A

Universal Theory

of

Evolution

INTRODUCTION

What if we've got it all wrong? What if the science we've inherited from our Victorian forefathers has instilled in us a way of looking at the universe which is fundamentally wrong. For the last hundred years, quantum mechanics has been trying to tell us something different. But we've been misinterpreting the message. It's time for a radical re-think.

Let me introduce you to a new universal framework for evolution.

200 years ago, Darwin originally penned his approach to natural evolution. From the outset, he was acutely aware that his concept had a glaring hole: it did not explain cooperation. With his concept of 'survival of the fittest' Darwin deduced there to be generic competition between members of species – self-same organisms competing to survive, the successful passing on their traits to each next generation. His was just the introduction to a much larger story. When you quantise Darwin's theory, then a whole new way of understanding the universe emerges.

This new theory proposes that systems (including but not limited to all living organisms) compete and cooperate in a priority set of very specific ways. This creates a layered framework for the progression of evolution from competition of lone entities through to the emergence of highly organised cooperative groups, such as multicellular organisms and us.

But this new construct goes much further than this. Applied to the physical sciences, the same approach shows why there exists the major phases of matter (plasma, gas, solid and liquid). Applied to the social sciences, it provides a way to understand the long-term development of civilisation, showing why we experience various types of social structure and cultural influence.

When it is appreciated that material systems compete or cooperate for energy in discrete ways, then it becomes apparent that there are four fundamental processes, which drive the emergence of all things from sub-atomic particles to galaxies.

SYSTEMS: ORGANISMS, AGENTS

Let's start with an autonomous organism, which does not currently appear to cooperate with others of its own kind.

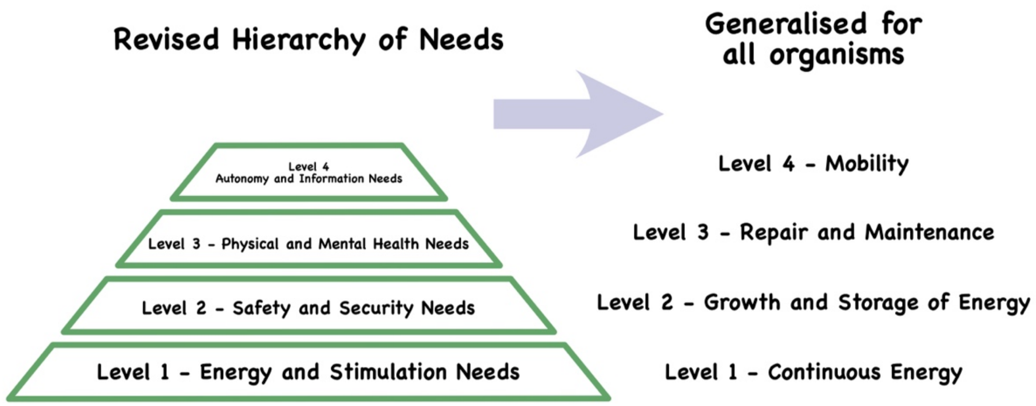
Every known living system must consume energy to survive. We can attribute a set of energetic needs to all such whole systems, as follows:

- Need 1 - to supply a steady flow of energy to all component parts (say, cells within a body);
- Need 2 - to be able to store or defend a source of energy, to withstand periods of scarcity;
- Need 3 - to obtain enough energy to self-repair and maintain good health; and
- Need 4 - to be autonomous, to search out new sources of energy on the physical landscape.

These needs form a priority hierarchy, where Need 1 is the most important survival need. These needs can also be expressed in terms of temporal urgency (Need 1 – immediate, Need 2 – near term, Need 3 – long-term, Need 4 – indefinite and spatial).

Example:
Within your body every one of your cells (each itself being a living system) needs to receive a continual supply of energy to survive (Need 1). Your whole body has a store of energy, and you can survive relatively short periods without energy by drawing down on those reserves (Need 2). You have a regulation and immune system, which maintains your health (Level 3). You are an autonomous creature, capable of intentional movement in real physical space (Level 4).

Figure 1



The Revised Hierarchy of Needs has been adapted from Maslow's Hierarchy of Human Needs.

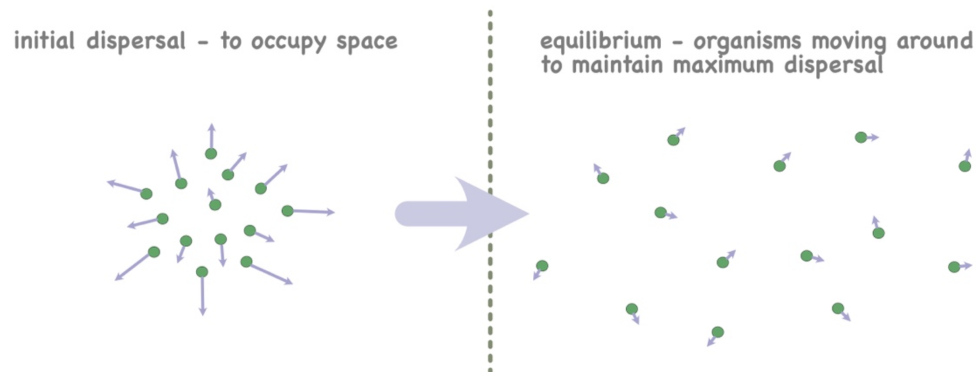
To aid understanding of this new approach, living organisms are used as the example system. However, the same principles apply to all naturally occurring systems, from sub-atomic particles up to stars, generically referred to as 'agents'.

ECOSYSTEM

Imagine a population of identical organisms released into a habitat.

Assume at the outset that these agents eat a singular specific food type. This new environment provides them with a continuous but limited supply of this energy dispersed across the landscape. As our population of self-same organisms all consume the same food, then they will be the most severe competitors for this limited supply of energy. They each respond by moving around on the landscape to both maximise their access to energy and minimise their experienced competition with others of their own kind. This leads to complete dispersal of the population into all areas where their preferred energy is available, resulting in a macroscopic equilibrium.

Figure 2



ENERGY

All food in the natural environment comes in discrete quanta – fruits on a tree, clumps of grass, individual prey and so on. This is critical for appreciating why cooperation eventually emerges.

