C: \ J-AGREG \ AgregY\ IccIsctYYY-08.120

Aggregation

A1 Introduction

The word *aggregation* will be used as defined in < The Oxford Dictionary >, namely: « Collected into one body », « collective» and « assemblage ».

The phenomena of *aggregation* are universal and verifiable at various scales .

In physics, «latus sensus», to explain how an aggregate is build, some mysterious forces are invoked as for instance: gravity, electrical-magnetic, strong, weak and nuclear forces. etc..

All beings with or without life are submitted to the above referred forces.

In general these forces are functions of the distance between the interacting entities and some forces are positive or negative depending of that distance as for instance with the elastic-plastic materials.

Life is a very important attribute and all entities may be classified in two sets wether the entity is endowed with life or not .

Living beings will be called *biota* .

B*iota*, are submitted to the physics forces but other life forces must created to explain the building of aggregates like families, flocks, bands, clubs, armies, nations .

It is assumed the existence of special and powerful forces and extraordinary attributes explain the creation or the destruction of an aggregate to accomplish a difficult task, to organise a club, party or religion, defend and propagate de specie, to accept and reject members etc.

Aggregation forces of *biota* can attract and repulse, meaning be positive and negative or aggregating and de-aggregating.

The symbol Ψ will be used to distinguish these *life* forces from the physics forces whenever necessary. E.g.: Ψaggregate, Ψforce, Ψbeing or the equivalent forms : aggregateΨ, forceΨ, beingΨ .

It is assumed that the operation of aggregation includes the creation of a sub-system to lead, command and preserve the aggregate.

This sub-system may be just one individual, the chief, lord, dominant agent, etc.

The leader functions include legislation, governance and justice.

The words *system* and *aggregate* are used to describe the entity resulting of an aggregation operation and the word, *leader*, means the *leading* sub-system and c*ommand* means the information to be executed.

The system permutes energy, mass and information with the outside world also referred as the *ambient* of the aggregate.

An aggregate without a leader or a leader without an aggregate are both imperfect entities or a transient state of an aggregate.

Biota have the capacity to send false information regarding the image, action or reaction they intend to execute and this capacity is transferred to the aggregate.

To gather food, defend the aggregate, to improve the dominance of the leader and also to make war or peace, all imply the use of true and false information.

Members and aggregates are characterized by a set of attributes and preferably measurable ones, enabling their identification and classification.

Living beings can also be described as a very complex system resulting from the aggregation of more simple sub-systems which are also interlocked aggregates and this process is applicable till a level is reached that all elements would be no living beings.

When alive, this complex system permutes with the ambient mass, energy and information («forma») and is provided with specialised subsystems, namely :

(a) A pair of subsystems to receive and send information, «forma», supported by light, sound, odours, temperature, facial and body signs, etc.

(b) A pair of sub-systems to input and output organic matter to repair and reconstruct its one subsystems.

(c) Many sub-systems simulating thermodynamic machines receiving high level energy, use part of that energy and rejecting the remaining low level energy.

A2, Information and Living Beings.

Living beings are endowed with a central processing system conveniently protected and isolated with a good capacity to memorise past information, a powerful information processor and many diverse and complex output instruments.

The principal steps are: receive information, interpretation, memorising, consult the memory, conceive and adopt a reaction and assist execution.

As all living entities have a finite life but they have the capacity to create similar living beings that are taught and acquire the information.

Species have a much longer life then their individual members.

Living beings are born actors and are permanently on stage.

Predators and their victims exchange false, true and ambiguous messages using various languages.

Formal, F, heuristic, H, idiomatic, I, languages have different domains and functions and all have universal sets of entities and operations .

- *Formal-language.* The entities proprieties are assumed to be true information. The authorised operators are faultless. The primitive sentences are axiomatically considered true and all derived sentences of the language are build using the authorised operators and the resulting inferences are also true.
- *Huristic-languages.* Are considered the interpreters of F-languages. They may use both formal and idiomatic languages.
- *Idiomatic-languages.* Are the imperfect, multi-valued and ambiguous languages used by biota to communicate truths, falsehoods and ambiguities.

The translation of all these different types of language is an imperfect process and formal languages must be considered abstractions and approximations of the real world.

Formal sentences can be used in different scientific domains like physic, biology, social science, economics, cosmology but it can be accurate in physics, approximate in biology and completely false in economics. Beware the similitude!.

A3 Aggregate Models
A3:1 Elements and Holons

The concept of member of an aggregate is supported by the concepts of *element* and that of *universal set of elements.*

All systems are build with a set of entities which are assumed to be "elements" , meaning that in the context of the model, although the *elements* may be real and divisible entities, it is assumed they participate as indivisible entities.

