturbance (u_{12}), are tightly interrelated. These two entities are inseparable, neither in the technical world nor in social situations. Events and incidents in life are too numerous to isolate one's path to one's goal. Disturbances always occur. In the formula (IV-4) the two influences x_i/u_{11} and x_i/u_{12} are either added together or subtracted from each other. If a disturbance u_{12} has a negative value for u_{11}, then x_i/u_{12} is to be deducted from x_i/u_{11}. If for example $G_i = 1$ and $|u_{11}| = |u_{12}|$,

but the value of u_{12} is opposite to u_{11}, the resulting x_1 becomes zero. See Figure IV-2. The goal attainment and the effect of the disturbance compensate each other.

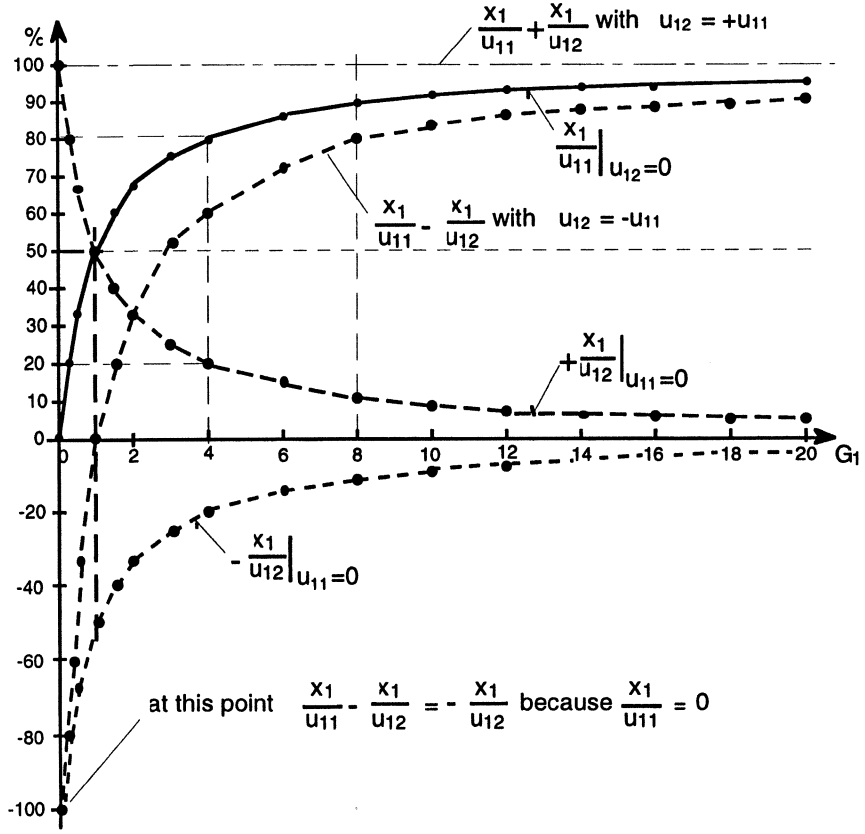

Figure IV-2: Steady state effects of the disturbance x_1/u_{12} as a function of G_1. The values x_1/u_{12} can be calculated with the expression $1/(1+G_1)$.

No loop at all - to mention this also - would mean no control at all; no feedback. Then x_1 would become $G_1u_{11}+u_{12}$ or

$$x_1/u_{11} = G_1+u_{12}/u_{11}.$$

In order to reach the condition $x_1 = u_{11}$, the willpower G_1 would have to be 1 only and u_{12} would then have to be equal to zero. There would be no control. The temperature control would not know where it stands! Neither would the individual know about his goal approach. It is the constellation of the loop that creates awareness, and awareness is consciousness - perhaps even for pure technical loops in the automatic control of machines. Who really knows?

A final question about the effect of a disturbance is in order. What is the steady state error ε_{1end} as a function of the disturbance signal u_{12}? A loop's endeavor is to attain a minimal steady state error in order to come as close as possible to the goal u_{11}. In the loop shown in Figure II-1 the steady state error ε_{1end} (with $S_{11} = 1$) becomes equations (IV-5) and (IV-6). We find equation (IV-5) if u_{12} is a disturbance *supporting* the goal approach ($u_{12} = +u_{11}$) and equation (IV-6) is correct if u_{12} is a disturbance *harming* the goal approach ($u_{12} = -u_{11}$).

$$\varepsilon_{1end} = \frac{u_{11} - u_{12}}{1+G_1} \qquad \text{(IV - 5)}$$

$$\varepsilon_{1end} = \frac{u_{11} + u_{12}}{1+G_1} \qquad \text{(IV - 6)}$$

If $u_{12} = u_{11} = +1$ (as applied in Figure IV-2) then $\varepsilon_{1end} = 0$ and x_1 becomes u_{11}. The helping disturbance helps to achieve 100%. If, on the other hand, $u_{12} = -u_{11}$ and both of magnitude 1, then there is a real and large disturbance, and

$$\varepsilon_{1end} = \frac{2}{1+G_1}.$$

The effect of the remaining disturbance is a severe reduction in u_{11}. The steady state goal proximity becomes

$$x_1 = 1 - \varepsilon_{1end} = 1 - \frac{2}{1+G_1}. \qquad \text{(IV - 7)}$$

But still: the larger G_1 is, the closer x_1 approaches the goal. The factor 2 in $\varepsilon_{1end} = 2/(1+G_1)$ can easily be verified in Figure IV-2.

The signs (+) and (-) in the abstract mathematical sense could seem to be insufficient for life situations. There are - one could say - not just plus and minus disturbances affecting an individual. Or one could argue that our thinking requires new terms for the application of the loop approach in social perspectives. But as we take refuge in the *effect* a disturbance has, with plus and minus attributes, we are headed in a sane direction. A disturbance then might even be physical or psychological or of whatever kind; it is its effect that counts.

An ulterior motive: Our contemporary thinking entails a fundamental rethinking of the function of life: to descend deep into the fundamentals of nature is necessary. In our opinion, the symbolic verbalization of social situations, as it is done today, is no longer adequate for the description and understanding of life's functioning. On the other hand, the transfer of conventional images of social, political, psychological, and religious situations into pure physically termed axiomatic language is a rather difficult task - as it comes to light here. It requires physics and all available mathematics. This becomes even more obvious in the following chapters. The many different cultures and branches of existing knowledge would have to be unified into one, into a *globalization of science* with the basic concept that all functioning of life as moving matter and energy in fields within natural laws! Each scientific branch would have to give up its own and private domain; - what a confusion of conflicts this would initiate!

IV-3. The Limits of Stability; the Homeostasis

The investigation of the goal attainment and the effect of a disturbance were presented on the basis of steady state conditions, i.e., of end states after a goal was set and the goal approach was accomplished. - The problem of stability, on the contrary, is of a dynamic nature and therefore somewhat more complex and also to some extent longer winded. But the dynamism leads closer to reality. Time plays a role and is even essential. It is known that stability in political and social realms is an extremely obscure topic. Politicians, sociologists, and economists try in vain to maintain balanced events and are helpless in curing social instabilities. Why? The logic of nature is deeper than we can think of or have the feeling for - or have the brain capacity to perceive! It seems that we have no memory for larger time spans. Our thinking is static, not dynamic. We are confined in time and move with it. Therefore we cannot see time from outside and definitely cannot take it into a dynamic account in interacting loop actions. Studies treating conglomerates of several units soon become unfathomable and go beyond our comprehension. Even studying simple dualisms, as this book demonstrates, requires perseverance and patience.

It was already mentioned that a being needs time to execute an action. In the model shown in Figure II-1 this notion *time* is concentrated and represented with the delay element

$$F_1 = \frac{1}{(T_1 s + 1)^{m_1}}.$$

This time delay is incorporated in our loop in an extremely simple manner, namely as a series of linear differential equations of the first order. The expression *differential equation* causes a fear in the hearts of most people. And it is a fright. Therefore, it is tried herein to avoid the anxiety by presenting a picture that makes the problem plausible.

A physical image of differential equations representing time delays in a series can be seen in Figure IV-3. It illustrates the delays of six such equations in a row in the form of six water tanks. The box F_1 in

Figure II-1 is the symbol for the water cascade of Figure IV-3. The parameter T_1 symbolizes the time which is needed to fill one of the six tanks from the level zero up to the level H when its outflow is closed, i.e., when it is a single, isolated tank. T_1 is the filling time of one of the tanks. The exponent m_1 indicates the number of tanks in a series, one after the other. One tank fills the next in the row. Therefore, in Figure IV-3 m_1 is 6. In the block F_1 it is assumed that there are only three such tanks. As all tanks are of equal size and the same structure, the filling time T_1 is the same for all three containers.

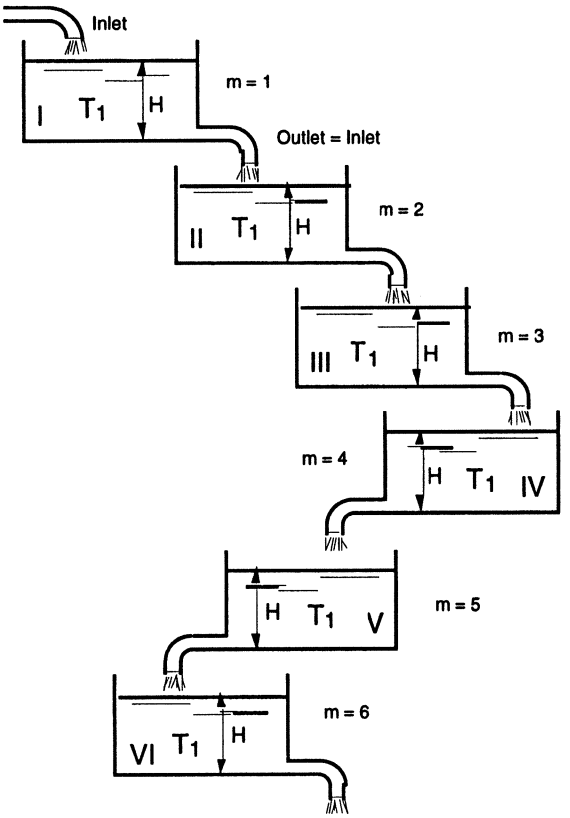

Figure IV-3: Arrangement of six equal delay elements in the form of six tanks.

When water flows through the whole interconnected cascade in a steady state manner, then the outflow of each tank is equal to the inflow of the next. The height H remains constant in all six tanks.

If now more water begins to flow into at the top tank, it takes a long time until the new level in all tanks reaches the new height. We call the new height $H+\Delta H$. During the transfer from the lower H to the new level $H+\Delta H$, the level increases more slowly in the second tank than it does in the first, and so on all the way down to the sixth. The longer the cascade, the longer it takes for the new levels to adjust and become equal. Theoretically and mathematically it takes an infinite long time for proper steady state adjustment. But if one waits about 10 times as long as the product of T_1 and m_1, then all heights $H+\Delta H$ will again be practically even. If, say, T_1 is about 10 minutes and if there are 6 tanks, then it will take about 10 times 6 times 10 = 600 minutes to equalize the levels. Therefore, it will take about 10 hours. One is reminded of such facts in reference to a row of bureaucratic processes in a democracy or in big industrial corporations: it takes time to get something new, or for a change to take place through long operational channels. One office, or department, has to adjust to the next one, be this on the higher or lower level, or all of them just to other circumstances.

Considering the model of the unit, each tank signifies a location of delay in the individual's operation. Such locations can be thinking, learning, drafting of something, a physical trial of performance, executing a task, or whatever. Whatever and however: each action needs time.

When the cascade is built into a control loop, i.e., when a circular continuous function for maintaining a certain *level* is established, then the stability is the more endangered the more delay elements there are in series if the *level* is measured at the last element and fed back to the input at the beginning. For the model Figure II-1 in our analogy: the more delay elements

$$\frac{1}{(T_1 s + 1)}$$

in F_1 there are, the slower the individual acts and the more the loop is endangered to become unstable. And the more delay elements there are, the smaller the willpower G_1 is allowed to be in order to avoid hunting, i.e., in order to assure that the individual remains capable of maintaining its steady goal approach. If all the tanks in the human being have the same size, what is assumed for the time being, then it can be seen in Figure IV-4 how the willpower G_1 has to be reduced if more and more tanks m_1 are put together to a human internal cascade - or any such cascade in nature. The smallest number of delay elements with which we are going to deal with from now on is 3. Then the limit of willpower at the stability limit is 8, independent of the magnitude of T_1, i.e., on the size of the *tanks*. The mathematical proof of this fact is given in Appendix IV. The reason to take 3 as the minimum is because with two or only one tank in the loop, the loop cannot become unstable. But as humans can become erratic and fluctuating and unstable, three differential equations in series is the minimum for our approach of a social model, Figure II-1.

This feature transferred into the social realm says that the slower an individual acts, i.e., the more internal delay elements an individual is built with, the smaller is the willpower he can exert to realize himself before he becomes unable and incapable to proceed toward his goal. Willpower is necessary to realize oneself, but too much willpower is dangerous. This is a further *natural law* symbolized mathematically.

If the delaying tanks are not all of the same size, if, e.g., one tank is much larger than the others, then Figure IV-4 is no longer valid. The situation increases in its complexity - as this is the case in every day situations. The more scrutiny a problem receives the more its complexity increases. - It can be said: the more different the various tanks are (allegorically the more different the various delays in a human being are) the greater G_1 can be before the loop becomes unstable. However, there is always a limit for G_1 whether m_1 is three or greater. This limit is given by another *natural law*.

Calling the three different time constants, i.e. the filling time T of three tanks of different sizes, T_1, T_2, and T_3, then the willpower G_1 in the loop can be the larger the more different the two relations T_1/T_2 and T_1/T_3 are. Figure IV-5 depicts the situation. It shows stability limits as a function of the two relations T_1/T_2 and T_1/T_3 and with G_1 as

parameter. If both relations are 1, i.e., if $T_1 = T_2 = T_3$, then this figure indicates that the limit of the willpower is 8. This is the very central point in Figure IV-5. $G_1 = 8$ at $m_1 = 3$ corresponds with this point in Figure IV-4.

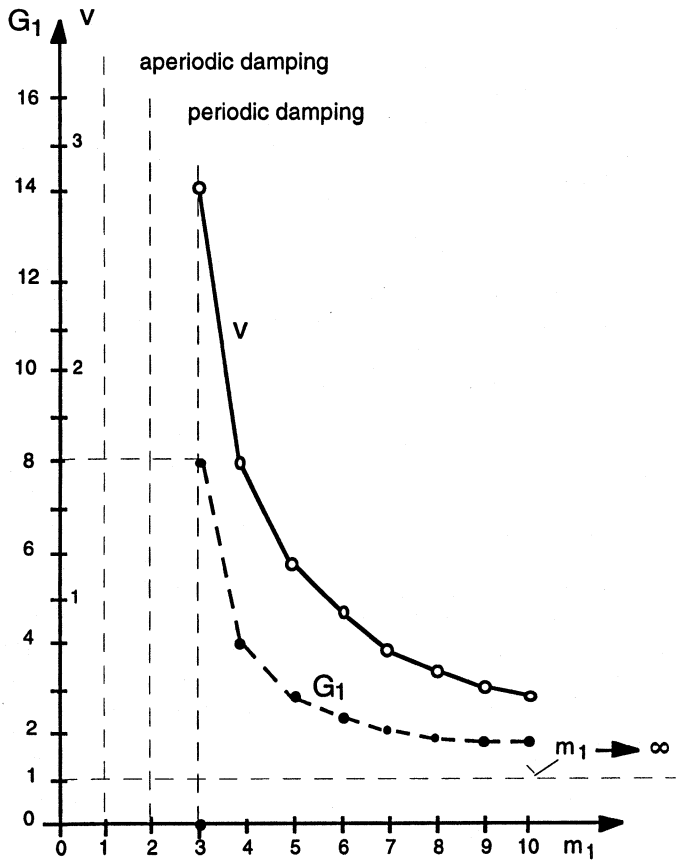

Figure IV-4: Representation of the necessary decline of the willpower G_1 and the decrease of the velocity v with increasing number m_1 of delay elements $[1/(T_1s+1)]$. G_1 and v are taken at the stability limit. v has a qualitative value only. At $m_1 = \infty$, $G_1 = 1$, $v = 0$.

If the two relations are not 1, the willpower can grow to the maximum. It never becomes smaller than 8, it only can grow. As an example, $T_1/T_2 = 1$ and $T_1/T_3 = 10$, then G_1 is 25. Indeed, this is much greater than 8. With such a greater G_1 the goal attainment will become somewhat greater as well. This can be checked with Figure IV-1. It can be observed that with $T_1/T_2 = 1$ and $T_1/T_3 = 0.1$ (point B) or with $T_1/T_2 = 1$ and $T_1/T_2 = 10$ (point A), the value G_1 is the same, about 25. It is relations that play the role, and not absolute values. This is not only the case in the technical world, but in social life as well. The fastest competitor in a race wins the competition, independent of the actual speed he has.

The distribution of the time constants within a human being can be called the *pattern of motion.*

Figure IV-1 shows that with $G_1 = 8$ the goal attainment is 89%, whereas with $G_1 = 25$ the attainment is 96%, i.e., 7% more. It shall be accentuated again that with a G_1 three times larger (25 instead of 8) the attainment grows only by 7% relative to 100%. The higher the goal attainment x_1/u_{11}, the more willpower G_1 is needed to gain an additional increment on the way toward the set goal. Frustrating, isn't it?

A further circumstance occurs with decreasing willpower G_1, which is with increasing m_1: the velocity v of action also decreases. This feature can be seen in Figure IV-4. The two curves, G_1 and v, have similar shapes. If G_1 goes down (decreasing willpower) with increasing m_1, the velocity v goes down too. The loop acts in a slower manner. [In order to find the speed v in our model we brought the loop at its stability limit. There its oscillation time is taken as a measure of its speed of acting. The stability limit is an easy way to measure this speed v. In reality, for stable conditions, G_1 has to be smaller than G_1 at the limit.]

We can state a universal law: The faster a unit thinks, acts, the larger its willpower G_1 can be before it runs into instability, and the better and faster it reaches its goal. And, indeed, vice versa. Slow people (in thinking and acting) generally have little willpower and achieve little. The model, because it is physical, is reality. And it well addresses this fact of nature.

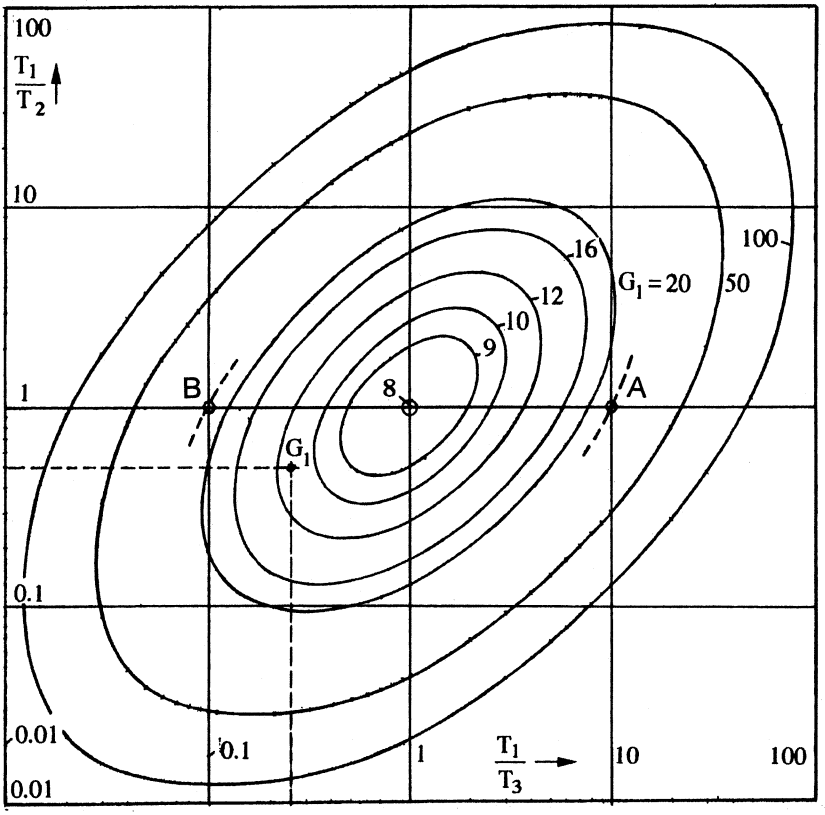

Figure IV-5: Stability limits with G_1 as parameter and as a function of the relations of the time constants T_1/T_2 and T_1/T_3.

There is a pleasant feature to be mentioned which shows how gentle nature is with the beings it created. Even very slowly acting humans (very large m_1) can at least achieve 50% of their goal and, thus, survive. With m_1 very large (up to ∞), G_1 does not decrease below 1, but the velocity v goes to zero. This is indicated with the horizontal, dashed line in Figure IV-4. This fact, however, is true only in autonomy; but in interaction with a second individual (or more

individuals), it is no longer so. An interacting partner complicates the situation. This will be seen further in the book.

The fact that great willpower allows higher velocity and that both, willpower and velocity in combination, result in higher goal attainment may be the reason that in society high velocity and great power have a high market value. In sports it is power and speed that count. It is unimaginable to have a competition for weakness and slowness. This would be absurd. And nobody would bother watching it.

But one should be careful about putting high willpower into an interacting effect! How quickly does a fight start between two powerful players of opposite teams in hockey or in soccer games! And if the willpower becomes excessive, the game ends in a crash, in instability. The game ends with the interaction of the police - and perhaps even in court. But this is already a matter of a dualism.

Already in this very simple model of one loop, an intricate combination of elements and factors makes perception difficult: Willpower, pattern of motion, stability, goal attainment, disturbance, and feedback. Yet, from the social standpoint, this system as described is still of extreme simplicity.

As already mentioned, a simple notion of intelligence can be defined: The faster and the closer an individual reaches his goal, the higher is his intelligence, or the higher is his I.Q.!

A small table, Table IV-1, shows some data to emphasize this little, simple rule. For four different units: A, B, C and D, each one encumbered with three time constants, T_1, T_2, and T_3, the velocity of action v and the steady state attainment (at the stability limit!), x_1/u_{11}, are indicated. Which unit is the most intelligent one? Still not so easy to determine!

The units A and D have both three equal time delays. A has three times a T of 1; D has three times a T of 0.1. Both achieve finally 89% of their goal. But D is 10 times faster than A. A then drops out. B and C, however, have both higher attainments than does D. And of these two units, C is faster. B drops out. Now the competition is between C

and D. If attainment has priority, C is the most intelligent unit. If velocity of action has priority, D is the smartest. *L'embarras du choix,* as in real life. What is better depends upon the circumstances or the person who judges.

Table IV-1: Test of intelligence for four units, A, B, C, and D.

unit	T_1	T_2	T_3	G_1	v	x_1/u_1	
A	1	1	1	8	1	89%	
B	1	1	0.1	24.2	2.7	96%	
C	1	0.1	0.1	24.2	6.3	96%	accurate
D	0.1	0.1	0.1	8	10	89%	fast

In making a side step from the human being to the animal world in general, another nice feature of nature might be mentioned. As the ratios, not the absolute values of the time constants are the criterion for stability and thus for survival, it can be said that any living being has the same potential of survival within its own species. Or in other words, a huge, slowly operating animal with three large time constants (an elephant) has within its own species the equal dynamic potential to exert power as an extremely fast acting creature with three very small time constants (a humming bird) within its own species. Nature offers equal potential of survival for any of its creatures within their own species. This is, however, no longer the case in the fight for survival among different species. There the faster catches the slower one, or the faster can escape from being caught in case he is too weak to fight.

These rather lengthy introductory remarks should give credit to the model Figure II-1 for further investigations, namely for the interaction between two units. Interaction is the next and the main topic of the book.

It can be seen now that it requires a tremendous amount of thinking and work to find natural laws, even if they are still very elementary. In order to take the burden of thinking away from us, natures gave us imagination, illusion, fantasy, hallucination, and faith - and the most important feature, the automatically functioning biological potential to survive. How long did it take to find the law of gravity to describe the free fall of an object, or the law for the parabola in Figure I-1! With faith and imagination people establish their social togetherness, but also fight and kill each other about who is right - and has therefore more willpower! To live and kill (for survival or pleasure or hate), no knowledge of physics is needed. The coming chapters, V to X, will demonstrate that nature favors enmity and sets amity second. Therefore, we shall not wonder that fighting on earth will go on - ad infinitum or until our extinction.

V. The Dualism

The objective of this chapter is to put two individuals of Figure II-1 together to a next higher system, to Figure V-1. Two individuals, P_1 and P_2, shall form a dualism with an unconscious information exchange within their frame of mind. P_1 and P_2 have an attitude toward each other through the channels with the informations $S_{12}\delta_2$ and $S_{21}\delta_1$. P_1 and P_2 are either friends and like each other, or enemies and hate each other. The intensity of friendship and of hostility is determined by the magnitudes of the factors S_{12} and S_{21}.

Figure V-1 depicts the structure of the dualism. The unconscious information exchange happens via the transfer channels of the factors S_{12} and S_{21}. The two other bilateral information exchange channels, via V_{12} and V_{21} and via A_{12} and A_{21}, as they are shown in Figure II-1, are now omitted. Dominance is given to the unconscious interaction.

Psychiatrists and psychologists know that the unconscious part of the human brain is about ten times stronger in its impact on daily life than the conscious part. Therefore the attitude of a being is considered to be the dominant motivation of his behavior. The limited but important concern of our consideration is therefore *attitude*.

As the loop concept represents a new perspective of the complexity of life, the number of loops a system is composed of might symbolize a measure of that system. We begin with this consideration.

The dualism Figure V-1 consists of three circular information loops which are interrelated to each other. These three loops are, firstly, the loop of the unit P_1, then the loop of unit P_2, and in addition the loop that connects the two units unconsciously via the attitude, the *coupling loop*. This coupling loop transfers bilateral information between the two individuals. The three loops are:

Loop P_1: $\quad \Sigma 1\text{-}G_1\text{-}F_1\text{-}\Sigma a\text{-}S_{11}\text{-}\Sigma 2\text{-}(-1)\text{-}\Sigma 1,$

Loop P_2: $\quad \Sigma 3\text{-}G_2\text{-}F_2\text{-}\Sigma b\text{-}S_{22}\text{-}\Sigma 4\text{-}(-1)\text{-}\Sigma 3,$

The coupling loop: $\Sigma 1\text{-}G_1\text{-}F_1\text{-}\Sigma a\text{-}S_{21}\text{-}\Sigma 4\text{-}(-1)\text{-}\Sigma 3\text{-}G_2\text{-}F_2\text{-}\Sigma b\text{-}S_{12}\text{-}\Sigma 2\text{-}(-1)\text{-}\Sigma 1$.

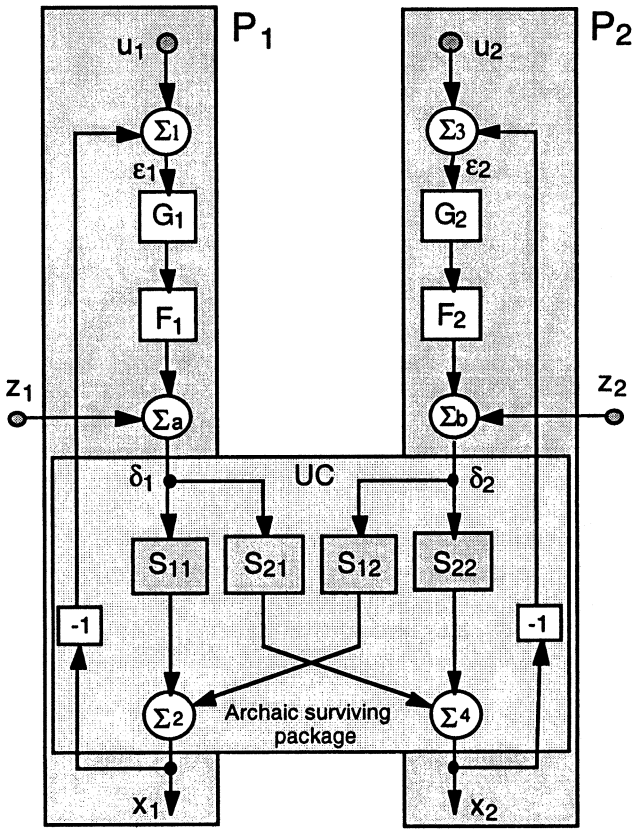

Figure V-1: The unconscious dualism, the attitude structure of two partners. The matrix $S_{11}\text{-}S_{12}\text{-}S_{21}\text{-}S_{22}$ can be called the archaic surviving package.

It can be expected that it is the coupling loop which determines whether the liaison of the two individuals is friendly or hostile, i.e.,

whether the connection is consentient or antagonistic. Two proverbs indicate that it needs two parties to establish either a friendship or hostility:

Amity: *D'un côté ne vient pas l'amitié*
Il faut que l'autre soit de moitié.
Amity is not single-sided.
The other part must be half of it.

Enmity: *It takes two to make a quarrel.*

As the loop concept requires a new kind of thinking, new terms are needed. It will be seen that the term moitié-moitié in „Il faut que l'autre soit de moitié" is not really adequate. It turns out in this model that it is one and only one partner of the two who has to give in to the opinion of the other that establishes the friendship. One partner accepts the position of his social participant. He has to submit himself to the other. In other words: one partner has to be *devotional*. The other partner exerts his opinion. We therefore use the term devotion parallel to consensus and friendship or amity. But such a single-sided situation does not satisfy the general public term friendship. We have to deal with a new concept, a new notion. At the end of the chapter the one-sidedness of devotional behavior will make sense. But devotional behavior can take turns between two partners, but only one at a time and for one topic to be arranged the other must submit. This is a first and main point we establish for the dualism concept.

The characteristic equation of the dualism, i.e. the character of the interrelation as a whole, is represented with all the symbols of Figure V-1 involved and shown with formula (V-1):

$$(1+G_1F_1S_{11})(1+G_2F_2S_{22})-G_1G_2F_1F_2S_{12}S_{21}=0. \qquad (V-1)$$

The mathematical meaning of this equation is the following: Equation (V-2) of (V-1) symbolizes the character of P_1.

$$(1+G_1F_1S_{11})=0 \qquad (V-2)$$

Equation (V-3) of (V-1) symbolizes the character of P_2.

$$(1+G_2F_2S_{22})=0 \qquad (V-3)$$

And the term of (V-1)

$$G_1G_2F_1F_2S_{12}S_{21}$$

includes the attitude element that adds into the two individuals' characters.

The loop in Figure V-1, $(-1)G_1F_1S_{21}(-1)G_2F_2S_{12}$, which is the term $G_1G_2F_1F_2S_{12}S_{21}$, shall be called the *coupling loop*. From this additional element, $G_1G_2F_1F_2S_{12}S_{21}$, it can be seen that the two individual attitude components S_{12} and S_{21} do not come into play separately. They come as a product; they multiply in order to determine the character of the dualism. Each partner's attitude is bound to the attitude of the other partner! This is an essential point, the second one, in our loop concept.

Here already, in the character of the dualism equation (V-1) it becomes obvious how strongly the two units P_1 and P_2 are interconnected. The character of the dualism is strongly different from the character of the individual partners. The two characters become multiplied by each other, $(1+G_1F_1S_{11})(1+G_2F_2S_{22})$, and in addition there is the third part in the equation which contains the product $S_{12}S_{21}$, involving both partners characteristics, $(G_1F_1S_{21})$ and $(G_2F_2S_{12})$. The product $S_{12}S_{21}$ determines predominantly the goal attainment of the individuals, i.e., their self-realizations x_1/u_1 and x_2/u_2 within the dualism. The individuals, once they interact, are no longer self, although we keep the term self-realization. The two self-realizations become involved, they become mutually dependent on each other as partners.

Our social curiosity is asking now about the effect of the factors S_{12} and S_{21}, or in other words the coupling loop's effect on the goal striving process of P_1 and P_2. How do the partners' self-realization change from autonomous state to the state in the relationship?

The most important facts shall be stated in advance. The detailed explanation follows.

If the resulting sign of the multiplied factors of the coupling loop, i.e., the factors G_1, F_1 (s = 0), S_{12}, G_2, F_2 (s = 0), S_{21}, is negative, then the goal attainments of the two partners increase compared to attainments without the attitude coupling $S_{12}S_{21}$. We call this coupling characteristic now devotion, or consent, or amity. This interaction produces mutual help. If, on the contrary, the overall sign of these coupling factors is positive, then the goal attainments of the partners become smaller than without coupling. This dualism is called hostility, or enmity. This interaction results in mutual damage. Repeating the facts:

If the sign of the expression $|G_1F_1S_{21}G_2F_2S_{12}|$ is < 0, i.e., negative, we talk about devotion, or consent, or amity;
If the sign of the expression $|G_1F_1S_{21}G_2F_2S_{12}|$ is > 0, i.e., positive, we talk about hostility, or enmity.

As the signs of G_1 and G_2 are assumed to be positive, and as the signs of the pattern of motion, F_1 and F_2, are positive (there is no negative time) the negative or positive sign of the product of the factors G_1, F_1, S_{21}, G_2, F_2 and S_{12}, is determined by the coupling factor $S_{12}S_{21}$. The negative product $S_{12}S_{21}$ has the meaning of producing a negative feed-cross signal within the coupling loop. If an influence, so to say an argument of unconscious information in the opinion of the two individuals, flows back and forth between them, one individual - only one! - subtracts this quantum of argumentation when it comes to him from his partner, he produces the friendship; he is devotional, or consentient to his partner.

Say that P_1 subtracts the signal $S_{12}\delta_2$ coming over from P_2, and P_2 adds the signal $S_{21}\delta_1$ coming over from P_1, then

P_1's x_1 becomes $S_{11}\delta_1$-$S_{12}\delta_2$ and
P_2's x_2 becomes $S_{22}\delta_2$+$S_{21}\delta_1$.

We assume that, due to this reduction of P_1's internal error of $S_{11}\delta_1$ by $S_{12}\delta_2$, P_1 feels in his *unconscious* to be closer to his goal u_1, because his internal error becomes smaller, although after the feedback signal passed through $\Sigma 1$, the new ε_1 becomes larger in his *consciousness*. We see that there is a discrepancy between the unconscious and the consciousness in the perception of the signal $S_{12}\delta_2$. As our thinking happens foremost in the consciousness, such facts are not readily understandable. But be that as it may, the effect is that both partners' self-realization increases. The fact is that one partner (P_1) has to be submissive, but not the other, not P_2. It seems that one partner (P_2) has to lead. He adds the signal coming over from the other partner. He is - so to speak - in an aggressive state. He unconsciously feels his increased error, his greater distance from his goal. His partner P_1, on the other hand, has to give in. P_1 is in a negative state! He subtracts the signal from his partner and is submissive. In a friendship, one constituent reduces his own signal $S_{11}\delta_1$ with the feed-cross signal, while the other partner aggravates his internal signal $S_{22}\delta_2$ with the feed-cross signal.

If, to the contrary, the exchanged arguments become continuously added by both individuals, the interacting loop becomes a positive feed-cross loop. Then the self-realization of both partners sinks. And it sinks drastically, as we will see. Such behavior establishes the enmity.

We use the term *feed-cross* for the bilateral information exchange via S_{12} and S_{21}. The information crosses over from one partner to the other, although sociologists still use the term feedback for this information transfer. And sociologists require a positive feedback in order to stay on good terms with the other party.

This attitude information flow between two individuals happens in an unconscious *field* between the two units. In order to emphasize our field-hypothesis, we borrow from Albert Einstein: *Not the behavior of the bodies, but the behavior of something between them, that is, the field, is essential for ordering and understanding events;* [1, pages 295-296]. We cannot measure such an assumed field yet. Its existence

is a premonition. But we want to keep in mind that all phenomena happen in the form of matter which functions. Even within fields it is matter which functions, matter which carries information (including the equivalence of matter and energy).

As only one individual in the friendly dualism has to give in, but not the other one, the relationship can also be called *agreement* instead of devotion or of consensus. But it is not a mutual agreement! This notion of unilateral pliability will become more transparent later.

The term hostility or hate fits well the circumstance that both individuals increase their internal unconscious error with the quarrelling information from the partner. Unconsciously they become, or want to become, angry at each other. In hostility

$$P_1\text{'s } x_1 \text{ becomes } S_{11}\delta_1+S_{12}\delta_2 \text{ and}$$
$$P_2\text{'s } x_2 \text{ becomes } S_{22}\delta_2+S_{21}\delta_1.$$

Adding the cross-signal, i.e., increasing the own error $G_1\varepsilon_1$, and $G_2\varepsilon_2$ respectively, and therefore forming in the unconscious the feeling of moving away from one's goal is reasonable cybernetic grounds for the explanation of anger and, from the standpoint of a dualism, of disharmony. The fact explains mathematically the term *hate* that is arranged in the unconscious.

Setting a devotional dualism and a hostile one side by side, then three individuals of the two dualisms will add the cross signal and only one will give in, the one in the devotional state of the amity dualism. This discovery could lead to the opinion or even conviction that there are three times as many individuals prone to aggressive conduct in our world than there are individuals ready for consentient behavior. Does nature favor aggression? We will see repeatedly that this is so.

In all the millions and billions of years of human history it was always the stronger party in hostile clashes that survived - and reproduced afterwards. Therefore it must be assumed that today we are full of aggressive genes today - even more than only three fourths of the world population - and that this hate in the coming overpopulation in

the competition for resources and therefore the competition for survival will rather increase. There is a tremendous probability for wars to come. Nonetheless, in the investigation to follow it will come to light that also friendship contains a strategy for survival. This is the case if in a partnership of two one of them contents to be the *altruist* and gives way to the *egoist*. We will see that in a favorable, *healthy* friendship, the altruist not only takes his partner's crossover signal in a deductive manner; in addition he reduces his will substantially in favor of the egoistic partner's will. One partner, the altruist, has to give in, has to reduce his will, he has to submit himself. The egoist on the other hand goes forward with a large will. - And the friendship works well.

But the egoist has to accept the altruist's submission. Otherwise the altruist has to

- Leave the relationship and become autonomous - if he can, if he is not legally bound, or
- Instead of subtracting the partner's feed-cross signal, change his mind by adding the feed-cross information and forming in this way a hostile relationship. This second way, going from friendship into an aggressive state, is much more probable than leaving the dualism. Due to the fact that it is so easy to make an about-turn from consensus to hostility (by changing one's mind) - but not the other way around (as we will see) - we created the bon mot: *Peace is latent enmity, war is manifest enmity.*

The probability is almost non-existent that a hate-relation changes back into a friendship. This fact comes to light especially when the two partners have different patterns of motion, Chapter VI.