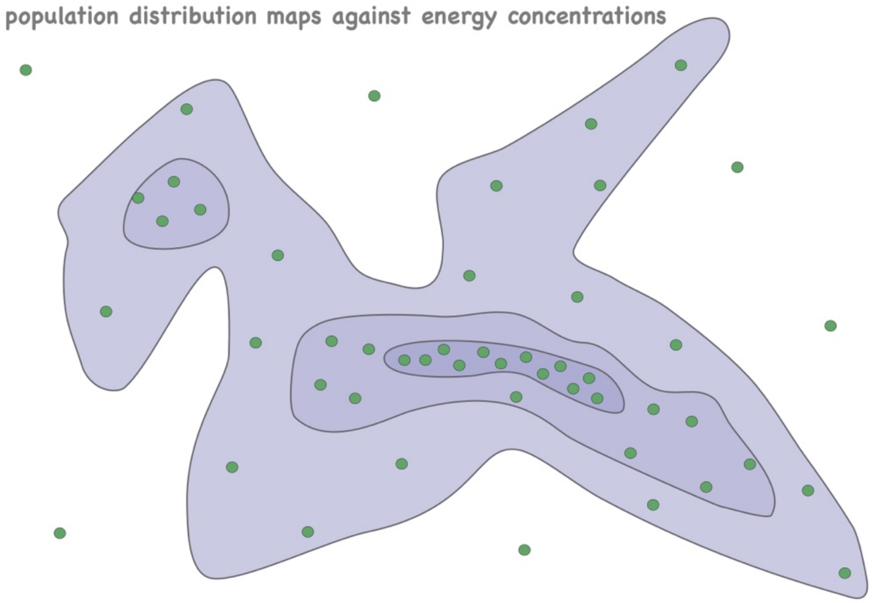
An individual organism will respond to its energetic environment broadly as follows:

- if there is general scarcity of energy, then it will focus on its Level 1 needs;
- if the average quantum of energy is sufficient, but frequency is low, then it will focus on Level 2 needs (stores of energy are depleted while looking for more food);
- if quantum of energy and frequency is adequate, then it can focus on Level 3 needs; and
- if there is spatial variation in energy, requiring the organism to move to obtain new energy, then it will focus on Level 4 needs.

IDEAL TYPES OF INTERACTION

As the organisms are the same and exist together in the landscape, competition between them causes their energetic circumstances to end up being similar. Hence, in first instance, they will spread out across the landscape, the population becoming evenly dispersed. If the distribution of energy across the landscape is uneven, then their spatial population density will map that unevenness so that they all experience a similar degree of competition for food. Competition equalises their situations.

Figure 3



In having the same energetic circumstances, they all prioritise their needs in the same way. For example, if energy is scarce, they will all be most focussed on satisfying their Level 1 needs. However, if there is sufficient food to readily meet their Level 1 needs, they may mostly progress to focussing on their Level 2 needs, and so on.

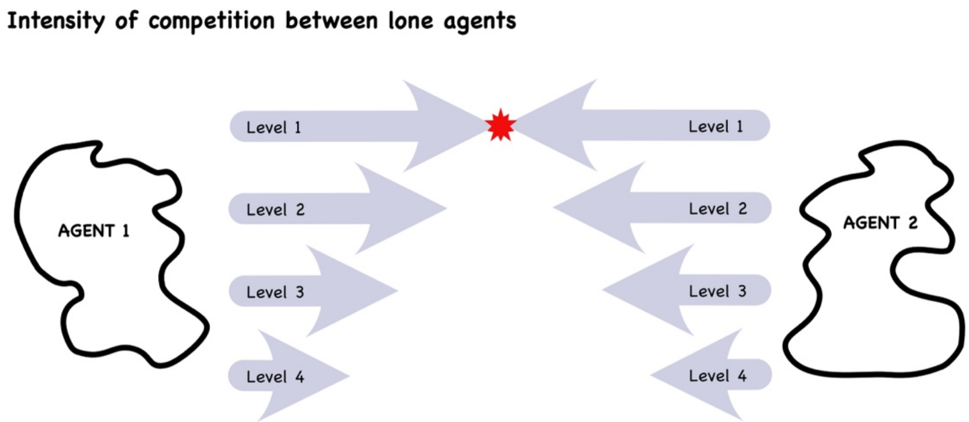
Wherever they interact, whether competitively or cooperatively, then the nature of the interaction will be defined by the need which they are each prioritising. In experiencing similar energetic circumstances and thereby all prioritising the same need, then this gives rise to dominant needs-driven interactions, which are labelled Ideal Types of Interaction. For instance, where the cohort of organisms are generally seeking to address their Level 1 needs, they primarily participate in Level 1 Ideal Type interactions. Where they are generally seeking to satisfy Level 2 needs, then Level 2 Ideal Type interactions will dominate, and so on. These needs-driven interactions correspond to the following situations:

Level 1 Ideal Type interactions – sourcing, stealing, sharing, or exchanging food;
Level 2 Ideal Type interactions – competing for, or cooperating to defend, a source of food;
Level 3 Ideal Type interactions – competing or cooperating to maintain health; and
Level 4 Ideal Type interactions – sourcing, stealing, sharing, or exchanging information.

The agents newly introduced to a habitat will compete in relation to all their needs. However, given that Need 1 is most critical, then competition will in first instance be most intense in terms of securing a continuous flow of energy. This is referred to as Level 1 competition. Competition at higher levels exists but is invariably less intense. Consequently, for this population of agents, the encounters that they experience will almost entirely correspond to Level 1 Ideal Type interactions.

In practice, in the absence of formation of any cooperative groups (see below), then interactions will mostly be of a Level 1 type.

Figure 4



The Ideal Type interactions are mechanistically different – compare sharing food against functioning together to defend a territory. This is explained in more detail in Appendix A.

FORMS OF INTERACTION

Within any population of identical energetic agents, there are **four** theoretical ways in which they can interact (compete or cooperate) when seeking to satisfy their individual energetic requirements.