The *universal set* of the model contains all entities that participate as *indivisible* entities.

The remaining participating entities are compositions or assemblages of members of the universal set.

The word, *holon,* will be used instead of *element,* to describe entities that may be divisible but participate in a process as indivisible.

In chemistry the elementary entities, the *holons,* are protons, neutrons and electrons and are assumed indivisible if no nuclear processes take place.

Human societies are build with humans that are considered the elementary entities meaning that the model uses the concept of a living human as an indivisible entity.

The universal set, UΨ, is a finite set of living humans which are the *holons* of UΨ.

An aggregate has a universal set of members, U, and the Cartesian set, U x U, will be used to describe the relations between the members. Vide 1N3.

A3:2 Connections and Relation Levels.

The connection or relation, R, between two members A and B, is given by a value , R(A,B), where (A,B) is an ordered pair,

The description of an aggregate implies a given set of relations, {R1,R2,...,Rn} and to each relation correspond-se a map on U x U.

An equivalent mode of representation is to use the same U x U to all {R1,R2,...,Rn}.

A typical relation is "master / servant" and different levels of command.

(a) *Two levels,* one master and the remaining members are his servants and the servants have no order relation between them. The upper level and lower level, have different structures.

(b) *Three levels,* one master , some servants are masters of other servants and the remaining members are servants of the master.

(c) *Many levels,* the extension of the description of (b) implies the recourse to a reticulate .

(d) *Circulations,* If there are circulations the members participating in the circulation have local levels but if the connections can be described as an reticulate then a supreme set and a minimum set exist and that enables the definition of a "general level" for each member of the universal set, U. Vide 2N3

A3:3 Example of Relations.

Many relations can be established and some examples are presented:

(1) *Neighbourhood.* Two members, A and B, of an aggregate are neighbours if they are directly connected, meaning there are two connecting arcs (A, B) and (B,A).

(2) *Half- neighbours.*   If only one of the two arcs exist.

(3) *Not neighbours.*   No direct arcs exist.

(4) *Master > Servant.* This relation is defined with the tri add, T(-1,0,1) with the following interpretation: if A>B then T= 1 , if B>A then T= -1 , other wise T=0.

There are many other types of order relations, e.g.: (envoy / receiver), (supplier / client) , (bank / client), (teacher / alumni), etc.

The intensity, I, and the quantity, Q, of a relation can be measured and the concept of energy, W, can be defined as the product of I and Q.

A general order relation can be imposed on U.

A4 Characterisation of *Biota.*

The modeller describes the elementary living being of the system, *holons,* by means of a list of characters and attributes that can be measurable and enabling the following tasks :   (a) identification and classification of these holons.

(b) input and output variables.

(c) formal operator that converts the input into output.

Three types of attributes are provided :

• Attributes that can be measured by instruments, e.g.: weight, force, distance, speed, etc. the variables are real or integer numbers.

- Attributes that are evaluated by specialists or observers, e.g. the levels of sympathy, aggressiveness, truthfulness, leadership, tiredness, needing food, sleep or treatment, etc., the information is given by a simple «yes or no» or « 0,1,2,3,4,5 ».
- Mixed or pellmell characters, e.g.: devilishness, sainthood, dreams, voices, inspirations, information without a definite origin etc.. Usually the solution is to choose a « yes or no » position.

The complete list of characters of an entity will be called, *profile*.

A5 Measures.

The measure of masse, distance, temperature can be made with such precision that a real number with 9 characters is feasible.

The measure of the attraction of a human being to football or music or painting the best one can do is to choose one value of the following ordered scale :
[-5 -4 -3 -2 -1 0 1 2 3 4 5] with the following interpretation : negative numbers means repulsive values and -5 is the maximum repulsion, 5 is the maximum attraction and 0 is absolute indifference.

Of course it is feasible to embed the above referred scale in the real numbers and declare that the attraction value is 3.8765 but this precision is meaningless.

The measure of typical properties of living beings should be in general represented by scales of few values.

Some examples of scales of Ψvalues :   [0, 1, 2, 3, 4]   or   [0,A,B,C,D] or [Reject, 3ª Class, 2ª Class, 1ª Class].

Some lyceums use the following classification scale as adequate :
[0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20] !!!.

Only living beings possess attraction forces, ΨF, and these forces will be treated independently of the general forces of physics.

Examples :

(1) Resistance to alter habits, vices, states, beliefs, love and hate, it emulates inertia of physics and can be understood as an *anima-inertia*.

(2) Dreams and images of "el dorados", religion beliefs, new endowers, business, etc. that are strong enough to emigrate, fight for, and endure sacrifices.

(3) Preservation of life and family, friends, country, freedom are reactions to real or virtual aggressions.