So far a preview of what we are going to prove:

Each cultured language demonstrates plenty of synonyms for a certain behavioral characteristic. We only make use of very few, but mention herein some more:

For friendship there are qualitatively similar expressions such as:

agreement
alliance
amity

benevolence
concord
conciliation
compliance
consent
devotion
harmony
peacefulness
pacification
pliability

For hostility there are many more synonyms than for friendship. Who wonders after discovering the relation *aggression-devotion* of 3 to 1!

abomination
animosity
acrimony
animus
antagonism
aversion
aggression
attack
cantankerousness
contradictoriness
competition
conflict
contrariness
disagreement
detestation
discord
disharmony
enmity
hostility
hate
inconsiderateness
incompatibility
intolerance
maliciousness
militancy
opposition
pugnacity

quarrelsomeness
self-opinionatedness
virulence

The statements given so far are: amity as mutual help and enmity as mutual damage. In section V-1 these statements will be calculated. Section V-3 takes a more differentiated look at these two features.

As our unconscious is a huge world of hidden complexity, which is not in a simple back-and-forth relation with the much less powerful consciousness, we become aware that problems of interacting beings can never be solved satisfactorily.

We assume herein (except in V-4 and V-5), that the two goals self-realization, the one of P_1, u_1, and the one of P_2, u_2, are independent from each other, that says that they are not compatible, they do not influence each other. Specifications in this regard will follow.

As a small interlude the following two formulas (V-4) and (V-5) will illustrate - just illustrate - how the complexity from the unit of one individual to a dualism of two individuals increases when more detailed parameters are taken into account. The representation is not meant to be studied; it shall merely give an impression and to make sure that we keep in mind that life is - compared to what we show here - rather more complex.

The character of one unit, P_1, of the formula (V-2) with three delay time factors, T_{11}, T_{12}, and T_{13}, becomes equation (V-4). It is a linear differential equation of the third order (in the Laplace-domain).

$$T_{11}T_{12}T_{13}s^3 + (T_{11}T_{12} + T_{11}T_{13} + T_{12}T_{13})s^2 + (T_{11} + T_{12} + T_{13})s + G_1S_{11} + 1 = 0 \qquad (V-4)$$

Of the total character of an individual, only three factors are considered, namely the willpower for self-realization, G_1, his pattern of motion (with T_{11}, T_{12} and T_{13}), and his own unconscious information transfer factor S_{11}. The character of the dualism is equation (V-5) if

P_2's characteristics are similar to P_1's, namely G_2, (T_{21}, T_{22}, T_{23}), and S_{22}.

The characteristic equation (V-5) with the six factors, G_1, G_2, S_{11}, S_{22}, S_{12}, S_{21}, and the time constants of two patterns of motion (T_{11}, T_{12}, T_{13}, and T_{21}, T_{22}, T_{23}), becomes very tangled and rather confusing.

The formula (V-5) stretched out is already 2.5m long. It is impressive how the interaction plays its role. In functional complexities, one of the guilty parties is time! And this is just one, but an important one, of the factors the human being cannot completely understand because he cannot perceive simultaneous functioning behavior over time spans in closed loops. Here we make a harsh statement: Functional *loop-thinking* is not possible. Loop behavior has to be calculated. And life is one huge ocean of interacting loops.

Why do we dare to make such a statement? We have already mentioned that we are co-passengers of time. Therefore, we cannot look at time from outside. We are in it and we are carried along with it, somehow similar sitting in a plane. We can neither look at the plane nor can we know speed, height and direction of it. We are in it as we are in time. And we cannot store time spans in our memory as we can store three-dimensional pictures. Surprisingly enough, we can calculate time (what we do here), but we cannot *think* it.

In a triplex of individuals of also only unconscious information exchange the formula similar to (V-5) would become 40 m long, and for a quadripartite the length would be 800m. Such is the gradient with which life deepens. Social systems literally explode in complexity. We will never achieve an understanding of them, because we cannot perceive time and our huge brain still has a very limited capacity! And whilst we increase our knowledge, the evolution continues to a higher complexity.

$$1 + (T_{11} + T_{12} + T_{13} + T_{21} + T_{22} + T_{23})s +$$
$$(T_{11}T_{12} + T_{11}T_{13} + T_{11}T_{21} + T_{11}T_{22} + T_{11}T_{32} + T_{12}T_{13} +$$
$$T_{12}T_{21} + T_{12}T_{22} + T_{12}T_{23} + T_{13}T_{21} + T_{13}T_{22} + T_{13}T_{23} +$$
$$T_{21}T_{22} + T_{21}T_{23} + T_{22}T_{23})s^2 +$$

$$T_{11}T_{12}T_{13} + T_{11}T_{12}T_{21} + T_{11}T_{12}T_{22} + T_{11}T_{12}T_{23} +$$
$$T_{11}T_{13}T_{21} + T_{11}T_{13}T_{22} + T_{11}T_{13}T_{23} + T_{11}T_{21}T_{22} +$$
$$T_{11}T_{21}T_{23} + T_{11}T_{22}T_{23} + T_{12}T_{13}T_{21} + T_{12}T_{13}T_{22} +$$
$$T_{12}T_{13}T_{23} + T_{12}T_{21}T_{22} + T_{12}T_{21}T_{23} + T_{12}T_{22}T_{23} +$$
$$T_{13}T_{21}T_{22} + T_{13}T_{21}T_{23} + T_{13}T_{22}T_{23} + T_{21}T_{22}T_{23})s^3 +$$

$$T_{11}T_{12}T_{13}T_{21} + T_{11}T_{12}T_{13}T_{22} + T_{11}T_{12}T_{13}T_{23} +$$
$$T_{11}T_{12}T_{21}T_{22} + T_{11}T_{12}T_{21}T_{23} + T_{11}T_{12}T_{22}T_{23} +$$
$$T_{11}T_{13}T_{21}T_{22} + T_{11}T_{13}T_{21}T_{23} + T_{11}T_{13}T_{22}T_{23} +$$
$$T_{11}T_{21}T_{22}T_{23} + T_{12}T_{13}T_{21}T_{22} + T_{12}T_{13}T_{21}T_{23} +$$
$$T_{12}T_{13}T_{22}T_{23} + T_{12}T_{21}T_{22}T_{23} + T_{13}T_{21}T_{22}T_{23})s^4 +$$

$$T_{11}T_{12}T_{13}T_{21}T_{22} + T_{11}T_{12}T_{13}T_{21}T_{23} + T_{11}T_{12}T_{13}T_{22}T_{23} +$$
$$T_{11}T_{12}T_{21}T_{22}T_{23} + T_{11}T_{13}T_{21}T_{22}T_{23} + T_{12}T_{13}T_{21}T_{22}T_{23})s^5 +$$
$$T_{11}T_{12}T_{13}T_{21}T_{22}T_{23}s^6 +$$
$$G_1S_{11}\left[1 + (T_{21}T_{22}T_{23})s + \begin{pmatrix} T_{21}T_{22} + T_{21}T_{23} + \\ T_{22}T_{23} \end{pmatrix}s^2 + \right.$$
$$\left. T_{21}T_{22}T_{23}s^3 \right] +$$
$$G_2S_{22}\left[1 + (T_{11}T_{12}T_{13})s + \begin{pmatrix} T_{11}T_{12} + T_{11}T_{13} + \\ T_{12}T_{13} \end{pmatrix}s^2 + \right.$$
$$\left. T_{11}T_{12}T_{13}s^3 \right] +$$
$$G_1G_2(S_{11}S_{22} - S_{12}S_{21}) = 0 \qquad (V-5)$$

Another remark: Because a person has an unconscious part in his head, an unconscious world, he cannot know himself fully. Similarly, another person cannot know himself either. In a concise form: *An entity cannot perceive itself!* How then shall an interaction of both, which is a multiple more complex than an individual, be understood

and perceived by either of the components of the dualism! We mean to be capable and we pretend to be able, although there is no way ever for this to be. *Each individual being part of a social system is ignorant of the behavior of the system as a whole,* [4, page 4].

V-1. The Partners' Self-Realization

The next step for this undertaking is to obtain and substantiate the basic laws that determine amity and enmity, i.e., friendship and hostility. The assumption is that the magnitude of the two attitude factors S_{12} and S_{21} in Figure V-1 shall be ± 1, that means that the transfer of unconscious information from one partner to the other is equally strong from both sides: $|S_{12}| = |S_{21}| = 1$. To make this magnitude 1, plus or minus, and rigid is indeed a simplification. As said, simplifications shall provide an easier way to understand the purpose of this book. By the same token it shall not be forgotten that reality has many more facets and forms of appearance than could be mentioned herein. Our focus is to demonstrate a few elementary and dominant characteristics of primeval social behavior. The real purpose is to illustrate that social and psychological occurrences could not only have a physical-biological component, but that they are realy physical, meaning in the deepest sense, functioning matter - substance which functions - be this a somersault on the floor, be it our soul's functioning or our spirit's working.

We emphasize: If the unconscious information transfer function S_{12}, which comes from P_2 and goes to P_1, is negative, and the information S_{21} from P_1 to P_2 is positive, the product $S_{12}S_{21}$ becomes negative. The coupling factor of the two units is -1. - The effect on the two self-realizations, x_1/u_1, and x_2/u_2, is an increase. This circumstance is called friendship, or devotion, or consent, or amity.

In a devotional relationship, on the basis of unconscious information exchange, a mutual increase in both partners' self-realization occurs. *Platonic consent* is mutual welfare.

If the exchanged information transfer functions are both positive, the product $S_{12}S_{21}$ becomes positive - in the present situation +1. The two self-realizations become reduced, damaged. This interrelation is called hostility, or hate, or enmity. By our definitions: friendship provides help, hostility results in damage.

In a hostile relationship, the unconscious interaction has a detrimental effect on both partners' self-realization. *Platonic hate* is mutual harm.

In a devotional togetherness an unconscious argument that goes back and forth between the two partners (the flow in a loop is continuous - as life is), one individual deducts from his own internal discrepancy signal (that is from $+S_{11}\delta_1$), the dualism's discrepancy signal coming over from the partner (i.e. $-S_{12}\delta_2$). The other individual in the dualism adds the signal (i.e., $+S_{21}\delta_1$) to his own discrepancy signal (that is to $+S_{22}\delta_2$). These two operations happen in the unconscious of the partners' minds. The operation results in an agreement of the two partners' conflict situation.

On the other hand, if both partners add the incoming feed-cross signals to their own, i.e., if both individuals are in an aggressive disposition, then both individuals' self-realization suffers from such behavior.

It has to be emphasized that although there is no real action, the unconscious inherent attitude toward each other is mutual help or mutual impairment to their goal striving process, to their self-realization.

In the case of friendship, the circular loop between the two parties contains a negative feedback notion that operates between the two partners. In the case of hostility, the circular loop between the two partners contains a positive feedback notion between the two. But this positive feedback loop does not result in an outburst, as is the case in a single loop. Terms and axioms from the single loop, from the single individual, cannot simply become extended to the next higher complexity. Involvements of higher levels require new terms, new definitions, because new situations occur.

It is the mathematical treatment that uncovers such new facts. The occurrence in social interactions is a continuous flow in time that our brain cannot perceive. We rely on calculations. What we cannot think, we have to calculate. That what is physical, has to be calculated. A

bridge, a plane, or a skyscraper cannot be thought; they must be calculated with the knowledge of physical laws. Social behavior, the way it is here in our mind, needs to be calculated as well.

Figure V-2 illustrates help and damage for the steady state self-realization of the unit P_1 upon interaction by P_2. The curves can be calculated with the formula (V-6) if $u_1 = 1$ (or 100%) - and with the assumption that only u_1 is acting as input on the looped system Figure V-1. The other three inputs, u_2, z_1 and z_2 are zero. To put u_2 to zero implies that the two attempted self-realizations of P_1 and P_2, i.e., u_1 and u_2, are not compatible. Every individual can realize only himself. Even if one acts in regard for another person, one still realizes only oneself. P_2 influences P_1's realization via his own willpower G_2 and not by acting directly with his own self-realization goal u_2.

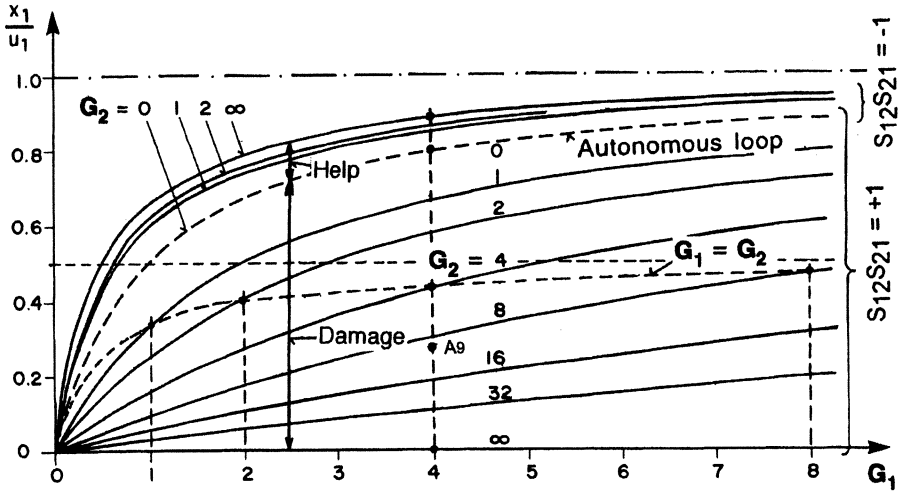

Figure V-2: Self-realization x_1/u_1 of the unit P_1 with the willpower G_2 of P_2 and as a function of the willpower G_1 of P_1. $S_{12}S_{21} = -1$ for friendship, and $S_{12}S_{21} = +1$ for hostility.

$$x_1 = \frac{1+G_2-S_{12}S_{21}G_2}{(1+G_1)(1+G_2)-S_{12}S_{21}G_1G_2}G_1 \qquad (V-6)$$

In section V-3 both of the goals, u_1 and u_2, and the two disturbance signals, z_1 and z_2, will be taken into account for the total system Figure V-1.

In Figure V-2, the unconscious information transfers, S_{11} and S_{22}, and as well S_{12} and S_{21}, are of magnitude 1. $S_{12}S_{21} = \pm 1$.

In Appendix I the formula (V-6) is given for x_1 with explicit functions S_{11}, S_{22}, F_1, and F_2.

Explanations for Figure V-2:

The upper dashed curve is the self-realization of P_1 without any influence from P_2, i.e., when P_1 is in an autonomous state, $G_2 = 0$). This curve is already known from Fig. IV-1. If now P_2 joins in, forming a dualism, the achievement x_1/u_1 grows with a growing willpower G_2 of P_2 in case of a friendship, i.e., if $S_{12}S_{21} = -1$. The increase is small, but it is an increase. This increase is indicated in the figure with *Help*. The pure presence of friendship with P_2 helps P_1 in his self-realization.

Because the structure in Figure V-1 is symmetric, the same is valid for P_2. Correspondingly, by replacing x_1 with x_2, u_1 with u_2, and G_1 with G_2, the same curves can be used.

In case of enmity, i.e., if $S_{12}S_{21} = +1$, then x_1/u_1 decreases strongly with increasing G_2. This is indicated in the figure with *Damage*. Therefore: An unconscious, hostile attitude - without physical, hard manifestation - already damages P_1 drastically, and indeed P_2 as well.

Friendship helps but hostility is detrimental. The help is minor but the damage is major. At very strong self-realization of P_2, i.e. at $G_2 = \infty$, the help for P_1 with G_1 of 2.3 (indicated as an example in the Figure V-2) is only about 16%, whereas the damage is complete. The self-realization of P_1 becomes zero. P_2 ruins P_1 fully with $G_2 = \infty$. P_1 is to

die. And this is the case at any $G_1 < G_2$ with G_2 being large compared to G_1. At such a result, one is tempted to refer to a marriage of two aggressive partners in which one partner is much stronger than the other. The weaker partner dies away after a short life span, and the stronger lives on - mainly quite happily. If such strong, aggressively disposed partners marry again, the combination is in most cases hostile once again. The aggressive being looks unconsciously for resistance to exert his aggressive attitude. Aggression is a determined behavioral symptom of an aggressive personality. And: *The weak always goes to the wall.* In an aggressive partnership the weak partner dies due to suffering from too much continuous degradation of his self. This can happen without any overt arguing, quarrelling, or fighting, just due to a hostile, unconscious attitude.

If the effort toward self-realization of both partners is equal, i.e., if $G_1 = G_2$, then the lower dashed curve shows the mutual damage. Whatever the strength is with which the two aggressive beings stay hostile toward each other, their self-realization reaches utmost 50%. The curve becomes horizontal for $G_1 = G_2$ toward the value $G_1 = G_2 = \infty$. This is an important fact for fanatic antagonists: Independent of the motivation pattern, for $G_1 = G_2$ the self-realization of both parties remains below 50%. They damage each other down to 50% or less of what they have in mind to attain. But there are factors that can make hostile relationships attractive for people of certain characteristics. This will be shown further in the book when time is taken into account with the dynamic homeostasis problem becoming involved.

Before penetrating into more detail about what happens in the dualism in Figure V-1 with all four input signals u_1, u_2, z_1, and z_2, the stability of the structure will be looked at. The stability areas set limits to the magnitude of the partners' willpower, be this in amity or in enmity.

V-2. The Limits of Stability; the Homeostasis

We know that for the investigation of the stability of a system its dynamic comportment has to be taken into account. This is an absolute necessity. A system can only live as a function of time if it is dynamic and stable, if it is homeostatic. A being needs time to reason and to act. Thus, including time is inevitable. Any analysis of a complex system that ignores the dimension of time is fragmentary.

It is a mandatory condition that a system is stable if it wants to act in a goal-oriented manner. With this condition, not only friendly systems, also hostile systems have to be stable if its constituents want to achieve their goal - and hostile systems are mostly long lasting and very stable! - It is wars that fill books of history, not peaceful periods. Hostile liaisons are even more stable and have a higher potential to survive than peaceful partnerships. This fact is not only a social and historical tragedy, but it is also an outcome resulting from our model! Animosity, it seems, is a survival requirement. *Consensus to establish peace is a horizon that is never reached;* [4, page 117].

Homeostatic behavior means continuously acting toward the goal (or goals) with final steady behavior as close as possible to the goal. Homeostasis means *staying the same.*

The assumption now is that the pattern of motion of each of the two units, P_1 and P_2, is similar to the water flowing through three equal tanks of Figure IV-3. Therefore, in Figure II-1, $m_1 = 3$. The three tanks shall have the same size. The stability limit of the autonomous loop therefore will be attained with a willpower G_1 of 8. This fact was already mentioned in the previous section, IV-3.

The next two Figures V-3 and V-4, represent stability limits with the two willpowers, G_1 and G_2, as coordinates when P_1 and P_2 interact unconsciously with each other. The vertical axis, the ordinate, is for G_1, the horizontal axis, the abscissa, is for G_2. If $G_2 = 0$, then $G_1 = 8$. If $G_1 = 0$, then $G_2 = 8$. Such willpower can be called *auto-willpower*, willpower in the autonomous state. If a partner's willpower is zero, e.g., if G_2 of P_2 is zero, then he does not exist for the other partner, for P_1. He, P_1, then is in an autonomous state, and P_2 is non-existent. The two auto-willpowers are marked in both figures with G_{10} and G_{20}.

Figure V-3 illustrates the stable area for hostility, or enmity. Figure V-4 depicts the stable area for consent, or amity.

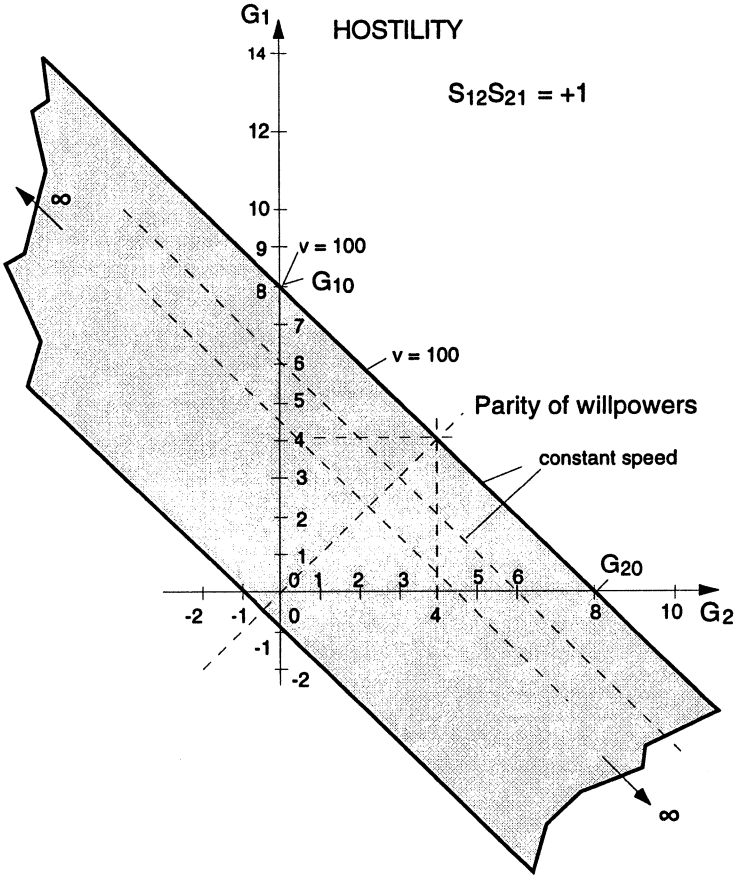

Figure V-3: Stability limits for hostility. The attitude-coupling factor $S_{12}S_{21}$ is +1.

What do these two pictures tell us?

It is of special interest when the two willpowers G_1 and G_2 have the same magnitude, $G_1 = G_2$, i.e., when there is parity of willpowers. The values can be found on the 45^0 line, as indicated in the figures. For the restriction of $S_{12}S_{21} = \pm 1$ it can be seen that the willpower for hostility is twice that of consent. In Figure V-3, $G_1 = G_2 = 4$, whereas in Figure V-4, $G_1 = G_2 = 2$. Our first important finding is when there is parity of willpower: Hostile interaction gives the feeling of having twice the willpower than devotion does. Hostility can afford to have twice the willpower to realize itself as devotion. This is a cardinal finding.

As Plato said: *Toute grandeur est dans l'assaut.* In attacking, one feels superior. In addition, hostile behavior acts almost twice as fast as devotion. At the stability limit for hostility the speed is marked with v = 100. For devotion it is only 60 when compared to hostility.

In short: hostility is fast, consent is slow.

The speed of motion in hostility is as fast as the speed of the autonomous individual, v = 100. This fact is indicated in Figures V-3 and V-4 at $G_2 = 0$ and $G_1 = 8$. Figure V-3 also indicates that the speed of action is constant along the upper line of the limit area, namely v = 100 - independent on the willpowers G_1 and G_2.

Hatred is always ready for fast emotion and action. Speed and hate go hand in hand! - A natural law. *A bold attack is half the battle* is a true English proverb.

The demonstration of hostility in connection with speed is clearly visible on the highway: Aggressive drivers want to be fast and pass. The more horsepower packed into their motor, the greater the feeling of might! (Such power, which can be bought for money, becomes transfigured into the drivers self: when my car is fast, I am fast!)

In nature, the hungry, faster aggressor survives. The slowly moving partner becomes the prey. Hostility is survival! This is true in the biological as well as in the social and monetary world.

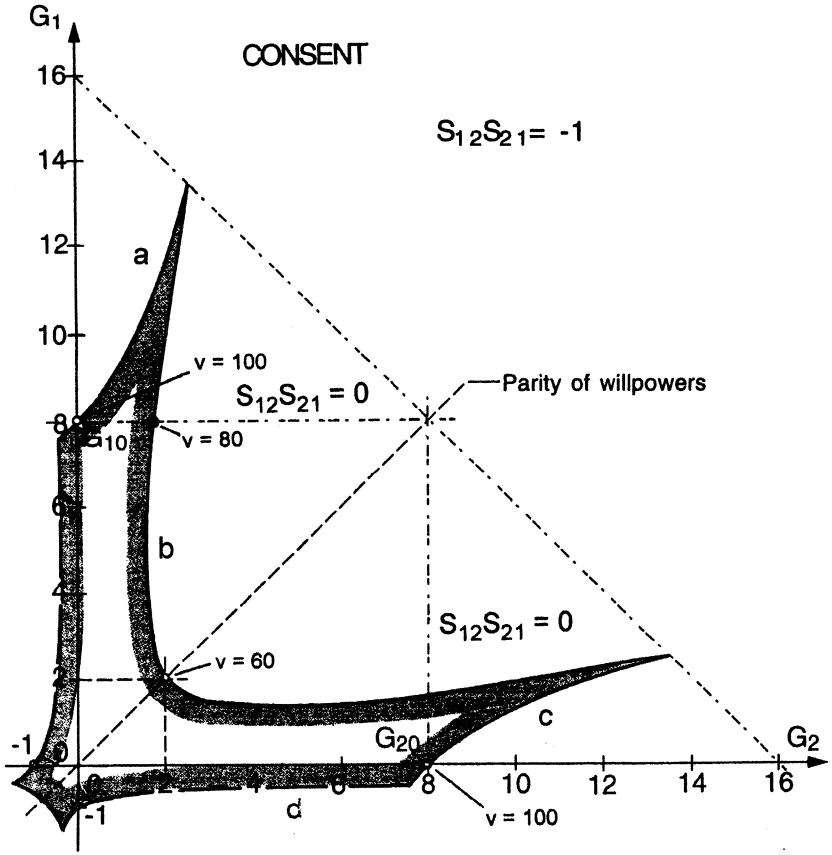

Figure V-4: Stability limits for consent. The attitude-coupling factor $S_{12}S_{21}$ is -1.

Peace-fighters (e.g., UN's combat-ready forces) make every possible effort to hold on to their belief that peace on earth is possible despite the overwhelming evidence of deep-rooted necessity of hostility for survival. In nature there is neither peace nor war, there is survival by fight or flight.

In the amity figure, Figure V-4, the speed of action changes along the curves a, b, c, and d. The situation in a devotional relationship is more complex than in a hostile one. We dare to say that perhaps because hostility is a requirement for survival, nature's design for enmity is a more simple construction than amity!

In Figure V-3, in hostility, the sum of G_1 and G_2 at the stability limit is constant: $G_1+G_2 = 8$. - This is however correct only if P_1 and P_2 are dynamically equal and $S_{12} = S_{21} = +1$.

Another quite amazing fact occurs in the figure. The strip of homeostasis extends in both directions to infinity. Due to this fact, it can be deduced that one unstable partner, say P_2, with a negative G_2 can go into a stable but hostile relationship with either a very stable or even also an unstable partner P_1. If, for example, P_2 with $G_2 = -6$ in a monotonously unstable state and thus, absolutely incapable of behaving in a goal oriented manner, but can go into a stable hostility with a stable P_1 of $G_1 = 7$ or with an unstable P_1 of $G_1 = 12$. Willpower of 12 is much more than P_1's willpower at the stability limit in autonomy - which is 8. This will indicate that two unstable partners - or nations - who are not able to achieve their goal, who are on the way to collapse, can get together in a hostile partnership and stay stable. The same situation is not possible in an amicable relationship. In Figure V-4, both partners must have a positive willpower. If one of the two partners is not able to stay stable in autonomy, i.e., cannot exert a positive willpower, the friendship cannot survive.

But in such hostility, the goal attainment of P_2 with a willpower G_2 of -6 together with a P_1 of $G_1 = 12$ is rather frustrating. P_2 achieves a negative goal in a stable relationship. The alliance exists, but one of the two, P_2, has no prospect of success.

Although the infinite strip in Figure V-3 brakes down to a finite length if for example $S_{12}S_{21}$ deviates from +1 by a tiny bit of more than $\pm 10^{-12}$, the facts just mentioned remain, as can be seen further down in Figure VI-4: Two partners who are not capable of coping with life in an autonomous state can survive in an partnership of animosity.

In Figure V-4, i.e., in devotion, the situation is more complicated. The curve consists of several parts, a, b, c, and d. Of interest is the quadrant in which G_1 and G_2 are positive. This quadrant contains the main conditions for a long lasting friendship; both willpowers have to be small: $G_1 = G_2$ 2.

Reference is given to the part: $G_1 > 0$, and $G_2 > 0$. If one partner claims a willpower which is larger than the willpower in autonomy (in autonomy it is 8 as a maximum), e.g., $G_1 = 9.5$, then the other partner has to give in to a willpower G_2 smaller than 1.6. P_1 with a G_1 much larger than G_1 of parity (which is 2 at $G_1 = G_2$) is called the *egoist*, and the one who has to be satisfied with a G_2 smaller than a willpower of parity is called the *altruist*.

In a well functioning, successful friendship one partner of the two has to be the leader, the egoist; the other part has to adapt, the altruist. If both would give in, the dualism would not survive because each partner would assume that the other partner *would do it*. Each one would expect the other to push forward. The goal attainments would become negative. We refer to such a situation as socially pathological although the common opinion is that both partners are submitting to each other; both are forbearing.

But now a very important circumstance comes to light. The altruist, the weaker partner, gains from the egoist. And the egoist also gains from the altruist. The egoist can exert a volition that is larger than the volition in autonomy ($G = 8$). The egoist (say P_2) could be called the initiator of the friendship as action, although the altruist (P_1) is the provider of the friendship with his *negative* intake of $-\delta_2 S_{12}$.

A numerical example makes this clear.

Let's assume that G_1 is 1.5 and G_2 is 9 at $S_{12}S_{21} = -1$. Then the formula (V-6) renders $x_1 = 0.74$ or 74%. If P_1 were fully on its own, i.e., $P_2 = 0$, then x_1 would be only 60% with a G_1 of 1.5. The help the altruist P_1 gains from the egoist P_2 is 14%.

What does the egoist gain from the altruist? If - in order to use formula (V-6) G_1 changes to G_2, G_2 changes to G_1, x_1 changes to x_2,

($u_1 = 0$ and $u_2 = 1$), then formula (V-6) renders $x_2 = 93.5\%$. In autonomy with $G_2 = 8$ as his maximum willpower, P_2 would attain 89% of u_2. Therefore he gains 4.5%. The altruist offers the egoist not only a willpower of $G_2 = 9$, what is greater than the autonomous willpower of 8, but in addition some help beyond the autonomous maximum features! Is the altruist too benevolent?

What would happen to the weak P_1 in hostility, i.e., if P_1, down with G_1 at 1.5, would change the approving behavior into a hostile one because he does not want to see P_2 on a level of 93.5% of attainment? Taking the stability conditions of Figure V-3 with $G_1 = 1.5$ and $G_2 = 6.5$, P_1´s attainment would be drastically reduced: $x_1 = 17\%$ (no doubt his dead (†). P_2´s attainment x_2 would still be 72%. The weak P_1 could not survive in such an aggressive partnership.

A further, important fact arises. The comparison of the two Figures V-3 and V-4 shows that the behavior in hostility is simple in contrast to devotion. If G_1 is given, the maximum G_2 can be determined for the system to remain stable ($G_1+G_2 = 8$). Not so in devotion. If, e.g., $G_1 = 1.7$, then there are two stable and two unstable regions for G_2. If G_2 grows from zero on, the system is first stable; then it becomes unstable, stable again and again unstable. The conclusion is that devotional or peaceful situations are much more sensitive to changes of parameter values than hostile cases. Hostility is solid. Friendship is fragile.

The change from a stable to an unstable and back to a stable area may be called *broken stability*. These are phenomena that occur sometimes in marriages. Two partners part out of stability and later, when a storm of instability is over, re-enforce themselves to form a new, stable situation.

As already mentioned: Figure V-3, shows large regions of willpowers where one willpower can be negative and the partnerships remain stable. Such situations have the character of positive feedback within one of the two partners. Autonomous partners, who are both highly unstable (e.g., P_2 with $G_2 = -4$, and $G_1 = 10$), can become partners in a stable hostile dualism. Such circumstances might belong to social ills. They shall be omitted herein, but pathology quite often exists in daily life. Partners who cannot live socially in a stable manner arrange a

hostile partnership and survive happily (people who join crime-gangs, or nations provoking warlike situations when they have uncontrollable, domestic problems).

We find a corroboration of life situations:

Enmity has a much larger stability area than amity. For further proof of this statement refer also to the next two Chapters VI and VII. This might indicate that hostility is more favored by nature than friendship. Enmity has therefore much more potential for survival. Such findings do not please, especially not philanthropic fanatics and religious zealots who endeavor to establish peace on earth. But nature does not care for our wishes, hopes, and anticipations. Nature reproduces so fast and excessively that destruction is unavoidable. The stronger and faster eats the weaker and slower. Eating, feeding requires killing of living beings. And nature does not distinguish between human beings and other living creatures. And there is the very old saying: *Naturam expellas furca, tamen usque recurret* - drive nature away, it comes back We human beings are biological animals and sometimes (quite often) show, animal, even bestial behavior.

Another interesting proof that enmity is much stronger than amity is given with the product of the two unconscious variables δ_1 and δ_2, Figure V-1. They form the unconscious *weight* of amity or enmity. For P_1 the formula (V-6a) gives the weight $\delta_1\delta_2$ for enmity, and formula (V-6b) for amity.

$$\delta_1\delta_2 = -\frac{(1+G_2)G_1{}^2G_2}{(1+G_1+G_2)^2}; \qquad (V-6a)$$

$$\delta_1\delta_2 = -\frac{(1+G_2)G_1{}^2G_2}{(1+G_1+G_2+2G_1G_2)^2}; \qquad (V-6b)$$

$$(u_1 = 1,\ u_2 = 0,\ S_{11} = S_{22} = |S_{12}| = |S_{21}| = 1)$$

Taking the parity of willpowers of the two partners at their stability limits, in Figure V-3, enmity, $G_1 = G_2 = 4$, and in Figure V-4, amity, $G_1 = G_2 = 2$, then we get the two different weights $\delta_1\delta_2$:

For enmity $\delta_1\delta_2 = -3.95$,

For amity $\delta_1\delta_2 = \pm 0.14$.

In the unconscious the weight of hostility is almost 30 times larger than the weight in friendship! As our example is symmetric in P_1 and P_2, P_1 and P_2 both have the same impression, or feeling. The dominance that nature gives to hostility compared to that of friendship is frightening. We must deduce that life in friendship is extremely delicate whereas hostility is extremely robust.

Before proceeding to the next chapter, it is appropriate to mention the third kind of attitude-interaction, namely where the two transfer factors are negative; $S_{12} < 0$ and $S_{21} < 0$, say $S_{12} = -1$ and $S_{21} = -1$. Both partners are mutually submitting; both are altruistic. The coupling factor $S_{12}S_{21}$ is positive, as it is in hostility. Chapter V-5 shows that u_1/x_1 and x_2/u_2 will also be the same as in hostility. Mutual altruism is self-damage compared to autonomy and friendship. One partner - and only one - has to be affirmative, has to be quasi in an aggressive disposition in order to lead the dualism to success.

We referred to such a situation where both, S_{12} und S_{21}, are negative, as socially pathological although the common opinion is that both partners are submitting to each other, are forbearing.

Further characteristic of our dualism trait shall be explained. We go to Section V-2a.

V-2a. Strong and Weak Enmity, Strong and Weak Amity

The bond between two parties that forms a hostile or a consentient relationship was defined with the two transfer factors S_{12} and S_{21} forming the coupling factor $S_{12}S_{21}$. For the two Figures V-3 and V-4 the coupling factors were given the values ±1. In reality the intensity of such bonds can be less or more than ±1. An enmity can vary from minor dislike up to intense hatred, and a friendship can be superficial or of fanatic passion. The graduation will now be described by coupling factors $S_{12}S_{21}$ between zero and three, i.e., from zero up to three. For this consideration only positive (socially healthy) willpowers are taken into account ($G_1 > 0$, $G_2 > 0$).

For the coupling factors $S_{12}S_{21}$ of enmity, the values are

+0.0
+0.03
+0.1
+0.3
+1.0
+2.0
+3.0,

for amity, the values

0.0
-0.03
-0.1
-0.3
-1.0
-3.0

are chosen.

For each of the above 13 values the stability limits are calculated and depicted in Figures V-5 and V-6.

For $S_{12}S_{21} = 0$, the two partners are in an autonomous state; there is no attitude field between them. They do not know each other. Formula (V-1) indicates, as we know, that S_{12} and S_{21} appear as the product of the two factors. It does not matter which information, S_{21} or S_{12}, contributes more to the relationship. It is the product of S_{12} and S_{21}

that counts - the togetherness, not the individual is the agent! If, for example, P_1 is attracted by P_2 or detests him with a strong transfer factor S_{21}, but P_2's response is nil with $S_{12} = 0$, there is neither a friendship nor a hate relation. Mutuality does not exist.

Figure V-5 depicts the gradual decrease of the stability area with increasing hostility. As we know, with our assumptions the maximum values for G_1 and G_2 are 8.

Figure V-6 - which is for amity - shows, in contrast, a stability limit line of 16, i.e., twice the limit of hostility, although this line has no substance. It only indicates very sharp peaks with practically no *flesh* underneath.

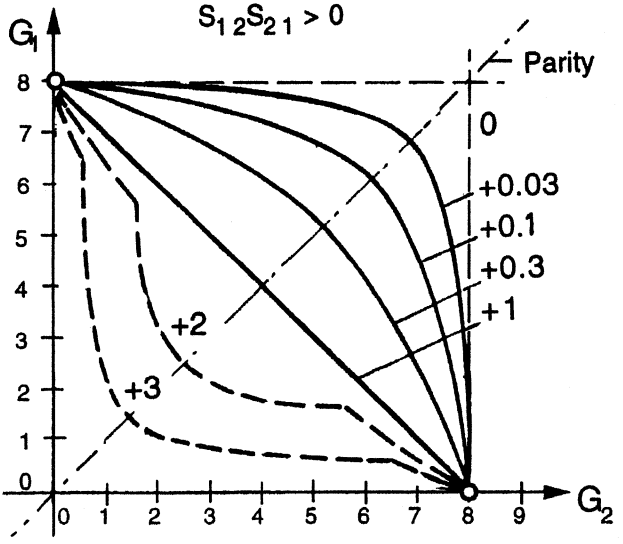

Figure V-5: Stability limits for partnerships of different intensity of hostility.

In both cases, in amity and in enmity, the willpowers G_1 and G_2 have to decrease with increasing intensity of the coupling factor if the relationship is in reasonable balance, i.e., when G_1 is about G_2. However, especially in amity, where we defined an egoist and an

altruist, the egoist can maintain the autonomous willpower G = 8. He can even go higher, although life out in the narrowing wing is extremely unsafe because the system can become unstable at the slightest change of the altruist's willpower. One could quasi say that in friendship the weak partner has the strong partner under control. But the same is true the other way around, although in a less delicate nature. A really robust state only exists at a parity of willpowers, when G_1 is about G_2, although such a state might not be very interesting at all for the egoist.