FORMS	PASSIVE	ACTIVE
COMPETITIVE	(1) latent competition	(2) taking
COOPERATIVE	(4) latent cooperation/exchange	(3) sharing

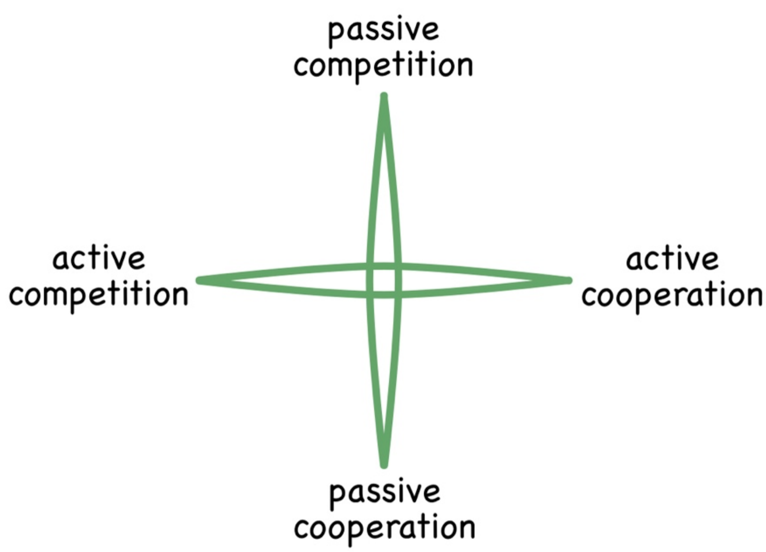
These Forms of Interaction apply in relation to each of the Ideal Types. However, the following examples pertain specifically to Level 1 Ideal Type interactions:

Passive Competition (latent competition)	This is the equivalent to someone picking blackberries on the side of a footpath and then someone else coming along later to find that there aren't any left. The two agents are competing for a limited supply of energy, but one obtains it first, the other is left without. There is no spatial interaction between the two agents and thence no conflict.
Active Competition (taking) (direct spatial interaction)	This represents one agent stealing energy from another. For instance, the second agent finds the first with a bag of blackberries and takes it from them. This involves direct spatial interaction and tends to lead to confrontation and conflict.
Active Cooperation (sharing)	This is expressed as two agents picking blackberries together and sharing the benefits of their harvest. It also involves direct spatial interaction or at least proximity.

(direct spatial interaction)	(*The motivation for sharing is explained further below.*)
Passive Cooperation (latent cooperation) (exchange)	This can be expressed in two ways: – in discovering that one party had picked blackberries, the other party seeks out a slightly different food type, say raspberries – this represents latent cooperation by reducing the level of competition for the limited supply of blackberries; or – the two parties could extend their latent cooperation by exchanging some blackberries for the same amount of raspberries, such that they each benefit from consuming a wider range of nutrients but there is no net flow of energy between them.

For visual assistance, the Forms of Interaction can be displayed on the diagram, as shown below. Active competition and active cooperation are, essentially, the opposite of each other. Likewise, passive competition and passive cooperation represent antitheses.

Figure 5

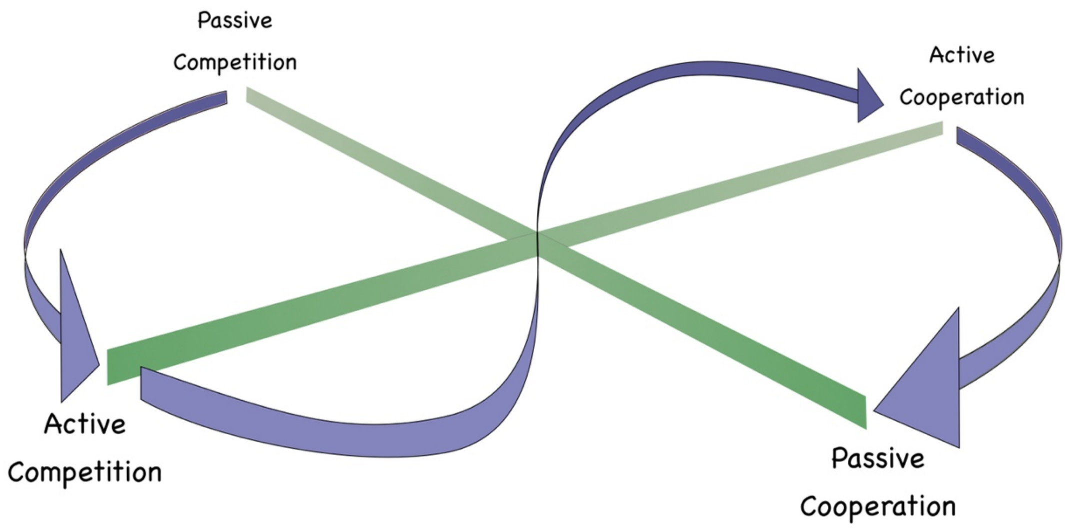


EVOLUTIONARY FRAMEWORK - COMPETITION AND COOPERATION

When a population of agents first interact, they follow a sequence of responses in terms of how they compete or cooperate. This starts with Level 1 passive competition, which effectively equates to seeking to avoid direct competition. This is a highly stable solution. Without any further changes in population pressure or energy supply, then this arrangement can perpetuate indefinitely. However, if intensity of competition for resources increases, then typical interactions can progress to Level 1 active competition. Level 1 active cooperation subsequently arises when active competition becomes too intense, progressing finally to Level 1 passive cooperation.