(4) Seeking pleasure, love, power, riches but in a practical and short time is a very general and common Ψ-force.

Attractive forces in physics are essentially functions of distance. On the contrary Ψ-forces are not much dependent of distance and it is rather difficult to find other variables of physics that are strongly correlated with Ψ-forces.

The usual solution is to rely on the expert opinion of a specialised professional.

The intensity of the force may be given by means of a set of 5 values [0,1,2,3,4].

A6 State of a living being, biota.

The state of an entity is variable and any interaction with the outside world can alter that state of the entity.

The real state of a biota is not the same as the image of that state due to the aptitude of biota to construct and project deceiving images of the real state.

Both the real and the projected image are time and space functions.

The concept of a referential or normal state or profile is associated to each entity.

A distance can be constructed to measure the alteration of normality of the entity.

It is assumed that altered states can be cured and normality is recovered and if normality is not achievable a new normal state must be redefined.

The characters that change frequently are courage in adversity, believe in victory.

A7 The ruling sub-set, Rss.

A sub-set of the aggregate is responsible for the good operation and the survival of the aggregate. The sub-set can be reduced to one member, the lord, master, chief, ruler, dominant member, etc.

The chief may even not be a member of the aggregate as for instance , colony, province of another aggregate or vanquished tribe.

A set without a chief , external or internal, is considered in a transition state.

The functions of Rss are , *Governance, Laws and Justice.*

The *Emperor, King or President* formally occupies the highest level of the hierarchy.

Two centuries ago the *King* held the crown and sceptre, nowadays only the crown.

The parliament with some hundreds of members issues the laws, controls de government.

The government composed by some dozens of members and a president or prime minister is responsible for the aggregate governance.

In general, the justice is an independent entity that abides to their interpretation of the law and decides based on the facts deemed proved true.

The written law is sometimes ambiguous or unjust and the final result may be inadequate.

A8 Aggregation Forces of living beings.

A distinction will be made between forces used in physics or chemistry and the forces endowed to living beings. The symbol, Ψ, will be adjoined to symbolises a living being force.

Never the less the same colloquial words will be used for the proprieties of living or non living entities , e.g..:

• *Inertia-Ψ.*   The resistance to alterations to the state, the objectives and positions of a living being. Resistance to alter habits, vices, states, beliefs, love and hate it emulates inertia of physics and can be understood as an anima-inertia.

• *Elasticity-Ψ.* The property of returning to the initial state after being deformed by external forces. Living beings have a good memory and remember the past states. It is an elastic force that attracts and repulses.

• *Plasticity-Ψ.* The property of keeping the deformation imposed by the external force. Preservation of life and family, friends, country, freedom, adaptation to real or virtual aggressions.

• *Elastic-Plastic-Ψ.* Living beings are typically negotiators trying to recover their primitive form but ceding some not very essential characters. Dreams and images of "el dorados" , religion, beliefs, new endowers, business, etc. that are strong enough to emigrate, fight for, and endure sacrifices. Seeking pleasure, love, power, riches but in a practical and short time is a very general and common Ψ-force.

A9 The Attraction Forces. Ψ-Atract

The attraction forces, Ψforces, that only living beings possess will be treated independently of the general physical forces.

Eventually, in the future it may be proved that Ψforces con be correlated to general forces and a new chapter of science will be written.
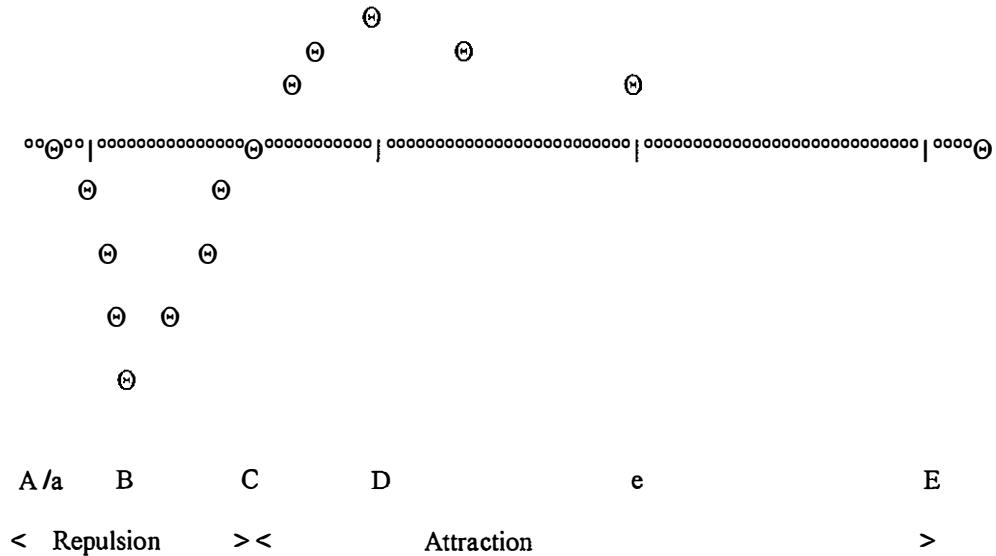
The basic structure of a Ψ-force is represented by Fig. I