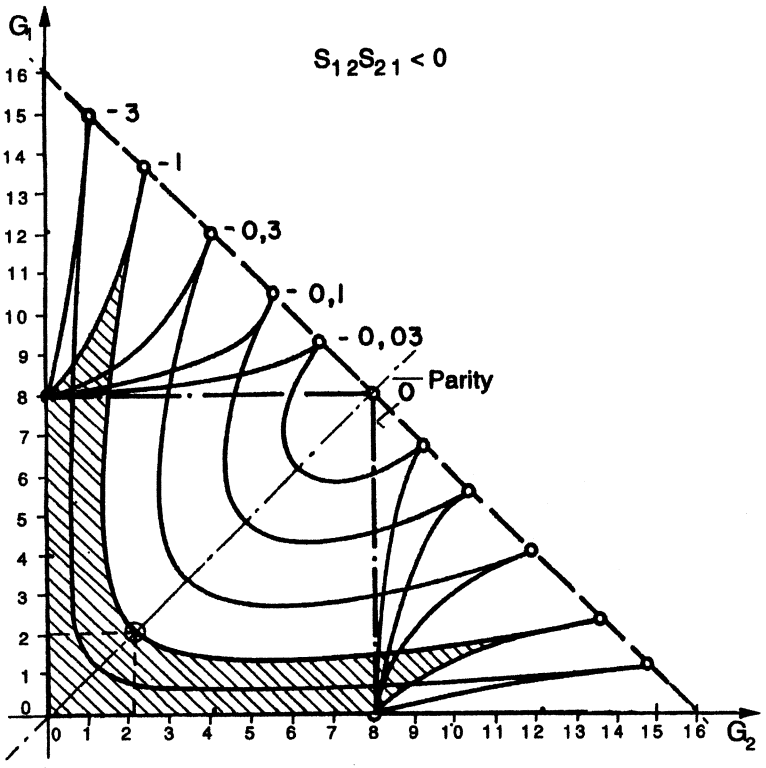

Figure V-6: Stability limits for partnerships of different intensity of consent.

A three-dimensional model, Figure V-7, represents the transfer from hostility via autonomy to friendship for $S_{12}S_{21}$ from +1 via 0 to -1.

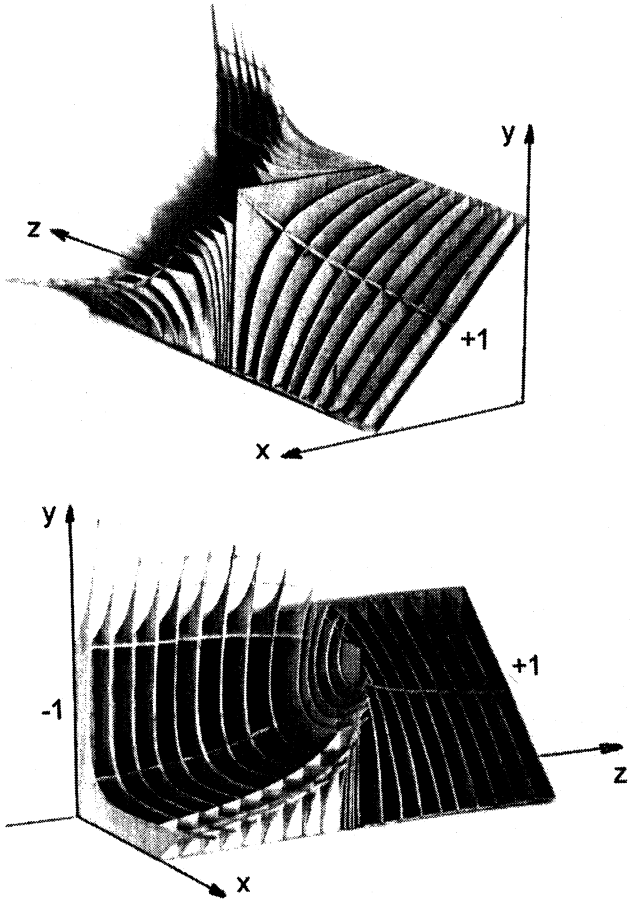

Figure V-7: Three-dimensional model of stability limits of the dualism. The x- and the y-axis are the willpowers G_1 and G_2. The z-axis indicates the coupling intensity $S_{12}S_{21}$ from +1 to -1.

Figure. V-8 indicates at parity of willpowers ($G_1 = G_2$) that in hostility the willpower each partner can exert is much larger than in amity, and the ratio [enmity/amity] grows with increasing $S_{12}S_{21}$.

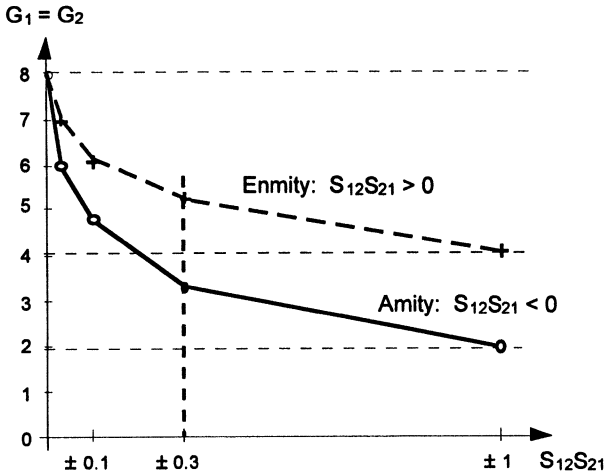

Figure V-8: Decrease of willpower with increasing magnitude of attitude.

If $S_{12}S_{21} = 0$, $G_1 = G_2 = 8$, there is no attitude-communication. If $\pm S_{12}S_{21} = 0.3$, the willpowers $G_1 = G_2$ are about 5.2 in hostility and $G_1 = G_2$ equal about 3.3 in friendship. If $\pm S_{12}S_{21} = 1$, $G_1 = G_2 = 4$ in hostility and $G_1 = G_2 = 2$ in friendship. Although some $S_{12}S_{21}$-values are shown greater than ±1 in the Figures V-5 and V-6, calculations indicate that such large values are no longer reasonable to apply to social aspects.

The two curves in Figure V-8 also indicate that the willpower in amity has to rapidly reduce with increasing attitude; about twice as fast compared with enmity. Devotional attitude requires humility. Hostility does too, but by far not so severely.

It seems and it becomes more evident in section V-5 that in high hostility, self-realization is no longer of much importance. Hate tends

toward destruction of the enemy with simultaneous and unconcerned self-destruction. When hate behavior starts with parity of willpower, bellicosity increases and quarrelling does not end until one of the parties becomes unfit to continue the fighting. *La guerre nourrit la guerre;* the war subsists the war. A good example of lasting hate and war stability is the conflict between Israel and Palestine.

When the intensity of amity grows, one of the parties must make sacrifices concerning his willpower if the partnership is to go on, i.e., is to remain stable. The altruist must give in in favor of the egoist. With growing surrender of the altruist, the egoist becomes stronger ($G_1 > 8$), the altruist becomes weaker: G_2 has to become smaller. In the extreme case $S_{12}S_{21} = -3$, G_1 can be 10, $G_2 = 0.4$. Nevertheless, amity is still a long-term gain for the altruist.

A weak person shall not exert an aggressive attitude toward a strong egoist. The weak individual will inevitably end in ruin. The weaker party's advantage is to hang on in devotion to an egoist, to give in to him. The proverb supporting such a finding is: *If you can't beat 'em, join 'em!* If you are weak and cannot defend your self-realization because a second person intends to build up an enmity against you, offer your friendship to the enemy. In case your opponent rejects your offer, then you are lost if you cannot run away and become autonomous. You then might become caught in a fatal relationship.

There is an Old-German saying: *Brim ersten Squirt sin wit fret, brim zweiten sin wit Knechte.* At the first step (out of autonomy into any relationship) we are free, at the second step (being in a specific relationship) we are slaves. And there is the symptom-loaded French proverb: *Qui se marie, se bride.*

One is free to engage in a dualism. But in doing so, the autonomous freedom is gone. The second step is adaptation to the partner. It follows a much more complex situation with positive and negative consequences. A friendship might work fine if the egoist is not too egoistic, too demanding, and does not force the altruist to rebel and become aggressive.

Caution is advisable: If the dualism grows into a larger partnership, the situation can become tragic! The first step is out of one's freedom,

out of autonomy, into a dualism. The second step is to give away some of your willpower, be the relationship hostile or devotional. A very tricky conflict can develop in a triangle if a third individual gets involved and with each one of the three keeping his independent goal in mind. It is certainly not true that the own freedom ends where the other's begins. One is interconnected, one into the other. An old and a somewhat nationalistic joke might show the meaning of steps from one to two to three:

• One Englishman is in the golf club,
•• Two Englishmen are a golf club,
••• Three Englishmen are the Commonwealth.

• One German is a philosopher,
•• Two Germans are an organization,
••• Three Germans are a war.

• One Frenchman is a poet,
•• Two French are an alliance,
••• Three French are a marriage.

Due to our findings, it might seem to be very disadvantageous to go into a relationship with a partner who is much stronger than oneself, be the relationship enmity or amity, because the findings might claim that the bad influence or danger a relationship has with a strong partner cannot be moderated or changed because the relationship is blocked in the unconscious, and the consciousness has no ability to interact. This is not really so. Things are not as simple. The unconscious interrelation in friendliness or animosity operates via the transfer variables $S_{21}\delta_1$ and $S_{12}\delta_2$. It is true that these variables cannot be changed willingly because they are solidly embedded in the unconscious. However, their effect can be moderated with the conscious variables ε_1 and ε_2 via the transfer intensity factors A_{12} and A_{21}. See Figure V-9. It is through the consciousness that we can manipulate - to some extent - our social interrelation. This action is mentioned in Appendix III and is called *decoupling the unconscious interrelation*. With the consciousness we can change, we can decouple, to some minor extent, the behavior we harbor unconsciously toward a

partner. This kind of social interaction with the transfer functions A_{21} and A_{12} is reserved for future work of the author.

V-3. Self-Realization in Extension

The investigation of the unit (Figure IV-1) was exclusively oriented toward realizing oneself; the goal attainment was called attained self-realization in autonomy. In this section V-3, goals can stand for anything partners are striving for in their lives.

In section V-1 the effort of x_1 to approach u_1 was investigated. P_1's pursuit of his own goal u_1, and with the influence of the attitude $S_{12}S_{21}$, and the impact of the willpower G_2 of partner P_2, both had their effect on x_1. It was assumed that the two goals of self-realization, u_1 and u_2, were incompatible. In this paragraph, further influences shall be considered as they can occur in a dualism, and in life, they clearly do.

Going temporarily back to Figure V-1!

Each individual has his goal. The goal of P_1 is u_1, the goal of P_2 is u_2. Each individual becomes disturbed. P_1 becomes disturbed by the signal z_1, and P_2 becomes disturbed by the signal z_2. Each individual has his own willpower. The willpower of P_1 to realize himself is G_1. The willpower of P_2 for his realization is G_2. These terms remain. To describe the unconscious composite of the dualism, i.e., the own unconscious information transfer of P_1 and P_2 within themselves, and the unconscious information exchange with the other unit, the four variables $S_{11}\delta_1$, $S_{12}\delta_2$, $S_{21}\delta_1$ and $S_{22}\delta_2$ are used.

Now the question is posed: How will the goal attainment of P_1 become influenced not only by G_1, G_2, S_{12}, S_{21}, and u_1, but in addition by u_2, z_1, and z_2?

Mathematically this relationship is represented with the formula (V-7):

$$\frac{x_1}{u_1} = \frac{1+(1-S_{12}S_{21})G_2}{D} G_1 + \frac{S_{12}}{D} G_2 \frac{u_2}{u_1} + \frac{1+(1-S_{12}S_{21})G_2}{D} \frac{z_1}{u_1} + \frac{S_{12}}{D} \frac{z_2}{u_1},$$

$$\text{where } D = (1+G_1)(1+G_2) - S_{12}S_{21}G_1G_2 \qquad (V-7)$$

(Note: the disturbance signals in (V-7) have a positive sign.) The goal attainment for P_2, x_2/u_2 is analogously symmetric to x_1/u_1; it will not be shown.

The terms S_{11} and S_{22} are set to +1; therefore they do not appear explicitly in (V-7). The time dependency is, again, not considered. Thus, F_1 and F_2 are put to 1. They do not therefore appear in the expressions (V-7) either. The first term of (V-7) corresponds with formula (V-6).

The goal attainment x_1/u_1 depends on many variables, definitely not only on the unit's own willpower G_1 as the proverb goes: *Where there is a will, there is a way.* Life provides many obstructions: interactions with partners and interferences with neighbors and the greater environment. Due to obstacles, the snappy proverb could even be reversed to make it more realistic: *Where there is a way, there will be a will.*

If for P_1 the way is absolutely barred by disturbances z_1 and z_2, or by P_2 with his G_2, all willpower G_1 can be in vain. As an example, take the somewhat related proverb: *Where ignorance is bliss, 'tis folly to be wise.* - If contradictory people with an irritating willpower barricade your path you become prevented from exerting your willpower.

In formula (V-7), its own willpower G_1 appears only in one numerator of the four fractions. The lucidity is somewhat increased if u_1 is set to 1 (The own goal then is 1 or 100%). Now the goal attainment of P_1, x_1, can be simplified and symbolically described with formula (V-7a).

$$x_1 = \{G_2, S_{12}, S_{21}\}G_1 + \{G_2, S_{12}, S_{21}\}u_2 + \{G_2, S_{12}, S_{21}\}z_1 + \{G_2, S_{12}, S_{21}\}z_2. \qquad (V-7a)$$

The variable x_1 depends firstly upon all the internal parameters, the inherent characteristics of the dualism [G_1. G_2, S_{12} and S_{21}], and secondly in addition upon the signals which enter the dualism from the outside, [u_1, u_2, z_1, and z_2]. (u_1 and u_2 are only structurally coming from the outside. They represent goals of the partners and are therefore part of them, but they are not elements within the loops.)

There is not doubt that an individual's success in attaining his goal is based on his willpower (here G_1 for P_1) and that his willpower is of domineering importance. But the formula (V-7a) indicates that in addition, many more factors play a role. The psychologist calls them direct and indirect relations with the environment. Influences on P_1 from inside the partnership come from G_2, u_2, S_{12} and S_{21}; Influences from outside of the dualism are originated by z_1 and z_2. - In addition it is to be emphasized again that the time-dependency, the dynamics, is not taken into account herein. The symbolic representation with time dependency would become much more labyrinthine. Whatever we investigate here is but a fraction of the real reality. Nevertheless, substantial fractions of knowledge based on natural laws are an enormous help in understanding our life situations. Such laws are - as we think - worth more than countless unrelated daily events - although they are at a point, better entertainers than formal concepts with their mathematical formulations.

Another important circumstance shall be looked at:

Up to this point, the goal of P_1 was basically our only concern. Therefore it can be assumed that his goal u_1 is equal to 1 or 100% and is in fact, positive, i.e. $u_1 = +1$. The own matter is definitely positive for a unit. Concerning the goal u_2 of P_2, there are three different situations that can be scrutinized:

a) The two goals, u_1 and u_2, are independent from each other, i.e., neither P_1 is concerned with what P_2 has in mind for his self-realization, nor does P_2 bother about - or cannot perceive - the goal of P_1. Nevertheless, the connection $S_{12}S_{21}$ cannot be avoided. It is an unconscious field through which emotions flow. With goal independency for the calculation of x_1 in the formula (V-7), u_2 is put to zero. Its influence is null. Under this assumption Figure V-2 was created.

b) The two goals are correlated, i.e., they have - what we assume - equal orientation and equal weight. For the calculation of x_1, the goal u_2 becomes included. Its magnitude shall be +1 as well. Mathematically such a situation seems to be a common goal - but not by adding x_1 and x_2 to x_1+x_2. Each person still has his own realization. Adding x_1 and x_2 together without or with a common feedback would

create a different structure. (Before a structure can be set up, the question has to be answered through what channels information will flow. Such channels have to be built into the structure. We stick to the structure Figure V-1.)

c) The two goals are antagonistic to each other, i.e., they are in opposition. P_1 wants the opposite of what P_2 has in his mind. This case of antagonistic goals will be dominant in enmities, in hate situations. The goal u_2 then has a negative aspect for P_1: $u_2 = -u_1$, or $u_1 = -u_2$, or in a simpler form: $u_1/u_2 = -1$. But a negative u_2 is negative only for P_1 if u_1 is positive, and not for P_2. If u_2 is negative and x_2 becomes negative as well, then $-x_2/-u_2$ becomes positive for P_2. If you want to attain something that is negative with respect to another person, and you attain the goal in this manner, this is positive for you. It is only negative for the other person. You yourself still get what you wanted to attain, namely the opposite of what the other is striving for. We can add here another verity, although a terrible one: *Mors tua, vita mea;* your death is my life.

If the model Figure V-1 simulates true life-situations, such basic circumstances as $u_1/u_2 = -1$ have to be taken into account and investigated.

The danger is that the reader could be pushed into too great a burden by too many presented aspects. But the more real the representation, the more difficult the elaboration becomes. Life is functionally extremely intricate. And in order to understand the meaning of a sign or an action, not only that sign, not only that action, but also the whole system is involved.

In section V-5: Examples, some different situations, numerically calculated, will be demonstrated. Figure V-2 already shows results for the case a), independent goals.

As a break in this strenuous study, a model of yet a higher complexity shall be slipped in, albeit without further investigations. It shall show another picture of the increasing involvement when approaching life conditions more closely. - It might be unavoidable to come to grips

with complexity in order to ensure survival of mankind - perhaps it is not possible at all.

If connections, as indicated in Figure II-1, are traced for two individuals with three mutual interacting channels, i.e., with the unconscious information exchange via S_{12} and S_{21}, the mutual observation of each other via V_{12} and V_{21}, and with hard physical action between the two individuals via A_{12} and A_{21}, Fig. V-9 occurs.

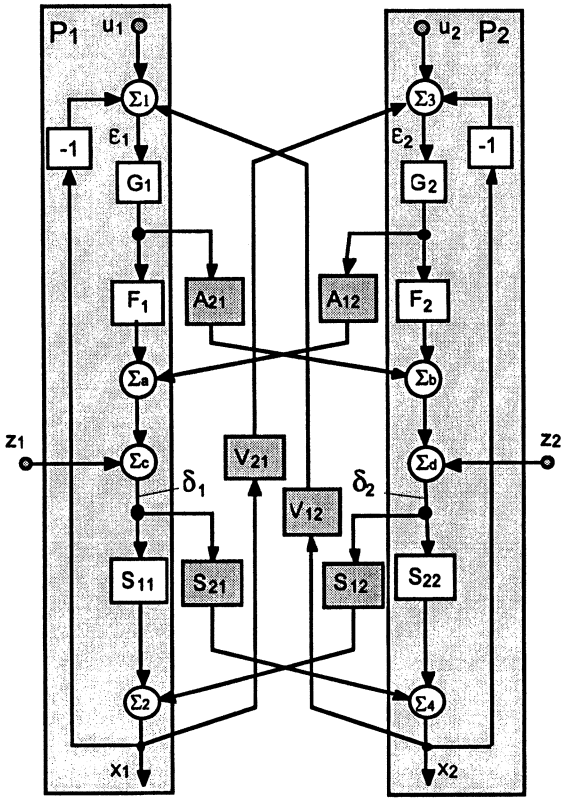

Figure V-9: Model of two units with three bilateral information exchange channels: S_{12}-S_{21}, V_{12}-V_{21}, and A_{12}-A_{21}.

In this Figure V-9 already twelve closed circular interacting loops can be traced through which information will flow. A thorough investigation of this structure could already fill many books.

The twelve loops are:

1. $\Sigma 1 - G_1 - F_1 - \Sigma a - \Sigma c - S_{11} - \Sigma 2 - \Sigma 1$
2. $\Sigma 3 - G_2 - F_2 - \Sigma b - \Sigma d - S_{22} - \Sigma 4 - \Sigma 3$
3. $\Sigma 1 - G_1 - A_{21} - \Sigma b - \Sigma d - S_{12} - \Sigma 2 - \Sigma 1$
4. $\Sigma 3 - G_2 - A_{12} - \Sigma a - \Sigma c - S_{21} - \Sigma 4 - \Sigma 3$
5. $\Sigma 1 - G_1 - F_1 - \Sigma a - \Sigma c - S_{21} - \Sigma 4 - V_{12} - \Sigma 1$
6. $\Sigma 3 - G_2 - F_2 - \Sigma b - \Sigma d - S_{12} - \Sigma 2 - V_{21} - \Sigma 3$
7. $\Sigma 1 - G_1 - A_{21} - \Sigma b - \Sigma d - S_{22} - \Sigma 4 - V_{12} - \Sigma 1$
8. $\Sigma 3 - G_2 - A_{12} - \Sigma a - \Sigma c - S_{11} - \Sigma 2 - V_{21} - \Sigma 3$
9. $\Sigma 1 - G_1 - F_1 - \Sigma a - \Sigma c - S_{21} - \Sigma 4 - \Sigma 3 - G_2 - F_2 - \Sigma b - \Sigma d - S_{12} - \Sigma 2 - \Sigma 1$
10. $\Sigma 1 - G_1 - A_{21} - \Sigma b - \Sigma d - S_{22} - \Sigma 4 - \Sigma 3 - G_2 - A_{12} - \Sigma a - \Sigma c - S_{11} - \Sigma 2 - \Sigma 1$
11. $\Sigma 1 - G_1 - F_1 - \Sigma a - \Sigma c - S_{11} - \Sigma 2 - V_{21} - \Sigma 3 - G_2 - F_2 - \Sigma b - \Sigma d - S_{22} - \Sigma 4 - V_{12} - \Sigma 1$
12. $\Sigma 1 - G_1 - A_{21} - \Sigma b - \Sigma d - S_{12} - \Sigma 2 - V_{21} - \Sigma 3 - G_2 - A_{12} - \Sigma a - \Sigma c - S_{21} - \Sigma 4 - V_{12} - \Sigma 1$

Appendix II symbolically shows the characteristic equation for Figure V-9. If the time dependency would be included according to the following transfer functions equations (V-8), the characteristic equation would extend to a length of 250m. As a side remark it might be demonstrated how many more loops will be created if more than two partners are generally interconnected similar to those shown in Figure V-9. The number of loops L(n) grows with the formula found by Ken Sollows, (V-9):

$$F_1 = \frac{1}{(T_{11}s+1)(T_{12}s+1)(T_{13}s+1)},$$

$$F_2 = \frac{1}{(T_{21}s+1)(T_{22}s+1)(T_{23}s+1)},$$

$$V_{12} = \frac{1}{T_{14}s+1}, \quad V_{21} = \frac{1}{T_{24}s+1}, \quad A_{12} = \frac{1}{T_{15}s+1}, \quad A_{21} = \frac{1}{T_{25}s+1} \qquad (V-8)$$

$$L(n) = \sum_{i=1}^{n} \frac{\left[\frac{n!}{(n-i)!}\right]^3}{i} \qquad (V-9)$$

(Ken Sollows was a graduate student of the author at the University of New Brunswick, Canada, and is now a Professor there)

n is the number of interconnected partners. The list for L(n) shows the inconceivable increase of circular loops with a growing n through which information can flow:

Table V-3-1: Number L(n) of loops of n partners in an extended structure Figure V-9.

n	L(n)	
1	1	autonomous loop
2	12	dualism
3	207	threesome
4	8 992	foursome
5	853 725	
6	4 149 111 316	
7	42 978 397 987	
8	18 985 066 966 272	

Although the transfer factors A_{ik}, A_{ki}, and V_{ik}, and V_{ki} can be avoided, depending on the circumstances, the unconscious information flow, $S_{ik}S_{ki}$, always exists in any togetherness. Then the formula to calculate the number of loops S(n) in which information flows among n partners is given with equation (V-10).

$$S(n) = n + n!\sum_{i=1}^{n-1}\frac{1}{(i-1)!(n+1-i)};\ n \geq 2,\ \left(\frac{1}{0!}=1\right) \qquad (V-10)$$

It is evident that the number of loops grows much slower with an increasing number of units if there are fewer interacting channels. This can be seen in the following table of S(n)-values.

Table V-3-2: Number of loops S(n) for n partners in an extended Figure V-1.

n	S(n)
1	1
2	3
3	8
4	24
5	85
6	415
7	2 372
8	16 072
9	125 673
10	1 112 083
11	10 976 184
12	119 481 296
13	1 421 542 641
14	18 348 340 127
15	255 323 504 932

How quickly we lose comprehension by only looking at or by pure thinking and have to resort to calculating can be shown with the following simple example. Taking some matches in your hand, how

V-4. The Disturbances

Figure V-1 indicates that there are four signals entering the looped system: u_1, u_2, z_1 and z_2. For P_1, who is again the only one under consideration in this paragraph, the signal u_1 is his own goal. This goal is now not necessarily his self-realization; it is just a temporary goal in his life. This signal can, indeed, indicate a disturbance for him. Therefore it is positive. Not only z_1 and z_2 can act as disturbances, but also u_2, i.e., P_2's goal. These three disturbances, u_2, z_1 and z_2, can have a positive as well as a negative effect on P_1's x_1.

In formula (V-7), which takes into account all four input signal the first term x_1 is a function of u_1 only. There, u_1 was called the self-realization of P_1. This x_1 was discussed already in section V-1, and the results are presented in Figure V-2. In this section V-4, the three other disturbance signals acting on P_1 are added, and u_1 is - as said - no longer P_1's self-realization, but any goal he wants to attain sometime within his lifetime.

Formula (V-7) is symbolically described with (V-11) and in more detail in equations (V-12). It consists of four parts, (u_1), $x_1(z_1)$, $x_1(u_2)$ and $x_1(z_2)$. For P_1, u_1 is equal to 1 or 100%. Formulae (V-12) are the same as formulae (V-7) with the difference that disturbances are indicated in (V-12) with a plus and minus sign.

$$x_1 = x_1(u_1) \pm x_1(z_1) \pm x_1(u_2) \pm x_1(z_2) \qquad (V-11)$$

All affects disturbances cause are considered to be steady state values, positive or negative.

The three kinds of disturbances, A), B), and C), are as follows:

A) The first disturbance of interest is the effect of z_1 on x_1. Therefore, u_1, u_2 and z_2 are in this situation set to zero. The formula is (V-13). This disturbance can be considered as self-disturbance or eigen-disturbance. (*eigen* is a German word and means *own* or *self*.)

The two expressions, $x_1(u_1)$ and $x_1(z_1)$, look similar. The difference between the two is that $x_1(z_1)$ does not have a multiplication factor of

G_1. In $x_1(z_1)$ G_1 appears only in the denominator. This means that the larger G_1 is, less is the effect of z_1 on x_1. The effect z_1 has on x_1 is calculated in Figure V-10 for a few values of G_2.

$$x_1(u_1) = \frac{1+(1-S_{12}S_{21})G_2}{D} G_1 u_1$$

$$x_1(z_1) = \pm\frac{1+(1-S_{12}S_{21})G_2}{D} z_1$$

$$x_1(u_2) = \pm\frac{S_{12}}{D} G_2 u_2$$

$$x_1(z_2) = \pm\frac{S_{12}}{D} z_2$$

$$D = (1+G_1)(1+G_2) - S_{12}S_{21}G_1G_2 \qquad (V-12)$$

$$x_1(z_1) = \pm\frac{1+(1-S_{12}S_{21})G_2}{(1+G_1)(1+G_2) - S_{12}S_{21}G_1G_2} z_1 \qquad (V-13)$$

What can be discovered in this figure V-10? Amity reacts more strongly upon disturbances than enmity. Surprising is especially the tremendous negative effect z_1 has on x_1 at low G_1 in case of amity.

An example with data taken from Figure V-10; $G_1 = 1$, $G_2 = 4$:
$x_1(z_1)$ for devotion is -66%
$x_1(z_1)$ for hostility is -16%.
Friendly relationships are much more sensitive than hostile ones. But nevertheless, the larger G_1 is, the less the effect of z_1 on x_1.

The lesson is that one shall, as a philanthropist z_1, never try to bring peace to a hostile relationship. Hostility of a dualism wants to continue and not become disturbed. A person who is prone to aggressive behavior wants to go into a hostile relationship in order to exert his aggressive disposition. He is unconsciously looking for quarrel. A quarrelsome person is satisfied only when he can find an

opponent to struggle with. And he wants to stay arguing, fighting. Proverbs in this regard are invariable truths:

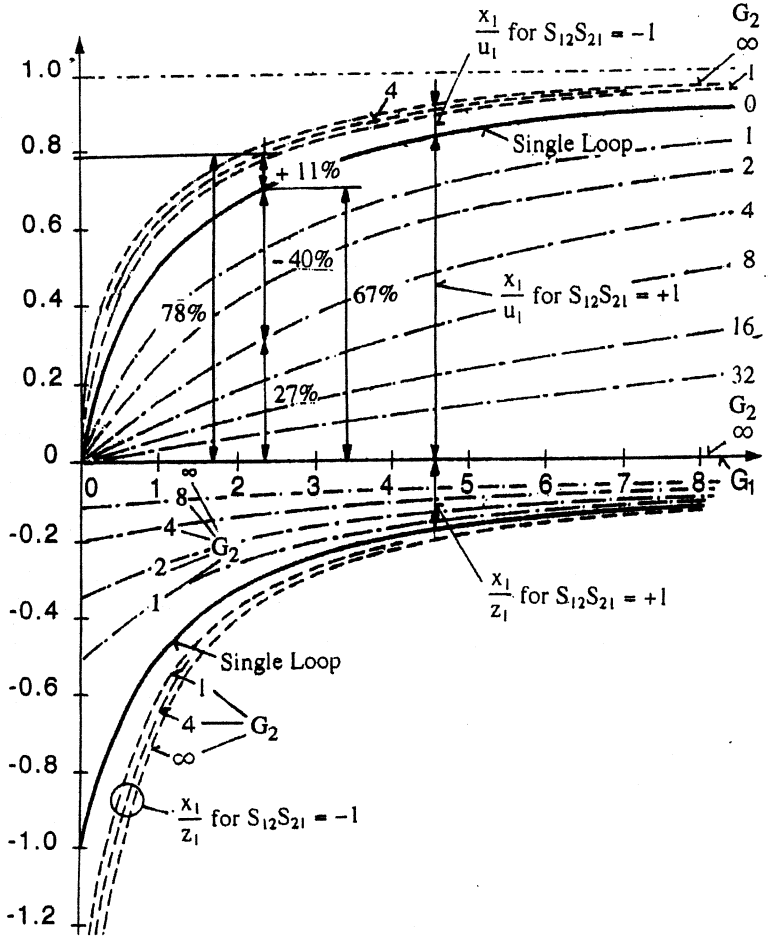

Figure V-10: Effects of steady state disturbances x_1/z_1 of Figure V-1 as a function of G_2 for the two values $S_{12}S_{21} = \pm 1$. Figure V-2 with x_1/u_1 is repeated in this figure. A negative value is given to x_1/z_1. $|u_1| = |z_1| = 1$.

It takes two to make a quarrel.
La guerre nourrit la guerre.
Zwei Streitköpfe werden nimmer eins! Two quarreler never come to an agreeing.
Krieg ist leichter angefangen als beendet. Starting a war is easier than ending it.

As nature has provided that the sensitivity of a consentient relation and the robustness of hostility can be proven physically-mathematically, it must be assumed that nature needs enmity as well as amity, but that enmity is given priority.

The Lord of the Christians is to have said: *Think not that I am come to send peace on earth: I came not to send peace, but a sword.* St. Matthew 10:34. And: *Suppose ye that I am come to give peace on earth? I tell you, Nay; but rather division.* St. Luke 12:51.

Such assessments that promote conflicts and consequences that lead to wars are not pleasant, but their certainty seems to be assured not only over centuries but also over millions of years. There is the not very nice but the more true, American saying: *Have a lunch or be a lunch,* which is valid for any living being in our world.

Conflicts and hostilities do exist by far not only among human beings, but among all beings: humans, animals and plants - and bacteria and viruses. How cruel are insects to each other! In this process of living, the weaker will always be defeated by the stronger. Generally, plants are defeated by animals, and animals by human beings. But also: the stronger plant kills the weaker, and the stronger animal kills the weaker. But plants and animals kill human beings as well - so do little beasts: viruses. However, in nature there is not much killing for its own sake. Killing is mostly for the purpose of reproduction, for defending or gaining territory, and for providing food for survival. *No grass wants to be eaten!* Has been said by a biologist.

The Latin proverb is centuries old: *Bellum omnium in omnes;* war of everybody against everybody. And the most terrible disturber of the human being is the human being himself: *Lupus est homo homini;* the human being is the wolf for himself.

Amity indicates that the greater P_2's willpower is, and the weaker P_1 is in his willpower G_1, the more sensitive the dualism becomes for P_1 in regard of his own disturbance z_1 concerning his achievement x_1.

B) The question is posed now how the goal of P_2, u_2, influences P_1's goal attainment x_1. The formula is given with the equation (V-14).

$$x_1(u_2) = \pm \frac{S_{12}}{(1+G_1)(1+G_2) - S_{12}S_{21}G_1G_2} G_2 u_2 \qquad (V-14)$$

What a friend's intention in regard to himself (u_2 on x_2), or what the aggressor's attitude is against his opponent (u_2 on x_1), are situations that can have an influence on the partner. Thus, the two goals are either correlated, that is oriented in friendship, or antagonistic, that is in opposition, in hostility.

It will become obvious that hostility is easier to be handled than friendship. - Concerning real life situations, it is important to think about such facts. Enmity can be modeled with simpler forms than amity - in both, in the steady state and in the time domain.

Enmity is determined by: $S_{12} > 0$ and $S_{21} > 0$.
For amity, there are two situations to be considered:
a) $S_{12} > 0$, $S_{21} < 0$, or
b) $S_{12} < 0$, $S_{21} > 0$.

In wide spheres, the human being is interested in simple forms, simple games, no thinking. Therefore, he might - unconsciously - prefer hostility compared to consent. One can lament about hostility, conflicts and wars, but they are of much higher public interest than consent, peace and harmony. Without a doubt, it is nature requiring such attitude. If - in the worst case - somebody close to me dies away, the possibility of my survival increases; a potential enemy is out of my way. What do many proverbs say in this regard?

Mors tua, vita mea. (Already mentioned in V-3.)
Mars gravior sub pace latet. A severer war lies hidden under peace.
Si vis pacem, para bellum. If you want peace, prepare for war.

We remember that in friendship one partner is the altruist, the other partner is the egoist. In hostility the coupling factor $S_{12}S_{21}$ is +1. In consent, $S_{12}S_{21}$ is -1. The question arises here: who makes the coupling negative? Who is responsible for the negative feed-cross signal? Is it P_1 or is it P_2? Who is altruist, who is egoist? Then, how does the egoist disturb the altruist, how does the altruist disturb the egoist?

For this partner-disturbance, i.e., the disturbance of P_1 by P_2's goal u_2, the third part of formula (V-12) is used, $x_1(u_2)$. The formula is already given as equation (V-14). We subdivide the problem.

a) What attracts attention in (V-14) is that the willpower of P_2 has a direct influence on P_1. G_2 stands in the numerator.

b) Concerning the influence of the goal u_2, it is of interest whether u_2 is correlated with u_1, or whether it is antagonistic to u_1. An additional possible branching is mentioned: It must be assumed that in the case of a friendship, the goals be correlated or independent. Antagonistic goals in a friendship, however, are a deception of the partner. Pretending amity is *hypocrisy*. But even for such a case the model has to be prepared to give an answer, although such special cases shall be omitted herein in order to avoid an overload.

c) The denominator in formula (V-14) has a negative part, (called $N_{13} = -S_{12}S_{21}G_1G_2$), This product is a major contributor to the value of $x_1(u_2)$. If $S_{12}S_{21}$ is a matter of a friendship, i.e., if $S_{12}S_{21}$ is negative, then N_{13} becomes positive. It is assumed (for the time being) that G_1 and G_2 are positive (a consideration of negative willpower follows later), therefore the first part of the denominator $(1+G_1)(1+G_2)$ is positive. Thus, in the case of amity the denominator becomes larger than in enmity. This means that the effect of the disturbance of u_2 on x_1 is smaller in amity than in enmity. The numerator is divided by a number larger in consentient behavior than in hostility. The consequence is:

P_2 - with what he wants for himself (for u_2) - disturbs his partner P_1 more as enemy than as a friend.

d) If the signal, which P_1 receives from P_2, is positive, then x_1 grows by $x_1(u_2)$; $[x_1 = x_1(u_1)+x_1(u_2)]$. But if this signal is negative, x_1 becomes

smaller. This fact will be mentioned in section V-5 - Some Examples. But if and only if the two signals $x_1(u_1)$ and $x_1(u_2)$ have mathematically the same dimension, the same *meaning,* they can be added or subtracted. Otherwise the influences have to be treated and evaluated separately.

C) If a partner, with whom I am interrelated, becomes disturbed, I can become influenced as well. This can irritate me or please me. Thus, the question is: What is the effect of the disturbance z_2 through the interrelation $S_{12}S_{21}$ upon me, P_1? To find the answer from formula (V-12) or (V-15) the value $x_1(z_2)$ has to be found. This is formula (V-15).

$$x_1(z_2) = \pm \frac{S_{12}}{(1+G_1)(1+G_2) - S_{12}S_{21}G_1G_2} z_2 \qquad (V-15)$$

For calculated data, see section V-5.

The four parts of formula (V-12) have been briefly discussed. As life consists of myriads of facets, there are many combinations possible within our realm. The list (V-16) shows some such combinations:

$x_1(u_1)$	influence of G_1, G_2
$x_1(u_1)+x_1(u_2)$	influence of G_1, G_2 and u_2
$x_1(u_1)+x_1(z_1)$	influence of G_1 and z_1
$x_1(u_1)+x_1(z_2)$	influence of G_1 and z_2
$x_1(u_1)+x_1(z_1)+x_1(u_2)$	influence of G_1, G_2, z_1 and u_2
$x_1(u_1)+x_1(u_2)+x_1(z_2)$	influence of G_1, G_2, u_2 and z_2
$x_1(u_1)+x_1(z_1)+x_1(z_2)$	influence of G_1, z_1 and z_2
$x_1(u_1)+x_1(u_2)+x_1(z_1)+x_1(z_2)$	influence of G_1, G_2, u_2, z_1 and z_2

(V-16)

In all formulae (V-12) to (V-15) the denominator always contains all four system characteristics: G_1, G_2, S_{12}, and S_{21}. This means that the whole character of the dualism hangs on with its influence and pulls down on the numerator.

In all these considerations we assume that it is P_1 who wants to reach his goal. Therefore $x_1(u_1)$ is always present; and the different influences of G_2, z_1, and u_2 and z_2, can join in either in a positive or in a negative sense.

The fact occurs now, that confusion becomes acute and, thus, unpleasant. Unfortunately this cannot be avoided if the model represents reality or approximate reality. One has to talk to a lawyer or read the daily papers to find out how many different events happen every day around us. How to classify them all?