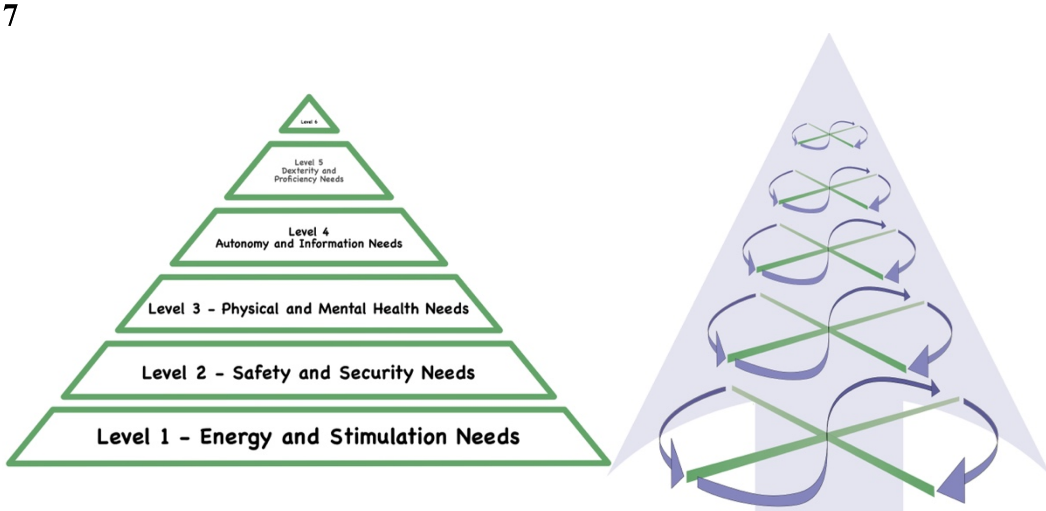
The reason for the switch from competition to cooperation differs for each need and is explained further below.

Figure 6 – Interaction Sequence



The layered Ideal Type interactions and the Forms of Interaction can be combined into a progressive evolutionary framework. A population of agents will start competing at Level 1 and progress through the competition-to-cooperation sequence. If agents within the population start to cooperate at Level 1, then groups appear – outwardly competitive and inwardly cooperative. Agents will no longer function as lone entities. These newly formed groups of agents will now be the competitive systems at Level 1.

Figure 7



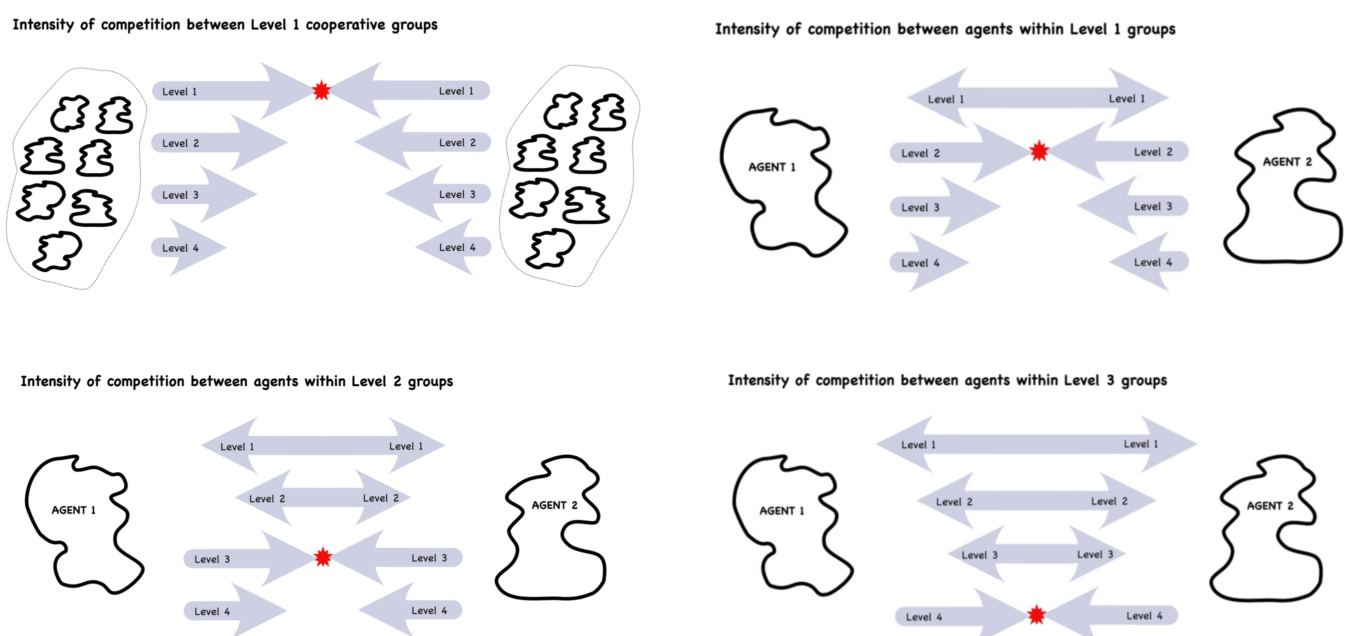
Within these groups, with Level 1 competition between the organisms having effectively been tamed, then the most intense competition now moves up to Level 2, repeating the same sequence from competition to cooperation. And then again at Level 3, and so on.

This framework gives rise to a hierarchy of system types. When agents are all competing individually and there is no cooperation between them, then they represent a population of lone agents. Where groups of agents exist, internally cooperating at Level 1 but competing at Level 2, then these represent Level 1 systems. Where those groups have progressed to internally cooperating in relation to Level 1 and Level 2 needs but internally competing at higher levels, then these represent Level 3 systems, and so on.

System	Population	Level 1	Level 2	Level 3	Level 4
Need 1	competition	cooperation	cooperation	cooperation	cooperation
Need 2	competition	competition	cooperation	cooperation	cooperation
Need 3	competition	competition	competition	cooperation	cooperation
Need 4	competition	competition	competition	competition	cooperation

Within a population or group, no substantial cooperation can take place at a higher level whilst there is still competition at a lower level. External competition between groups influences how these groups internally cooperate. Increased intensity of external competition forces increased levels of internal cooperation, which in turn forces the agents themselves to evolve.

