

ON THE LOGIC OF ATTITUDES

Daniel Vanderveken (Université du Québec) www.vanderveken.org¹

Descartes in his treatise on *Les passions de l'âme*² analyzed a large number of attitudes. His work is a major contribution to modern philosophy of mind. Contemporary logic and analytic philosophy are confined to a few paradigmatic attitudes such as belief, knowledge, desire and intention. Could we use Cartesian analysis to develop a larger theory of all kinds of attitudes? Searle in *Intentionality*³ criticized Descartes who tends to reduce all attitudes to beliefs and desires. Many different kinds of attitudes such as fear, regret and sadness reduce to the same sums of beliefs and desires. Moreover, our intentions are much more than a desire to do something with a belief that we are able to do it. Of course, all cognitive attitudes contain beliefs and all volitive attitudes desires. But we need more than the two traditional basic categories of cognition and volition in order to analyze attitudes.

By nature, attitudes have *intentionality*: they are *directed*, as Brentano pointed out, *at* objects and facts of the world. For that reason, they have *conditions of possession* and of *satisfaction* that are logically related but different. In order that an agent *possesses* an attitude, he or she must be in a certain mental state. In order that his or her attitude is *satisfied*, represented things must be in the world in a certain way. Whoever has a desire is able to determine what must happen in the world in order that his desire is satisfied. However in order that something happens it is not enough to desire it. Beliefs and convictions are satisfied whenever they are *true*, desires and wishes whenever they are *realized* and intentions and plans whenever they are *executed*. The main purpose of this paper is to contribute to analytical philosophy of mind and to the foundations of the logic of attitudes in formulating a general *recursive theory of the conditions of possession and of satisfaction of individual attitudes*.

Propositional attitudes are the simplest kinds of individual attitudes directed at facts. They are possessed by a single agent at a moment or during an interval of time. From a logical point of view, they consist of a *psychological mode* M with a *propositional content* P. I will first proceed to an explication of the nature of psychological modes. In my analysis, psychological modes divide into other components than the *basic categories of cognition and volition*. Complex

¹ I am grateful to Hugolin Bergier, David Kaplan and John Searle for their critical remarks.

² Le traité sur *Les passions de l'âme* est réédité in R. Descartes *Œuvres complètes* La Pléiade Gallimard 1953

³ J. Searle *Intentionality* Cambridge University Press 1982

modes also have a *proper way* of believing or desiring, proper *conditions on their propositional content* or proper *preparatory conditions*. Thanks to these other components one can well distinguish stronger and weaker modes. I will *recursively define the set of all modes* of attitudes that human agents can have towards facts. As Descartes anticipated, the two primitive psychological modes are those of *belief* and *desire*. They are the simplest modes. As we will see, other more complex modes are obtained from the two primitives by adding to them special cognitive and volitive ways, special conditions on the propositional content and / or special preparatory conditions.

There are more *complex individual attitudes* than propositional attitudes. So are *denegations of attitudes* like discontent and disagreement, *conditional attitudes* like intentions to defend oneself in the case of an attack and *conjunctions of attitudes* like doubt. I will *define inductively the conditions of possession and of satisfaction* of all these kinds of individual attitudes. For that purpose, I will exploit the resources of a non standard *predicative logic* that distinguishes propositions with the same truth conditions that do not have the same cognitive value. We need to consider *subjective* as well as *objective possibilities* in the logic of attitudes and action in order to account for the fact that human agents are not perfectly but only minimally rational. By virtue of their logical form, attitudes are logically related in various ways. There are four different fundamental *relations of implication* between attitudes. Some attitudes *strongly commit* the agent to having others: an agent cannot possess them without possessing others. No one can enjoy something without desiring it. Some attitudes have more satisfaction conditions than others. Whenever an aspiration is fulfilled so is the corresponding hope. Certain attitudes cannot be possessed unless others are satisfied. Whoever knows something has a true belief. Conversely, certain attitudes cannot be satisfied unless others are possessed. Whoever executes a plan possesses the intention of executing that plan. The single most important objective of my logic of attitudes is to formulate a recursive unified theory of attitudes that can prove all fundamental valid laws governing their possession and satisfaction. Strong psychological commitment is *a priori* known by virtue of competence. So it has to be decidable in that theory.