It comes more and more to light that social relationships do not reside in any individual, but in the *relationship* between individuals. Social characteristics emerge through the process of interaction within the system. Therefore an individual embedded in a relationship is ignorant (but not innocent) of the behavior of the whole system. The whole system has its own character. How much more complex is the whole compared to its individual parts!

The obsession to find one essential truth (e.g., as a simple, short formula) blinds us to the relationary nature of complexity, and especially to the intricacy of social relationships. Being humble enough: perhaps the whole universe, with us in it, is interrelated and entangled by fields and forces. Still: Trying to tap the laws of nature is still worth more than hiding one's head in the sand.

V-5. Some Numerical Examples

In order not to lose perspective amid the numerous symbols and possibilities of combinations it is necessary to find a simplified mode for the arrangement of some calculated examples. One has to be aware that it is an arduous task to read and comprehend calculated cases. *Exempla sunt odiosa.* Examples are hated, and this is really true.

Our main point is still the characteristics of the coupling, i.e., the type of the bond. Whether there is amity or enmity depends on the coupling $S_{12}S_{21}$. The strength of the bond $|S_{12}S_{21}|$ shall be |1| for all calculated examples in this section.

In the hostile relationship, both S_{12} and S_{21} are positive. In the following, this type shall be called (+ +). In the consentient relationship there are, as outlined, two cases. Either S_{12} is positive and S_{21} is negative, called (+ -), or, S_{12} is negative and S_{21} is positive, called (- +). The first sign in the parentheses indicates how P_1 receives information from P_2, or how the information is imposed on P_1 - with a positive or negative interpretation. And the second sign means how P_2 gets information from P_1, or is forced to take it from P_1. The model cannot distinguish whether an individual takes information voluntarily or whether he is forced to take it. Our interest is the effect information has that comes from one individual and goes to the other. Thus,

(+ -)$S_{12}S_{21}$ means that the information $S_{12}\delta_2$ is added positively to P_1, and the information $S_{21}\delta_1$ is added negatively to P_2; (- +)$S_{12}S_{21}$ means that the information $S_{12}\delta_2$ is added negatively to P_1, and the information $S_{21}\delta_1$ is added positively to P_2. In short: The reading for S_{12} is „goes to P_1 - comes from P_2“, and for S_{21} it is „goes to P_2 - comes from P_1“. Three cases for the willpowers of the two units shall be considered:

For enmity:	a) Parity:	$G_1 = 4$ and $G_2 = 4$
	b) P_1 is weak, P_2 is strong:	$G_1 = 1$ and $G_2 = 7$
	c) P_1 is strong, P_2 is weak:	$G_1 = 7$ and $G_2 = 1$

For amity:	d) Parity:	$G_1 = 2$ and $G_2 = 2$
	e) P_1 is weak, P_2 is strong:	$G_1 = 1$ and $G_2 = 9$
	f) P_1 is strong, P_2 is weak:	$G_1 = 9$ and $G_2 = 1$

The reason that in enmity the willpower is only seven, but in amity 9, takes the stability limits into account in Figures V-3 and V-4. In order to make cases comparable, the willpowers have to be taken from the stability areas, either right at the border of the stable area or very close to the border inside the area.

We shall not make use of the eight combinations (V-16). A more reasonable approach is taken. The effect of the disturbances is shown in separate modes. This way, their influences become more apparent.

For the strength of coupling of ±1 and the above six pairs of willpowers, a) to f), the seven goal attainments will be shown:

1. $x_1(u_1)$, the attainment of the own goal
2. $x_1(z_1)$, the effect of the own disturbance, z_1
3. $x_1(u_2)$, the effect of the partner's goal, $u_2 = +1$
4. $x_1(z_2)$, the effect of the partner's disturbance, z_2
5. $x_1(u_2)$, the effect of the partner's opposite goal, $u_2 = -1$
6. $x_1(u_1)+x_1(u_2)$ with $u_2 = +1$
7. $x_1(u_1)+x_1(u_2)$ with $u_2 = -1$

These seven modes already give quite a list of results. To have the needed seven formulas close, they are listed again:

$$1.\ x_1(u_1) = \frac{1+(1-S_{12}S_{21})G_2}{D} G_1 u_1$$

$$D = (1+G_1)(1+G_2) - S_{12}S_{21}G_1G_2$$

$$2.\ x_1(z_1) = \pm\frac{1+(1-S_{12}S_{21})G_2}{D} z_1$$

$$3.\ x_1(u_2) = \pm\frac{S_{12}}{D} G_2 u_2$$

$$4.\ x_1(z_2) = \pm\frac{S_{12}}{D} z_2$$

5. $x_1(u_2) = \pm\frac{S_{12}}{D} G_2 u_2;\ (u_2 = -1)$

6. $x_1(u_1) + x_1(u_2)\ ;\ u_2 = +1$

7. $x_1(u_1) + x_1(u_2)\ ;\ u_2 = -1$

The following results, List V-1, were found.

List V-1: Goal attainments x_1 of P_1; x_1 in %.

$u_1 = 100\%$; $u_2 = \pm 100\%$; $z_1 = z_2 = 100\%$;

α	$G_1 = 4$ $G_2 = 4$		$G_1 = 2$ $G_2 = 2$	
	(+ +)	(- -)	(+ -)	(- +)
1. $x_1(u_1)$	44	44	77	77
2. $x_1(z_1)$	11	11	38	38
3. $x_1(u_2 = +1)$	44	-44	15	-15
4. $x_1(z_2)$	11	-11	8	-8
5. $x_1(u_2 = -1)$	-44	44	-15	15
6. $x_1(u_1)+x_1(u_2 = +1)$	89	00	92	62
7. $x_1(u_1)+x_1(u_2 = -1)$	00	89	-62	92

β	$G_1 = 1$ $G_2 = 7$		$G_1 = 1$ $G_2 = 9$	
	(+ +)	(- -)	(+ -)	(- +)
1. $x_1(u_1)$	11	11	66	66
2. $x_1(z_1)$	11	11	66	66
3. $x_1(u_2 = +1)$	78	-78	31	-31
4. $x_1(z_2)$	11	-11	3	-3

5. $x_1(u_2 = -1)$	-78	78	-31	31
6. $x_1(u_1)+x_1(u_2 = +1)$	89	-67	97	35
7. $x_1(u_1)+x_1(u_2 = -1)$	-67	89	35	97

γ	$G_1 = 7$ $G_2 = 1$		$G_1 = 9$ $G_2 = 1$	
	(+ +)	(- -)	(+ -)	(- +)
1. $x_1(u_1)$	78	78	93	93
2. $x_1(z_1)$	11	11	10	1
3. $x_1(u_2 = +1)$	11	-11	3	-3
4. $x_1(z_2)$	11	-11	3	-3
5. $x_1(u_2 = -1)$	-11	11	-3	3
6. $x_1(u_1)+x_1(u_2 = +1)$	89	67	97	90
7. $x_1(u_1)+x_1(u_2 = -1)$	67	89	90	97

We mentioned that the effects of disturbance signals z_1 and z_2 could be positive or negative. Positive effects can be added to x_1 and x_2 - if they have the same meaning and if they support the goal approach. Otherwise a disturbance has a negative effect.

The richness of possible situations could easily grow to profusion, even if only a limited amount of cases were investigated. Life does not consist of average data, but of uncountable single events. And each event has its importance and its value, or insists upon having it and wants to have it. As every day brings thousands upon thousands of different occurrences, described in journals, magazines and newspapers broadcasted over the radio and television, thousand of stories in books, and conflicts and crimes filling offices of lawyers, there is no simple average event that can be categorized in a generalized story. In addition, there is pathology, insanity, corruption, perversion, slandering, and what not, but also believed miracles and blessings, for this reason the row of facts could be extended immensely.

More questions could be scrutinized, e.g., what does (+), what does (-) mean? A certain signal could be positive for a masochist, but for a normal person extremely negative. Or a state of mind can change from (+) to (-), or vice versa all of the sudden. As examples of such different interpretations and unexpected changes, some proverbs may serve:

Le diable devenu vieux se fit ermite.
Today: hosanna; tomorrow: crucify him!
The end justifies the means.
To the pure all things are pure.
Too far east is west.
One man's death is another man's breath.

Another fact concerning the (+)- and (-) signs has to be kept in mind. Minus times minus is plus, whether in the model or in the daily language. If you never have no time, you always have time. If you never have no money in your pocket, then there is always some in it.

A few remarks to the data of Table V-1:

As our system's concept is based on linearity, combinations of effects of disturbances as shown in the list (V-16) are simply additions of the corresponding single effects.

In friendly interrelations, the goals are independent in the case of self-realization, and they can be independent or correlated in the case of every day goals - not as self-realization.

In hostile interrelation, goals are either independent or antagonistic.

Disturbances are rather uncorrelated, i.e., of any kind. But the effect they have on the goal striving process counts, not the disturbance as such.

It is to say that in every specific situation of self-realization a certain goal attainment is needed for survival. Is it 10%, is it 25%? A specific circumstance results in a specific interpretation. So that everybody can pretend to be right and justify his being right. The world has a very open mind!

What is the worst relationship P_1 can become involved in? It is case $\beta 7$, (+ +): a weak P_1 ($G_1 = 1$) with a strong P_2 ($G_2 = 7$) and antagonistic goals ($u_1/u_2 = -1$). P_1 faces a desperate goal approach of -67%. The powerful P_2 kills easily the feeble P_1. - Can P_1 in the situation of antagonistic goals become damaged if he is strong ($G_1 = 7$) and P_2 is weak ($G_2 = 1$)? We look at case $\gamma 7$, (+ +). The answer is: Not at all. P_1's goal attainment is now just the opposite of case $\beta 7$, namely +67%. A weak enemy, ($\beta 7$), becomes an easy catch for a strong opponent.

What is the most favorable situation for a weak P_1? It is the friendly relationship (+ -) with common goals, case $\beta 6$. P_1 attains 97%. In autonomy he would reach only 50%. Through friendship the strong P_2 helps P_1 with 47%. But such a situation can have a bad outcome! The interaction (+ -) requires that the strong P_2 provide the devotion with $-S_{21}\delta_1$. A strong person in relation with a weak person is not likely to be devotional, or submissive. If P_2 recognizes or thinks that he is being exploited by P_1, he could:

a) Change the $-S_{21}\delta_1$ into a $+S_{21}\delta_1$ and thus make the relation hostile (+ +) and damage P_1 slightly ($x_1 = 89\%$), or

b) Stay aggressive and disrupt the goal-relation, i.e., make goals incompatible. Then x_1 would become 11% only (case $\beta 1$). Or even

c) Be nasty, stay aggressively disposed and go into hostility, make his goal u_2 antagonistic toward the partner P_1 and create situation $\beta 7$ with $x_1 = -67\%$. P_1 gets ruined.

Going from a) to b) or c) and with the assumption of equal patterns of motion of P_1 and P_2, P_2 would have to reduce his willpower from 9 to 7 in order to remain in a stable relationship. But probably the opposite will happen. The weak P_1 will have to provide the devotion [case $\beta 6$ (- +)], and the strong P_2, the egoist, is after his benefit. Then P_1, the weaker, has to suffer. He gets only 35%, what might not be

enough for survival. The strong P_2, on the other hand, does not make a bad deal. He now gets 97%.

We mention again the social verity:

The weak always goes to the wall - if the strong wants it so. And as need and greed are principles of survival, he generally wants it this way.

The combination of togetherness, when both partners are in an aggressive disposition, (+ +), and the goals are correlated, can be called collectively pushing forward. Goal attainments in this state of behavior are quite favorable. Whatever the two willpowers are, G_1 and G_2, if their sum is a maximum 8, the goal attainment for both partners is always 89%, independent of the distribution of the two willpowers; see cases α 6, β 6, and γ 6.

It could be assumed that the situation $G_1 = G_2 = 4$ [α6 (+ +)] would be socially peacefully stable if the unlucky fact were not in the air: *Duo cum faciunt idem, non est idem*; if two do the same, it is not the same. If two are in equal situations, each one thinks the other has an advantage. If a weak person P_1 could not run away from an unsatisfactory friendship with a strong egoistic P_2 without falling into the worst state β6 (- -), the rule for P_1 is: Try to go in β6 (+ +) according to the proverbs

A bad peace is better than good war.
If you can't beat them, join them
Make your enemy your friend.
The wiser head gives in.
C'est le plus sage qui sède.

But it is practically a miracle when a weak P_1 is accepted in a (+ +)-relationship by a much stronger partner P_2. In this situation β6 (+ +) both, P_1 with $G_1 = 1$ and P_2 with $G_2 = 7$, would make 87%. „No way", definitely says the powerful egoist.

The effect of disturbances through z_1 and z_2 in the state of seeking independent goals and in (+ +)-relations is 11%. Hostility is almost immune to being disturbed.

Concerning disturbances through z_1 and z_2 in devotion, (+ -) or (- +), the situation is very different. The effect of z_1 on P_1 is grave, whereas the effect of z_2 via P_2 on P_1 is moderate.

In the friendship, the weak partner is extremely prone to disturbances. It seems that the weak partner's low self-esteem makes him sensitive, which makes it easy to disturb him.

The effect of the direct disturbance on a partner is in friendship three times as large as in hostility. And on the contrary, the effect of the disturbance coming via the other partner is in friendship smaller than in hostility. Amicable relations are prone to disturbances of their own disturbance, i.e., if z_1 acts on P_1. Hostile relations, in contrast, do not want to become disturbed.

Concerning long-term self-realization, it is extremely advantageous to maintain friendships - or to stay autonomous. Hostile relationships create damage.

Where then is the attractiveness for hostility, for hate and war?

As explained already, it is manly the dynamics, the immediate event, not the far away steady state. There are three reasons that come to light:

a) Hostile systems at parity of willpowers allow twice the willpower to act before they become unstable compared to friendly systems, and

b) Hostile systems act twice as fast as consensual systems. *The characteristic of behavior, as biologists use the term, is that it is fast.* And *Time is the currency of survival;* [2].

c) Hostile systems have a much larger range of stability than consensual systems. Thus, hostility has more biological potential to exist and operate.

d) If the opponent can be destroyed, the victor can take from the opponent what he possessed, and once the opponent is gone, the victor's own survival possibility increases.

In the two Figures V-3 and V-4 the coupling factor $S_{12}S_{21}$ is ± 1. At parity in hostility, $G_1 = G_2$ is 4; in consent, $G_1 = G_2$ is 2 only. The hostile dualism is as fast as the autonomous individual is; the consensual dualism is much slower than the autonomous individual. Such stagnation irritates the two partners in amity. Concerning willpower and flexibility in the consensual relationship makes the partners feel an urge to turn hostile!

Putting together more then two units, the speed of action in hostility remains the same, independent of the number of units in interaction and independent of the magnitude of hostility. Devotion becomes slower the more units interact and the stronger the consensual interaction is. This is demonstrated with Figure V-11 where the number n of partners grows from 1 to 8 units; See also [5].

Because speed is of such importance, the next chapter shall serve to investigate the behavior of a dualism of two units of different patterns of motion. It is notorious that speed is a significant parameter in life, be this in transportation, in any sports, in manufacturing, or in plain thinking and arguing. Speed is an eminent factor for quality of survival. Let's look therefore at a dualism wherein unit P_1 acts faster than unit P_2; Chapter VI.

Repeating an important finding: Compared with Figure IV-4, $m_1 = 3$, the critical willpower is 8, independent of time T. T can be a fraction of a second, a day, one full year, or a century, G is always 8. This fact was mentioned in section IV-3. This is to say: For beings - or any dynamic systems - of pattern of motion of equal ratio, nature provides the same willpower to survive within its own species, be the being a humming bird, an elephant, or a tortoise.

From this standpoint, we dare to say that every species of beings created by nature has the same value, whether a human being or a tuft of grass. Nevertheless, within different species the faster being has an advantage over the slower one when it comes to survival. Compare Table I in Chapter IV! D has a reaction time that is 10 times faster

than A. In life, speed pays. *A bold attack is half the battle.* Or, *He travels fastest who travels alone.* This means that the autonomous unit is faster than a friendship of two or several units. Another remark might be brought in:

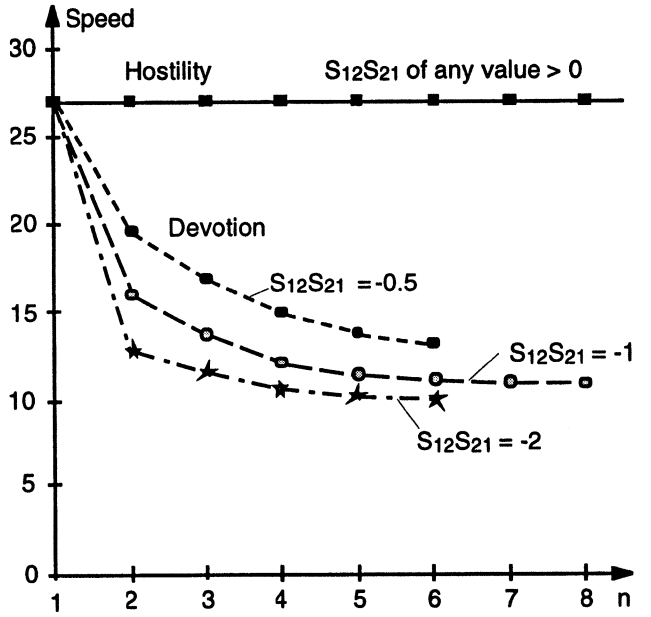

Figure V-11: Speed of units in series according to Figure V-1. In hostility $S_{12}S_{21}$ can have any value > 0; in amity $S_{12}S_{21} < 0$.

Besides a dualism of correlated goals, a dualism of a common goal with a common feedback signal can exist. Two partners work together and live for one common goal. This concept requires another structure, called perhaps totalitarianism. There, then, is only one common feedback to one higher authority that sets the goal u. Such an arrangement can also be called dictatorship or slavery, because neither of the two units in this situation has the possibility, or the right, or the desire to realize itself.

Finally:

The philosophical meaning of self-realization is not, what one might presume, money or possessions, or at least not exclusively. A megalomaniac might need two Ferrari cars, a yacht, and a villa on an island in the Pacific, a second person needs only a holiday home in the Alps to be happy, and a third one perhaps just a little flower garden, or he enjoys watching birds in the woods. The evaluation of self-realization is a very personal matter. Interactions between different partners with goals of different magnitudes or different values are beyond the scope of this investigation.

VI. Individuals of Different Patterns of Motion

In Figures V-3 to V-7, the model Figure V-1 was interpreted with equal patterns of motion for the two individuals. Both partners' time behavior was described with three linear differential equations of first order with equal time constants for each. In this Chapter VI a further behavioral mode is described. One individual is faster acting than the other; P_1 is faster than P_2. P_1's time constant is set to four different smaller values than P_2's time constant, which stays the same. That means we look at four different systems. But both individuals' pattern of motion is still of third order. Each partner's pace is symbolized with three internal *tanks* to be filled when he acts. The partnerships' stability limits, shown in Figures VI-1 and VI-2, shall serve to demonstrate the outcome of these situations. One must take into account that not only in the technical world, but in the social realm too, time is a central variable in living fields.

Figure. VI-1 depicts stability limits for consentient interrelations; Figure VI-2 does the same for hostile partnerships. The two figures show stability limit contours for a variation of the frequencies f_1 and f_2 of the mobility of the two partners. Table VI-1 indicates the two chosen sets of frequencies of the two autonomous partners, f_1, and f_2. The frequency is - as mentioned earlier - a direct measure of the speed of motion. The higher the frequency of an individual at his stability limit, the higher is the speed of his behavior - in the autonomous state, but no longer in interacting.

The individuals lose their autonomous velocity once they are involved in a partnership. The partnership gets its own speed that is not f_1, not f_2, and not a simple relation of both - as will be seen again. The functioning of the togetherness is intimately linked to the complexity of interrelated behavior.

The four different dualisms, 4 for a devotional relation, and 4 for a hostile relation, are called A, B, C and D. The speed acting of the autonomous partners are shown in Table VI-1.

Table VI-1: „velocity" of motion of the autonomous partners, P_1's f_1, and P_2's f_2. The velocity of P_2 is a reference.

	f_1	:	f_2
A	1	:	1
B	1.25	:	1
C	2	:	1
D	5	:	1

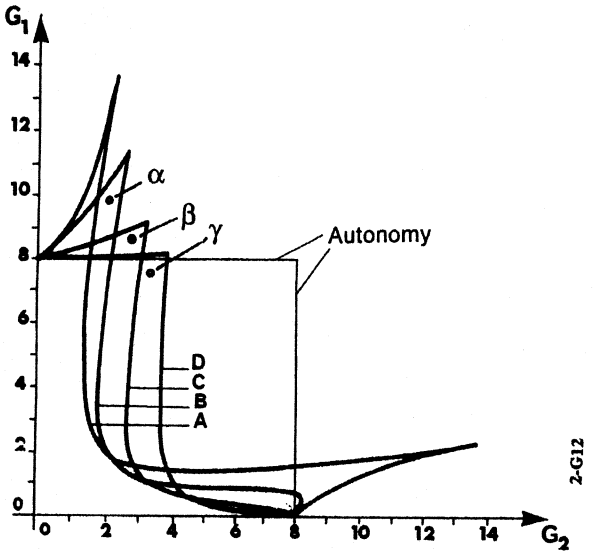

Figure VI-1: Stability limits for friendly relationships of individuals of different patterns of motion. $S_{12}S_{21} = -1$.

It must be remembered that only the ratio f_1/f_2 comes into play and not absolute values of f_1 and f_2 in the four following figures - as in reality: it is the difference that determines the graduation. Concerning stability limits and concerning social features, absolute values have no

significance. As can be expected, the shape of the stability patterns for amity, in Figure VI-1, is very different from them of enmity, in Figure VI-2.

In both Figures, VI-1 and VI-2, one curve of each shall be taken for a closer inspection. We select C. These are the Figures VI-3 and VI-4. In these two figures, the three time constants of the individuals are for P_1: $T_1 = 0.1$, and for P_2: $T_2 = 0.2$. In other words, in the autonomous state, partner P_1 is twice as fast as partner P_2 : $f_1 = 2$, $f_2 = 1$.

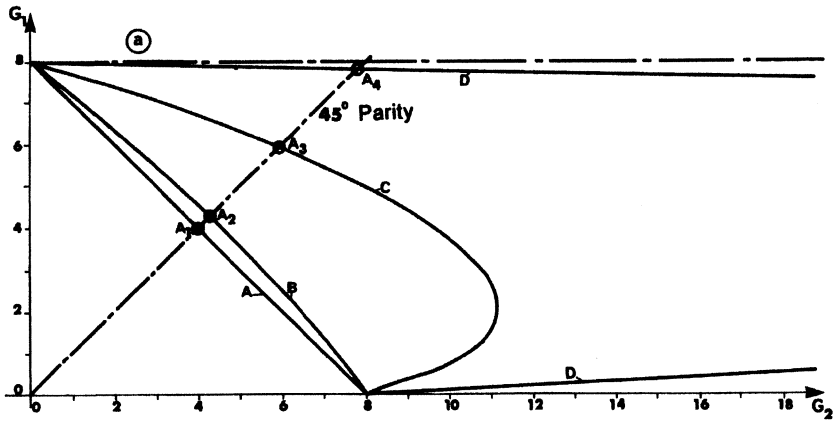

Figure VI-2: Stability limits for hostile relationships of individuals of different patterns of motion. $S_{12}S_{21} = +1$.

Although the time constants for the two units are different, the willpowers in their autonomous state are, as we know, the same, namely 8. From Figure IV-5 it is known that G is 8 for three equal time constants, independent of their magnitude.

Some remarks about Figure VI-3, the consentient dualism.

a) If the slow partner, P_2, is satisfied with a low willpower, say, $G_2 = 2.5$ or less, P_1 can dominate, and the system can act even slightly faster

than when P_1 is in the autonomous state. The slow P_2 helps to increase the speed of the dualism by 3%, or 6%, depending whether it is considered relative to P_1 or relative to P_2; f = 2.06. The speed of the dualism (speed = 2.06) is just a bit higher than the speed of the fast autonomous P_1 (f = 2).

b) If the slow partner, P_2, enforces a willpower of 6, P_1 has to come down to a willpower of 0.3. The flexible, i.e., the fast partner has to suppress his willpower almost completely so that the slow one can exert his willpower. In addition, the speed of the dualism is slower (f = 0.86) than the slow P_2 in his autonomous state (f = 1). Such a liaison cannot last long, and the dualism runs into instability already with a minor increase of P_1's willpower. The partnership collapses. The domineering slow partner is a torture for the fast acting (or intelligent) being, although we talk about a friendship! That the speed of action in the dualism is smaller than that of P_2 in autonomy worsens the situation. The genetically faster individual is forced to lower his desire to move, and in addition he is not allowed to have any reasonable willpower to exert for striving toward his goal. How many marriages break up because of this natural law, even companionate marriages! And what an insufferable torture for the flexible partner if the bond is ecclesiastically for a lifetime obligation! If the slow - or the sluggish - partner dictates predominantly, the divorce is programmed, is justified, and is in fact, necessary. If you seem to be forced to deal with a distinctively slower partner than you are yourself, make yourself autonomous, stay alone - if you can!

Proverbs may support the fact:

> *He travels fastest who travels alone.*
> *Gain time, gain life.*
> *Nunquam minus solus quam cum solus*: I'm never less alone then when I'm alone.

Figure VI-1 indicates that the fast individual tends more to autonomy the slower the partner. The partner wants to move - from point α to β to γ. But what a potential for conflict if the slow partner requests dominance!

c) At the parity of willpowers, $G_1 = G_2$, in Figure VI-3 both partners have to agree on a maximum willpower of about 2.6. But the system in this state of parity is the slowest: f ~ 0.75. Then it's a matter of fact that the fast, impatient P_1 tries to dominate. In order to make this possible, the slow P_2 has to give up some of his willpower. P_2's willpower $G_2 = 2.6$ has to be reduced to, say, $G_2 = 2.3$. Then P_1 can go up to $G_1 = 8.2$. If, however, P_2 is jealous of the fact that P_1 can be much more powerful than he, he will try to increase his willpower to a G_2 larger than 2.6, and the friendship will decay immediately into instability – justifiable conflict of interests.

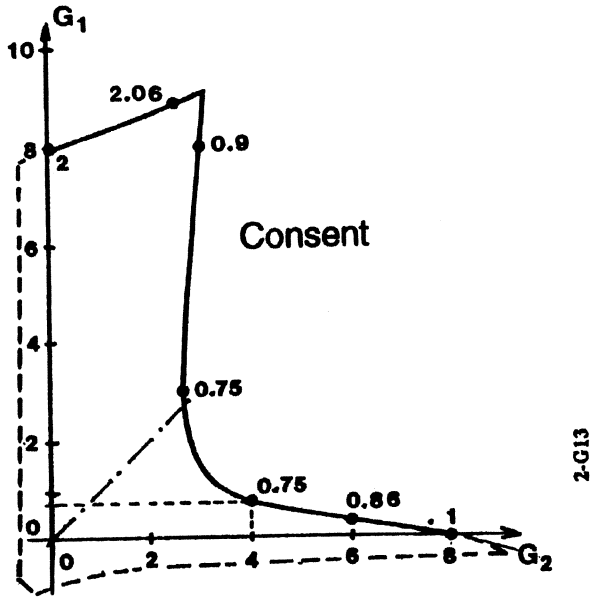

Figure VI-3: Stability limits for a consentient dualism with a ratio of speed of action of 2. $S_{12}S_{21} = -1$. P_1 is fast, P_2 is slow.

Although the devotional relationship looks attractive because it supports each other' self-realization, there are dynamic disadvantages which endanger its existence. And life is dynamic, is time functioning! *In a friendship the intelligent partner has to behave as backward as his partner is in order to maintain togetherness.*

Some remarks about Figure VI-4, the hostile relationship.

a) If the slow partner, P_2, wants to dominate ($G_2 = 8$), the fast one, P_1, has to reduce his willpower as in amity, although by far not to the same wearing measure. But what is a great advantage to the slow unit is that: he can increase his willpower considerably beyond the autonomous willpower, if the fast acting indicates a reduced willpower. G_{2max} is about 11; this is 37.5% more than in autonomy (at $G_1 = 2.5$). But the dualism is under all circumstances faster than the consentient system. Hostility is agile!

b) At the parity of willpowers enmity is definitely very different from amity. In hostility, $G_1 = G_2 = 5.9$. In amity, $G_1 = G_2 = 2.6$, i.e., about half of the volitions of enmity. Hostility renders the feeling of being strong, powerful - and fast. If one takes the stability area as a measure of existence, then Figure VI-3 has only half the area of Figure VI-4 within the region of $G_1 > 0$, and $G_2 > 0$. Taking the total area into consideration, i.e., including the region of $G_1 < 0$ and $G_2 < 0$ (dashed lines), then the hostile domain is four times larger than the area of amity. This fact suggests again what was said earlier: Hostile systems have a much wider area of stability than friendly systems. Therefore, it can superficially be said that inimical systems are better stable than amicable ones. Hostile systems have much more vigor to exist before they end their existence.

Our old question: Does nature favor hostility when compared with friendship? It seems so, although for our own purpose, our own survival, we intend to promote peace efforts. *The much misunderstood topic of hostility, the topic of enmity!* [2].

c) The situation becomes tragic with two aggressors of an extremely large difference of flexibility; Taking in Figure VI-2, curve D where $f_1/f_2 = 5$, the very fast partner P_1 can exert a willpower of 4 only, when the slow one goes to the maximum, to 110! (no longer shown on the

figure) Well, perhaps a speed ratio of $f_1/f_2 = 5$ is socially no longer a reasonable assumption. At the parity of willpowers (45^0-line) both can exert a willpower that is practically the autonomous willpower of 8 (point A_4, Figure VI-2). How attractive for a very slow (and therefore dense, dumb, sluggish) person to be extremely stubborn in exerting his will!

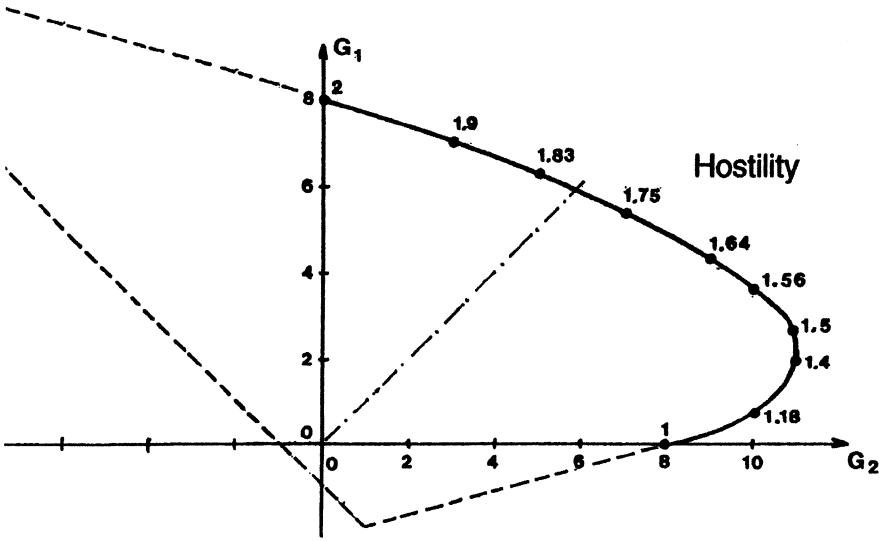

Figure VI-4: Stability limits for a hostile dualism with a ratio of speed of action of 2. $S_{12}S_{21} = +1$. P_1 is fast, P_2 is slow.

Very slow, slack enmities have extremely large areas of stable conditions, and the large areas guarantee a great willpower for the slow aggressor. This fact can be reversed: The very strong aggressor (if mentally slow and therefore sluggish) can keep the hostile situation very long lasting. It might be that this is the reason that feuds can last with utmost tenacity over generations. One hopes in vain for lenient

behavior from slow and powerful aggressors. They drag the conflict on and on.

On the basis of all these considerations of hostile relationships, of these *Natural Laws*, it is understandable that hostility enjoys such a tremendous interest, be this in sports, in movies, in courtrooms, in politics, and in daily events. What a malicious pleasure for the media when a friendship between famous people turns into hostility!

Our conclusion is:

Although it might hurt enormously any ethical attitude: There will never be peace on earth (I know that one should never say never!). The slow (or less intelligent) aggressor will dominate with his stubborn will. When he, in addition, perseveres and integrates his willpower (see Appendix IV) he confirms our model's findings.

VII. Anticipation and Enforcement

In Chapter II a rudimentary definition of intelligence was coined. We said that the synergetic combination of willpower and pattern of motion could be used as a measure for intelligence of an autonomous individual. But at that point it was also mentioned that a third factor could be taken into consideration, foresight, or anticipation. This term can be modeled with the derivative of the error signal $\varepsilon(t)$, that is with $d\varepsilon(t)/dt$. Anticipation enhances intelligence. Yet, there is one more factor we pointed out in section IV-1, the enforcement of the willpower, modeled with the time integral of the error signal, $\int\varepsilon(t)dt$.

The two elements, anticipation and enforcement, incorporated into the individual have very different effects on his behavior. They are described in some length in Appendix IV. In short, for our immediate purpose we mention just a few facts and demonstrate them afterwards:

a) Anticipation, $GC_a d\varepsilon(t)/dt$. (The index a stands for anticipation.)
Some synonyms for the term anticipation might be mentioned: apprehension, awaiting, expectancy, foresight, foretaste, forethought or preconception. In our model, an individual with anticipation can exert a higher willpower before he becomes unstable, and he can act faster than without this feature. His final goal attainment becomes better, not directly due to anticipation, but indirectly, because he can exert greater willpower G for the same basic pattern of motion. See for this feature Figure IV-1 where it is shown that the goal attainment is better the greater the willpower G_1.

b) Enforcement, $GC_p\int\varepsilon(t)dt$. (The index p stands for perseverance.)
Some synonyms for enforcement are in order as well: coercion, compulsion, insistence, pressure, determination, persistence, and tenacity. The model shows that an individual, who slowly and continuously increases his willpower over time and brings it in synergy with the internal error signal, endangers stability of his functioning, and eventually, if he remains stable, comes very close to his goal. If no further disturbance arrives during his endeavor, he reaches his goal of 100%. But the initial willpower G has to be set

lower than without enforcement in order to remain inside the stability border. And the enforcement has to be done slowly in order not to endanger the stability. We see here again in a) and b) how time plays its role and what enormous influence it has.

In this Chapter VII the already faster acting individual, i.e., P_1 of Figure V-1, is to be provided with anticipation. The slower and less intelligent, P_2, is supplied with enforcement. The structure to be used is shown in Figure VII-1. The magnitude factor for anticipation for P_1 is C_{a1}, the magnitude factor for the enforcement of P_2 is C_{p2}. The factors C_{a2} and C_{p1} will be zero.

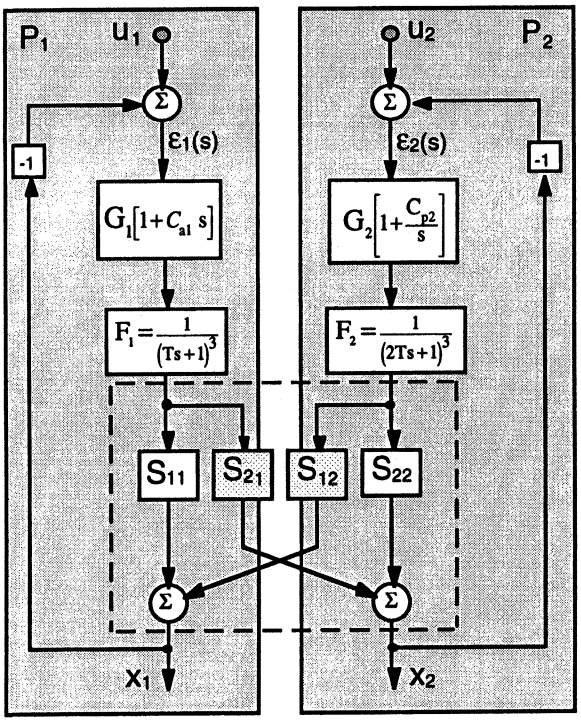

Figure VII-1: Anticipation added to P_1 and enforcement added to P_2 of Figure V-1.

The following consideration is done with the usual assumption that the system has to remain stable in order to be goal approaching. We refer to the two Figures VI-3 and VI-4 of the previous chapter to find out whether there is any advantage or disadvantage these two features, anticipation and enforcement, will bring to the partners in their togetherness.

Referring firstly to the dualism of amity, Figure VI-3, we notice that P_1's willpower G_1 has to stay far below the value of 1 if P_2 exercises a willpower close to his autonomous level of 8. We now provide the more intelligent individual P_1 with some anticipation C_{a1} in order to find out whether he can increase his willpower although P_2 stays, we say, sticking to his high G_2 of 6 but without enforcement yet. Only P_1 is provided with a change compared to Figure VI-3, with C_{a1}, (C_{p1}, C_{a2} and C_{p2} remain zero).

In Figure VII-2, where the area of stability limit is plotted, the parameters are: $C_{a1} = 0.2$, $C_{p2} = 0$. P_1 is given some minor anticipation. P_2 remains the same as in Figure V-1 or VI-3, respectively. Contrary to the expectation: there is no betterment for P_1 if P_2 wants to keep his high level of willpower. We conclude: If an individual is in a relationship with a partner who is inferior (slow and without anticipation) but who insists on exerting his willpower because he might be stubborn, the more intelligent individual has no way to exert his intelligence to realize himself. We see another delicate and dangerous feature of friendship, the potential of a certain collapse.

Referring now to the hostile partnership with the same amount of anticipation given to P_1: $C_{a1} = 0.2$ and with C_{p2} still 0. Figure VII-3 depicts the stability area that can be compared with Figure VI-4. Here, in the hostile situation, the facts look better for P_1, but better also for P_2. In Figure VII-3, P_2 can exert twice the autonomous willpower of 8, namely 16. At the maximum G_2 of about 16, G_1 is about 5 compared to 2.5 in Figure VI-4.

The more intelligent P_1 gains potential to exert his willpower, but he also helps his sluggish and strong-willed opponent P_2 to almost double his willpower. Again: it really seems that, concerning the

potential to exert willpower, nature favors hostility. Impressive is the enormously greater realization area of enmity compared with amity.