Figure 8



Examples of different cooperative systems include:

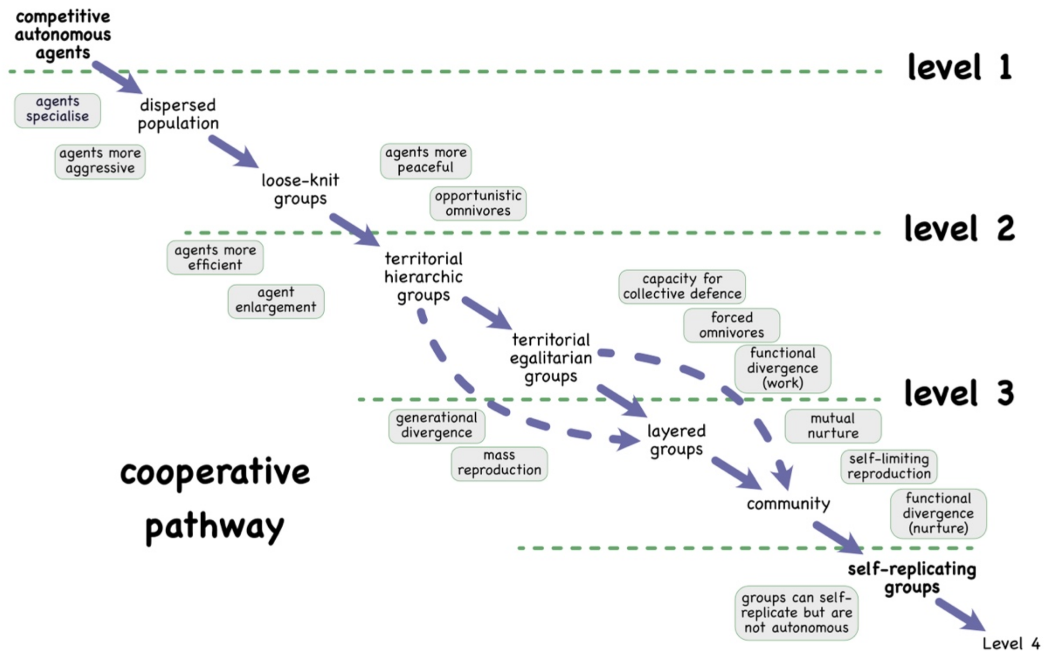
- Level 1 systems – herds, peaceful animals capable of sharing food
- Level 2 systems – territorial groups, such as chimpanzee troops
- Level 3 systems – self-replicating groups, such as social insect colonies
- Level 4 systems – whole new systems of agents becoming autonomous

EVOLUTIONARY PATHWAY

It is the initial Level 1 competition that drives survival of the fittest within Darwin's theory of evolution. However, this is just the first step in a sequence of survival strategy responses, which can be explored by our population of agents. If the agents progress all the way to Level 4 cooperation, then new super-agents will be given form – being coherent, self-replicating, autonomous systems. These can now commence the same process again, starting back at Level 1.

Example
Starting with a population of bacterial cells at Level 1, this evolutionary process leads to a population of replicating, autonomous multicellular systems at Level 4, where the original simple prokaryotic (i.e. bacterial) agents have themselves evolved into much more complex eukaryotic cells, now component parts of a larger whole. These Level 4 systems (i.e. multicellular organisms) can now start the whole process again, the fruition of which would be cooperative social systems (say, human tribes, capable of roaming the landscape).

Figure 9



In summary, when intensity of competition amongst a population of self-same agents becomes sufficiently intense, this gives rise to a symmetry break, representing the first step of the formation of new larger competitive systems, made up from those self-same agents now cooperating in groups. As these new larger systems compete for survival, this drives selection for progressively more sophisticated internal cooperation amongst those self-same agents. As a result, those agents themselves evolve, becoming ever more tightly knitted into being component parts of a larger whole. Concurrently, the larger systems, of which the agents are a part, become more complex. The stages of progression and the rationale for the switches to cooperation at each Level are set out in more detail below.

SEQUENCE OF INTERACTIONS AT LEVEL 1

Returning to the population of identical organisms placed in a habitat, using the ideas presented above, we now explore in more detail how they respond to their new environment.

STEP 1 – PASSIVE COMPETITION

Our introduced organisms begin looking for food. They seek to minimise the level of experienced competition with others of their own kind. So, the population spreads out on the landscape, seeking to be as far apart as possible from any of their peers. This also maximises the amount of food that they each can obtain. This is the type of competitive evolution that Darwin observed. It provides the arena for selection of the fittest set of traits, facilitated by mutations, allowing organisms to adapt to different food sources and environmental circumstances.

Example:
If the population increases, then competition intensifies, this may drive some of the agents either into neighbouring habitats with different foods or to try out different food types within the original habitat. Over time, this could cause the appearance of new subspecies, specialising in those alternative food types. The outcome of this dispersal is either a patchwork of subspecies across the landscape or diversity of species within any one habitat. This response is directly consistent with Darwin's original theory. Each subspecies has become slightly biologically differentiated.

STEP 2 – ACTIVE COMPETITION

Assuming that our organisms are successful and that they experience minimal levels of predation, then their population numbers may swell. This will deplete the food supply and further intensify competition. The consequence is that simply wandering around the landscape looking for food is no longer adequate. Individuals need to develop an alternative strategy.

They adapt to realise that the best way to obtain food is to take it from others. This requires watching others of their own kind to see if they have found any food. The chances are that if there are more than two others co-located that it will be because of food. Instead of dispersing, they transition to mobbing food sources whenever found. This drives a behavioural change, whereby those who become more aggressive, stealing food from others, prove to be more successful.

Example:
A fantastic example of this in nature is sea gulls. The fly around looking for food, keeping a beady eye on each other. As soon as one looks as though it may have found some food, others flock in. And the more of them there are, the more likely there is to be food, attracting even more. Suddenly the tourist throwing a piece of bread to a passing gull is surrounded by a whole throng of sea gulls, squabbling for pieces of food, stealing it off each other. But as soon as the food source has been consumed, they all fly off in their separate directions.

STEP 3 – ACTIVE COOPERATION

When everyone is competing intensively and aggressively for food, what possible motivation could there be for cooperation ever to emerge?

Imagine that there is a tree laden with fruit in the jungle. It has just become ripe. It is quickly mobbed by a population of monkeys, actively competing to get some luscious food. Let's say there are 90 fruits on the tree and 100 monkeys turn up. As active competitors, only 90 of these monkeys can eat because the fruit comes in defined lumps - a quantum of food. Those 10 monkeys who don't eat today may not survive until tomorrow. The evolutionary solution to this is that some monkeys choose to share fruit. Each of these sharing monkeys now get 9/10ths of a fruit - enough to survive another day.

This may not appear to be a good strategy on any one occasion. But if there is a paucity of food supply over a long time, then those monkeys who shared food would ultimately do better than those who won't. The huge benefit that sharing confers to organisms within the species is to smooth the supply of energy. As they will each only benefit from sharing if they are actively present, they end up roaming around the jungle as a loosely connected group. Over time, the descendants of our original population of organisms all end up in competing loosely-knit groups.