Section 1 Analysis of the propositional content of attitudes

Basic problems of standard logic

Following Carnap⁴, standard propositional logic tends to identify propositions that have the same truth values in the same possible circumstances. However it is clear that strictly equivalent propositions are not the contents of the same attitudes and intentional actions just as they are not the senses of synonymous sentences. We absolutely need a much finer criterion of propositional identity than strict equivalence in logic for the purposes of philosophy of mind, action and language. May be Carnap's reduction of Fregean *senses* to *intensions* enables us to define logical truth in the special cases of modal and temporal logics? But it does not work for richer logics dealing with attitudes, actions and illocutions. We need a better logic of sense in order to formulate an adequate theory of meaning, action and thought.

We need first to analyze the logical form of propositions so as to distinguish propositions with the same truth conditions that do not have the same cognitive value. Clearly we do not know *a priori* by virtue of competence the necessary truth of many propositions. We have to learn a lot of essential properties of objects to which we refer. By *essential property* of an object I mean here a property that it really possesses in any possible circumstance.⁵ We discovered in modern times that whales are essentially mammals. So we can ignore necessary truths (such as the proposition that whales are mammals). We can even be inconsistent and believe necessary falsehoods. (We believed in the past that whales are fishes). However we always remain paraconsistent. As the Greek philosophers already pointed out, we cannot believe every proposition (the sophist's paradox). Any adequate logic of attitudes and action has to account for such facts. Few necessarily true propositions are pure *tautologies* such as the proposition that whales are whales that we know *a priori* to be true. What is the logical nature of such *tautologies*? My predicative propositional logic gives an answer to that question. It also explains why certain strictly equivalent propositions have a different cognitive value. This solves the first problem of propositional identity.

A second important problem of the standard logic of attitudes is related to the way in which it analyzes the relations of compatibility with the truth of beliefs and the satisfaction of desires of agents. According to standard logic, such relations of psychological compatibility are simple modal relations of accessibility existing between agents and moments, on one hand, and possible circumstances, on the other hand. Thus in standard epistemic logic⁶, possible

⁴ R. Carnap *Meaning and Necessity* University of Chicago Press 1956.

⁵ See A. Plantinga *The Nature of Necessity* Oxford University Press 1974.

⁶ J. Hintikka "Semantics for Propositional attitudes" in L. Linsky (ed) *Reference and Modality* Oxford U Press 1962

circumstances are compatible with the truth of beliefs of agents at each moment of time. To each agent a and moment m there corresponds in each model a unique set $Belief(a,m)$ of possible circumstances that are compatible with the truth of all beliefs that agent a has at moment m . Moreover, according to the new meaning postulate for belief propositions: an agent a believes a proposition at a moment m when that proposition is true in all possible circumstances belonging to the set $Belief(a,m)$ of circumstances compatible with what that agent then believes.

Given such a formal approach, all human agents are either *perfectly rational* or *totally irrational* according to standard epistemic logic. On one hand, they believe all necessarily true propositions. And their beliefs are closed under strict implication. Whoever believes a proposition P *eo ipso* believes all propositions that are strictly implied by P . So human agents are perfectly rational when at least one possible circumstance is compatible with what they believe. Otherwise, they are totally irrational. Whoever believes a necessary falsehood *eo ipso* believes all propositions. However, all this is absolutely false according to standard philosophy of mind and empirical psychology. First of all, human agents are not logically omniscient. They ignore most logical truths and they do not draw all logical inferences. Moreover even when they are inconsistent, they never are entirely inconsistent. **Problems are worse in the case of the logic of desire if we proceed according to the same approach.** In that case, to each agent a and moment m there corresponds in each model a unique set $Desire(a,m)$ of possible circumstances that are compatible with the satisfaction of all desires of that agent at that moment. We can make mistakes and wrongly believe necessarily false propositions. However, when we recognize their falsehood, we immediately stop believing them. On the contrary, it is not enough to learn that something is impossible in order to stop desiring it. We keep many desires that we know to be not satisfiable.