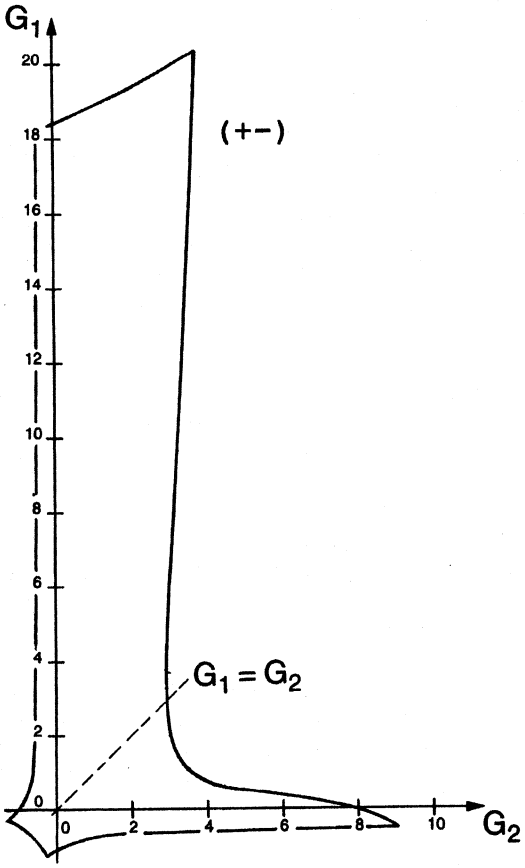

Figure VII-2: Stability area of the consentient partnership. P_1 is provided with anticipation.

If the comparison is made at the parity of willpowers, $G_1 = G_2$, P_1 does not gain much with his anticipation in amity. The ratio of Figure VII-2 and Figure VI-3 is about

$$\frac{3_{\text{Fig. VII-2: } G_1=G_2}}{2.6_{\text{Fig. VI-3: } G_1=G_2}} = 1.15.$$

P_1's gain is 15%. In enmity, in a comparison of Figures VII-3 and VI-4, it comes to

$$\frac{11_{\text{Fig. VII-3: } G_1=G_2}}{5.8_{\text{Fig. VI-4: } G_1=G_2}} = 1.9.$$

P_1's advantage is 90% over P_2. But the main point is the tremendously greater willpowers the anticipation of P_1 provides for both, P_1 and P_2.

The next point of interest is the situation when P_2 becomes really stubborn and enforces more and more goal attainment by integrating his willpower G_2 over time in connection with the error signal $\varepsilon_2(t)$: $G_2C_{p2}\int\varepsilon_2(t)dt$. P_1 will retain his anticipation: $G_1C_{a1}d\varepsilon_1(t)/dt$. Again, consentient and hostile interaction shall be looked at. The parameters in Figures VII-4 and VII-5, which serve for this point, will be set to: $C_{a1} = 0.2$, $C_{p2} = 0.2$. P_1 has anticipation, P_2 exercises enforcement.

In the amicable relationship, in Figure VII-4, the disadvantage is for P_1. The stability area shrinks to the disadvantage of P_1. He has to become even more modest if, e.g., P_2 enforces a G_2 of 4. But P_2 has to set back his G_2 as well (from 8 to 5 at $G_1 = 0$), because enforcement augments the possibility of instability.

In hostility, in Figure VII-5, the shape of the stability area looks similar to the one in Figure VII-3. Enmity, it seems again and again, is so much more attractive compared with amity, in both, in willpower and living area. (Due to the integration $G_2C_{p2}\int\varepsilon_2(t)dt$ there is no stability area for $G_2 < 0$.)

The last word comes from the attainments of the goals of P_1 and P_2. In order to clear up this point, we take equal willpowers of the two partners, $G_1 = G_2$, and calculate their goal attainments. These attainments are taken as steady state values. There are new surprises. We look at some situations and take two different goal constellations into account, a) and b):

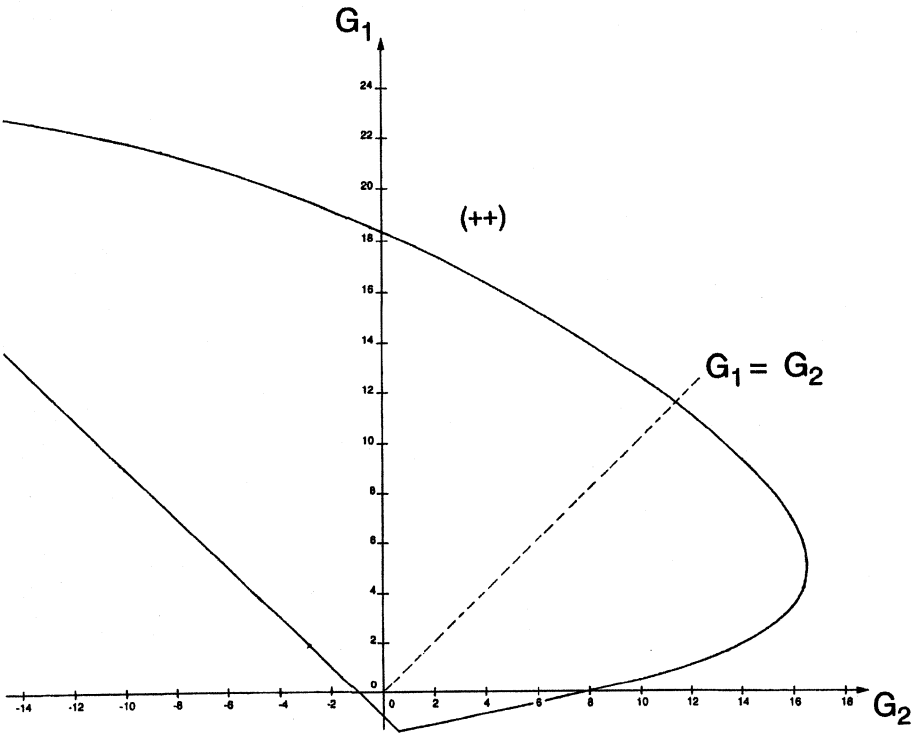

Figure VII-3: Stability area of the hostile partnership. P_1 is provided with anticipation.

a) When goals are incompatible. And they are incompatible if goals are self-realizations. We repeat: when the goal attainment for P_1 is determined, $u_1 = 1$ or 100% and $u_2 = 0$; and $u_1 = 0$ and $u_2 = 1$ or 100% for calculating P_2's goal attainment.

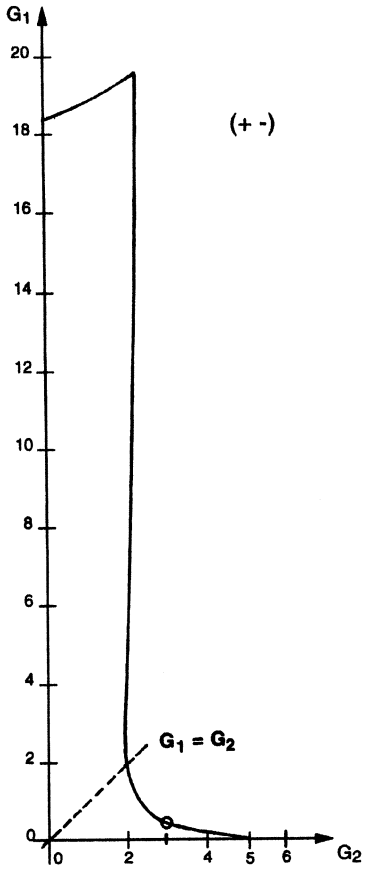

Figure VII-4: Stability area of the consentient partnership. P_1 is provided with anticipation, P_2 with enforcement.

b) If P_1 and P_2 work for a common goal, then $u_1 = 1$ or 100% and $u_2 = 1$ or 100% too.

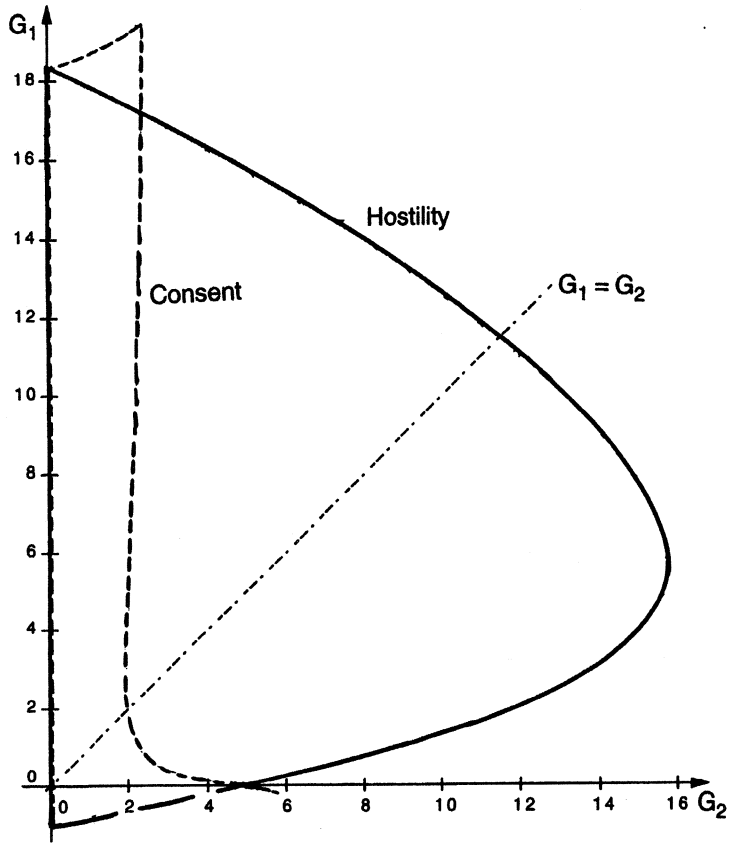

Figure VII-5: Stability area of the hostile partnership. P_1 is provided with anticipation, P_2 with enforcement. For comparison, consentient behavior from Figure VII-4 is indicated.

A reminder is necessary here. The stability areas do not change when goal concepts change. Stability depends only on the internal properties of the system, the system's character.

The findings are in Table VII-1. A short discussion about them is in order: As we are looking at steady state results, it has to be kept in mind that derivative action, $d\varepsilon(t)/dt$, speeds up goal approach, but does not increase goal attainment x/u; and that integral action, $\int\varepsilon(t)dt$, slows down goal approach and increases final goal attainment. Therefore the results 1 and 2 in Table VII-1 are *goal-symmetric*.

Case 1: (- +) The more intelligent (faster) individual, P_1, provides submission with $-S_{12}$. Striving toward his own goal u_1 ($u_1 = 1$, $u_2 = 0$) he achieves a goal attainment of 81%, and he helps his partner P_2 with 13%. But, if P_2 strives toward his goal u_2 ($u_2 = 1$, $u_1 = 0$) with P_1 still providing devotion, he, P_2, also reaches 81%, but P_1 suffers by -13%. As it is unlikely that the less intelligent P_2 shows submissiveness ($-S_{21}$), the more intelligent individual has to suffer for the less intelligent burgher. The less intelligent person is with highest probability the more egoistic fellow in life.

Working toward correlated (or common) goals, $u_1 = u_2 = 1$, the less intelligent person gets more, 95%, compared to the more intelligent one, who only makes 67%! Friendship is not necessarily friendly!

Case 2: (+ -) This case is, as mentioned, in some way symmetric to case 1. We call it *goal-symmetry*. The symmetry is obvious. If in the common goal situation ($u_1 = u_2 = 1$) the slow and, thus, the less intelligent partner P_2, who is the slow one, provides conciliation with $-S_{21}$ then P_1 reaches 95%. But will P_2 do that? The instinct for survival says no.

Case 3: (+ +) In the hostile partnership the common goal shows another feature. If P_1 works toward his goal, he achieves only 47%, and his opponent, P_2, takes 47% from his goal benefit. But in the case that they work together toward one goal ($u_1 = u_2 = 1$) they add „give and take" to 95%. We see here: What we defined as hostility is not just a detriment (as friendship is not a mandatory benefit). If goals are

Table VII-1: Goal attainments in % for Figure VII-1; u_1 and u_2 in %.

	$u_1 = 1$, $u_2 = 0$		$u_1 = 0$, $u_2 = 1$		$u_1 = 1$, $u_2 = 1$	
	x_1	x_2	x_1	x_2	x_1	x_2
1. Amity: $C_{a1} = 0.2$, $C_{p2} = 0$; (- +); $G_1 = G_2 = 2.5$:	81	13	-13	81	67	95
2. Amity: $C_{a1} = 0.2$, $C_{p2} = 0$; (+ -); $G_1 = G_2 = 2.5$:	81	-13	+13	81	95	67
3. Hostility: $C_{a1} = 0.2$, $C_{p2} = 0$; (+ +); $G_1 = G_2 = 11$:	47	47	47	47	95	95
4. Devotion: $C_{a1} = 0.2$, $C_{p2} = 0.2$; (- +); $G_1 = G_2 = 1.5$:	75	0	-25	100	50	100
5. Devotion: $C_{a1} = 0.2$, $C_{p2} = 0.2$; (+ -); $G_1 = G_2 = 1.5$:	75	0	+25	100	100	100
6. Hostility: $C_{a1} = 0.2$, $C_{p2} = 0.2$; (+ +); $G_1 = G_2 = 10$:	0	0	100	100	100	100
7. Nega-Devotion: $C_{a1} = 0.2$, $C_{p2} = 0.2$; (- -); $G_1 = 1$; $G_2 = 1$:	0	0	-100	100	-100	100

The signs: (- +), (+ -). (+ +). and (- -) in Table VII-1 have, as already explained, been given the following meanings:

(- +): S_{12} is negative, and S_{21} is positive,

(+ -): S_{12} is positive, and S_{21} is negative,

(+ +): S_{12} and S_{21} are positive, and

(- -): S_{12} and S_{21} are negative.

common, mutual aggressive disposition is beneficiary for both partners. Hostility is not imperatively detrimental. It can be mutual help. This is one point more where hostile interrelation has its advantage! Functional models ask for more careful differentiation then the colloquial language is capable of.

What happens if now the less intelligent person becomes stubborn with $C_{p2} = 0.2$ and increases the effect of his willpower by multiplying it with his error integral and his willpower? There is no such clean symmetry anymore as was the fact between the cases 1 and 2. The diversity with stubbornness increases.

Case 4: (- +) P_1 provides conciliation. With a low G_1 of 1.5, he gets 75%, and P_2 cannot realize any benefit from P_1's goal striving endeavor. If P_1 is still submissive with $-S_{12}$ and P_2 works toward his goal u_2, then P_1 suffers by -25% and P_2 attains a formidable 100%. P_1 has either to take the pain or revert into hostility.

Case 5: (+ -) If P_2 is submissive ($-S_{21}$), P_1 achieves his goal still to 75%, and P_2 cannot profit anything. If, on the other hand, P_2 strives toward his goal, he makes fully 100% and P_1 profits 25% out of P_2. The very best situation occurs when the stubborn person and the flexible one work toward a common goal. Then with the help of P_2's stubbornness, they both achieve 100%. But as P_2 with $-S_{21}$ and $u_1 = 0$ makes 100% anyhow, he very likely begrudges P_1 the 100% and stays away from him by rejecting cooperation. Or he continues in cooperation and tries to force P_1 to a $-S_{12}$ in order to damage him with -100% of his goal prospect. This is then shown in Case 7.

Case 6: (+ +) This case of hostility with a stubborn person shows a daily verity. If P_1 is trying to realize his goal, the result is zero for both. But P_2 does not care about ending in zero because in any case, he has no goal regarding the relationship ($u_2 = 0$). Without an own goal within the partnership he can kill P_1's effort with his obstinate behavior. This potential to damage might give him malicious pleasure: If only the neighbor has nothing on his plate!

If P_2 is after his goal and u_1 is zero: what a surprise! His stubbornness, his integration, transmits over to produce success for P_1. Both achieve 100% goal attainment. The result is the same as in Case 5 with a common goal. Be aware that 100% can be achieved with any G_1, $G_2 > 0$. It is the integration over time that does that. Less willpower makes the goal approach slower, but always up to finally 100%. Although we call this situation a verity, it has to be kept in mind that the facts are steady state values, values states after (theoretically) an infinite time span. Therefore, such a *verity* has to be taken with appropriate reservation! But we see that stubbornness in willpower is a delicate social parameter.

Case 7: (- -) This last case can be considered as social pathology. Both partners submit themselves to each other. What is the outcome? If P_1 strives toward u_1, neither one of the two makes anything, independent on the magnitude of the willpower they exert. If P_2 with his stubbornness has his goal in mind, he gets to a full 100%, and P_1 ends in just the opposite, namely in -100%. And this result does not change when they both work toward a common goal.

Mutual devotion (- -) - it could be called *nega-devotion* - is only meaningful for one partner, the stubborn one (here P_2). The other individual in the game gets the loss. If both, P_1 and P_2, are stubborn ($C_{p1} = 0.2$, $C_{p2} = 0.2$) with or without anticipation, neither one gains anything; the goal attainment is zero for both.

Weak, philanthropically people tend to preach mutual devotion, nega-devotion. What a catastrophe for the more intelligent one who has anticipation when he has to deal with stubborn partners! No wonder peace on earth is - has to be - fiction. Be always aware of what stubbornness can enforce, and that it will do so! Perhaps behind the saying *Where there is a will there is a way* is hidden the saying: Be stubborn, then you will make it and you can kill your partner.

The structure Figure VII-1 is capable of showing many situations:
- Consideration for the partner
- Cooperation with the partner
- Causing damage to the partner

Most behavioral characteristics are bivalent or even multivalent. Taking more than one bilateral interaction between partners into account and having more than two partners establishing a social system, the effect parameters have becomes unpredictable for our human perception.

In the next Chapter, VIII, we have a look at systems of several partners in the two behavioral concepts, amity (+ -), and enmity (+ +).

VIII. Multi-Partner Systems

In expanding the partnership monotonously from two to several constituents, what we intend here, it is necessary to restrict oneself to only a few system parameters. The focus is on the tenor that hostility enjoys a much higher interest - biologically, socially, and psychologically - than consent. With our model we can impressively illustrate this natural law. We take the system of two partners, Figure IV-1, and expand it up to eight interconnected partners. They all are unconsciously either in a hostile state among each other or in a friendly relationship. A further parameter we take into account is the intensity of interaction $S_{12}S_{21}$. This coupling factor $S_{12}S_{21}$ will be given two values, weak (± 0.25) and strong (± 1). There is no mixture of hostility and friendliness within any one system. A system is either all enmity or all amity. This will say that in any one system all constituents are either in a hostile or in an amicable state with each other.

As done in Table VII-1, again we will label hostile systems with the sign (+ +), and consensual systems with the sign (+ -) in the following figures. The pattern of motion of the individual partners is the same for all systems, a third order delay. In addition, in any one system under scrutiny, all willpowers are equal, but indeed, not the same from system to system because we put the systems at their stability limit for reading the values we are going to look for. That means in a system of three partners, $G_1 = G_2 = G_3$; in a system of six partners, $G_1 = G_2 = G_3 = G_4 = G_5 = G_6$. The goals are taken as independent from each other, which means, for calculating the goal attainment of the individual partner, his goal is set to 1 or to 100%. All other goals are set to zero. Therefore, goals are meant to be incompatible, i.e., self-realizations. The mutual influence happens only via the willpowers and the unconscious interaction among the partners, and not via the goals of everyone's self-realizations. The graphs of goal attainments and the effect of the disturbance will be steady states. The data of the dynamic graphs, i.e., of the willpower and the speed of behavior, are measured at the stability limit of the appropriate system. The structure of a four-partner system is depicted in Figure VIII-1.

The main purpose of this chapter is the emphasis of the dominance of hostile behavior compared to friendliness in not only two-

partnerships, as done so far, but in growing conglomerates of several system constituents. We already mentioned that in Figure VIII-1 there are 24 loops through which unconscious information can flow and which can create a troublesome togetherness (formula (V-10). A system of 8 partners has the *structural complexity* of 16,072 loops. And perhaps just out of curiosity, a system of 16 partners comes up to the enormous number of 3,809,950,977,008 loops through which information can and will flow.

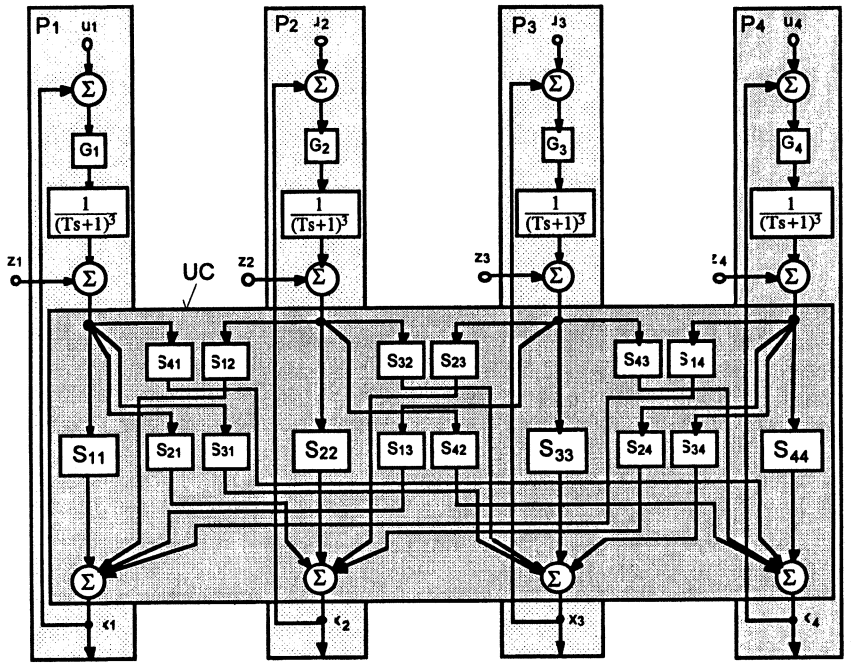

Figure VIII-1: Four partners with generalized unconscious information exchange.

For the magnitudes of the two values of interaction we take $S_{12} = S_{21} = \pm 0.5$ and ± 1, the coupling factors will be $S_{12}S_{21} = \pm\ 0.25$ and ± 1. The *monotonous* growth of systems from two to eight partners, as done

here, is indeed a very specific consideration, but it serves well for a comparison of hostile systems, indicated with (+ +), with consensual systems, indicated with (+ -). As the systems are fully symmetric there is no difference in the outcomes of our results between (+ -) and (- +).

Systems of more than two partners can be found among relatives, working groups, business competitors. Of interest in our context are four variables:
a) The maximum willpower G_i each partner can exert in a system of a certain number of partners;
b) The speed of action of the system v;
c) The goal attainment x_i/u_i and
d) The effect of a disturbance x_i/z_i
for hostile, (+ +), and consentient, (+ -) behavior - before the systems collapse due to instability.

Figure VIII-2, demonstrates the variable G_i. The graph shows the utmost willpower each partner can exert in either relationship. The decline of allowable willpower with an increasing number of interacting parties is obvious. How the autonomous willpower of 8 has to come down in amity is extremely surprising. One dares say that forbearing togetherness of large groups with individual goals of each partner is highly improbable among any kind of beings. Such an adaptation in favor of large systems is very much against the doctrine of survival.

It seems that interaction consumes so much energy, that the willpowers have to come down for the systems to stay alive. The law of entropy pops up!

In enmity, G_i is still about twice that of amity. Going from autonomy, where there is a willpower G of 8, to only a very small interaction of a coupling factor 0.25, already demands an enormous reduction of every partner's willpower if the system is to be capable of operating properly.

Especially indicated in the figure are the two values for n = 2, G = 4 for (+ +)-systems, and G = 2 for (+ -)-systems with $S_{12} = S_{21} = \pm 1$. These values are known from the two figures V-3 and V-4 at the parity of willpower.

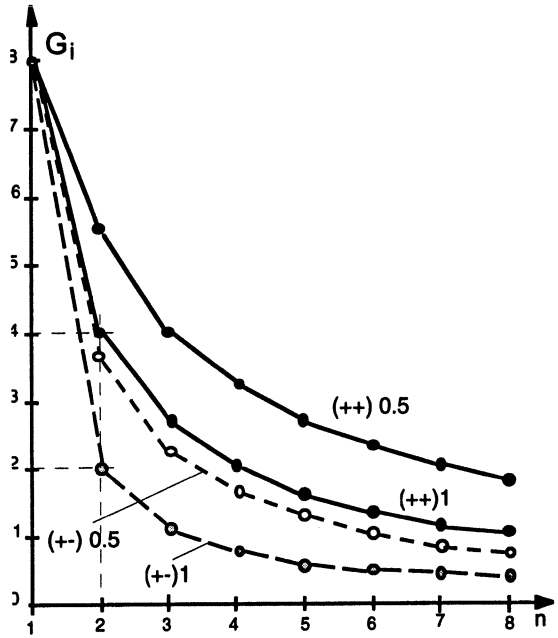

Figure VIII-2: Maximum willpower G_i per partner for homeostasis. n = number of constituents per system. $S_{12} = S_{21}$ for hostility (+ +) is +0.5 and +1; for amity (+ -), $S_{12} < 0$, $S_{21} > 0$, or $S_{12} > 0$ and $S_{21} < 0$, and $|S_{12}| = |S_{21}| = 0.5$ and 1. $|S_{12}S_{21}| = 0.25$ and 1.

Figure VIII-3 depicts the motion of behavior. The graph depicts two absolutely fascinating interesting facts:

α) A consensual systems (+ -) become slower with an increasing number n of partners, but the speed does not go to zero with n growing to ∞. There is a final speed of the value of about 10, (the numbers are a relative measure only!). The interpretation is that consensual systems, e.g., large peaceful bureaucracies with many different goals, are still active, although willpower and goal attainment of the systems become zero (See Figures VIII-2 and VIII-4). Labor

unions want to have activity paid (Figure VIII-3), management wants to pay for what is produced (Figure VIII-4), an ongoing conflict. But in all honesty: It is the final product that makes profit and deserves to be paid for, not activity as such.

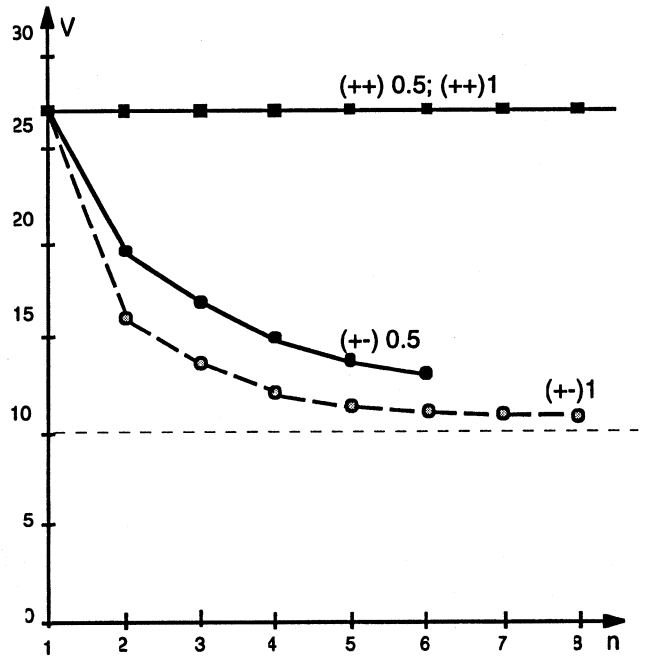

Figure VIII-3: Miximum speed v of system´s acting. n = number of constituents per system. $S_{12} = S_{21}$ for hostility is +0.5 and +1; for amity, $S_{12} < 0$, $S_{21} > 0$, or $S_{12} > 0$ and $S_{21} < 0$, and $|S_{12}| = |S_{21}| = 0.5$ and 1. $|S_{12}\, S_{21}| = 0.25$ and 1.

β) Hostile systems, whether they are slightly aggressive ($S_{ik} = S_{ki} = 0.5$; $S_{ik}S_{ki} = 0.25$), or very aggressive ($S_{ik} = S_{ki} = 1$; $S_{ik}S_{ki} = 1$), independent of the number of parties involved, the speed of behavior remains constant and high, as high as the speed of the autonomous party. The interpretation is that aggressive emotion is always fast! We

already know: if in a consentient dual partnership with $S_{12} = +1$ and $S_{21} = -1$ the partner who provides the devotion with $S_{21} = -1$ changes from $S_{21} = -1$ to $S_{21} = +1$, the partnership flips over into aggression. Then the dualism's speed increases from $v = 16$ to $v = 27$, i.e., by 70%, and the willpower of the two parties doubles. Greed for willpower and speed of emotion always carry the mark of aggression!

We already referred to Figure VIII-4. This figure illustrates the decline of the goal attainment x_i/u_i in %. Attainments for amity and enmity are shown. The willpowers in Figure VIII-2 tend toward zero, as do the goal attainments in Figure VIII-4. It is to be noted that the decline of goal attainment in systems of strong enmity is much stronger than in strong amity. At the very moment in life, enmity is attractive; in the long run, enmity is damage.

Concerning consentient systems where the output is zero but not the speed of behavior, there is the situation which can be recognized in huge agglomerations, in companies and governments: Activity is paid, idling activity, the output can be zero! – *strenua inertia!* (Energetic idleness, Horace).

In the case of hostility with its enormous mutual damage, one is reminded of the Latin saying: *bellum omnium contra omnes* – war of everybody against everybody. Every party wants to get rid of every other party until one only is left to become the unique world power!

The fatal force behind this circumstance is nature: *the survival of the fittest.* But even the fate for democracies is fatal. It is a natural law that even the widely preferred democracies degenerate too in the long run. The energy becomes eaten up in internal information exchange instead of being goal related. Agglomeration of many goal related cohesive parallel-systems carry the sign of entropy.

We can repeat the iron clad verity: At the instant of life, enmity is preferred due to willpower and speed; in the long term (steady state), amity is advantageous due to high goal attainment. But people live at the very point in time and exert their behavior at that very moment and neither in the remote future - nor yesterday!

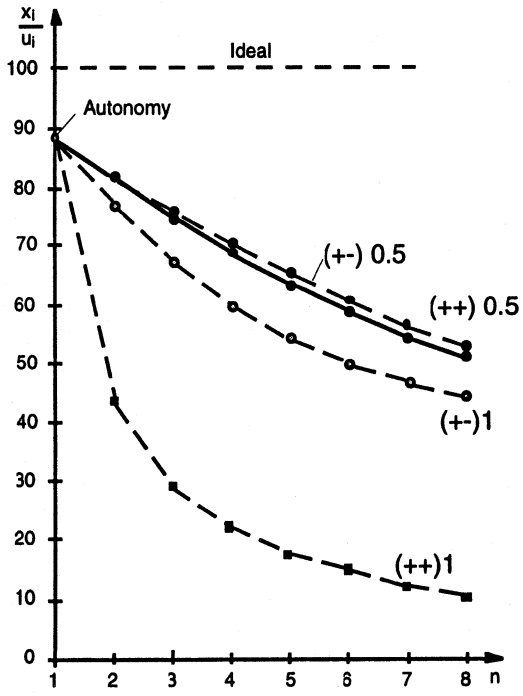

Figure VIII-4: Maximum goal attainment x_i/u_i per partner (in %) for hostile (+ +) and for consentient systems (+ -).

Figure VIII-5: This figure is also extremely illustrative. It shows the effect of disturbances entering the system. Normal hostility ($S_{ik}S_{ki}$ = +1) can almost not be disturbed, independent of the number of partners involved. Amicable systems, on the contrary, are extremely sensitive, and they are the more sensitive the more intense the consent and the more partners involved. Disturbances can have effects far above 100% of the desired goal, what means a total collapse if z_i is negative with reference to the goal.

History demonstrates again and again the futility of the effort to establish peace among conflicting parties. Hatred is an unconscious

fatal and necessary disease. In search for a proverb supporting this statement we found the French proverb *Ce qui ne brûle pas pour toi, laisse-le brûler;* what does not burn for you, let it burn. If you want to bring peace to a war-situation you burn your own fingers.

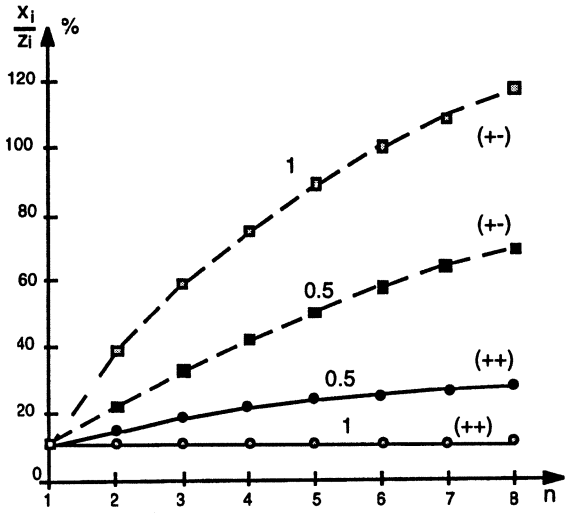

Figure VIII-5: Receptivity of disturbances x_i/z_i.

In summary: The model Figure VIII-1 illustrates clearly that hostility begets momentary self–aggrandizement in the form of strong willpower, whereas consent results in lowliness; that hostility creates heavy mutual damage, whereas in the long term consent renders some mutual help; and aggressive systems are quickly ready to act, whereas consensual systems are slow, sluggish; furthermore, aggressive systems are insensitive to exogenous peace endeavors, whereas consensual systems are extremely vulnerable to penetrating disturbances. Angels of peace can come in when one side of the war is burned out and is longing for peace.

IX. The Group Aggression Phenomenon

It is appropriate to use at least one additional bilateral interaction of Figure II-1 in order to demonstrate the model's value in regard to social behavior. Beside the attitude interaction, in this chapter a bilateral observation of two groups' goal attainment is investigated. Therefore, the two transfer functions V_{12} and V_{21} of Figure II-1 come into play. We consider a common group-phenomenon and take the model Figure IX-1 for our purpose.

The focus is the following: Opposing groups of people face each other in a more hostile manner the stronger the loyalty is within the group, i.e., the more the individuals of the group submit to their group policy. Leaders know that groups in opposition battle each other more vigorously if there are strong bonds within the group. Internal group ties are enhanced if individual members submit to the group symbols (obedience to „authority") in preference to their own individual goal attainment.

Dynamic simulations of this arrangement confirm what every sports team member (and coach) knows, that the prospect for goal attainment increases with giving top-notch efforts, with dedication to team goals over personal ones, and with high aggression towards an opposing team. As long as the opposing team does not match this combination of group behavior, victory on the field of contention is assured. However, if the opposition responds, by acting with the same effort, the chances of attaining goals plummet for both contestants. In this case, different factors become significant while the influence of others, such as devotion to the team, tail off. If one group acts faster than the other, then devotion in both teams goes to the maximum and the amount of personal sacrifice will determine the winner. This inherent character of successful combatant groups requires individuals willing to adopt an alien value system - giving up their freedom. They must be cemented in devotion and develop strong aggression towards opposing teams, becoming programmed *robotic zealots* in the process.

For this social phenomenon the model Figure IX-1 is built with elements of Figure II-1 and simulated with some of the figure's parameters. It will be found that the volition due to internal pressure

for heroism of group individuals strongly influences the goal attainment of the group. If the willpower toward *self*-realization of the group members becomes large, the devoted ties within the group decrease and the group aggression diminishes. Thus, goal attainment of the group declines. In the extreme case, the group may disintegrate. If however, the willpower for *self*-realization of the individuals is small, the group may, with strong internal devotion, achieve a maximum of hostile attitude. This leads to a high goal attainment of the group if the opposing group does not build up a counter potential and intervene.

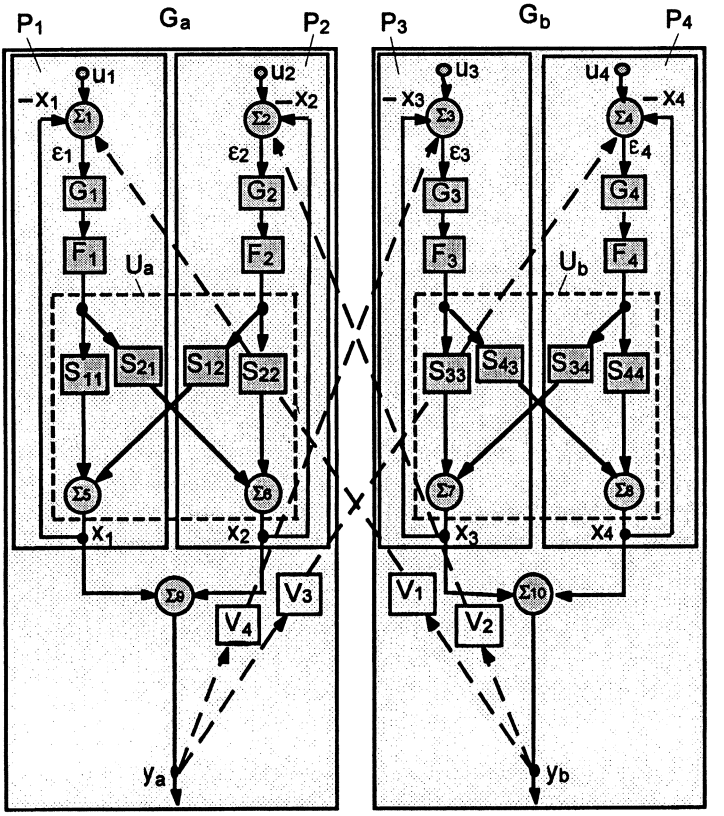

Figure IX-1: Model of two groups, G_a and G_b, with bilateral communication.

With very small volition of self-realization of the group's members a very strong group aggression may occur even without the presence of significant devoted ties within the groups (rioting). The model explains the advantage of a lively attitude and the disadvantage of a sluggish, hostile attitude.

Some prerequisites are:

- Each and every individual has self-control towards his goal. It is the biological cardinal requirement to be viable, to be alive. The prime goal is self-realization.
- Each and every individual within a group, and every group, as well as the whole system of groups, can become unstable.
- The individual's drive to reach a set goal can trigger instability. Too much vigor to achieve the goal upsets homeostasis - physiological, social, or psychological.
- The attainments of the group's members are summed up in the sense of *viribus unitis*, united strength.
- Through mutual observation of the other group's behavior, bilateral group hostility is nourished. An example of the consequence of such observation is retaliatory measures.
- The internal relations of a group can be competitive, indifferent, or supportive. Here, they are postulated as unconscious, supportive, mutual devotion; i.e., as group attitude. Religious zealots, e.g., operate on unquestioning common faith - as their group attitude.
- Members of groups do not know, and do not want to know, their status and direction. Each group member is concerned only about his own survival. He assumes, and believes, that his conforming to the loyalty of the group justifies his behavior. To police this relationship, everyone in the group is foremost sensitive to what the other group achieves: *And why beholdest thou the mote that is in thy brother's eye, but considerest not the beam that is in thine own eye?* (St. Matthew 7/3). In other words, there is no group feedback because there is no controlling group goal.

Description of the Model, Figure IX-1

As this model is one level higher in its complexity and elaboration than the basic dualism, many notions and definitions will be repeated.

This shall help the reader by reducing the strain of memorizing previous statements and definitions.