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              Θ       Θ

                Θ   Θ

                  Θ


A /a      B          C          D                    e                          E

 <   Repulsion      > <              Attraction                          >
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Fig. I

A10 Comments on ΨAtract, ΨA.

(1)   The standard function, **ΨA,** is an elastic-plastic function, its domain is [A,E] and in the interval [A,C] the attraction is negative (repulsive) and in the interval (C,E] it is attractive.

(2)   In the interval [A,C] the function ΨA has the maximum repulsive force at point B and in the interval (C,E], ΨA, has the maximum attractive force at D.

(3)   At point C   ΨA is null , no attraction and no repulsion .

(4)   Point (a) is the starting point of the fusion process of the pair of entities .

Point (e) is the starting point of the desegregation of the pair, the attraction is very small to maintain the aggregation.

(5)   In the interval [B,D] the system may oscillate with different amplitudes.
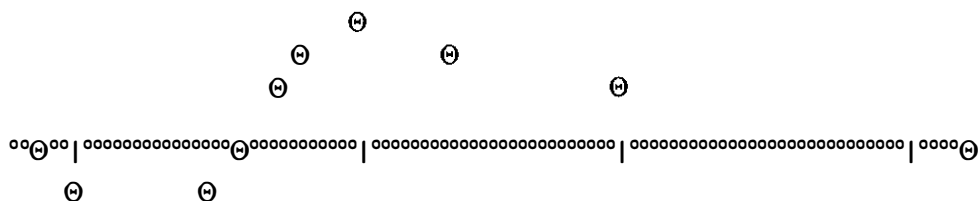
If the amplitude of these oscillations is small it represents the common situation of marriage , friendship , etc. and may be of long duration.

External forces may increase the amplitude and the system may escape to the regions (D,E) or (A,B)

(6) In general the absolute values of the function at B and D are different and at B it is higher then at D. The interpretation of this dissimilarity is that fusion implies much more energy then the de-aggregation of the system.

(7) In general the absolute values of the function at B and D are different and at B it is higher then at D. The interpretation of this dissimilarity is that fusion implies much more energy then the de-aggregation of the system.

If the model is a description of a living entity, AgΨ, then its mass, M and the inertial moment , IM, must be known.

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A /a   B   C   D   e   E

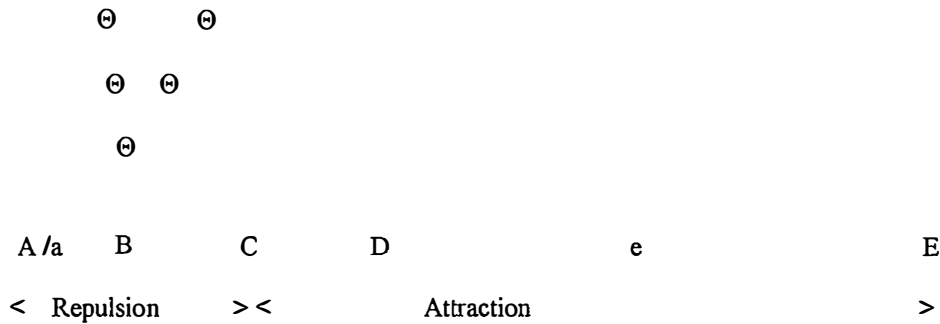< Repulsion   > <   Attraction   >

Fig. I

A11 Interpretation of ΨForces
The X coordinate may be considered a « virtual distance» to be adjusted in each case by an expert.

The interval (Xa,Xe) is portioned in 5 parts.

The Ψforce attains the maximum value at Xd and the attraction starts reducing if distance is diminishing and is null at Xc and if the process continues Ψforce starts to be negative and repulsive.

The system may oscillate around XC.

The set of attractive forces in physics are essentially functions of the distance of the two interacting bodies.

The most simple problem is a pair of Ψentities, (ΨU , ΨV) that interact with a ΨF force. The force ΨF depends of the attraction forces of the entities and also of their physical distance.

The Ψsystem is considered an aggregate if the coordinate X is in the interval (A,E) and if X<A the system was crunched and X>E the system is de-aggregated and in both cases the system is annihilated.

Vide 3N12 .