Some have advocated the introduction in epistemic logic of so-called *impossible circumstances* where necessarily false propositions would be true (where, for example, whales would be fishes). However, such a theoretical move is very *ad hoc*. Moreover it is neither necessary nor sufficient. So I prefer to keep only possible circumstances while changing the approach. In logic, *possible circumstances* are *objective possibilities* as Belnap says. So objects keep their essential properties (whales are really mammals) and necessarily false propositions remain false in all possible circumstances. However, according to human agents certain necessarily false propositions are true. We did believe that whales are fishes. This is an *epistemic*

possibility. In order to account for that fact, we need to consider *subjective* in addition to *objective possibilities* in logic. Many subjective possibilities are not objective. There is no way to explicate such pure subjective possibilities and to define adequately the notion of truth according to an agent within the standard approach. In my view, we not only need to enrich the conceptual apparatus of propositional logic so as to analyze the logical form of necessarily false propositions that we can believe and desire. But we also need a better analysis of the compatibility relation with respect to the satisfaction of attitudes of agents as well as a finer meaning postulate for defining the truth conditions of propositions attributing attitudes.

New principles of my predicative propositional logic

My propositional logic is *predicative* in the very general sense that it analyzes the logical form of propositions by taking into account predications that we make in expressing and understanding them.⁷

- In my view, each proposition has a finite *structure of constituents*. It predicates a positive number of *attributes* (properties or relations) of *objects subsumed under concepts*. Each proposition serves to make finitely many predications. As Frege and Russell pointed out, we understand a proposition when we understand which attributes objects must possess in a possible circumstance in order that this proposition be true in that circumstance.

- In addition to taking into account the structure of constituents of propositions, we also need a *better explication of their truth conditions*. We ignore in which possible circumstances most propositions are true because we ignore *real denotations* of most attributes and concepts in many possible circumstances. One can refer to Smith's murderer without knowing who he is. However we can always in principle think of persons who could be that murderer. Sometimes there are even suspects. So in any possible use and interpretation of language, there are a lot of *possible denotation assignments to attributes and concepts* in addition to the standard *real denotation assignment* which associates with each propositional constituent its actual denotation in every possible circumstance. They are functions of the same type. They, for example, associate with individual concepts a unique individual or no individual at all in each possible circumstance. According to a possible denotation assignment, Smith's wife murdered Smith. According to another possible assignment, another person is Smith's murderer. According to others, no one

⁷ For more information on predicative logic see my collective book *Logic Thought & Action* Springer, 2005

murdered Smith. By hypothesis, all possible denotation assignments respect *meaning postulates*. A murderer is not only an individual object; it is a person who has caused death.

We ignore the value of the real denotation assignment for most concepts and attributes in many possible circumstances. But we can in principle think of denotations that they could have. Moreover, when we have in mind certain concepts and attributes only some possible denotation assignments to these senses *are then compatible with* our beliefs. Persons born after Smith's death could not have murdered him. Suppose that according to the chief of police at the beginning of his investigation Smith's murderer is a foreigner. In that case, only possible denotation assignments according to which a foreigner falls under the concept of being Smith's murderer are then compatible with his actual beliefs. So in my approach, possible denotation assignments rather than possible circumstances are compatible with the beliefs of agents in possible circumstances. This is my way to account for subjective possibilities.