•• The model Figure IX-1 consists of two groups, G_a and G_b.
•• Each group consists of two partners, P_1 and P_2, and P_3 and P_4, respectively. With only two partners per group and two groups, the above-mentioned points can be illustrated.
•• Each and every partner, or individual, of the group strives toward his goal u_i and attains the goal's amount $x_i(t)$ ($i = 1,2,3,4$). The goal attainment is defined by the quotient $x_i(t)/u_i(t)$. As formerly decided, the time term (t) will be dropped. The own goal is surviving, is an unconditional requirement.
•• The autonomous behavior of a partner is structured as a feedback loop. Thus, the partner has control over his existence via the feedback signal. The feedback signal x_i is equivalent to the awareness of P_i's behavior.
•• A partner needs time to act. This circumstance is symbolically described with F_i. Therefore, the loops become dynamical.
•• The attainment of the group members are added:

$$x_1+x_2 = y_a; \quad x_3+x_4 = y_b.$$

This means that the group's endeavor is a unification of the group members' attainment: *viribus unitis*.
•• The two group-attainments can be mutually observed by each other group via the channels with the transfer functions V_i. V_i can be a factor of assumed or of real magnitude. It is the effect of what one group sees on the other group that will count. In a state of hostility it is easy to see more than the real facts: V_i can be larger than 1.
•• The members of each group have an unconscious perception of their group-membership, called attitude. This communication is performed via the transfer functions S_{12}, S_{21}, S_{34}, and S_{43}. Further down, this attitude is called devotion, marked with D for all four S_{ik}'s. U_a and U_b are the unconscious communication blocks. Although we describe the unconscious with a simple symbol, we are aware that it is a full world in itself but related to the consciousness of the group members.
•• Due to the visible goal attainments y_a and y_b, a conscious relation of communication exists. Each partner, P_1 and P_2, perceives the goal achievement of the other group in his own manner and takes it into account, connecting it with his own goal u_i. The way he does that is

expressed with the magnitude factors V_i. The factors V_i are called aggression, marked with A for all four V_is'. For example, V_1y_b is added to u_1 together with $-x_1$. The notions *devotion* and *aggression* were defined in previous chapters.

•• The G_i-factors are magnification factors. They are the willpower with which each member of the system acts in order to realize himself, i.e., to attain u_i, but in addition these factors work into the whole group and the whole system.

•• The devotion within a group is, as before, characterized with the coupling factor $|S_{12}S_{21}|$, or $|S_{34}S_{43}|$, respectively, which have a negative sign. They indicate the union with which the group-members are in a bond with each other. The negative sign of a coupling factor comprises a negative feed-cross notion that *stabilizes* and reinforces the group's behavior.

•• The strength of aggression between the groups is characterized with the factors V_i, all being positive. A signal coming from an alien group is added to its own discrepancy with respect to its own goal, thus increasing the individual's own internal discrepancy ε_i.

•• A negative factor, $-|S_{12}S_{21}|$ e.g., results in a negative circular loop, called devotion or conciliation. Example: $-|S_{21}\text{-}G_2\text{-}F_2\text{-}S_{12}\text{-}G_1\text{-}F_1|$, whereas a positive product $+|V_4V_1|$ is part of a positive circular loop, called aggression, or hostility. Some notions are repeated here in order to show that they are indeed standard within our investigation's framework.

•• The goal attainment variables, y_a and y_b, do not have their own feedback signals. The groups as such (as also its members) do not know, do not want to know, where they stand and where they go as an ensemble. They are irresponsible about their overall own doing. Every partner is concerned only about his own action. He assumes - believes - that his devotion together with the group's behavior justifies what he does. But everyone in the group is extremely interested in what the other group has in mind and is doing.

As there are 30 parameters in Figure IX-1 for which the effect could be scrutinized, it is necessary to reduce the scope in order not to lose comprehensibility. Some restrictions, (IX-1), we impose on our investigation are the following, a) to h). Some of them are already incorporated in the specific model Figure IX-2.

a) For any specific system, all four willpowers will be equal:
$0 \le G_i \le 8$; $(i = 1,2,3,4)$; $G_1 = G_2 = G_3 = G_4 = G$.
b) $S_{ii} = +1$, i = 1, 2, 3, 4.
c) $u_1 = u_2 = u_a$; $u_3 = u_4 = u_b$; a common goal per group.
d) $x_1+x_2 = y_a$; $x_3+x_4 = y_b$; added group efforts.
e) Immediate or delayed devotional attitude factors:

$$S_{12} = S_{34} = \frac{-D}{(s+1)^m}; \; S_{21} = S_{43} = \frac{+D}{(s+1)^m}; \; (m = 0 \text{ or } 1).$$

f) Immediate or delayed aggressive factors:

$$V_1 = V_2 = V_3 = V_4 = \frac{+A}{(s+1)^p}; \; (p = 0 \text{ or } 1).$$

g) For Figures IX-5 and IX-6, all of the four individual's patterns of motion are equal:

$$F_i(s) = \frac{1}{(s+1)^3}; \; i = 1,2,3,4.$$

h) For Figures IX-7, Group G_a is faster than group G_b:

$$F_1 = F_2 = \frac{1}{(s+1)^2}; \; F_3 = F_4 = \frac{1}{(s+1)^3}. \qquad \text{(IX-1)}$$

The assumption b) means that S_{ii} is the internal unconscious information transfer. This transfer is identical to itself; thus, $S_{ii} = +1$; (i = 1, 2, 3, and 4). This far-reaching simplification was applied above as well.

The assumption g) means that all group members are functionally equal (equal patterns of motion). It also has to be remembered that with the dynamics $1/(s+1)^3$ the autonomous partner becomes unstable with $G \ge 8$.

•• The S_{ik} ($i \neq k$) are all of the same magnitude for a specific system. Further down they will be called D; D for devotion.
•• V_i ($i = 1, 2, 3, 4$) are all equal transfer factors of aggression, called A.
•• In general, all partners will be dynamically equal to $(s+1)^{-3}$. In one case, however, one group, G_a, has the dynamic pattern of $(s+1)^{-2}$. With $(s+1)^{-2}$ this group acts faster than the group with $(s+1)^{-3}$. What is the advantage of being faster? The question will be answered.

With these many restrictions a) to h), the generalized structure Figure IX-1 changes to the Figure IX-2. This figure will be applied for our purpose.

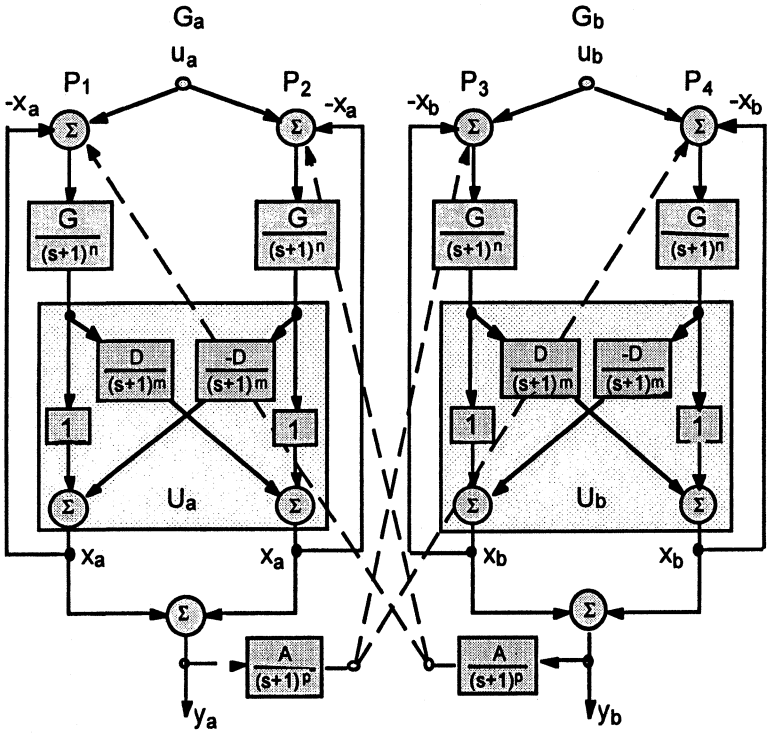

Figure IX-2: Specific model applied for the calculations.

Performed Steady State Calculations on Figure IX-2

The investigation comprises two cardinal questions to be answered:

•• Firstly: what is the goal attainment y_a and, due to symmetry of the model, y_b, as a function of G, D, A, u_a and u_b? This attainment is defined as the steady state value after a step input u_a and u_b, respectively, is imposed on the system. The attainments calculated in this manner, as we know, are time-independent (s = 0). They are end values. Terminal values are always of interest. They are the final reach. The two goals, u_a and u_b, will be considered either as independent (incompatible) or as antagonistic. For incompatible goals: for y_a the goal u_b will be 0, for y_b, the goal u_a will be 0; for antagonistic goals: u_a/u_b will be -1.

•• Secondly: With what magnitudes of G, D, and A does the dynamic system reach its limit of stability? Due to the requirement of homeostasis the limit of stability sets an upper limit to the willpowers G, devotion D, and aggression A and thus, to the attainment y_a (or y_b, respectively).

•• The steady state goal attainment $y_a(u_a)$ was found to be equation (IX-2):

$$y_a(u_a) = \frac{2G\left[(1+G)^2 + D^2G^2\right]\left[1+G(1+D^2)\right]}{\left[(1+G)^2 + D^2G^2\right]^2 - 4A^2G^2\left[1+G(1+D^2)\right]^2}; \ (u_a \text{ will be } +1) \quad \text{(IX-2)}$$

•• The next question to be answered is: What is the steady state effect of disturbance of one group's goal striving process based on the goal of the other group via the other group's behavior, i.e., when the goals are antagonistic: $y_a(-u_b)$, i.e., when $u_b = -u_a$, and $|u_a| = |u_b| = 1$? Equation (IX-3) will provide the answer.

$$y_a(u_b) = \frac{4AG^2\left[1+G(1+D^2)\right]^2}{\left[(1+G)^2 + D^2G^2\right]^2 - 4A^2G^2\left[1+G(1+D^2)\right]^2}; \ (u_b \text{will be } +1) \quad \text{(IX-3)}$$

In equation (IX-2) aggression A does not appear in the numerator. It appears, however, in the denominator and reduces it. Therefore,

aggression increases the goal attainment $y_a(u_a)$. Equation (IX-3) says that aggression increases the numerator and decreases the denominator. These are two facts that increase the group's own goal attainments with the influence of the goal of the other group if u_b is positive in regard to u_a.

However, if the goals are antagonistic, i.e., when the aggressive behavior becomes manifest, then equation (IX-3) carries a negative sign in regard to y_a. The result is $y_a(u_a)$-$y_a(u_b)$ given with equation (IX-4). It cannot be assumed that one group can strive toward its goal without being affected by the other group in the case of antagonism.

$$y_a(u_a) - y_a(u_b) = \frac{1+G(1+D^2)}{(1+G)^2 + D^2G^2 + 2AG\left[1+G(1+D^2)\right]} 2G \qquad \text{(IX-4)}$$

A high level of aggression ruins both groups' attainment (all G's equal!). In addition, equation (IX-4) indicates for positive willpowers, $G > 0$:

- growing D increases the value $y_a(u_a)$-$y_a(u_b)$ and
- growing A decreases the value $y_a(u_a)$-$y_a(u_b)$.

But growing devotion D has less effect than growing aggression A. These effects will be illustrated in Figure IX-4.

We may now ask the question of what is going to happen to the two groups if in manifest aggression, both groups' willpower grows great. With $G = \infty$, equation (IX-4) results in the expression (IX-5).

$$y_a(u_a) - y_a(u_b)\,|_{G \to \infty} = \frac{2}{1+2A} \qquad \text{(IX-5)}$$

The more aggression A, the more there will be enemy destruction and as well the more self-destruction!

The results of the following calculations are now depicted:

- Steady state goal attainment $y_a(u_a) = y_b(u_b)$ of equation (IX-2) Figures IX-3a, b, and c. The willpower G is variable; A, the aggression,

is parameter: A = 0; 0.2; 0.4; 0.5; 0.75; 1. - D, the devotion, is changed in three steps: D = 0, Figure IX-3a; D = 0,5, Figure IX-3b; D = 1, Figure IX-3c. It has to be noted that for $y_a(u_a)$, $u_b = 0$; and for $y_b(u_b)$, $u_a = 0$.

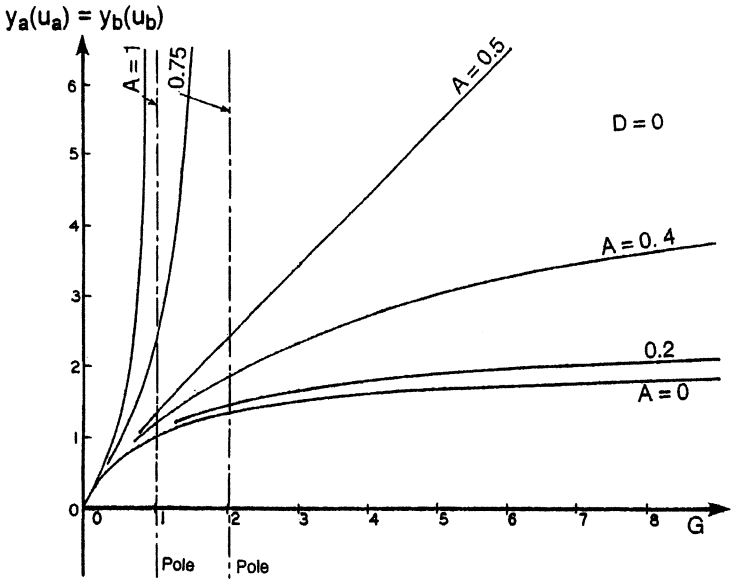

Figure IX-3a: Goal attainments $y_a(u_a)$ or $y_b(u_b)$ as a function of the willpower G. Devotion D = 0; Aggression A is parameter.
For $y_a(u_a)$, $u_a = 1$, $u_b = 0$, and for $y_b(u_b)$, $u_b = 1$, and $u_a = 0$.

• Figure IX-4: Steady state goal attainments with the effect of the opposing group, $y_a(u_a)$-$y_a(u_b)$; equation (IX-4); $u_a = 1$, $u_b = -1$.

Notes for stability limits, Figures IX-5, IX-6, and IX-7:

• Figure IX-5: Each partner is of 3rd order fast, i.e., $F_i = 1/(s+1)^3$. There is a delay in the A-channels: $V_i = A/(s+1)$. Devotion is instantaneous.

• Figure IX-6: Each partner is of 3rd order, $F_i = 1/(s+1)^3$. There is a delay in the D-channels: $S_{21} = S_{43} = D/(s+1)$, $S_{12} = S_{34} = -D/(s+1)$. But aggression A is instantaneous.

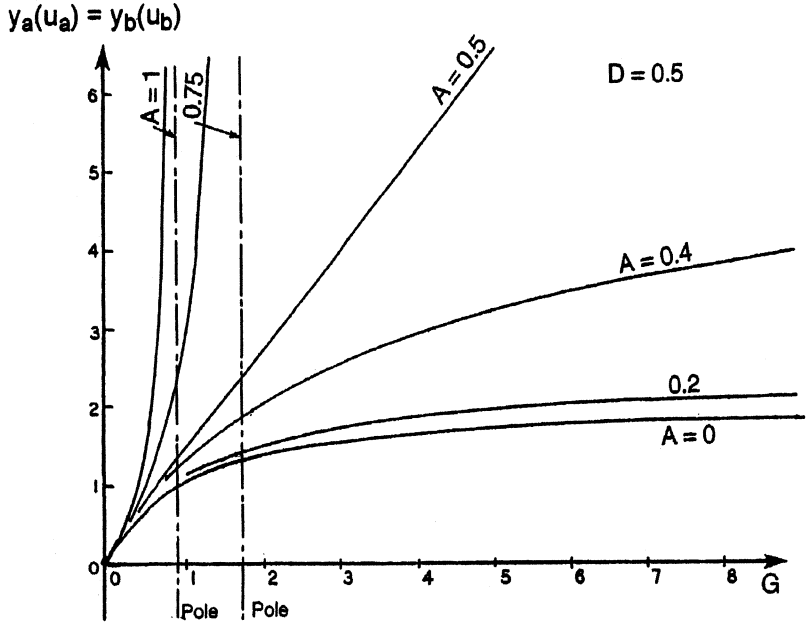

Figure IX-3b: Goal attainments $y_a(u_a)$ or $y_b(u_b)$ as a function of the willpower G. Devotion D = 0.5; Aggression A is parameter. For $y_a(u_a)$, $u_a = 1$, $u_b = 0$, and for $y_b(u_b)$, $u_b = 1$, and $u_a = 0$.

• Figure IX-7: In group G_a each partner is of 2nd order, i.e., $F_1 = F_2 = 1/(s+1)^2$. Each partner of the other group is of 3rd order, i.e., $F_3 = F_4$

$=1/(s+1)^3$. Therefore, G_a is (inside the system) faster acting than G_b. There is no delay, neither in channels A nor in channels D.

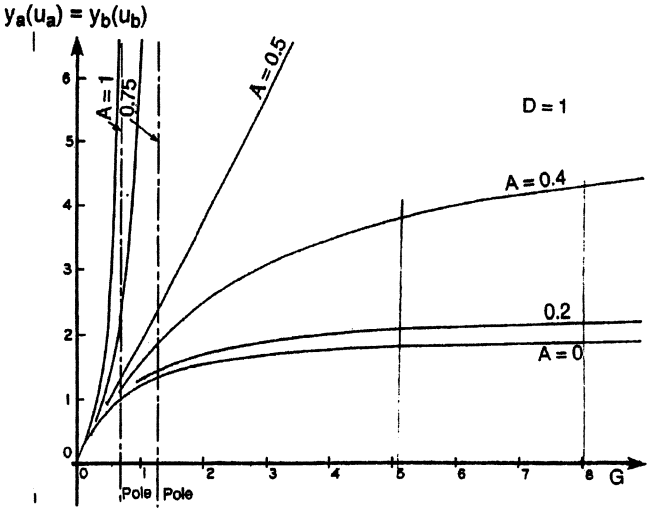

Figure IX-3c: Goal attainments $y_a(u_a)$ or $y_b(u_b)$ as a function of the willpower G. Devotion D = 1; Aggression A is parameter. For $y_a(u_a)$, $u_a = 1$, $u_b = 0$, and for $y_b(u_b)$, $u_b = 1$, and $u_a = 0$.

Discussion of the Results

First we look at goal attainments Figure IX-3: Figures (IX-3a), (IX3-b), and (IX-3c). The indication is that the goal attainments increase with increasing devotion D, increasing aggression A, and increasing willpower G. Data in Table IX-1, taken from Figure IX-3 illustrates the fact: If G, D, and A increase, $y_a(u_a)$ and $y_b(u_b)$ will increase.

With A = 0 and G = ∞, the limit is $y_a(u_a) = y_b(u_b) = 2$. This is so because in the group (in both groups) there are two partners with their

added attainments of the value 1 each. - The step input u_a (or u_b) is of the amplitude 1 (or 100%).

For A = 0.5 and G = ∞, the values $y_a(u_a) = y_b(u_b)$, tend to ∞. Indeed, no social system has a G of ∞. The stability limits found in the following three Figures IX-5 to IX-7 will solve the problem of G being limited.

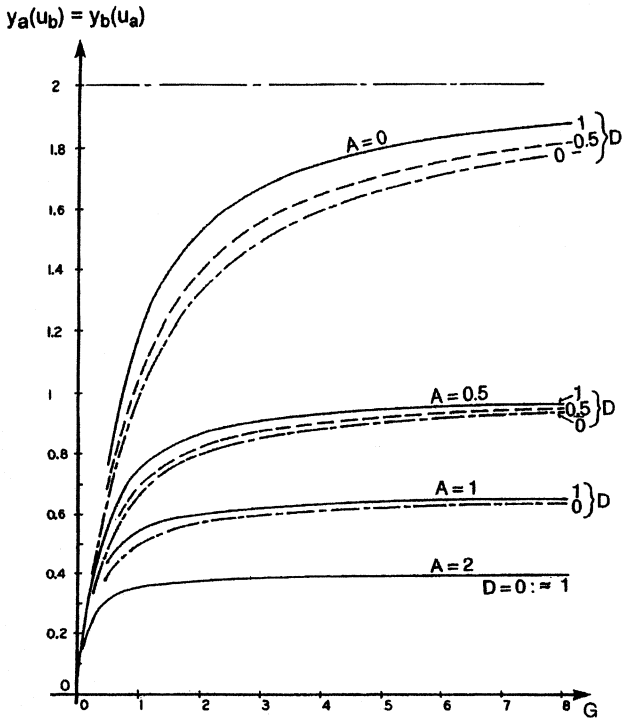

Figure IX-4: Goal attainments $y_a(u_a)$ - $y_a(u_b)$ or $y_b(u_b)$ - $y_b(u_a)$ with devotion D = 0, 0.5, and 1, and with aggression A = 0, 0.5, 1 and 2.

With A > 0.5 poles occur with G's still of possible social reality. If G grows larger than the value for which A creates poles, then attainments become negative. This fact, the flipping over from positive to negative values reminds us of the saying attributed to Napoleon: *Du sublime au ridicule il n'y a qu'un pas!* It seems that magnitudes of aggression higher than 0.5 create *Napoleonic transgressions.* Negative attainments are not shown here.

Figure IX-3 shows results of behavior of one group which is undisturbed by the other group. Behavior like this can be interpreted as a situation where the enemy has no prospect of winning a fight, or does not have the legal right to attack. But under the assumption that the opponent attacks and has the opposite goal in mind, then Figure IX-4 shows results.

Figure IX-4: This figure demonstrates that aggression in antagonism is mutual destruction. With A = 0, the curves are the same as in Figure IX-3 (note the different scales!). Now aggression has the opposite effect than in Figure IX-3. With A = 0.5 the final attainments (G = ∞) are no longer ∞, but only 1. For A = 2, G = ∞, $y_a(u_a)$ is only 0.4. And at high aggression, the influence of devotion becomes negligible, practically zero. In abhorrence-situations, aggression is domineering and is the cardinal outcome.

Table IX-1: Increase of the goal attainment, $y_a(u_a) = y_b(u_b)$, with increasing G, D, and A.

	Fig. (IX-3a)			Fig. (IX-3b)			Fig. (IX-3c)			
G	A	D	$y_a(u_a)$	A	D	$y_a(u_a)$	A	D	$y_a(u_a)$	
2	0.5	0.0	2.4	0.5	0.5	2.6	0.5	1.0	3.8	
										increase of G & D
4	0.5	0.0	4.4	0.5	0.5	5.2	0.5	1.0	7.8	
2	0.2	0.0	1.45	0.2	0.5	1.5	0.2	1.0	1.7	
										increase of D & A
2	0.5	0.0	2.4	0.5	0.5	2.8	0.5	1.0	3.8	

It becomes obvious that counteraction ($u_b = -u_a$) is necessary for one group if a neighboring group's behavior becomes antisocial or belligerent.

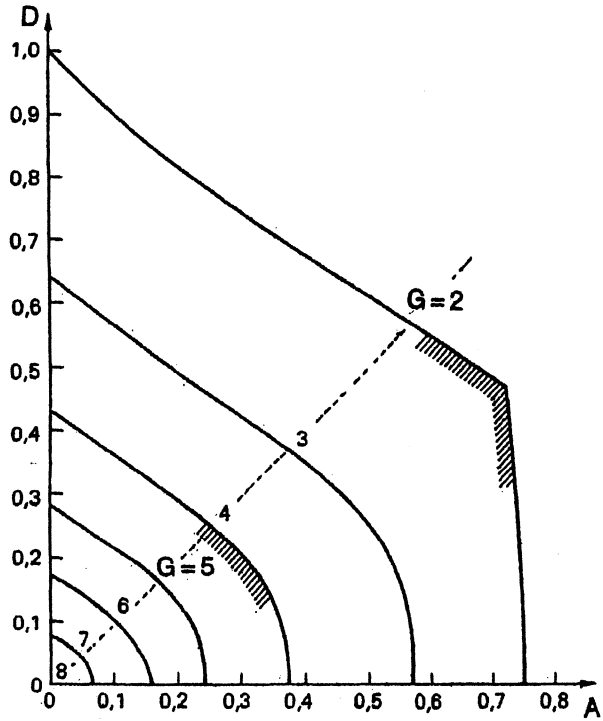

Figure IX-5: Limits of stability with D and A as variables and with the willpower G as parameter. Instant devotion D, delayed aggression A.

As aggression is a condition sine qua non for survival, the aggressor will come. So, be prepared for $y_a(u_a)$-$y_a(u_b)$. *Si vis pacem, para bellum. Qui desiderat pacem, praeparet bellum:* If you want peace, prepare and be ready for war, for $y_a(u_a)$-$y_a(u_b)$. The greed for social and political willpower is overwhelming. We may in this context

mention the Christian Lord's manifestation in St. Matthew 28/18: *All power is given unto me in heaven and in earth.*

Table IX-2: Comparison of three goal attainments. Data from Figure IX-5.

A	D	G	$x_1(u_1)$ autonomy	$y_a(u_a)$	$y_a(u_a)$-$y_a(u_b)$
0.165	0.165	5	0.83	1.81	1.31
0.37	0.37	3	0.75	2.27	0.98
0.86	0.86	1	0.50	100	0.58

Figure IX-6: If devotion becomes slow (S_{ik} = D/(s+1), V_{ik} = A) compared with aggression - or better, if aggression becomes fast compared to devotion -, the stability areas grow in favor of devotion. Taking the parameter G = 5 - then for D = 0.8 and A = 0.3 the attainment becomes $y_a(u_a)$ = 2.87 - without disturbance, or not giving the enemy time to react, (See Figure IX-5, or Table IX-2 for G = 5: $y_a(u_a)$ = 1.81). This value shows that quick aggression brings great attainment. In this case, Figure IX-6, it is no longer justified to make A = D because devotion can be very high when fast aggression sets in. This is in war-situations always the case. We have here the proverb: *A bold attack is half the battle.*

Figure IX-7: In this last set of curves one group, G_a, has faster acting members than the other group, G_b. [The total system (G_a with G_b) has, indeed, only one speed.] Figure IX-7 has a tremendously larger area of stability than Figure IX-5. Comparison of data with G = 4 can be seen in Table IX-3.

The faster group is the more intelligent one. We know from former chapters that in an autonomous state the fast unit reaches its goal not only faster but also better than taking place in the more slowly acting group.

The point in Table IX-3 is the increase of devotion and of attainment with no disturbance from any other group. The attainment $y_a(u_a)$ of the fast group is 26.16. In the case, however, when there is counteraction by another group, the high devotion does not mean much anymore. The effect of the aggression is then enormously domineering. The groups become fanatic and kill each other: $y_a(u_a)$-$y_a(u_b)$ = 0.11. The fast group has to attack before the enemy group is ready with a counterforce.

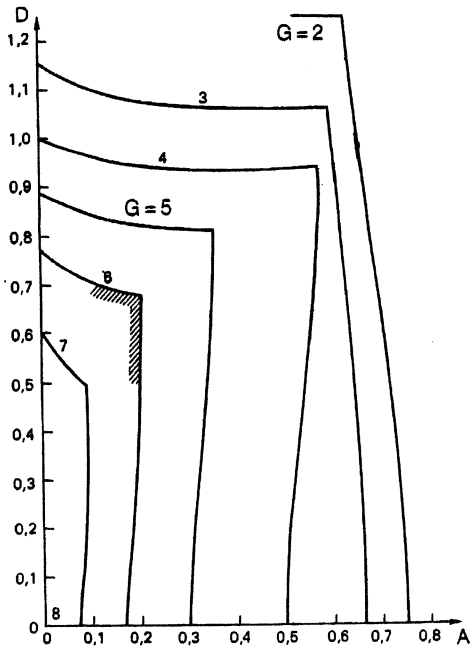

Figure IX-6: Limits of stability with D and A as variables and with the willpower G as parameter. Delayed devotion D, instant aggression A.

One group acting faster than the other involves the circumstance where the faster acting group anticipates victory over the slower acting

group, leading to euphoria. The slower group, on the other hand, falls into the state of forgoing survival, i.e., of agony. Both facts stimulate high group devotion. One group sees itself as winner, the other fights for its survival.

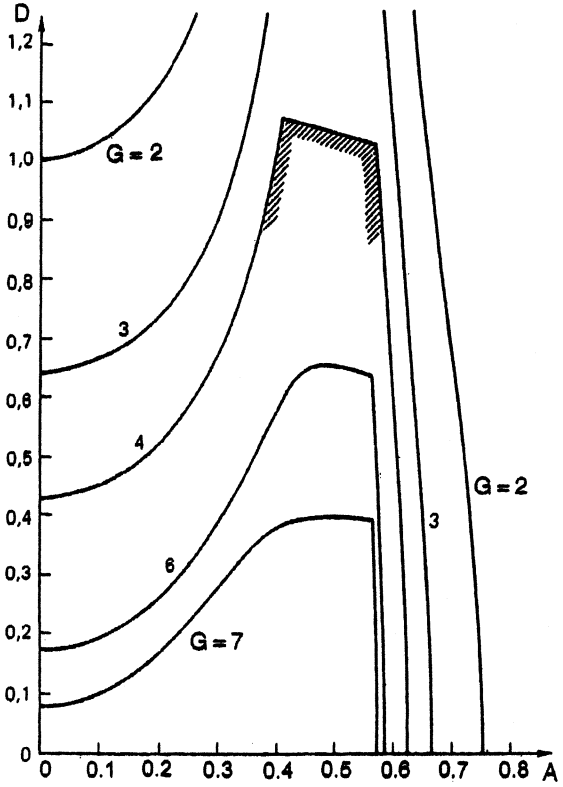

Figure IX-7: Limits of stability with D and A as variables and with the willpower G as parameter. Group G_a acts faster than group G_b.

Summary

Individuals in social autonomy who have a weak willpower for self-realization (small G) and, therefore, little self-attainment x(u) often tend to form groups which turn into aggressive behavior toward other groups. Members of such groups can be very devoted to each other within their group because togetherness renders strength. Animals have the same tendency. Due to the feeling of being socially underprivileged such groups often turn quickly into aggressive behavior (persecuted religious denominations and sects, gangs, political parties, racial groups, weak nations). The lower the self-value G of the individual, the larger the group-internal devotion D builds up, and the heavier the aggression factor A becomes which develops between groups - and the better such groups achieve their goal - if no balancing counter action from opposing groups occurs.

Table IX-3: Comparison of the goal attainments for G = 4 of two cases, both without delay in A and D, but with different group velocities.
a) Both groups of the third order; b) G_a is faster than G_b.

	A	D	G in autonomy	$x_a(u_a)$	$y_a(u_a)$	$y_a(u_a)-y_a(u_b)$
a)	0.55	0.35	4	0.80	8.26	0.107
b)	0.55	1.00	4	0.80	26.16	0.11

With counter action of an opposing group the domineering aggression ends in mutual destruction of both if they have equal will (equal power G) to fight each other. It is not shown that in a discord between two groups of different willpowers the group with greater willpower destroys the weaker group. But this is almost self-evident after the investigation of a parallel structure, the hostility dualism of single individuals, and leads to the fact: the stronger ruins the weaker.

Individuals with high G-values want to realize themselves as independent beings. They are not interested in group-agglomerations.

Groups with individuals who exert high G-values make the collective easily unstable and groups can break off.

The cry of weak people is: *Liberté, égalité, fraternité* - and the revolution moves forward. It is *égalité* in groups and *fraternité* in devotion that leads groups into attack and warfare. Nature still supplies us - human or animal - with a rapacious animalistic part in our brain in order to give us the weapon for survival.

To be said as well: Deprived people who have no chance to develop their self-realization and to become independent individuals have to unify and fight: *Conjunctis viribus!* - With united forces!

To give an idea of the functional complexity of the structure Figure IX-1 one might list the number of loops that can be traced in this figure. The number is 42. These loops through which information flows are indicated with the Σ-points in Figure IX-8. Knowing how demanding the grasp of the concept of one single continuously functioning loop is, one might estimate the immense complexity occurring in social interrelations. And being a single loop, an individual, one cannot perceive the involvement of which one is a part. There is no way ever one can understand a system in which oneself and more individuals are embedded.

The 42 loops in Figure IX-8:

1-5-1	6-9-4-7-10-2-6	1-6-2-5-9-3-8-4-7-10-1
2-6-2	6-9-4-8-10-2-6	1-6-2-5-9-4-7-3-8-10-1
3-7-3	6-9-3-7-10-2-6	1-6-9-4-7-3-8-10-2-5-1
4-8-4	6-9-3-8-10-2-6	1-6-9-3-8-4-7-10-2-5-1

3-8-4-7-3	1-5-9-3-8-4-7-10-1
1-6-2-5-1	1-5-9-4-7-3-8-10-1

1-5-9-3-7-10-1	1-6-2-5-9-3-7-10-1
1-5-9-3-8-10-1	1-6-2-5-9-3-8-10-1
1-5-9-4-7-10-1	1-6-2-5-9-4-7-10-1
1-5-9-4-8-10-1	1-6-2-5-9-4-8-10-1

1-6-9-3-7-10-1
1-6-9-4-7-10-1
1-6-9-3-8-10-1
1-6-9-4-8-10-1

5-9-3-7-10-2-5
5-9-3-8-10-2-5
5-9-4-7-10-2-5

5-9-4-8-10-2-5

1-6-9-4-7-3-8-10-1
1-6-9-3-8-4-7-10-1
1-6-9-4-7-10-2-5-1
1-6-9-4-8-10-2-5-1
1-6-9-3-7-10-2-5-1
1-6-9-3-8-10-2-5-1

2-6-9-3-8-4-7-10-2
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2-5-9-4-7-3-8-10-2

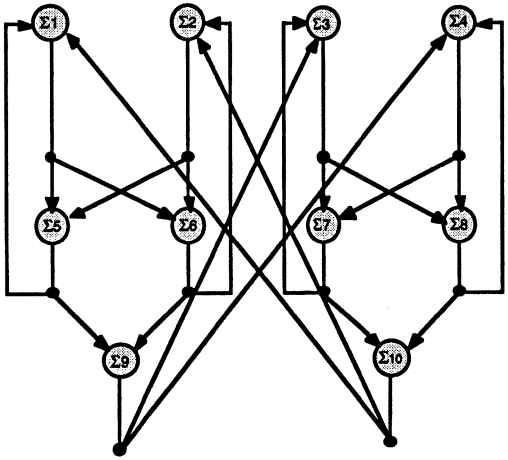

Figure IX-8: Skeleton of Figure IX-1 for the loop demonstration.

X. The Loop Structure of the Mammalian Brain

Surprisingly it was found that the architectural structure of the mammal's brain, i.e., its neurological control structure, is very similar to the structure of technical, industrial, multiply controlled organizations. The structural element of the central nervous system of mammals is represented in Figure X-1. The nerve fibers, known as dendrites D, transmit stimuli that were sent out by neurons. These signals are manipulated when passing through the synapse S. The neuron N collects the incoming signals (one neuron up to several thousands) and manipulates its contents again (this manipulation is still unknown). Only one information channel, called axon A, offers an output from the neuron. This axon branches into multiple dendrites leading to other neurons.

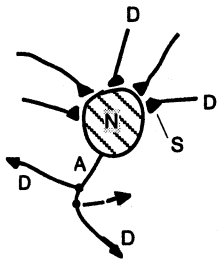

Figure X-1: Structural element of the central nervous system.

An ensemble structured in the described way is presented in Figure X-2. The heavy line forming a circular loop and including two neurons (N1 and N2) is considered in our view an organizational unit. The signal u(t) coming in through an efferent fiber can mean a request for action for the ensemble; the signal x(t) can be considered the response upon u(t); and the signal d(t) is for example, a disturbance signal which is not directly related to the task of this loop. This brief description is intended in principal to parallel a technical control loop.

The structure of a technical control loop is diagrammed in Figure

X-3. Here, the task is to produce x(t) upon an order u(t), despite the disturbance d(t). C(t) is the controller which leads the process S(t) towards the performance u(t).

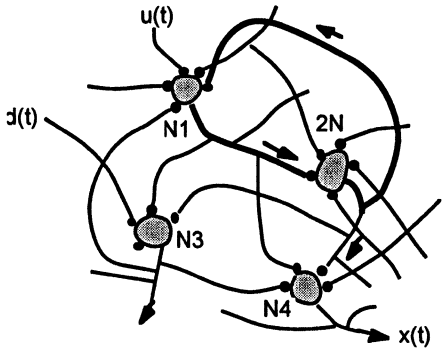

Figure X-2: Network of four elements Figure X-1.

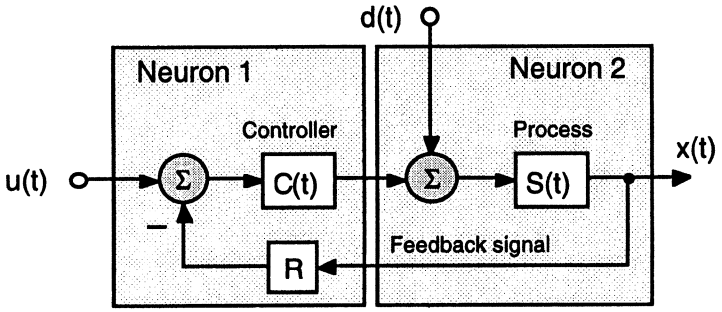

Figure X-3: Basic structure of a technical control loop.

By investigating the structure of technical multiple control systems of higher complexity it becomes apparent that in any particular area within the system an arbitrary number of channels – each channel carrying its individual information – is led into one operational block where this information undergoes functional treatment, and that the operational block has one outlet of information through one channel

only. This channel, then, branches into an arbitrary number of leads, transporting this information in full, to other blocks. This situation is illustrated in Figures X-2 and X-4. The repeated architecture is: two to several variables are summed up into a Σ-point to form one output variable. After passing through a transfer function, this output variable leads to several transfer functions of which the output goes to other Σ-points. Figure X-4 illustrates this principle, called an operational block, (ΣK).

It is of interest to determine the number of closed loops that can be traced within an arrangement of a large system and to take this number as a measure of the complexity of such a system - being aware that the dynamics is not included yet, which would increase the complexity to a multitude.

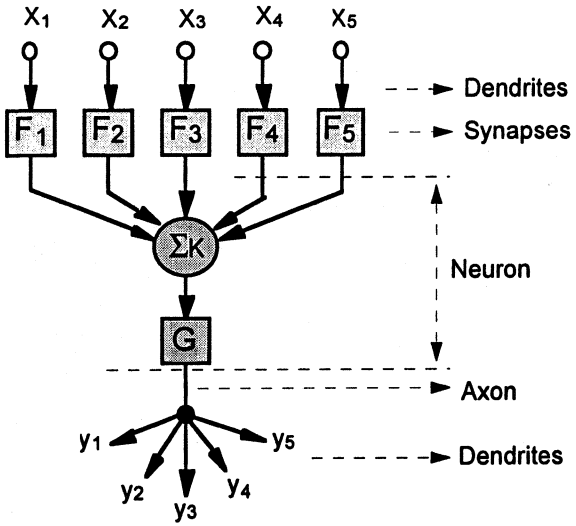

Figure X-4: The operational block (ΣK), Figures A-III-2 and A-III-4.