A12 Conjugated Forces .
Some typical cases will be presented based on a simplified ambient , namely, 1- Dimensional space or exceptionally a 2-dimensional.

Conjugation of Inertia with Ψforces, the trajectory, velocity (linear and angular), and the resulting acceleration can be evaluated.

The inertial force, F=M.Ac and moment, InF=InMxInAc, where Ac is the acceleration vector and InAc the rotation acceleration.

It is an hard problem of calculation if many agents intervene simultaneously and move in a 3dimensional space.

Case-1
The agent , AgΨ, is positioned in the interval [e , E] , consequently outside the influence of the attraction of the agent, AgΨ, is null and the force FΨ(A)=0, .

Assuming that agent AgΨ, is moving with a constant speed and directly to C, then the attraction force, FΨ, if acting alone, will accelerate the movement till it reaches, C, and the maximum speed and energy are attained .

From point C to A , the attraction is negative and the speed of AgΨ will be reduced.

The shape of the function, FΨ, enables the evaluation of the amount of energy, E(ce), that will be produced by the force, FΨ, in the intervals [A, C], and [C, E].

If AgΨ has mass and Ac is the acceleration, than inertial force intervenes , F=M.Ac , and the trajectory, velocity and acceleration must be calculated and the conjugated forces is obtained by adding the vectors of F and FΨ.

Case-2

Assuming that Eac>Ece and EΨ, EΨ0 are the inertial energies of AgΨ, AgΨ0, and the referential corresponds to the coordinates of AgΨ0, then EΨ0=0 .

If EΨ > Eac-Ece then the two agents will fuse and subsequently either disperse, or create a new living entity or even may even annihilated.

To avoid the loosing life, Ψ, normally Eac >> Ece .

Case-3

Assuming that Ebc >Ece and EΨ < (Ebc - Ece) then the agent AgΨ will never fuse with AgΨ0.

If EΨ at E, EΨe, is such that the energy at D, EΨd, is null then the system will start to oscillate in the interval [B,D].

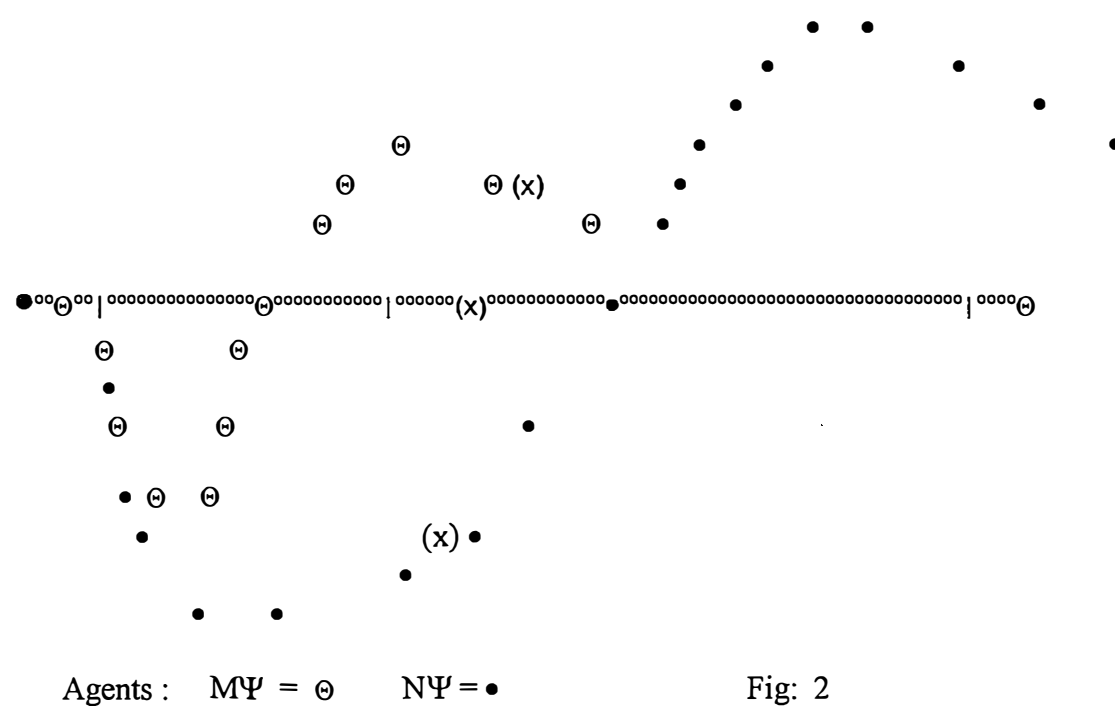This oscillation can be perturbed if energy of the system is altered by means of an external interference.

If the systems energy is reduced the amplitude diminishes and the system can be stopped at C.