- In predicative propositional logic, the truth definition is relative to both possible circumstances and possible denotation assignments. Propositions are true (or false) in a possible circumstance according to certain possible denotation assignments to their constituents. In understanding propositions we in general do not know whether they are true or false. We just know that their truth in a possible circumstance is compatible with certain possible denotation assignments to their attributes and concepts, and incompatible with all others. Thus an elementary proposition predicating an extensional property of an object under a concept (e.g. the proposition that Smith's murderer is tall) is true in a possible circumstance according to a possible denotation assignment if and only if according to that assignment the person who falls under that concept has that property in that circumstance. Otherwise, that proposition is false in that very circumstance according to that assignment. We only know this by virtue of competence. Most propositions have therefore *a lot of possible* in addition to their real *truth conditions*. Suppose that a proposition is true according to a certain possible denotation assignment to its constituents in a certain set of possible circumstances. By definition, that proposition would be true in all and only such possible circumstances if that denotation assignment were the real one.

Of course, in order to be *true in a circumstance* a proposition has to be *true in that circumstance according to the real denotation assignment*. So among all possible truth conditions of a proposition, there are its *real Carnapian truth conditions* which correspond to the set of possible circumstances where it is true according to the real denotation assignment.

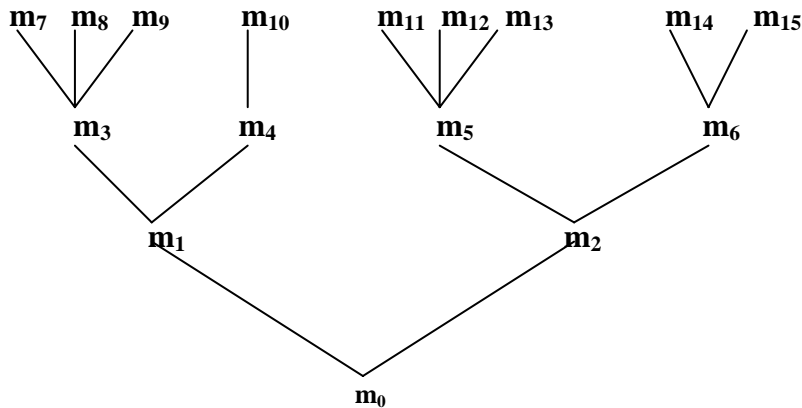
- As one can expect, two propositions are identical when they have the same structure of constituents and they are true in the same possible circumstances according to the same possible denotation assignment. Such a finer criterion of propositional identity explains why many strictly equivalent propositions have a different cognitive value. Propositions whose expression requires different acts of predication have a different structure of constituents. So necessarily true propositions about different objects (e.g the propositions that Cicero is Cicero and that Caesar is Caesar) are different. We do not have them in mind at the same moments. My criterion also distinguishes strictly equivalent propositions that we do not understand to be true in the same possible circumstances: these are not true according to the same possible denotation assignments to their constituents.

- My logic accounts for the fact that few necessarily true propositions are *pure tautologies* that are also *a priori* known to be true. In my approach, a proposition is *necessarily true* when it is true in every possible circumstance according to the real denotation assignment. In order to be *tautologically true*, a proposition has to be true in every possible circumstance according to all possible denotation assignments to its constituents. Unlike the proposition that whales are whales, the necessarily true proposition that whales are mammals is not a pure tautology. It is false according to possible denotation assignments according to which whales are fishes. So we can believe that it is false. We now can distinguish logically subjective and objective possibilities. By definition, a proposition is *subjectively possible* when it is true in a possible circumstance according to at least one possible denotation assignment. In order to be *objectively possible* a proposition has to be true in a possible circumstance according to the real denotation assignment.