The brain structure of mammals, as shown in Figure X-1 (simplified), has about the same architecture as shown in Figure X-4, but where the

transfer function G and the Σ–point are packed into a neuron, as indicated in Figure X-4.

In order to derive a mathematical formula for the number of closed loops within a structure, a generalization is necessary. Referring to Figure X-4, this generalization is based on the following:

Every output y_i leads (via a transfer function) to all other Σ–operational blocks (ΣK). As an example, a system with three operational blocks (ΣK), $\Sigma 1G_1$–$\Sigma 2G_2$–$\Sigma 3G_3$, looks like Figure 5. It renders five individual loops, namely 3 loops containing 2 operational blocks ($F_{12}\Sigma 1G_1$-$F_{21}\Sigma 2G_2$, $F_{13}\Sigma 1G_1$-$F_{31}\Sigma 3G_3$, $F_{23}\Sigma 2G_2$-$F_{32}\Sigma 3G_3$) and two loops containing three such blocks: ($F_{12}\Sigma 1G_1$-$F_{31}\Sigma 3G_3$-$F_{23}\Sigma 2G_2$, and $F_{13}\Sigma 1G_1$-$F_{21}\Sigma 2G_2$-$F_{32}\Sigma 3G_3$).

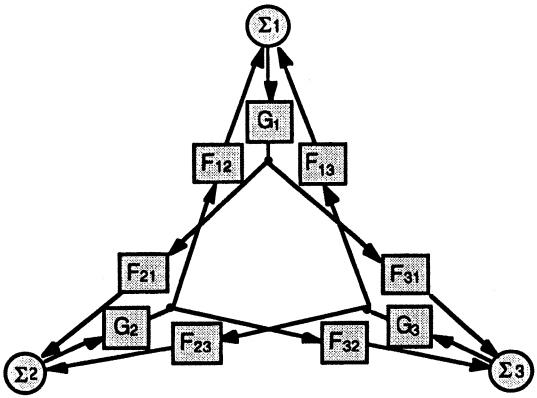

Figure X-5: The three-neuron system.

In the system with four blocks (ΣK), i.e., in a brain of 4 neurons, already 20 loops can be counted, loops which contend 2, 3, and 4 Σ–

points. Schematically the system looks like Figure X-6. The 20 loops can be shown with more clarity with Figure X-7.

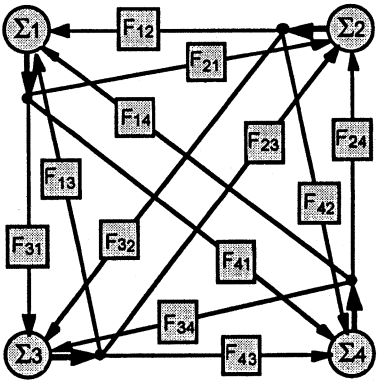

Figure X-6: The 4-neuron brain with four (ΣK).

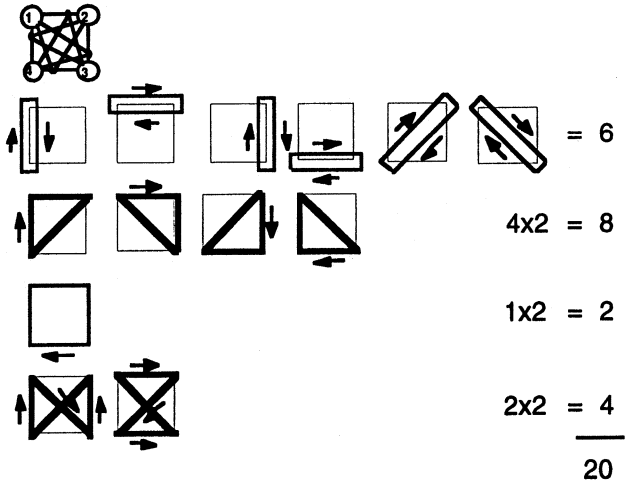

Figure X-7: The 20 loops in a generalized 4-(ΣK)-system.

The formula to determine all possible loops L(n) for a brain of n neurons was found to be the expression (X-1)

$$L(n) = n! \sum_{k=0}^{n-2} \frac{1}{k!(n-k)}; \quad n \geq 2. \qquad (X-1)$$

The application of the formula (X-1) for n = 12 is

$$L(12) = 12! \left[\begin{array}{l} \frac{1}{0!12} + \frac{1}{1!11} + \frac{1}{2!10} + \frac{1}{3!9} + \frac{1}{4!8} \\ + \frac{1}{5!7} + \frac{1}{6!6} + \frac{1}{7!5} + \frac{1}{8!4} + \frac{1}{9!3} + \frac{1}{10!2} \end{array} \right] = 119,481,284$$

Table X-1 shows the increase of loops L(n) with an increasing number n of neurons; $2 \leq n \leq 18$.

Table X-1:

n	L(n)
2	1
3	5
4	20
5	84
6	409
7	2,365
8	16,064
9	125,664
10	1,112,073
11	10,976,173
12	119,481,284
13	1,421,542,628
14	18,348,340,113
15	255,323,504,917
16	3,809,950,976,992
17	60,683,990,530,208
18	1,027,542,662,934,897

Figure X-8 shows the generalized interconnection of 12 neurons from which 119,481,284 loops can be extracted.

With formula (X-1) it can demonstrate that a brain of 30 neurons which are generally interconnected to each other - each output of every neuron leads to all other 29 neurons - would lead to such a number of loops that if each loop would given the area of 1 square millimeter to form a carpet, this carpet would cover the surface of the earth 50,000,000,000 times, and, to give some perspective, an ant already has a brain of 60,000 neurons!

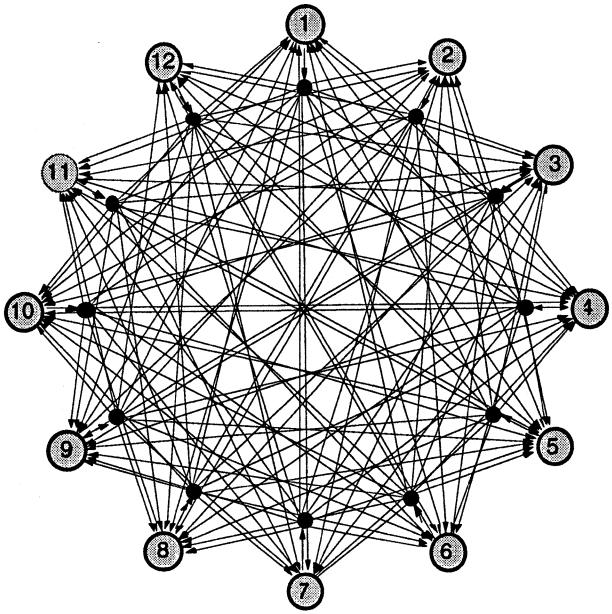

Figure X-8: 12 interconnected neurons.

The human brain, indeed, does not have a mere 60,000 neurons but approximately 10^{15}. Without assuming a generalized interconnectedness – which could mean complete chaos – but allowing

different "transfer functions" per neuron in different individuals and specific interrelations among neurons in different individuals, a still unimaginable amount of different beings can occur, thus, resulting in different behavior. From such a standpoint, it can be said that there will never be two equal human beings (not even after cloning) on earth, and the potential for differentiation is far beyond our perception.

Another amazing fact is the following. Adding one neuron to a brain of 30 neurons would create a number of additional loops close to the number 265,252,859,812,191,058,636,308,480,000,000 multiplied by e. The number e is the basis of the natural logarithm; (e = 2.718).

The immense diversity in nature is based on the combination of relatively few elements and their concerted dynamic interaction. This can be seen here as well as in the combination of the DNA elements.

Closing Remarks

Our stroll through dualism indicated that many more situations of social behavior could be figured out from the basic model Figure V-1. We scrutinized mainly one bilateral interconnection, $S_{12}\delta_2$ and $S_{21}\delta_1$, the unconscious information exchange, called the attitude or, in a broader sense, the mind two partners harbor for each other. In one further case, in Chapter IX, a further bilateral interaction was explored, the mutual observation of two groups on the basis of their attitude.

One outstanding aspect we brought to light is that in the amity structure the partner (say P_1), who creates the negative sign for the incoming information (that is $-S_{12}\delta_2$), must only flip his attitude from (-) to (+), he only must be unconsciously contradictory, he only must change his mind, and amity (- +) turns momentarily into enmity, (+ +). It is as simple as that to change friendship into hostility. For this effortless reversal of position these proverbs come to mind:

The closest friends, the worst enemies.
The closer the friendship, the bitterer the enmity.
Better an open enemy than a false friend. (antagonistic goals)
Deux oiseaux sur le même épi ne restent pas longtemps amis.
Dévote d'église, diable de maison. (Changing the mood on the way home!)

A further possible track could widen the topic by applying anticipation to the attitude relation between the two partners and not just within a partner for his own purpose, as has been done here. That is to say the ability exists, although it is very rare, that a person feels intuitively the unconscious of another person. A person then could sense, could anticipate, what his partner was building up and more. We could assume that dogs have such ability. But a person's demonstration of such an aptitude cannot be understood by another persons' consciousness because one person's unconscious reaches into the unconscious of another person. One could say that two individuals make in such a case all together four interacting brains; two brains as the consciousness of the two partners, and two brains as

their unconscious. According to Figure X-6 such a system would already create 20 basic loops that exchange information among them.

A further meaningful perspective could be worked out by varying the magnitude of the feedback signal R_1 in Figure II-1, the awareness that is the subjective evaluation of one's own momentary achievement. We only used $R_1 = 1$ for the correct evaluation of the momentary status x_1. A radical, fanatic politician might have a poor awareness of what he does and achieves, ($R_1 < 1$); a person suffering from depression, on the other hand, may be over sensitive in the perception of his awareness, an over evaluation ($R_1 > 1$). The person with $R_1 < 1$ would be called hypersensitive, the person with $R_1 > 1$ the hypersensitive being.

In the basic social behavior of human beings and animals, equal relative simple modes, as demonstrated herein, can be observed. The laws of nature are the same all over on earth and in space whether we accept or reject them on the grounds of ethical or religious claims: *Naturam expellas furca, tamen usque recurret;* Drive away nature, it comes back. (We know that even plants exchange information between each other.)

It became apparent that explaining the human being in mathematical, system-theoretical terms requires extreme care in making analogies. And the path to find such analogies is rather burdensome and arduous. As - in addition - our undertaking is interdisciplinary, the fact can and will occur that scientists defend their own discipline and reject rigorously invasion into their territory. Such defense is a most natural behavior: Defense of one's own domain. On the other hand, the quantitative laws of nature can be found only by bridging the gap between dominions and jurisdictions as they became established by separated scientific disciplines. Observation of life-situations with the physical-mathematical background for their formulation is a means of overcoming verbal, subjective descriptions of the so-called soft sciences, the arts and humanities. Our attempt to break into the socio-psychological domain with physical-mathematical formulization might be equivalent to crossing the Rubicon.

Nonetheless, *a line of thinking developed in one branch of science can very often be applied to the description of events apparently quite different in character;* [1, page. 36]. The analogy made herein is the functional patterns of multiple automatic control terms in the technical realm to conventional social, interacting processes with the involvement of the mind.

To transfer a purely conventional image of social situations into a mathematically termed theory is a rather difficult task and requires some endurance and also a change of thinking. In addition, as the reader may have found out: considerable amount of work yields relatively little result. In general, it is much easier to deal with sounds or emotionally loaded impressive expressions than with hard physical statements. What, for example, a strain of labor it was to build up the details of Chapter IX - for author and reader! And the fruits are not at all tremendous.

Models with simple linear elements can already create a huge variety of possible social circumstances. And each new component introduced into an elementary structure uncovers new facts. – Throughout nature, it is the combination of relatively simple elements and their interaction that form incomprehensible structures. When it comes to the functioning over time of such structures, unfortunately only mathematics helps.

A few additional applications in this regard may be mentioned with other publications [6, 7, 8, 9 and 10].

Although our first attempts made in this book, to tap the laws of the behavioral world, may look simplistic or even somehow simpleminded, it is a challenging and fascinating experience. What we described in a rational way operates irrefutably in life, day by day - on the earth and outside of it - because there is only one Nature.

Up to the present time, how the world works has been explained in philosophical, psychological, social, and religious terms. And these explanations have been formulated verbally, with the available tool of languages. When the physical-functional content of nature still was unknown, descriptions of social phenomena had to be expressed on the basis of observation and reasoning. The methods were pictorial,

narrative. The real truth, however, lies deeper than in what can be expressed and described with verbally constructed examples on the basis of observation. The complexity of which reality is made of is so tremendous that innumerable doctrines in philosophy, religion, psychology, and sociology were and still can be created - but they do not reach the core. The enormous functional entanglement has created different concepts, dogmatic and ideological, over millions of years up to the present time.

But there is the conviction surfacing now that there is only one set of physical-natural laws in the whole wide universe where all matter (and energy) is operating within their basic forms and in their innumerable combinations. Although this set is indeed extremely involved and in fact, unlimited for our perception, it is some of these laws we have tried herein to bring up and to catch, and to come in this way a step closer to the understanding of the world dynamics of which we are part.

When modeling human behavior with abstract mathematical models, there are stop signs. Care must be taken by marking out the limits of the model's applicability. As we are limited in perceiving the world around us with our five senses and their narrow range, so is a model to be restricted in its validity. - Very probably there are more than five human senses operating crisscross among us. One is, and we made formal use of it, the unconscious perception of the neighbor's attitude.

It must have become obvious that we, with the philosophy of our presentation herein, do not want to be the image of a personalized God. Such a perspective is by far too naive for the world of today. On the other hand, the physical world is so enormously difficult to perceive that a tolerant acceptance is necessary for symbolism and mythology so that the whole range of people can find an explanation for life on both sides of time: before and after death. For us, as we worked out a few elementary social facts, the enormous effort needed to discover nature's law became well apparent.

Because proverbs are either universal truths or truths which hold within a large category of specific behavioral patterns, we have paralleled our findings with many proverbs. Finally it has to be

emphasized that we did not want to make inventions. The purpose of this book is to show that there are physical laws that govern our behavior.

And finishing with the words of Bertrand Russell: *What was most remote from ourselves was first brought under the domain of law, and then, gradually, what was nearer: first the heavens, next the earth, then animal and vegetable life, then the human body, and last of all (as yet very imperfectly) the human mind;* [11, page 49].

Appendix I

General formula for Figure V-1.

Formula (A-I) can be used for the calculation of the goal attainment $x_1(u_1)$ of Figure V-1, with $u_1 = 1$.

$$x_1 = \frac{S_{11}(1+G_2F_2S_{22}) - G_2F_2S_{12}S_{21}}{(1+G_1F_1S_{11})(1+G_2F_2S_{22}) - S_{12}S_{21}G_1F_1G_2F_2} G_1F_1 \qquad (A-I)$$

Appendix II

Characteristic equation of Figure V-9.

The feedback transfer functions are called R_1 and R_2 instead of -1 as Figure V-9 shows.

$$
\begin{aligned}
&1 - G_1F_1S_{11}R_1 - G_2F_2S_{22}R_2 - G_1A_{21}S_{12}R_1 - G_2A_{12}S_{11}V_{21} \\
&- G_2F_2S_{12}V_{21} - G_1F_1S_{21}V_{12} - G_1A_{21}S_{22}V_{12} - G_2A_{12}S_{21}R_2 \\
&+(G_2F_2S_{12}V_{21})(G_1F_1S_{21}V_{12}) \\
&+(G_2A_{12}S_{11}V_{21})(G_1A_{21}S_{22}V_{12}) \\
&+(G_1A_{21}S_{12}R_1)(G_2A_{12}S_{21}R_2) \\
&+(G_1F_1S_{11}R_1)(G_2F_2S_{22}R_2) \\
&-G_1G_2F_1F_2S_{12}S_{21}R_1R_2 \\
&-G_1G_2A_{12}A_{21}S_{11}S_{22}R_1R_2 \\
&-G_1G_2A_{12}A_{21}S_{12}S_{21}V_{12}V_{21} \\
&-G_1G_2F_1F_2S_{11}S_{22}V_{12}V_{21} \qquad = 0 \qquad \text{(A - II)}
\end{aligned}
$$

The first two parts of equation (A-II) are the characteristic elements (the characters) of the partners P_1 and P_2. These are the elements G_1, F_1, S_{11}, and R_1 for P_1; G_2, F_2, S_{22}, and R_2 for P_2. All remaining 14 parts in (A-II) are due to the interactions of the two partners. It becomes obvious that a social system is not just in some way the sum of its parts; but it is rather the intricate involvement of its components in a tremendous complexity.

Appendix III

We owe the reader an explanation of why the concept Figure II-1 was taken as the analogy for a social being. The foremost question to be answered might be: How was the unconscious in this figure established? Can it be validated? In order to approach this parallelism, we give this Appendix III the subtitle

The Technical Unconscious,

and set this technical unconscious in its functioning equal to that of the human unconscious. This daring comparison was born within the realm of working with multiple automatic control systems in engineering. Dealing with such control systems, one is confronted with extremely intricate structures. Multiple automatic controls means that in a plant, that is to say within a defined system in a factory, several variables have to be controlled continuously, automatically, simultaneously. Within such a multi-controlled plant a tense exchange of information happens between the controlled variables. Such information, and the channels through which the information passes, are given by nature. It is a mutual dependency among physical quantities.

As a simple example of the term *given by nature*, we mentioned the density of gas and its temperature in a hermetically closed vessel. When the gas becomes heated, the pressure in the tank increases. Another natural law is gravity. We cannot avoid the fact that an object falls toward the center of our planet when we drop something. It is the physical laws that determine such happenings. Were such laws of dependency here before or only after the big bang? Or were they created at the time of the big bang? We do not know. Physical laws are here and everywhere, and they have to be obeyed and dealt with. - Even the way we handle physical laws has to be done bearing in mind the physical laws within us!

When machines are built, their design is based on the steady state behavior of the machines forming the plant, that is, the state when the machines work under required specifications. Energy balances are considered on the basis of known, physical laws. Performance of mechanical, electrical and chemical operations have to be studied and

designed on the drafting board with appropriate calculations according to the properties of the material and the required data of the plant's expected operation.

In order to put our story in concrete terms, we look at a dual-control system of a power plant in a factory, a plant that produces primarily electricity. The plant in question is not an electrical power plant that produces solely electricity. It is the power plant of a manufacturing enterprise, e.g., of a paper mill, or of a textile mill. The factories produce some goods (e.g. paper or textiles) and simultaneously the factory produces electric energy but only for its own internal manufacturing purposes.

Our interest is focused on the - as we call it - *unconscious of the power plant* to be controlled, that means in our context, we look at the unavoidable mutual interaction of the physical quantities which are given by nature and which act within the plant. Figure A-III-1 depicts schematically such a process. We firstly give a short description of this factory's plant, i.e., the power plant, as it is called by those who work in the factory.

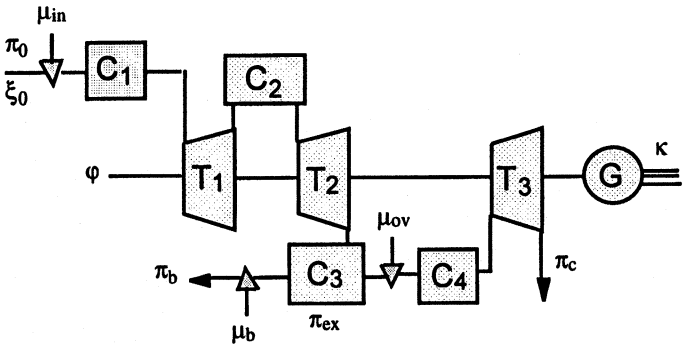

Figure A-III-1: Set of three turbines, T_1, T_2 and T_3, and four steam capacities, C_1, C_2, C_3, and C_4. The turbines and the generator G are on one shaft.

The three steam turbines, T_1, T_2, and T_3, drive a generator G that produces electric energy κ used in the factory, the mill. The live steam that drives the turbines comes from a boiler with the steam pressure π_0 and its temperature ξ_0. All steam passes through the inlet pipe C_1, the turbine T_1, the overflow pipe C_2, and the turbine T_2. There, at the outlet of T_2, one part of the steam becomes extracted via C_3. The remaining part passes through C_4 and Turbine T_3 toward the condenser where the steam becomes turned back into water and brought back to the boiler for reuse.

The two variables to be controlled are the speed, i.e., the number of revolutions per minute φ of the turbines and the extraction pressure π_{ex} in the conduit C_3. The speed control is necessary in order to maintain a constant frequency for the local electric net. It is to be underlined that the plant is not connected to an external electric net. It stands on its own. The factory is located, e.g., far out in the country. Therefore, the generator has to control its own frequency.

The extracted steam serves, e.g., for the production of paper in the mill (or textiles in a textile mill). As the needed electric energy and the amount of needed extraction steam vary, the magnitude of the variables, related to the electric energy and to the extracted steam, have to be controlled. These are φ and π_{ex}.

(The variables denoted with Greek letters are dimensionless; they are the ratio of the time dependent variables divided by their steady state values.)

The opening of the steam input valves for the steam from the boiler is symbolized with μ_{in}. The opening of the overflow valves - for the steam passing from C_3 to C_4 and T_3 - is symbolized with μ_{ov}. Thus, for the control of the two variables, φ and π_{ex}, one set of valves controls the frequency φ, the other set controls the extraction pressure π_{ex}. (There are several valves in a series for the steam input and several for

the overflow.) Therefore, the factory's power plant to be controlled has two inputs, μ_{in} and μ_{ov}, and two outputs, φ and π_{ex}.

The variables π_0 and ξ_0 in Figure A-III-1 signify pressure and temperature of the live steam coming from the boiler. The constant π_c symbolizes the steam pressure in the condenser, and with π_b we denote the backpressure of the used extraction steam.

If now an increase of electricity is required from the generator, the frequency φ will drop and the speed controller will open the input valves μ_{in} to increase the inlet steam quantity to make up for the demand. As a consequence, the pressure π_{ex} in the conduit C_3 increases too, and the extraction pressure controller will open the overflow valves μ_{ov} in order to reduce the increasing extraction pressure. Due to this opening of μ_{ov} more steam flows into the turbine T_3 than is required. The speed φ will increase, and the speed controller has to interact again and close somewhat the input valves μ_{in}. A similar operation occurs when more extraction steam is required. The overflow valves will close in order to get more steam through μ_b. Less steam then passes through T_3, the speed drops, and the input valves have to open, and the extraction pressure controller has to correct, because π_{ex} increases. It can be seen that there is strong mutual interaction between the two variables φ and π_{ex}. Such interaction is given by natural laws. It is unavoidable; it is, as we risk calling it, unconscious. Yet, this interaction can be compensated for by man-made interaction, with our consciousness, as we will see further down.

All this information is not to be understood in detail. It serves merely as an indication of the complexity with the aim to find the notion for the term *attitude* as unconscious behavior for our social model.

After calculating the dynamics of the steam within the capacities C_1, C_2, and C_3, as well as the steam's pressure and temperature through

the three turbines and their influence on the speed of the shaft of the turbines, the following structure was found, Figure A-III-2.

There are - as mentioned - two input variables, μ_{in} and μ_{ov} for the control input; and accordingly two output variables, φ and π_{ex}. The other five input signals in Figure A-III-2 are disturbance signals. Their input lines are dashed.

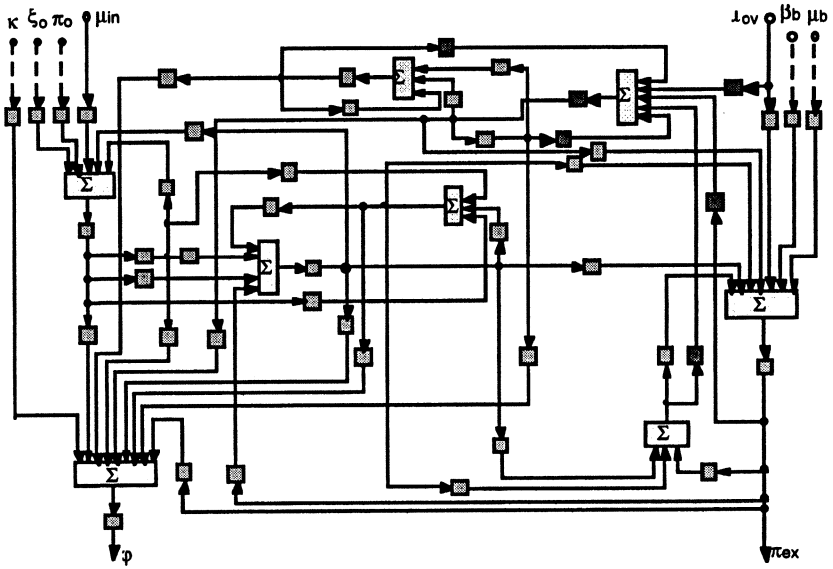

Figure A-III-2: Block diagram of the plant Figure A-III-1.

Figure A-III-2 looks frighteningly complicated, and concerning all its details it really is. The content of the many blocks with their mathematical formulas in them are not shown. The purpose here is merely to show the intricacy of nature's interaction. But as this structure Figure A-III-2 was developed mathematically on the basis of physical laws, in the same manner it can mathematically become reduced in its complexity by eliminating all variables between the

input and out variables of the individual blocks, and, for our purpose, by neglecting the disturbance signals. (For engineers it shall be mentioned that all nonlinear differential equations in the blocks had been simplified (mutilated) in order to make them linear for the purpose of reducing the structure Figure A-III-2 to a two by two matrix, Figure A-III-3.)

The result of the elimination process of Figure A-III-2 to a simple structure of two input to two output variables and the interaction between the two input-output streams is represented in Figure A-III-3. The complex interaction in Figure A-III-2 is reduced to two feed-cross channels as mutual information exchange: Figure A-III-3. This figure is now taken as the unconscious of the social dualism Figure II-1. S_{11} and S_{22} are the transfer functions of the unconscious of the partners P_1 and P_2. The variables δ_1 and δ_2 change their magnitude when they flow through the unconscious of S_{11} and S_{22}, respectively. S_{12} and S_{21} are the changing factors, or transfer functions of *attitude* when unconscious information is bilaterally exchanged between the two individuals.

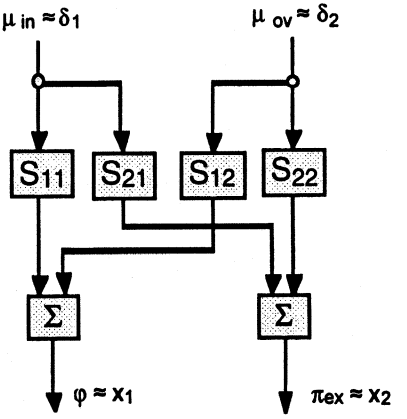

Figure A-III-3: Analogy of the unconscious of Figure A-III-2.

The same way the interactions in Figure A-III-2 are unavoidable, because they are given by nature, equally considered as unavoidable is the attitude of human individuals (and other beings).

For Figure A-III-2 the mutual interaction means again in short. When more electrical energy is required, the variable μ_{in} has to open its valves to let more steam flow through the turbines. This increased flow unavoidably changes the extraction pressure π_{ex}. In order to correct this deflection of π_{ex}, the variable μ_{0V} comes into action with the corresponding valves for correcting. This action in turn disturbs the frequency φ, and the speed controller tries to correct it via the input valves μ_{in}. That is: μ_{in} not only changes φ, but also π_{ex}, and μ_{0V} not only changes π_{ex}, but also φ. We call this mutual interaction inherent and therefore unconscious. Speed control and pressure control argue with each other, or they fight for their own rights!

In order to avoid such strong mutual interaction, an additional, now man-made device, called a decoupling device, can be incorporated between the controllers and the valves. The schematic structure of such an installation is shown in Figure A-III-4. Mathematically reducing this structure Figure A-III-4 into a small package in the same way as was done with the plant Figure A-III-2 results in Figure A-III-5. The two transfer factors A_{21} and A_{12} correspond to the same two factors in Figure. II-2. Which means, as already mentioned, direct conscious physical action. By direct physical social action, discussing, arguing, or fighting is meant. In the technical world there is a direct parallelism, there is a verbal, exchange of information, between the two control loops. Figure A-III-6 depicts the very basic structure of a technical dual control system of which Figure A-III-2 is its controlled plant.

The two channels with the transfer functions A_{12} and A_{21} have the task of decoupling the interactions S_{12} and S_{21}, in other words, to separate statically and dynamically the two loops, frequency φ-control, and extraction pressure π_{ex}-control. Thus, our analogy is a parallelism between the compulsory interaction among all the natural variables in

the technical figure, Figure A-III-2, and the unconscious attitude in social life. This analogy might not be acceptable to everyone, but it is our presumption to build a new social theory.

Unconscious, unavoidable behavior in daily life shows up in hate, xenophobia, heresy, loquacity - and all kinds of affection, illusions, and dreams. They happen via S_{21} and S_{12}. It is the consciousness that has to intervene and to try to correct the unconscious dilemma, the unwanted interaction, as much as possible. This intervention happens via the transfer functions A_{12} and A_{21}.

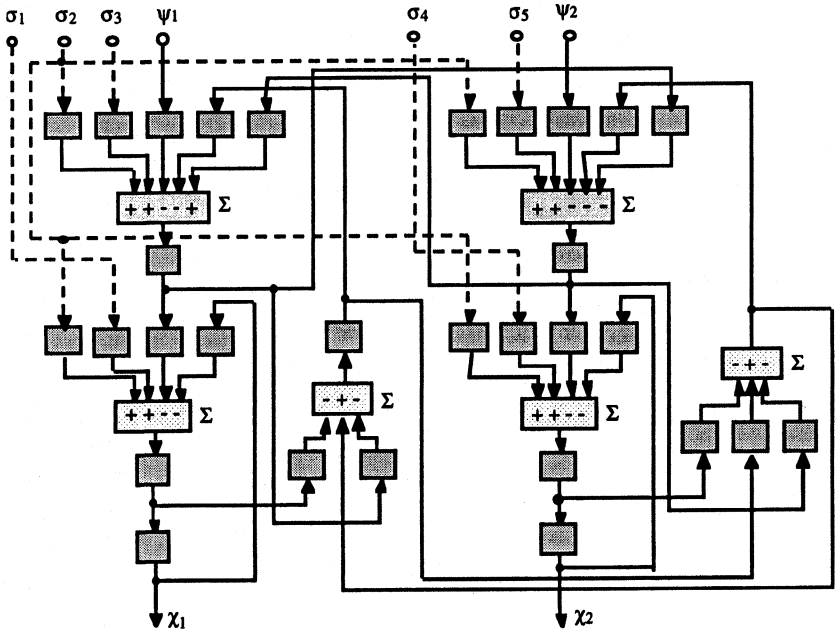

Figure A-III-4: Schematic structure of a decoupling device.

If this decoupling cannot be done, we have the outcome as described in the previous chapters: the *Natural Laws* in their action, in their *status nascendi*: Uncontrollable affinity and animosity.

The two transfer factors, V_{21} and V_{12}, in Figure V-9 do not exist in Figure A-III-6. They mean a mutual observation of each other's goal variable. Social individuals spy, observe, and check on each other if they have a chance. But investigations of Figure V-9 would be beyond the framework of this introductory treatise.

The purpose of the decoupling device in Figure A-III-6 is the cancellation of the *unconscious* mutual interaction within the plant, S_{12} and S_{21}, Figure A-III-2, or Figure A-III-6. The designer builds in this interaction; it is man-made, hard physical action!

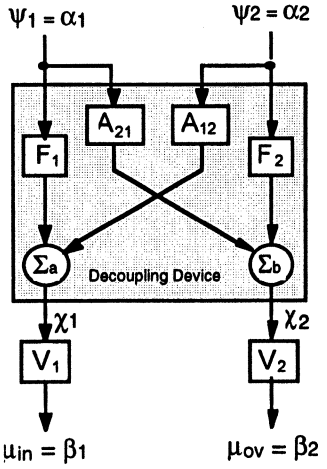

Figure A-III-5: Analogy of the conscious mutual interaction for compensating the plant's unconscious.

If a plant, handled by man is so full of interactions and disturbances on the basis of nature's creation, how complex must the interrelation of human beings be! But the very principles are the same whether the subject is machines, plants, animals, or human beings. Nature is built on the basis of surprisingly simple principles (e.g., DNA-elements). It is the complexity found in the myriad of combinations of elements that lead to the uncountable diversities of live phenomena and what

entangles our minds. The troublemakers in life are interaction and time, i.e., the feed-cross in connection with its dynamics.

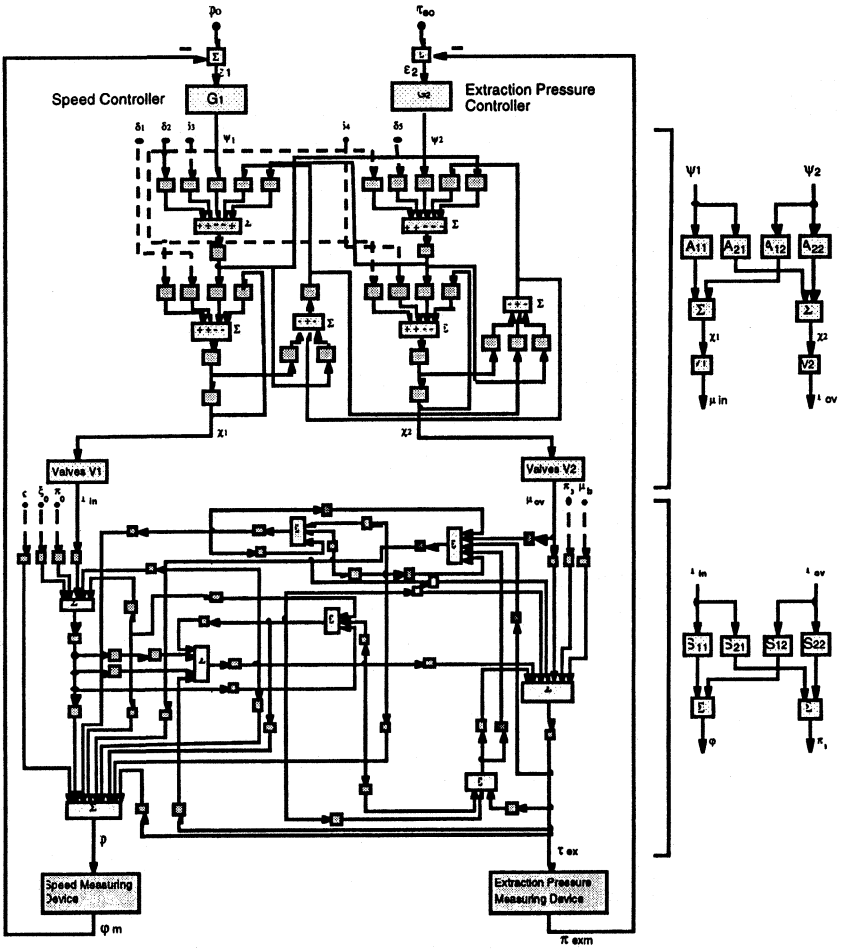

Figure A-III-6: Overall structure of the dual control system.

Appendix IV

Anticipation and Enforcement

In Chapter II the term *intelligence* was coined using the two behavioral characteristics of *willpower* and *pattern of motion*. Two more terms were mentioned, the term $d\varepsilon_1(t)/dt$ for *anticipation* and the term $\int\varepsilon_1(t)dt$ for *enforcement* (formula (IV-1). These two terms were mentioned once more and applied in Chapter VII.

For readers who show further interest in the mathematical-physical explanation of these two more advanced characteristics a detailed description is given herein. Anticipation allows higher speed and enforcement, or perseverance, and in consequence, it induces more willpower for the goal striving process. Naturally, the two characteristics - anticipation as foresight and enforcement as pertinacity - will lead to more sophisticated expressions. The description is done with some explanatory mathematics. It shall assist in reaching deeper insight into the physical-biological functioning.

One of Darwin's statements is: In the realm of survival the rule is that the fast and strong being outlives the slow and weak. The dominant features for survival are therefore power and speed. In this very elementary two-term-notion, as we described them above, there are for example, no association of thought and no intuition.

Already mentioned proverbs for power and speed summarize this fact:

More power:
Contra vim non valet ius: Might makes right.
The weak always goes to the wall.
Higher speed:
A bold attack is half the battle.
He travels fastest who travels alone.

The two terms *power* and *speed* for the notion of intelligence have been discussed exhaustively. The question will be answered now of

how a more elaborated definition and modeling of intelligence can be found, based on the two terms power and speed but for more power and higher speed.

The Webster's dictionary defines intelligence as: superior mental power. From our perspective we say that intelligence is the ability to work effectively toward one's goal. Intelligence is the greater, the faster and the closer a being reaches his goal. It is self evident that this has to happen without running into instability. The New Webster's Dictionary says: instability is excessive or uncontrollable emotions. In the technical world an alarm rings when a system comes close to the limit of stability so that the installation does not run collapse and result in an accident.

Because of our conviction that all life is matter (and energy) which moves over time, the search for finding the answer now goes back to basic physical concepts. With reference to Chapter I, we stated that the living being is a functioning substance with self-realization as its goal.

To this point the attributes for self-realization are.

1) Willpower or volition.
2) Speed or velocity, or pattern of motion. In nature, females choose to mate with powerful and fast males in order to guarantee long survival of their own species.
3) Self-control (requiring feedback) Self-control is the third important attribute for survival. Self-control belongs to both, the realms of the consciousness and the unconscious. Both are necessary for remembering continuously what the being wants, i.e., where it is headed to for its self-realization. Self-control with time is awareness of the own doing, is - as we mean - consciousness.
4) Attitude or belief. They are built by inheritance and indoctrination.
5) Interaction with other beings by observing them, being observed by them, acting on them and being acted upon by them.
6) Fighting the effect of disturbances that are derived from the environment in which the being lives (exogenous or endogenous disturbances).

These terms are structured in Figure A-IV-1. In order to widen our concept of intelligence we add the two terms *anticipation* and *enforcement*. The syndrome of intelligence is rather complex with many social, psychological, and intellectual attributes. Therefore, in order to build a workable computer model, only the main parameters can be taken into account, definable parameters, so that numerical values can be put into the model and calculations are made possible.

Phenomena in the observed world are usually too complex to be understood by modelling all their parts and interactions; some form of simplification is necessary; [12].

The dictionary provides the following descriptions for the two terms perseverance and anticipation.

Perseverance: Steadfast adherence to a course of action, belief, or purpose.
Anticipation: The act of feeling or knowing beforehand.

To model all six self-realization attributes mentioned above and including the two new terms, perseverance and anticipation, we use the self-controlling loop Figure A-IV-1. In this figure the total willpower is in technical terms a PID-controller. PID means Proportional-Integral-Derivative. The proportional action is contained in the power factor G_1. The integral part performs the perseverance, and the derivative part is accountable for the anticipation. The controller contains three of the now four survival parameters: willpower, speed, perseverance, and anticipation. The factors of willpower and the related speed were extensively treated in Chapter IV. Willpower is also related to the two parameters perseverance and anticipation. Therefore, the willpower factor G_1 stays connected to the new terms. The term pattern of motion, in Figure A-IV-1, called time delay, stays separate from the PID-controller.