Sharing requires a behavioural change, whereby they need to adapt from being aggressive to being peaceful with each other in the presence of food.

Example:
Herds and flocks and shoals are all examples of grouping behaviour from active cooperation. Whilst many food sources, such as grasses, may appear continuous, in times of drought even these revert to being found in small clumps that have to be shared.

STEP 4 – PASSIVE COOPERATION

Our population of organisms now function in groups roaming the landscape together. Individuals are no longer able to operate alone, and they always congregate in groups. At times of scarcity, they may continue to explore different food types. But now that they are operating in a group together, when they do start trying out other foods, instead of diversifying into separate species, they will remain one species which becomes more omnivorous. As per Passive Competition, this is also facilitated by biological adaptations.

At a system level, becoming omnivorous provides scope for a further behavioural change. Now that the species is capable of consuming more than one type of energy, then sharing can progress to exchanging – say, swapping a blackberry for a raspberry – same quantum of energy, but qualitatively different nutrients.

Example:
Social insects are generally omnivorous, including bees. They create nests, which represent focal points of interaction (for exchanging food types). However, their levels of organisation go well beyond just Level 1 cooperation.

LEVEL 1 SUMMARY

These, then, are the potential survival strategies at Level 1. They follow through a logical sequence running from Passive Competition, through Active Competition and Cooperation to Passive Cooperation. Both Passive Competition and Passive Cooperation select for mutations in our organisms, leading to biological diversification. Active Competition and Active Cooperation select for behavioural changes.

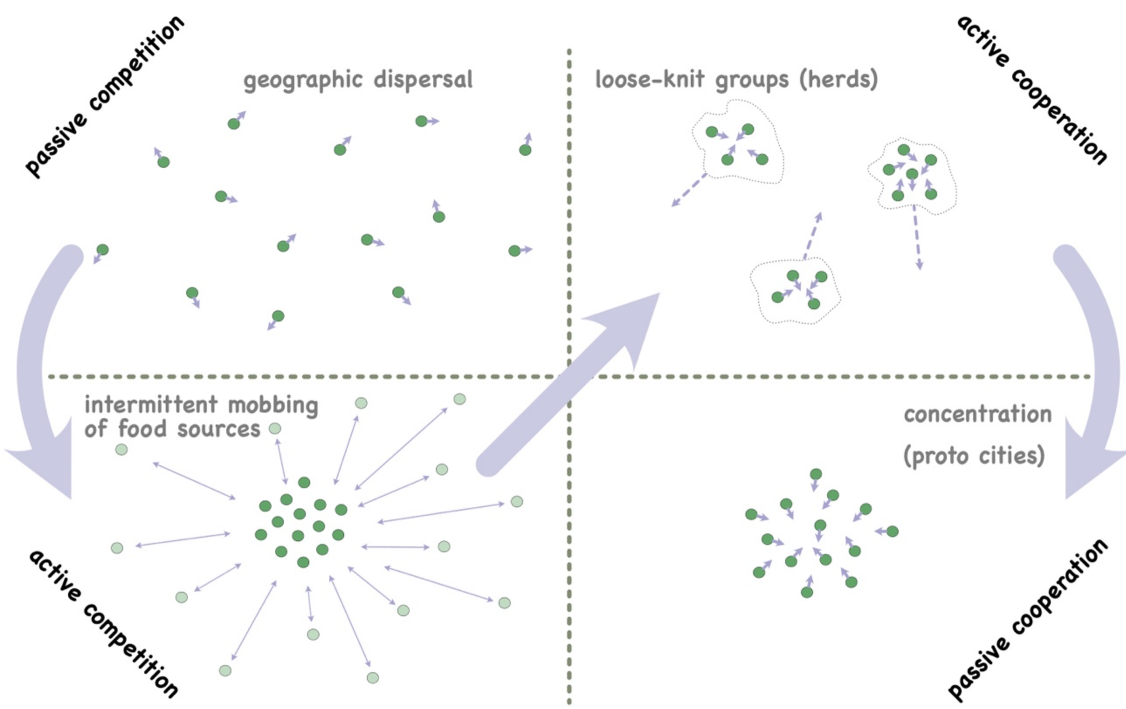
In transitioning from Active Competition to Cooperation, the prior aggressive behaviour becomes tamed but does not entirely disappear. Variation in degrees of aggressiveness amongst agents transforms into leaders and followers within the cooperative groups.

The different Forms of Interaction are shown in the table.

Level 1	**Individual Response**	**Population / Group Behaviour**
Passive Competition	biological / activity specialist	physical dispersal
Active Competition	more aggressive	intermittent mobbing/flocking
Active Cooperation	more peaceful	roaming as a loose-knit group
Passive Cooperation	biological / activity generalist	focal points of interaction

The figure below summarises the system level consequences of these competitive and cooperative strategies.

Figure 10



FORMS OF INTERACTION AT LEVEL 2 AND ABOVE

Once our organisms have formed Level 1 loose groups, then they are no longer individually competing at Level 1. Rather, it is now the whole groups which are directly competing for food across the landscape. With supply of energy smoothed by cooperating in groups, the most intense form of competition between individuals then raises up to satisfying Need 2.

The same sequence of strategies is now pursued, running from Passive Competition through to Passive Cooperation. These are, however, expressed differently, given the different character of the need. Subsequently, when cooperation emerges at Level 2, then the most intense competition between the organisms again moves up a level. And so on. It is not, however, a precise progression – think degrees of prioritisation rather than rungs of a ladder.

At each level of this layering of competition and cooperation, passive strategies give rise to definite biological changes in the organisms and the active strategies lead to identifiable behavioural changes. Rising up the cooperative framework, the interactions between the members of the groups become more sophisticated, leading to evolution of the agents and structural changes of the groups themselves.

LEVEL 2 - COMPETITION

With the supply of energy smoothed through Level 1 cooperation, organisms within groups can compete in terms of quantity of food or rate of intake of food.

Passive Competition is expressed in terms of individuals becoming more efficient with respect to their preferred food type, possibly involving a reduction in size. Active Competition is expressed in terms of increased rate of energy consumption, leading to competitive growth. Passive Competition becomes expressed at a population level in terms of more, leaner organisms, whereas Active Competition produces a reduced number of larger individuals, all of whom can withstand longer periods of scarcity.