If the systems energy is increased the amplitude is increased and the system may be destroyed.

A13 Conjugation of a pair of agents, (MΨ , NΨ) .

Agents MΨ and NΨ create attraction forces depending of the distance, Ψmn between the two agents , namely, FmΨ (Ψmn), FnΨ(Ψmn).

In general, the two forces are different . Vide Fig: 2

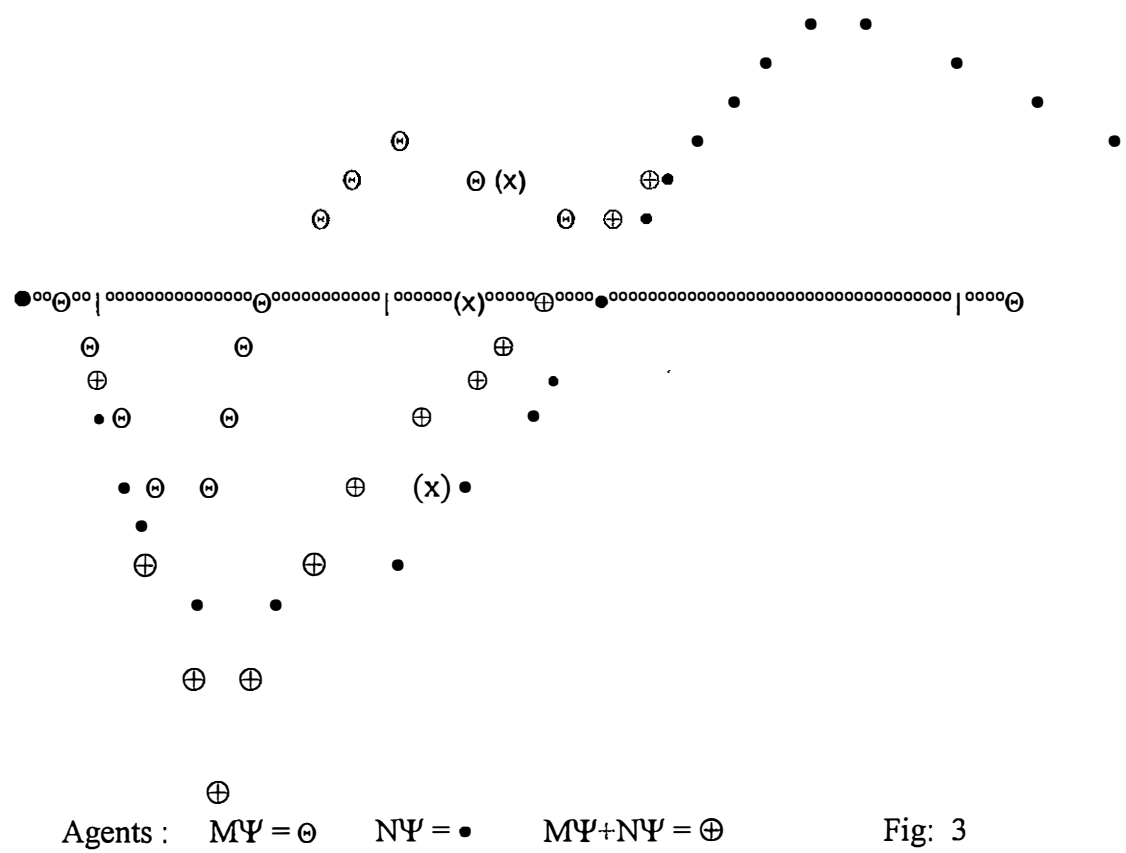Agents :   MΨ = Θ NΨ = •   Fig: 2

   The two agents , $M\Psi$ and $N\Psi$, are at a distance $\Psi mn = (x)$ and the respective attractive forces are, $Fm\Psi (x) > 0$ and $Fn\Psi(x) < 0$, $Fm\Psi (x) < Fn\Psi(x)$ and jointly , $Fm\Psi (x) + Fn\Psi(x) < 0$.
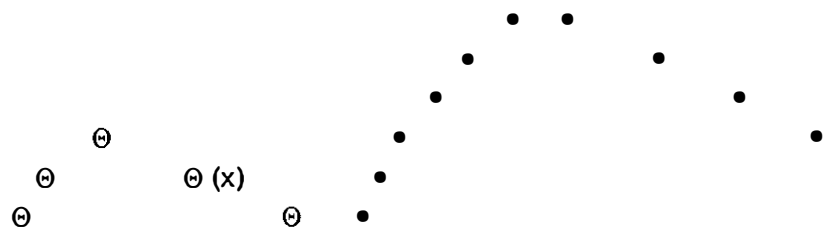
   If some external force is applied to the system reducing the distance (Ψmn) the system may be destroyed , for instance , one of the agents is destroyed or both or a new agent is build .
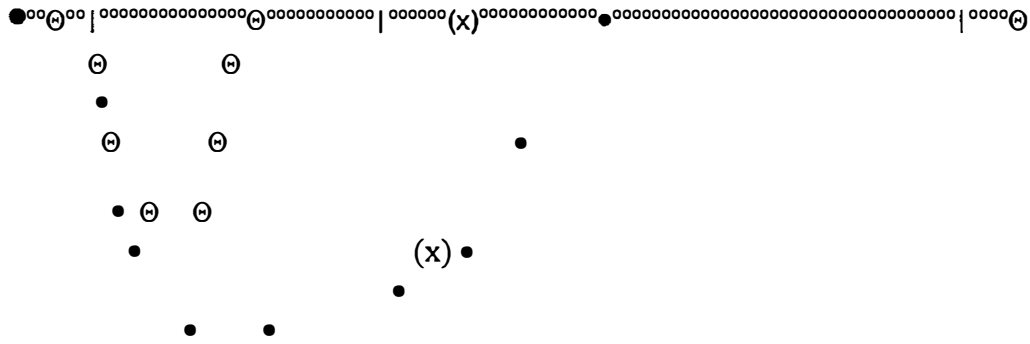
A14 The Conjugation of two attractive fields .

   The conjugated attraction forces of agents $M\Psi$ and $N\Psi$ create attraction forces depending of the distance, Ψmn is represented in Fif:3 .

Agents : $M\Psi = \ominus$ $N\Psi = \bullet$ $M\Psi + N\Psi = \oplus$ Fig: 3

   Agents $M\Psi$ and $N\Psi$ create attraction forces depending of the distance, Ψmn between the two agents , namely, $Fm\Psi (\Psi mn)$, $Fn\Psi(\Psi mn)$.

   In general, the two forces are different . Vide Fig: 2

●ºº☉ºº | ºººººººººººººº☉ºººººººººº | ºººººº(x)ºººººººººº●ººººººººººººººººººººººººººººººººº | ºººº☉

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Agents :   MΨ = ☉   NΨ = ●   Fig: 2

The two agents , MΨ and NΨ, are at a distance $\Psi mn = (x)$ and the respective attractive forces are, $Fm\Psi (x) > 0$ and $Fn\Psi(x) < 0$, $Fm\Psi (x) < Fn\Psi(x)$ and jointly , $Fm\Psi (x) + Fn\Psi(x) < 0$.