Analysis of possible circumstances

In the logic of attitudes and action, the set of possible circumstances is provided with a ramified temporal structure. Human agents are free. Their attitudes and actions are not determined. When they do or think something, they could have done or thought something else. For that reason, one needs a ramified conception of time compatible with indeterminism. In branching time, a *moment* is a complete possible state of the actual world at a certain instant and the *temporal relation* of *anteriority* / *posteriority* between moments is partial rather than linear because of indeterminism. On the one hand, there is a single causal route to the past: each moment *m* is preceded by at most one chain of past moments. And all moments are historically connected: any two distinct moments have a common historical ancestor in their past. On the

other hand, there are multiple future routes: several incompatible moments might follow upon a given moment. For facts, events or actions occurring at a moment can have incompatible future effects. Consequently, the set of moments of time has the formal structure of a *tree-like frame* of the following form:



A maximal chain h of moments of time is called a *history*. It represents a *possible course of history of our world*. When the history has a first and last moment, the world has according to it a beginning and an end. A *possible circumstance* is a pair of a moment m and of a history h to which that moment belongs. Thanks to histories logic can analyze important modal notions like settled truth and historic necessity and possibility in addition to temporal notions. Certain propositions are true at a moment according to all histories. Their truth is then *settled at that moment* no matter how the world continues after that moment. So are past propositions because the past is unique. Their truth does not depend at all on histories. So are also propositions attributing attitudes to agents. Whoever believes or desires something at a moment then believes or desires that thing no matter what happens later. Contrary to the past, the future is open. The world can continue in various ways after indeterminist moments. Thus the truth of future propositions is not settled at each moment; it depends on which historical continuation h of that moment is under consideration. As Belnap [1994] pointed out, the future proposition that it will be the case that P (in symbols $WillP$) is true at a moment m according to a history h when the proposition that P is true at a moment m' posterior to m according to that very history. When there

are different possible historic continuations of a moment, its actual future continuation is not then determined. However, as Occam pointed out, if the world continues after that moment, it will continue in a unique way. The actual historic continuation of each moment is then unique. Indeterminism does not prevent that. Let h_m be the proper history of moment m . If m is the last moment of a history h , that history is then its proper history h_m . If on the contrary that moment continues, then all moments of its proper history have the same real historic continuation. Among all possible courses of history of this world, one will be its actual course of history. It is by hypothesis the proper history of the present actual moment *now*. From now on, I will say that a proposition is *true at a moment* according to a possible denotation assignment when it is then true in the history of that moment according to that assignment.

My new approach in the logic of attitudes

In my approach, the relation of compatibility with the truth of the beliefs of agents is defined differently: First of all, beliefs, desires and other attitudes of human agents are about objects that they represent under concepts. Each agent has in mind a certain set of attributes and concepts at each moment. (That set is empty when the agent does not exist or is totally unconscious at that moment.) In my view, no agent can have a particular belief or desire without having in mind all attributes and concepts of its propositional content. Otherwise, he would be unable to determine under which conditions his belief or desire is satisfied. An attitude with entirely undetermined satisfaction conditions would be an attitude without content, so it would not be a real attitude. No one can believe or desire to be janissary without having in mind the property in question.

Secondly, possible denotation assignments to propositional constituents rather than possible circumstances are compatible with the satisfaction of attitudes of agents. So to each agent a and moment m there corresponds in each model a unique set $Belief(a,m)$ of possible denotation assignments to attributes and concepts that are compatible with the truth of beliefs that that agent has at that moment according to that model. By hypothesis, $Belief(a,m)$ is the whole set Val of all possible denotation assignments to senses when the agent a has no sense in mind at the moment m . In that case, that agent has then no attitudes. Otherwise, $Belief(a,m)$ is a *non empty proper* subset of Val . Whenever an agent has in mind propositional constituents, there always are possible denotation assignments compatible with what that agent then believes. In my view, an

agent a believes a proposition P at a moment m when he or she has then in mind all its constituents and that proposition is true at that moment according to all possible denotation assignments belonging to $Belief(a,m)$. We all ignore what will happen later in this world. But we now have a lot of beliefs directed at the future. As Occam pointed out, such beliefs are true when things will be as we believe in *the actual future continuation* of the present moment. Other possible historic continuations do not matter. The same holds for desire. In order that a present desire directed at the future is satisfied, it is not enough that things will be at a posterior moment as the agent now desires. They must be so later in the actual historic continuation of this world.