Competitive growth intensifies the competition between groups. This causes them to become territorial, to defend a supply of food. In seeking to defend a territory, the erstwhile leaders and followers (of Level 1 groups) are forced to adopt a formal hierarchy. This is because the group becomes dependent on the larger and fiercer members to fight for the territory. In compensation for taking a lead in defending their territory, these larger group members get to choose the best food (amongst other potential benefits).

LEVEL 2 – COOPERATION

The transition to cooperation is driven by external group competition. A group, which is reliant on a single largest member to fight for them, will be less successful than a group, which is able to operate as a coherent fighting unit, where all individuals stand together as a team to defend their patch of land. This requires a behavioural adaptation – for members of the group to become more predictable towards each other and trust that their groupmates will hold the line when threatened.

Trust within the group must be built up on a day-to-day basis. This requires that they all act more predictably towards each other generally and necessitates a more equitable sharing of food. Erstwhile competitive growth tails off and the previous hierarchy becomes moderated: for example, previous behaviour, where a leader may threaten and take out their anger on junior members of the group, is no longer tolerated.

Passive Cooperation becomes expressed by means of a transition to forced omnivorousness. For Level 1 roaming groups, eating a wider range of foods was an opportunistic response. For Level 2 groups, constrained to inhabit a specific territory, they find themselves having to eat a selection of food types, eventually becoming dependent on consuming more than one food type. Where they function together to defend a territory, then individuals will take on different roles.

Level 2	**Individual Response**	**Population / Group Behaviour**
Passive Competition	functional specialist competitive efficiency	individual territoriality
Active Competition	more unpredictable competitive growth	group territoriality (expanding) hierarchic groups
Active Cooperation	more predictable managed growth	group territoriality (fixed size) structured egalitarian groups
Passive Cooperation	functional generalist, capable of taking on different roles	division of labour within group

LEVEL 3

The first step of Level 3 competition is for organisms to continue to look after their own health with no assistance from others in a group. This includes individuals rearing young themselves. This can lead to considerable overlap between generations, which in turn causes generations to compete for energy.

Level 3 Active Competition is expressed in terms of frequency of reproduction or number of offspring. This represents competitive reproduction.

Within Level 2 hierarchical groups, competitive reproduction manifests as preferential health care and reproductive opportunities for those higher up the social system. Those lower down find themselves marginalised. Rather than a precise hierarchy, the format of the underlying interaction means that the group becomes layered. Those at the bottom suffer from ill-health and are hindered from rearing offspring. This limits the reproductive success of the whole group.

Those groups, which begin to fully cooperate in mutual healthcare and the rearing of offspring, are reproductively more successful and expand in numbers relative to internally competitive groups. Passive Cooperation is expressed as individuals taking on specific health care roles.

The group, which has fully mastered Level 3 Passive Cooperation, is itself capable of replication.

Level 3	**Individual Response**	**Population / Group Behaviour**
Passive Competition	focus on self and own offspring	individual nurture intergenerational competition
Active Competition	more unreliable competitive reproduction	layered groups with factions
Active Cooperation	more reliable managed reproduction	community increased group size
Passive Cooperation	nurture generalist, capable of adopting different nurture roles	welfare community group capable of replication

LEVEL 4

Level 4 competition and cooperation become relevant when a group of organisms is forced to explore new unfamiliar territory. This may happen when Level 3 self-replicating groups increase in number and force the species outwards beyond existing habitat boundaries.

The first step of Level 4 competition is for members of a group to seek out information about the physical landscape themselves. This can cause the group to lose coherence, enacting internally chaotic behaviour.

As the group becomes more stressed, members within the group compete for information about the surrounding landscape and seek to influence the group's decisions and direction of travel. Any existing internal factions will likely take different viewpoints and vie for control. This can cause the whole group to exhibit chaotic movement.

Cooperation arises from members of the group being honest with each other about discovered sources of food and other found dangers. It is reliant on all members of the group accessing the same information and having equal influence on decisions. This enables the group to operate with coherence and gain autonomy. Passive Cooperation represents a further step, whereby individuals become experts in different areas of information.

Level 4	**Individual Response**	**Population / Group Behaviour**
Passive Competition	increasing spatial intelligence	individual exploration group incapable of movement
Active Competition	more deceitful competitive lying	factions vying for control chaotic movement
Active Cooperation	less deceitful sharing of knowledge	coherent group movement collective decision-making
Passive Cooperation	information generalist, capable of adopting different roles	coherent group exploration collective intelligence

FORMS OF INTERACTION - SUMMARY

The outcome of cooperation at each Level is as follows:

- at Level 1, we see sharing groups, able to smooth the flow of food for each organism;
- at Level 2, we see territorial groups, capable of defending a patch of the jungle;
- at Level 3, we see groups which become capable themselves of replication; and
- at Level 4, we see groups which have gained autonomy.

Level 4 fully cooperative groups represent new fully functional autonomous organisms, which can again compete at Level 1 against other similar super-organisms.

NESTING OF SYSTEMS

This new way of looking at evolution could be called an Agent Based Construct (ABC) for evolution. The evolutionary pathway starting at Level 1 (Passive Competition) functions for any openly competing unit, which does not otherwise already express any cooperation with other self-same systems. To this end, the starting agent could be: an atom, a prokaryotic cell (bacterium), a multi-cellular organism or a social agent (such as a human tribe).

By the time a group of original agents is cooperating at Level 4, then they have formed a new super-agent, which can start the whole process again at Level 1 Passive Competition, competing against other super-agents. However, it should be noted that in the process of progressing up the ladder, the agents themselves will have fundamentally changed. Hence:

- atoms progress up the layers to become complex molecules within prokaryotic cells (bacteria);
- prokaryotic cells progress up the layers to become eukaryotic cells in multi-cellular entities;
- basic multi-cellular systems progress up the layers to become complex autonomous organisms;
- complex multi-cellular systems progress up the layer to form human tribes at the apex; and
- human tribes compete and then cooperate to give form to ever-more complex society, where the latter is beginning to exhibit Level 4 tendencies but by no means fully achieved Level 4 cooperation.