If some external force is applied to the system reducing the distance (Ψmn) the system may be destroyed, for instance, one of the agents is destroyed or both or a new agent is build .

NOTES
1N3, Universe and Models.
The models of the Universe are always limited parts of the Universe and the typical procedure is the following:

Part 1 the system or systems to be studied.

Part 2 the milieu where the systems are embedded .

Part 3 the remaining Universe.

The union of the 3 parts reconstructs de Universe and the 3 parts are all disjoint.

The hypothesis that part 3 is a silent partner is very difficult to prove and generally is not true in social problems.

2N3, Description of Human Aggregates.
Humans as *holons* of the universal set of entities of an aggregate or systems of aggregates will be modelled as indivisible entities and only external attributes are considered and their actions and reactions are only formally described.

The organs and any subsystem of the living being, (human) are not modelled.

No internal description of the organs that compose the human body but only the external characterisation and the actions and reactions.

The milieu is also considered a system of aggregates and the modelling procedure is limited to a formally description of the input, output activity.

3N12   Example of a ΨF
The basic structure of a ΨF is derived from a deformation of a cosine .

The range of ΨF is $(\pi/2 , 5/2\pi)$ and the partitioned as follows :

Arcs	Angles		Cosine	Observations
(A,B)	$(1/2\,\pi$,	$\pi)$	(0 , -1)	repulsion increases to the maximum.
(B,C)	(π ,	$3/2\,\pi)$	(-1 , 0)	repulsion decreases to zero.
(C,D)	$(3/2\,\pi$,	$2\,\pi)$	(0 , 1)	attraction increases to the maximum.
(D,E)	($2\,\pi$,	$5/2\,\pi)$	(0 , 1)	attraction decreases to zero.