This technical PID-controller has the form of equation (A-IV-1) or (A-IV-2). It is shown, first in the s-domain (the Laplace-domain), then in the time domain.

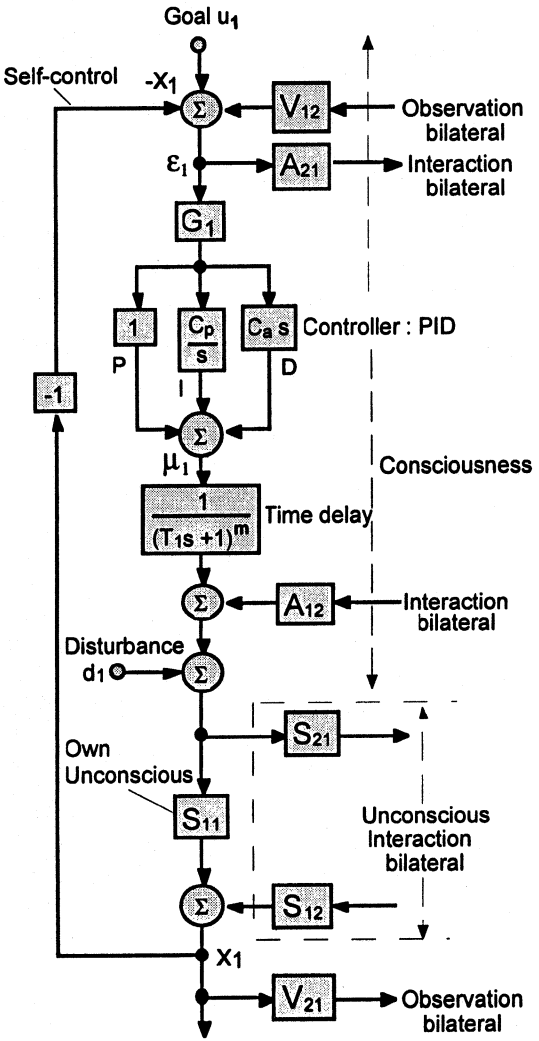

Figure A-IV-1: The model of the individual.

The PID-controller in the s-domain is the equation (A-IV-1):

$$\frac{\mu_1}{\varepsilon_1} = G_1\left[1 + \frac{C_p}{s} + C_a s\right]. \qquad (A-IV-1)$$

In the time domain, the controller is the equation (A-IV-2):

$$\mu_1 = G_1\left[\varepsilon_1(t) + C_p\int \varepsilon_1(t)dt + C_a\frac{d\varepsilon_1(t)}{dt}\right]. \quad (A-IV-2)$$

The specific behavioral characteristics of the PID-controller are the following:

P stands for *proportional* action. The error $\varepsilon_1(t)$ is multiplied by the willpower factor G_1. Increasing the error provokes the loop to work harder toward the goal u_1 and eventually to get closer to it. This fact, *increasing* the internal error, that increases the distance from the own goal, makes it feel larger than it really is. This stimulates the effort to push more vehemently. Such a fact, as many other facts we are confronted with in this book, cannot be perceived within everyday social terminology, but in the back of our mind it might well happen this way. Our willpower increases the actual error and sees it larger than it is. - The loop as self-controlling action brings this situation to light. It is indeed not possible to understand the system's behavior by reference to its elements only. It is the holistic concept, the loop feature that is the explanation of the behavior of the system, the system as a whole.

I represents *integral* action. The error $\varepsilon_1(t)$ becomes integrated by $\int\varepsilon_1(t)dt$, and the integral becomes multiplied by the willpower factor G_1 and the weighing factor of perseverance, C_p. C_p is the intensity factor with which perseverance acts. Integral action is equivalent to enlargement or enforcement. It is, in connection with G_1, an increase of provocation to force the loop to work harder toward the loop's goal u_1. As a consequence it also further reduces the effect a disturbance d_1 can exert on the loop's action.

D signifies *derivative* operation. The speed with which the error $\varepsilon_1(t)$ changes in time, $d\,\varepsilon_1(t)/dt$, becomes multiplied by G_1 and the weighing factor C_a. Derivative action is equivalent to anticipation or premonition. It is mathematically the rate of change of the error $\varepsilon_1(t)$ over time.

It will be seen that perseverance performs a goal approach par excellence. It forces $x_1(t)$ toward the goal u_1 to 100% and therefore the effect of disturbances down to zero. But the price to pay for 100% performance is twofold.

• Integral action reduces the speed with which the system is allowed to act.

• The willpower G_1 has to be set at lower rate at the start of a goal striving process. The higher the magnitude of C_p, the lower G_1 has to be set. And a lower G_1 results in lower speed of the loop. But in the course of the loop's action, the integration $GC_p\int\varepsilon_1(t)dt$ will compensate for the G_1 which had to be set low. Because, as a function of time, G_1 will increase (integrate) continuously further and further.

Anticipation, on the other hand, allows G_1 to increase. The increase depends on how high the magnitude of C_a is. In addition, the larger C_a can exist without endangering stability, the faster the loop's action becomes. In the technical field it is relatively easy to perform perseverance, but it is somehow difficult to produce anticipation. The same holds true for the human being. It is easy to express willpower through obstinacy; it is difficult to foresee, to feel in advance. Perseverance as steadfast adherence to a course of action, or belief, or purpose, can be observed in beings in the form of stubbornness or coercion, or fundamentalism. Anticipation is a more delicate and rare feature of behavior. It is a foreknowledge or presentiment. It is the loop's recognition of how its way toward the goal is changing.

Equation [A-IV-3] shows the loop's description with all its own attributes. It is without the interactions indicated with the functions V_{12}, V_{21}, A_{12}, A_{21}, S_{12}, and S_{21} as shown in Figure A-IV-1. The loop's own unconscious (S_{11}) is assumed to be equal to the magnitude 1

because it is the loop's own unconscious. S_{11} only comes into play when the loop has attitude interaction via S_{12} and S_{21}. Then the loop's behavior becomes a matter of comparison with a second loop. S_{12} and S_{21} are then seen in relation to S_{11}. Due to this situation, that S_{11} is set equal to 1, S_{11} does not appear in the equation (A-IV-3).

$$(u_1 - x_1)\left\{G_1\left[1+\frac{C_p}{s}+C_a s\right]\frac{1}{(T_1 s+1)^m}\right\}+d_1 = x_1;\ (S_{11}=1). \quad (A-IV-3)$$

The characteristic equation, i.e., the character of the loop, becomes the equation (A-IV-4); indeed, with $u_1 = 0$, $d_1 = 0$, i.e., with no external signals. Character is the combination of the own idiosyncratic features only which is of G, C_p, C_a, T_1, and m, and the hidden S_{11}.

$$G_1 s + G_1 C_p + G_1 C_a s^2 + (T_1 s+1)^m s = 0. \quad (A-IV-4)$$

In order to demonstrate the effect of the three parameters, willpower G_1, perseverance factor C_p, and anticipation factor C_a, four different cases will be presented with the pattern of motion: m = 3, T_1 = 1.

Case a: Willpower G_1 without perseverance and without anticipation;
$C_p = 0$, $C_a = 0$;
Case b: Willpower G_1 with perseverance C_p, but without anticipation;
$C_p \neq 0$, $C_a = 0$;
Case c: Willpower G_1 with anticipation C_a, and without perseverance;
$C_p = 0$, $C_a \neq 0$,;
Case d: Willpower G_1 with perseverance C_p and with anticipation C_a.
$C_p \neq 0$, $C_a \neq 0$.

• Case a) Willpower G_1, $C_p = 0$, $C_a = 0$.
The characteristic equation of the loop Figure A-IV-1 with the willpower G_1, the time delay $(T_1 s+1)^{-3}$, and with $S_{11} = 1$ is expressed with the equation (A-IV-5).

$$T_1^3 s^3 + 3T_1^2 s^2 + 3T_1 s + G_1 + 1 = 0. \quad (A-IV-5)$$

We ask the question: What is the maximum willpower G_1 with which

the loop can operate before running into instability? In order to answer the question, G_1 and T_1 have to be calculated at their stability limit. At this limit, where there is an oscillation with no damping α; s (which is in general $\alpha+i\omega$) is simply $i\omega$. Putting $s = i\omega$ into equation (A-IV-5) results in equation (A-IV-6).

$$G_1 - T_1^3 i\omega^3 - 3T_1^2\omega^2 + 3T_1 i\omega + 1 = 0. \qquad (A-IV-6)$$

This complex equation has a real and an imaginary part. The two parts have to be solved separately. Each part is set to zero.
The two equations become a) and b):

$$a) \quad G_1 - 3T_1^2\omega^2 + 1 = 0,$$

$$b) \quad -T_1^3\omega^2 + 3T_1 = 0.$$

From equation b) it follows:

$$\omega = \pm\frac{1}{T_1}\sqrt{3}. \qquad (A-IV-7)$$

Putting ω^2 into equation a) yields $G_1 = 8$, and T_1 is cancelled. This result shows that whatever the time constant T_1 is, the willpower G_1 is 8. The loop's willpower G_1 at the stability limit is independent from the time constant T_1 - with the assumption that all three time constants are equal [$(T_1s+1)^m$; m = 3]. This fact was already mentioned in Chapter IV-3.

The same independency for G_1 can be shown with any $m > 3$. For example for m = 4, $G_1 = 4$. See Figure IV-4.

We can state: Without perseverance and without anticipation the maximum willpower is 8 for m = 3 and, thus, the maximum goal attainment is

$$\frac{x_1}{u_1} = \frac{G_1}{1+G_1} = \frac{8}{9} = 0.89 \text{ or } 89\%.$$

See graph Figure IV-1.

•• Case b) Willpower G_1, perseverance C_p; $C_a = 0$.

The characteristic equation becomes equation (A-IV-8).

$$T_1^3 s^4 + 3T_1^2 s^3 + 3T_1 s^2 + (G_1 + 1)s + G_1 C_p = 0. \qquad (A - IV - 8)$$

The procedure to solve the equation for ω and G_1 is the same as for case a. At the stability limit ($s = i\omega$) the speed ω is expressed with the expression (A-IV-9).

$$\omega = \frac{1}{T_1}\sqrt{\frac{G_1 + 1}{3}} \quad \text{(Note that } C_p \text{ is not involved!).} \quad (A - IV - 9)$$

The integration factor C_p does not change the speed of action, i.e., ω. However, C_p changes G_1 that in turn changes the speed ω, i.e., the speed of acting.

The maximum willpower G_1 can be calculated with equation (A-IV-10).

$$G_1^2 + (9C_pT_1 - 7)G_1 - 8 = 0. \qquad (A - IV - 10)$$

(Note that with $C_p = 0$, G_1 shows the two values, 8 and -1. $G_1 = -1$ belongs to an astatic stability limit, not considered for our social purpose.)

Example: With $C_p = 0.25$ and $T_1 = 1$, for G_1 at the stability limit, it was found that $G_1 = 6.05$. This is less than in case a) where $G_1 = 8$. With perseverance, the willpower G_1 has to be set lower. Nevertheless, the final goal attainment u_1 will be 1 or 100%. The attainment will be 100% due to the integration of G_1 over time (at $t = \infty$).

••• Case c) Willpower G_1, anticipation C_a; $C_p = 0$.

The characteristic equation taken from (A-IV-4) becomes equation (A-IV-11):

$$T_1^3 s^3 + 3T_1^2 s^2 + (G_1 C_a + 3T_1)s + G_1 + 1 = 0. \quad (A\text{-}IV\text{-}11)$$

Similarly as before, by splitting the equation into two parts, it will be found that the speed at the stability limit is given with the same equation (A-IV-9). This means that C_a has no direct effect on ω.

$$\omega = \frac{1}{T_1}\sqrt{\frac{G_1 + 1}{3}}$$ (Note that C_a is not involved!).

The willpower G_1 can be calculated with equation (A-IV-12).

$$G_1 = \frac{8T_1}{T_1 - 3C_a} = \frac{8}{1 - \frac{C_a}{T_1}}. \qquad (A\text{-}IV - 12)$$

The larger C_a the smaller the denominator and thus, the larger G_1 can be set. With $C_a = 0$, G_1 is indeed 8 again.

Example: With $C_a = 0.2$ and $T_1 = 1$ the power G_1 becomes 20.

Anticipation allows much higher willpower and, as a consequence, much higher speed ω, because a higher G_1 goes into formula (A-IV-9). In addition, as it is already known, an increased G_1 increases the speed. But it must be kept in mind that in reality it is not easy to create large C_a's, be this in non-human devices, be this in social behavior. Not many people are in a fortunate state of having much anticipation. For example, auto and ski racers must possess much of it in order to handle car and skies at high speed and in the bends of roads and tracks.

•••• Case d) Willpower G_1, perseverance C_p, and anticipation C_a.

The characteristic equation is (A-IV-13).

$$(T_1 s + 1)^3 s + G_1 C_a s^2 + G_1 s + G_1 C_p = 0. \quad (A\text{-}IV\text{-}13)$$

We solve the equation once more explicitly.

Substituting $i\omega$ for s results in equation (A-IV-14).

$$T_1^3\omega^4 - 3T_1^2 i\omega^3 - (G_1 C_a + 3T_1)\omega^2 + (G_1 + 1)i\omega + G_1 C_p = 0. \quad (A\text{-}IV\text{-}14)$$

Separation into two equations, (A-IV-15) and (A-IV-16), yields

$$T_1^3\omega^4 - (G_1 C_a + 3T_1)\omega^2 + G_1 C_p = 0, \quad (A\text{-}IV - 15)$$

$$G_1 + 1 - 3T_1^2\omega^2 = 0. \quad (A\text{-}IV - 16)$$

From equation (A-IV-16) equation (A-I-9) occurs again. Putting ω^2 into equation (A-IV-15), equation (A-IV-17) results. This equation is quadratic in G_1:

$$G_1^2(T_1 - 3C_a) + (9C_p T_1^2 - 7T_1 - 3C_a)G_1 - 8T_1 = 0. \quad (A\text{-}IV - 17)$$

Using the same data as above: $C_p = 0.25$; $T_1 = 1$; $C_a = 0.2$, results in $G_1^2 - 13.375G_1 - 20 = 0$. $G_1 = 14.9$.

Compared with case c) it can be seen that perseverance brings down the willpower factor G_1 from 20 to 14.9.

Listing speed ω and willpower G_1 for all 4 cases results in Table A-IV-1.

Where can the highest intelligence be found?

Both, high speed and high willpower, have to be favored: case c) is best. But as case d) offers 100% goal attainment, as will be seen

further down, case d) could be given priority instead.

Table A-IV-1: Comparison of the four cases a) to d). Although ω is the angular velocity, we call it velocity or speed.

case	ω	G_1	C_p	C_a
a)	1.7	8.0	0	0
b)	1.5	6.1	C_p	0
c)	2.4	20.0	0	C_a
d)	2.3	14.9	C_p	C_a

Figures A-IV-2 and A-IV-3 depict the two performance factors, ω and G_1 as a function of C_p and C_a, respectively.

Before discussing these two figures, it is advantageous to look at the final attainments of the four cases of Table A-IV-1.

The general expression for goal attainment is shown with equation (A-IV-18).

$$\frac{x_1}{u_1} = \frac{G_1(C_a s^2 + s + C_p)}{G_1(C_a s^2 + s + C_p) + s(T_1 s + 1)^m}. \quad (A\text{-}IV-18)$$

For final goal attainments the time has to be set to ∞, or, what is mathematically equivalent, s, the Laplace-Operator, must be set to = 0.

• Case a) $C_p = 0$, $C_a = 0$
In equation (A-IV-18), first C_p and C_a have to be set to zero. Then one s in numerator and denominator can be cancelled; finally in $(T_1 s+1)^m$ for time $T_1 = \infty$, the operator s has to be 0. The result is

$$\frac{x_1}{u_1} = \frac{G_1}{G_1 + 1}. \qquad \text{(A - IV - 19)}$$

This formula (A-IV-19) created Figure IV-1.

•• Case b) $C_p \neq 0$, $C_a = 0$. Formula (A-IV-18) leads to

$$\frac{x_1}{u_1} = \frac{G_1(s + C_p)}{G_1(s + C_p) + s(T_1 s + 1)^m}\Big|_{s=0} = \frac{G_1 C_p}{G_1 C_p + 0} = 1 \text{ or } 100\%.$$

$$\text{(A - IV - 20)}$$

With s = 0, i.e., after time is set to infinity, the final goal attainment is 100%. Thus, it can be seen that perseverance leads to 100% of u_1. The attainment x_1 becomes the goal u_1.

But it must be mentioned that $x_1 = u_1$ only holds true if within a goal approaching process no disturbance d_1 [see Figure A-IV-1] of any kind and magnitude repeatedly occurs. A disturbance penetrating into the loop throws the system back or around on its track, on its way to the goal. Every time this happens, the system takes a new effort to reach the 100%-goal attainment. The system gives the impression of being stubborn, saying to the disturbance: „I want to go there. I have set my mind. Please, leave me alone! Stay away!"

••• Case c): $C_a \neq 0$, $C_p = 0$.
Equation (A-IV-18) leads to equation (A-IV-21).

$$\frac{x_1}{u_1} = \frac{G_1(C_a s + 1)}{G_1(C_a s + 1) + (T_1 s + 1)^m}\Big|_{s=0} = \frac{G_1}{G_1 + 1}. \qquad \text{(A - IV - 21)}$$

This is the same result as in case a). But anticipation nevertheless improves the final goal attainment compared to case a) because C_a allows a higher willpower G_1. This higher willpower results in higher speed, as Table A-IV-1 indicates ($\omega = 2.4$ compared with case a) of $\omega = 1.7$).

•••• Case d): $C_a \neq 0$, $C_p \neq 0$, $s = 0$.
Formula (A-IV-18) with $s = 0$ renders

$$\frac{x_1}{u_1} = \frac{G_1 C_p}{G_1 C_p + 0} = 1 \text{ or } 100\%. \quad (A-IV-22)$$

Again, we see the advantage of case d): not only 100% goal attainment due to C_p, but also higher speed can be attained, due to C_a.

The graphic representation of perseverance, formula (A-IV-8) as a function of C_p is verified in Figure A-IV-2. And of anticipation, formula (A-IV-11), as a function of C_a, is depicted in Figure A-IV-3.

Figure A-IV-2 illustrates the decline of both, willpower G_1 and speed ω of operation, when the integration factor C_p increases. But whatever C_p is, over time the goal attainment tends toward 100%. Figure A-IV-3 demonstrates just the opposite behavior. Willpower G_1 and speed ω increase, as a function of increasing anticipation C_a. Anticipation is a very valuable intelligence feature. The figure shows clearly how the loop performance can be increased if anticipation is present. But it has to be repeated that it is not easy to produce anticipation, i.e., to realize the derivative of the error ε_1 in real life as easily as this can be done mathematically.

A physical example to illustrate the anticipation term, to feel in advance, is driving a car. In heavy fog a curve in the road, marked by a white line in the middle of the street, and the curvature, which is the rate of change of the curve, both cannot be anticipated. Therefore it is not possible to preset the steering wheel position at the beginning of the curve to maintain a high speed through the curve. In order not to lose control, the speed has to be slow in order to follow the road's marked middle line. The distance (or error) $\varepsilon_1(t)$ of the car from the line is the only signal in fog to stay properly on the road. This would mean proportional control. When there is no fog, a much higher speed is possible because the curve on the road can be seen, and how much the curve is bent, can be foreseen. The steering wheel can be preset. The speed can be doubled or more. Anticipation allows much

more willpower G_1 than proportional control alone.

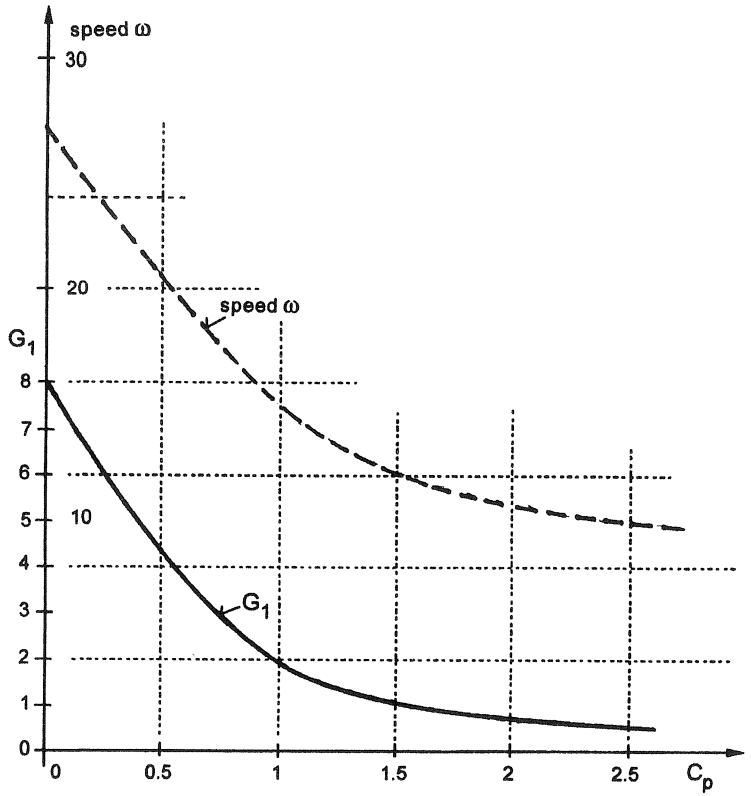

Figure A-IV-2: Decrease of willpower G_1 and speed ω with increasing C_p at the stability limit with m = 3.

Figure A-IV-3 looks fascinating. But are the facts really valid? Not quite! The fact that G_1 tends to infinity with growing C_a makes the third order (m = 3) unsuitable for a model of a finite individual. The reason is the following: Because the derivative action compensates

quasi an element $1/(T_1s+1)$, the third order unit (m = 3) tends toward the behavior of a second order system (m = 2). In a second order system, G_1 at the stability limit is infinite.

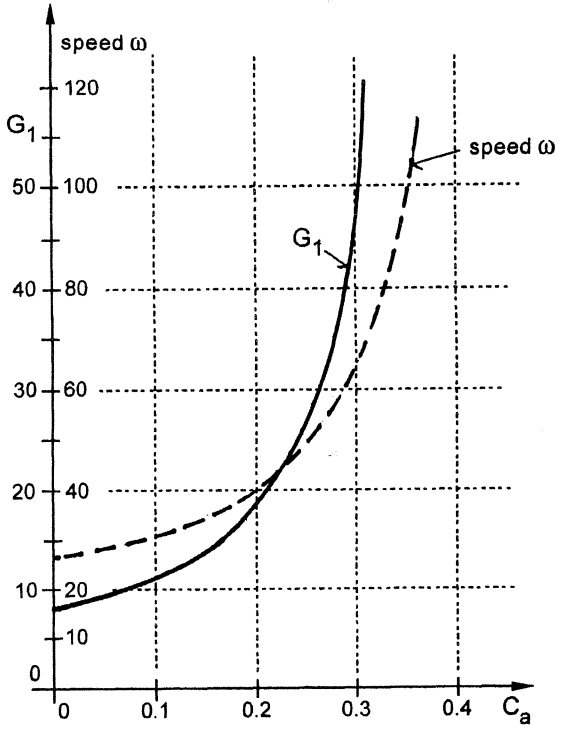

Figure A-IV-3: Increasing willpower G_1 and speed ω with increasing capability of anticipation C_a at the stability limit with m = 3, T_1 = 1.

As a consequence, the curves in Figure A-IV-3 have a G_1- and a speed-asymptote. Nothing on earth extents to infinity! (The two words infinite and eternal should not be used in everyday language - not even in religious purposes! They reach beyond, *infinitely* beyond, our brain´s capacity. The system of fourth order (m = 4), however, seems

to be adequate for the model of anticipation. For a comparison of m = 3 and m = 4, some curves are depicted in Figures A-IV-4 to A-IV-7. This is done for different time constants T_1 in order to demonstrated anew the enormous influence time has on behavior and attainment.

Figures A-IV-4 and A-IV-5 show willpower G_1 and speed ω for m = 3. At no anticipation ($C_a = 0$), G_1 is 8 at the stability limit; see Figure IV-4.

Figure A-IV-4: The faster a system acts, i.e., the smaller T_1 is, less anticipation C_a is needed for a certain G_1, and vice versa. But any amount of anticipation permits G_1 to increase. For example, in order to increase G_1 from G = 8 (at $C_a = 0$) to 20 (i.e., by 250%) the following C_a's are required:

for $T_1 = 1$, $C_a = 0.2$,
for $T_1 = 2$, $C_a = 0.4$,
for $T_1 = 4$, $C_a = 0.8$,
for $T_1 = 8$, $C_a = 1.6$.

The anticipation factor C_a is extended to $T_1 = 8$ to illustrate the relation between the time constant T_1 and the factor C_a. In Figures A-IV-2 and A-IV-3 the three time constants T_1 are of magnitude 1.

Figure A-IV-5: As the willpowers G_1 go up, so do the speeds ω. The formula (A-IV-12) indicates that G_1 becomes infinite when $T_1-3C_a = 0$, or when $C_a = T_1/3$. Indeed, with G_1 growing to infinity, the speed ω does the same.

Very different now are the curves for m = 4.

Figure A-IV-6 depicts the willpowers G_1, and Figure A-IV-7 shows the corresponding speeds ω.

Figure A-IV-6: At low anticipation, increasing anticipation C_a allows higher willpower G_1. This increase continues until the anticipation compensates one delay-element $1/(T_1s+1)$. This compensation occurs

when $C_a = T_1$. It turns the fourth order system into one of third order. The change happens for all T_1 at $G_1 = 8$, the power at the stability limit of a system of m = 3.

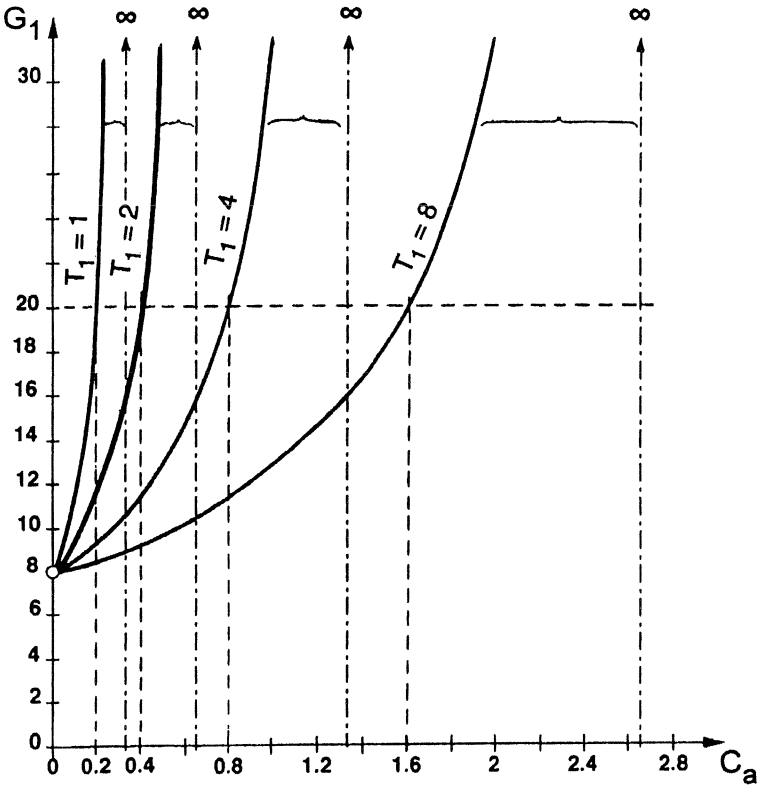

Figure A-IV-4: The willpower G_1 as a function of the anticipation C_a for an individual with m = 3.

A further increase of C_a has a negative effect on G_1, i.e., G_1 has to be reduced for stable operation. Too much anticipation makes the

system nervous, makes it overreact, and as a consequence, makes it unstable. This fact is absolutely conforming to social behavior. If one becomes too nervous, one ruins the goal approach. Keep calm - if you can! *Festina lente!* More haste, less speed!

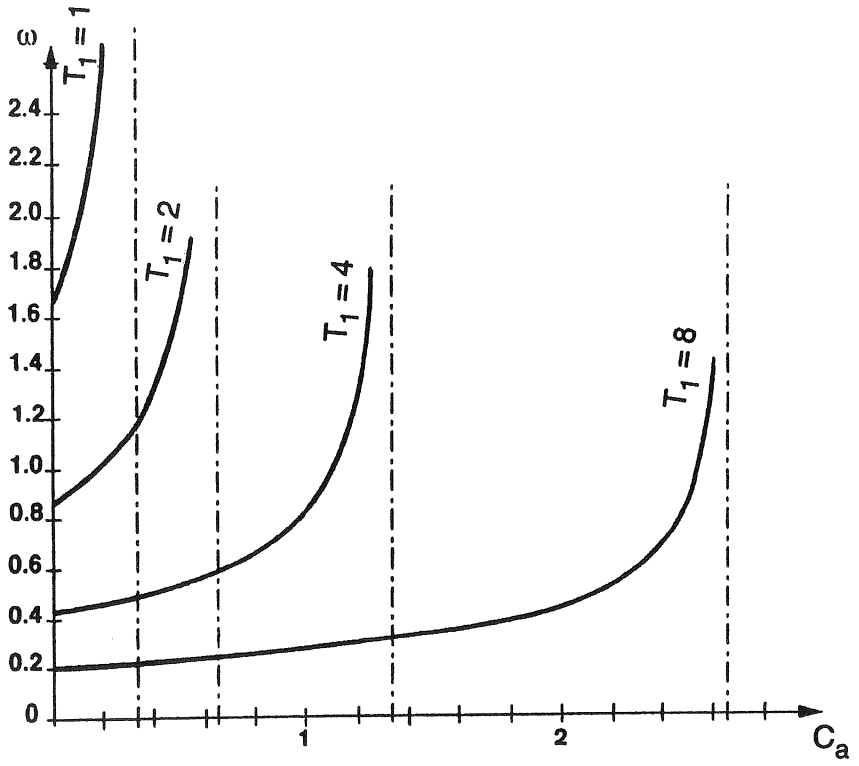

Figure A-IV-5: The speed ω as a function of the anticipation C_a for an individual with m = 3.

As with m = 4 the willpowers become limited to earthly dimensions, so do the speeds ω. This is illustrated with Figure A-IV-7. *Natura non*

facit saltum; Nature doesn't take leaps, definitely not to infinity. (Quantum physics is left out within the realm of our macro-dimensional concern!)

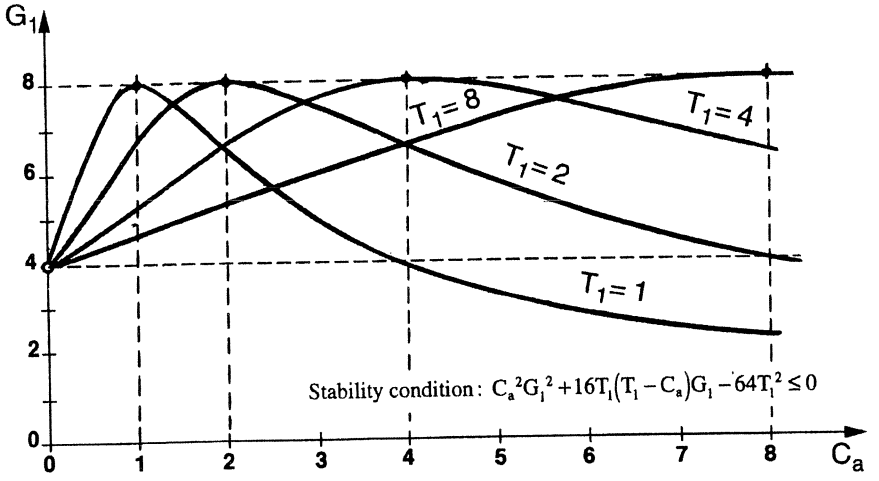

Figure A-IV-6: The willpower G_1 as a function of the anticipation C_a for an individual with m = 4.

There is no need to investigate a model concept for perseverance with m = 4 as this was necessary for anticipation, because perseverance does not decrease the order m as anticipation does. On the contrary, it rather increases m from 3 to 4.

Summary:

a) Willpower and speed: - The willpower G_1 that can be exerted by an individual within his stable area and the appropriate speed ω of action are highly interrelated. With equal pattern of motion [we took $1/(T_1 s+1)^3$, $T_1 = 1$ for this purpose] an individual acts the faster the

higher his exerted willpower G_1 is. This is indicated in Figure A-IV-8. This means that a person in a fit of anger (high G_1, e.g. 8) acts faster than when he is in a state of calmness (low G_1, e.g., 2). As a syndrome: The smaller T_1 in (T_1s+1) is and the larger G_1 is (m is assumed to be 3), the faster the individual acts, and vice versa: the larger T_1 and the lower his willpower G_1, the more sluggish is the action of that individual - both persons with m = 3, indeed. But be careful! There is the limit of stability if a person's G_1 goes too high. If he goes beyond his limit, he ruins his goal approach.

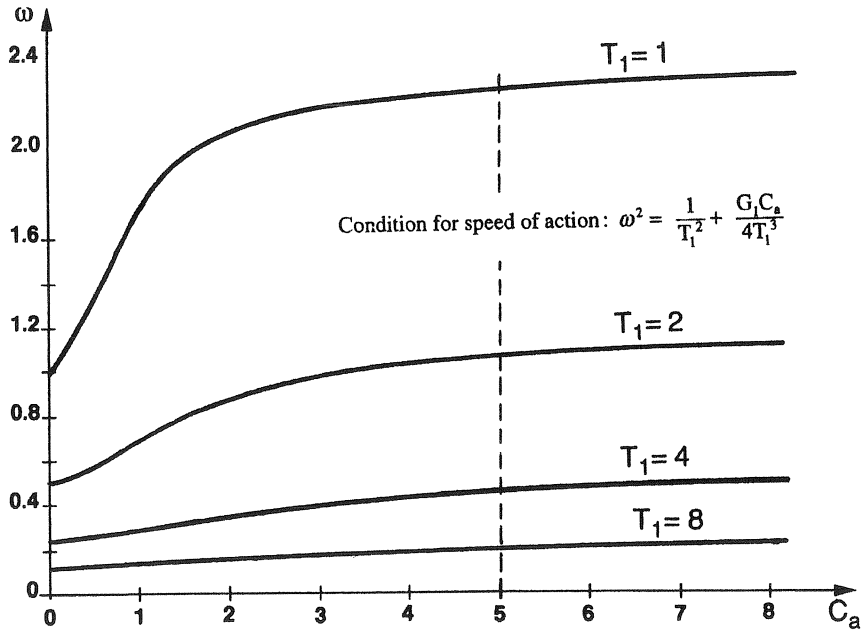

Figure A-IV-7: The speed ω as a function of the anticipation C_a for an individual with m = 4.

b) Perseverance: - Perseverance means increasing the exerted willpower whilst acting toward a goal. It is symptomatic for a stubborn person to begin with a relatively acceptable low willpower G_1 to strive toward his goal, but then increases it further and further in the sense of firmly becoming determined about what he is doing. This obstinacy reduces the speed of action toward the goal. The person hinders himself in the flexibility of acting although he achieves his goal finally to 100% - if *no* continuous disturbances occur, and if there is *no* time limit. Such *nos* comes from outside or from inside himself and tries to brake his will. In case of outside disturbances he will be thrown back on his x_1, and he has to try again to get his willpower further strengthened and to force himself anew, because he is determined or - stubborn! In the case of an endogenous disturbance the individual can run into instability by becoming hysterical.

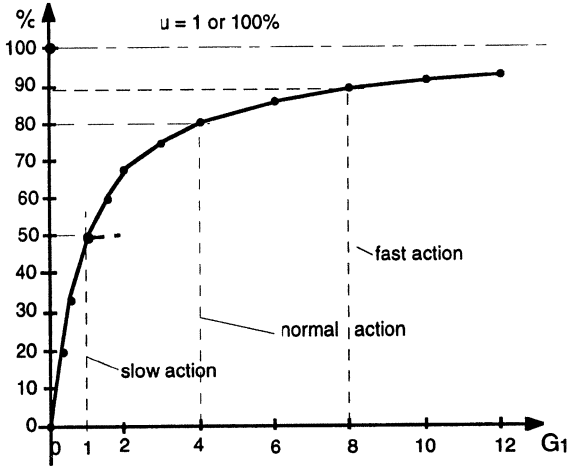

Figure A-IV-8: Steady state goal attainment $x_1(u_1)$ in % of a single loop; no perseverance included.

This symptom perseverance is not attributed to intelligence in sociology, although concerning our definition of intelligence it holds true. That perseverance reduces both, initial willpower G_1 and speed

ω, can be seen by comparing Figures IV-4 and A-IV-2. Both figures show the same basic shape.

c) Anticipation: - Anticipation increases a person's capability to exert willpower for his self-realization. But too much feeling of what is to come renders a human nervous and eventually instable. He becomes overexcited and incapable of keeping himself on a constructive track (stage fright). The faster his pattern of behavior is, the more effective the anticipation will be. In a very slow acting being anticipation has no effect anymore. A person has to act quickly in order to make use of his anticipation, otherwise its effect is lost. It dies away.

Again it can be restated that nature favors high willpower and high speed, the two main features for survival.

Appendix V

Characteristic equation of the structure Figure IX – 1 :

$$(B_1K_2 - B_2L_2 + B_2K_1 - B_1L_1)(B_3K_4 - B_4L_4 + B_4K_3 - B_3L_3)$$
$$-(K_1K_2 - L_1L_2)(K_3K_4 - L_3L_4) = 0$$

where

$$B_1 = G_1F_1S_{11}V_1 + G_2F_2S_{12}V_2$$
$$B_2 = G_1F_1S_{21}V_1 + G_2F_2S_{22}V_2$$
$$B_3 = G_3F_3S_{33}V_3 + G_4F_4S_{34}V_4$$
$$B_4 = G_3F_3S_{43}V_3 + G_4F_4S_{44}V_4$$

and

$$K_1 = 1 + G_1F_1S_{11} \qquad L_1 = G_1F_1S_{21}$$
$$K_2 = 1 + G_2F_2S_{22} \qquad L_2 = G_2F_2S_{12}$$
$$K_3 = 1 + G_3F_3S_{33} \qquad L_3 = G_3F_3S_{43}$$
$$K_4 = 1 + G_4F_4S_{44} \qquad L_4 = G_4F_4S_{34}$$

F_1, F_2, F_3, and F_4 have to be taken in accordance to the appropriate Figures IX - 5, IX - 6, and IX - 7.

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