CIVILISATION

Human civilisation has arisen from the same set of processes operating on originating human tribes, representing super-agents. These have gradually come together, interacting in increasingly sophisticated ways to create the modern society that we know – forming cities, nation states, major religions and democratic systems. When cooperation takes place, then this is reliant on identifiable adopted behaviours and attitudes between people.

Process	Social Structures	Cultural Themes	Behaviours	Attitudes
Level 1	marketplaces	consumerism	peacefulness	acceptance
Level 2	bureaucracies	capitalism	predictability	trust
Level 3	communities	religion	reliability	faith
Level 4	movements	democracy	inclusivity	honesty

FUNDAMENTAL PROCESSES

This agent-based construct suggests that sitting behind the evolution of all things in the universe are four fundamental processes. These processes each manifest in competitive and cooperative ways.

	COMPETITIVE MODES	COOPERATIVE MODES
1	chaos and anarchy	identity and liberty
2	growth and dominion	structure and security
3	layering and alignment	holism and welfare
4	control and manipulation	democracy and inclusivity

Applied in the context of the physical sciences, these processes give rise to the major phases of matter that we experience: (1) plasmas and gases, (2) solids, (3) liquids, and (4) vortices.

A UNIVERSAL THEORY OF EVOLUTION

This Agent Based Construct for evolution provides a mechanism to unite all our key areas of science, showing general processes which underly the evolution of all energetic and material systems within our universe. The same process can, for instance, be applied to stars, ultimately leading to autonomous galaxies.

This new theory suggests that:

1. there was no Big Bang - the universe has taken far longer than 13bn years to evolve;
2. there are no fundamental laws or forces - the universe made it up as it went along and all forces (including gravity) are a consequence of the behaviour of matter, not a cause;
3. there are no gods - these are natural human constructs arising from the way we interact; and
4. there is no multiverse - this is also a human construct arising from the way we interact.

This alternative perspective is entirely consistent with Darwin's theory of evolution, layering on the inherent quantum nature of energy (food). It is also entirely consistent with quantum mechanics and the laws of thermodynamics, albeit leads to a different interpretation of the meaning of entropy. This approach suggests that matter itself arose because of the original Level 1 symmetry break and the first emergence of cooperation.

APPENDIX - IDEAL TYPES OF INTERACTION - MECHANISMS

When two (or more) agents interact to satisfy their needs, whether competing or cooperating, then the nature of such interactions differ depending on the need being addressed. These have been denoted Ideal Types of Interaction (1 to 4). These emergent relationships are summarised below and then explained in more detail in subsequent sections together with the rationale for cooperation.

Ideal Type - Level 1 – to supply a steady flow of energy to all component parts	
Passive Competition	operate individually, searching for own food
Active Competition	take food from others of own kind
Active Cooperation	share food equally within a group
Passive Cooperation	explore other food types (and exchange different types of food)
Ideal Type - Level 2 – to be able to store or defend an energy source	
Passive Competition	operate individually to defend own territory or source of food
Active Competition	collective territoriality, but inequitable distribution of food therein
Active Cooperation	collective territoriality with equitable distribution of food
Passive Cooperation	collective territoriality, taking on different defensive roles
Ideal Type - Level 3 – to self-repair and maintain good health	
Passive Competition	self-nurture and individuals rearing own offspring
Active Competition	collective grooming, but inequitable levels of attention
Active Cooperation	collective grooming, everyone receives same level of nurture
Passive Cooperation	collective grooming, taking on different nurturing roles
Ideal Type - Level 4 – to be autonomous, to search out new sources of energy	
Passive Competition	operate individually to seek out new food sources
Active Competition	collective exploration, vying for correct spatial information
Active Cooperation	collective exploration, sharing information about landscape
Passive Cooperation	collective exploration, becoming specialist in different areas of ken

These Ideal Type interactions are mechanistically different, which are best explained through examples.

Example: Ideal Type 1
The acts of taking, sharing or exchanging are all relatively instantaneous events. They may occur wherever two or more parties coincide in physical space.

Example: Ideal Type 2
If two people collaborate to defend a territory or store of energy, then they will likely take turns to ensure permanent protection of the resource. For each party, then, the experience of the interaction is intense periods of being on guard and other times being off duty. Such activity has the effect of creating formal spatial relationships. The interaction also incentivises an outward looking perspective – looking out for signs of menace.

Example: Ideal Type 3
Interactions at Level 3 involve regularly repeated nurture, which when cooperative are reciprocated. They need to operate into perpetuity for the life of an organism. When participating in such interactions, those involved are incentivised to focus their attention on another party. Collectively this creates an inward-looking perspective.

Example: Ideal Type 4
These types of interactions have similarities to the lower three Ideal Types. They involve:

- sharing or exchanging of information (instantaneous)
- time to reach a decision based on new information (limited time period)
- living with the consequences of an action (on-going)

The interaction mechanisms are summarised in the table below. These inform what types of group social structures emerge. The character of the interactions also has an influence on how energy becomes distributed spatially and within the population.

Need	Spatial Structure	Temporal Structure	Flow of Energy
1	Passive Competition leads to dispersal to avoid interaction	No interaction	Dispersal
	Active Competition interactions take place randomly	Chaotic, Instantaneous, Opportunistic	Dispersal
	Active Cooperation interactions take place randomly	Chaotic, Instantaneous, Opportunistic	Static
	Passive Cooperation generates a spatial focal point to promote interaction	Promoting increased rate of interactions	Concentration to focal point
2	Passive Competition leads to individual territoriality	Limited interaction to defend border	Energy is bounded
	Interactions create direct hierarchical and spatial relationships within defined territories	Regularly Repeated (on/off) Fixed Time Periods	Linear flows of energy within defined boundaries

3	Passive Competition sees organisms operating alone Interactions cause focal points: – Competition – focal point is fixed within the group – Cooperation – focal point moves around the group	No interaction other than rearing offspring On-going, continual	Energy is reserved to each agent Circular flows of energy between agents within group
4	Passive Competition sees individuals operating independently Active Competition generates random focal points Cooperation enables information to determine outcome	No interaction Irregular Instantaneous, Fixed Time Period and Continual	Varies according to underlying Form of Interaction