The deformations are applied both in XX and YY coordinates , for example :

1: Arc (A,B),

Let W be any arc of (AB) , the coordinate X will be given by the linear expression X(W)=Mab(W-A) + Nab and consequently X(B)= Mab(B-A) + Nab. The parameter Mab will be used to alter the relation of arcs to coordinate and Nab interferers with the origin of coordinate X .
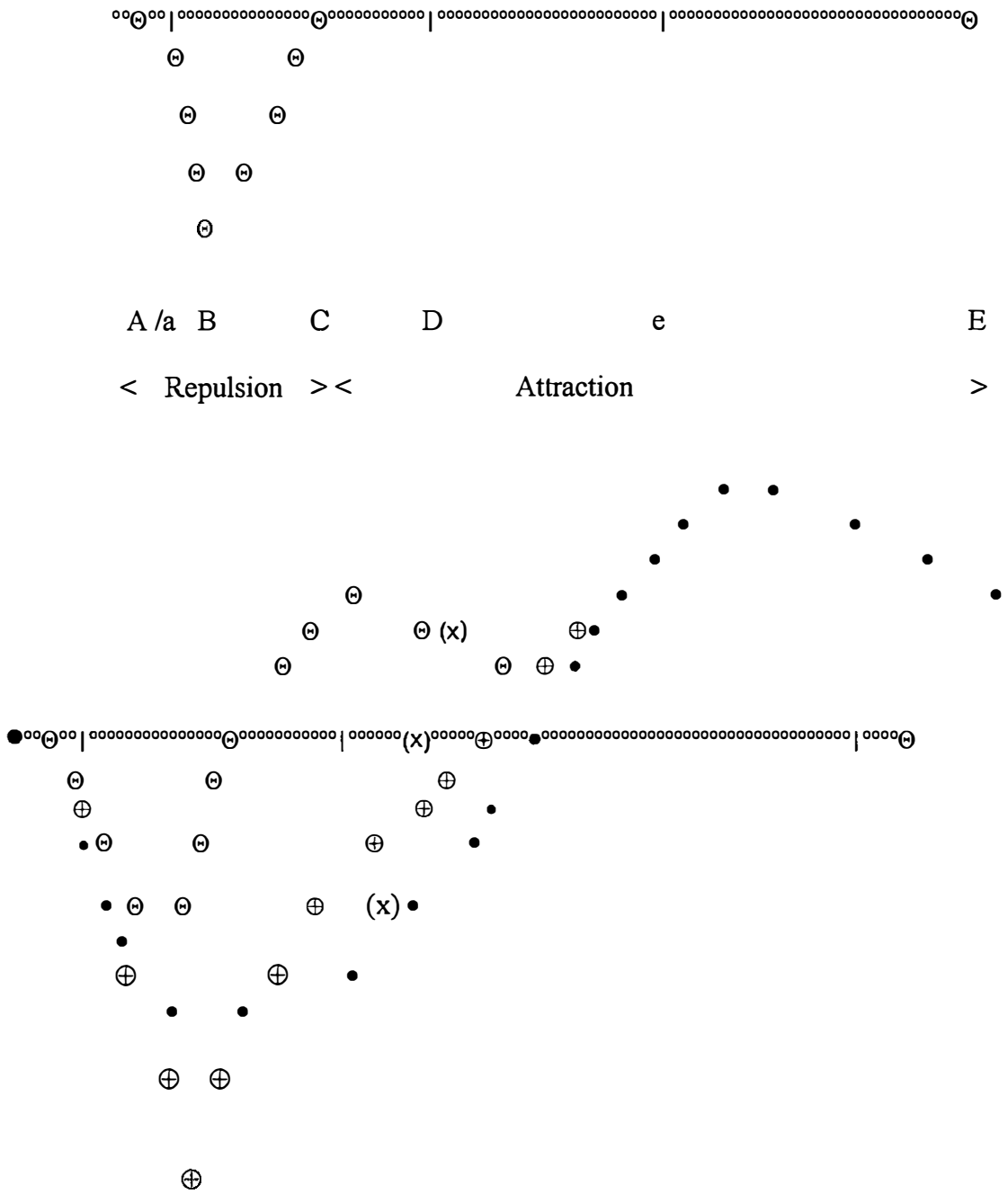
Regarding the coordinate Y, the expression will be Y(W)=Sqr(W-A)+Y(A) and consequently Y(B)=Sqr(B-A)+X(A).

2:   Arc (B,C), For W in (B,C), the formulas are similar X(W)= Mbc(W-B) + Nbc and X(C)= Mbc(C-B) + Nbc and for coordinate Y, the formula is :
Y(W)=Sqr(WB)+Y(B)

3,4: Arcs (C,D) and (D,E) the formulas have the same structures and eventually different parameters.

The final result is the function ΨF

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  Θ   Θ

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A /a B   C   D   e   E

< Repulsion > <   Attraction   >

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                 Θ   Θ   ⊕   •

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       •
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       •   •

      ⊕   ⊕

       ⊕

Agents :   MΨ = Θ   NΨ = •   MΨ+NΨ = ⊕   Fig. 3

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