One can analyze desire according to the same approach. To each agent a and moment m there corresponds in each model a unique non empty set $Desire(a,m)$ of possible denotation assignments to attributes and concepts that are compatible with the satisfaction of all desires of that agent at that moment. There is however an important difference between desire and believe. We can believe, but we cannot desire, that things are such and such without believing that they could be otherwise. For any desire contains a *preference*. Whoever desires something distinguishes two different ways in which represented things could be in the actual world. In a first preferred way, things are in the world as the agent desires, in a second way, they are not. In the first case, the agent's desire is satisfied, in the second case, it is unsatisfied. Thus in order that an agent a desires a proposition P at a moment m , it is not enough that he or she has then in mind all its constituents and that proposition is true at that moment according to all possible denotation assignments belonging to $Desire(a,m)$. It must also be false at a moment in a history according to possible denotation assignments belonging to $Belief(a,m)$.

My logic of belief and desire is compatible with philosophy of mind. Given new meaning postulates and the nature of possible denotation assignments, it accounts for the fact that *human agents are not perfectly rational*. We do not have in mind all concepts and attributes. So we ignore logical as well as necessary truths. Our knowledge is limited: we ignore the denotation of properties in many circumstances. In that case assignments associating different denotations to these properties in these circumstances are then compatible with our beliefs. We have false beliefs and unsatisfied desires. So many possible denotation assignments compatible with our beliefs and desires do not assign real denotations to attributes that we have in mind. Some of these assignments can even violate essential properties of our objects of reference. In that case we believe necessarily false propositions and desire impossible things. Each human being has a

unique mother who gave birth to him or her. However that essential property does not correspond to any meaning postulate. Certain adopted children believe that their adoptive parents are their natural father and mother. One can easily account for such necessarily false beliefs in my analysis. Many traditional epistemic paradoxes are solved.

However *human agents are never totally irrational* according to my approach. On the contrary, they are *minimally rational* in a well determined way. First of all, they cannot believe or desire everything since some possible denotation assignments are always compatible with the satisfaction of their beliefs and desires. Moreover, they cannot possess certain beliefs and desires without possessing others. For all possible denotation assignments compatible with their beliefs and desires and consequently the contents of such attitudes have to respect meaning postulates. So we are *minimally logically omniscient*, in the sense that we cannot have in mind a pure tautology without knowing for certain that it is necessarily true. Represented things could not be in another way according to us. Similarly, so called *pure contradictions* (that is to say negations of tautologies) are false in every possible circumstance according to any possible denotation assignment. We can neither believe nor desire contradictory things. Things could never be in a contradictory way according to us. Actual logicians still hope that arithmetic is complete (a necessarily false proposition if Gödel's proof is right). But no one could believe and desire both the completeness and the incompleteness of arithmetic (a pure contradiction). Sometimes we desire something (to be somewhere at a moment) for one reason and another incompatible thing (to be elsewhere at the same moment) for another reason. But when the logical form of such attitudes is fully analyzed, they are not desires with a contradictory content. Although agents believe all tautological propositions that they have in mind, they cannot desire the truth of such tautologies. In order to desire a fact one must believe that it could not be the case. One can desire to drink; one can also desire not to drink. But one cannot desire to drink or not drink.

Incidentally, there is in predicative logic a new *strong* propositional *implication* much finer than Lewis' strict implication that is important for the analysis of psychological commitment. By definition, a proposition P *strongly implies* another Q when firstly it has the same or a richer structure of constituents than Q and it is tautologically true that if P then Q. Strong implication is finite, paraconsistent, decidable and *a priori known*. As one can expect, any agent who believes a proposition also believes any proposition that is strongly implied by it. For that agent cannot have in mind the first proposition without having in mind the second and

without understanding that the first cannot be true unless the second is. Unlike belief, desire is not closed under strong implication. Whoever desires to drink does not desire to drink or not drink.

Section 2 Analysis of propositional attitudes

The notion of psychological mode is too rich to be taken as a primitive notion. Like Descartes, I consider that the two traditional categories of cognition and volition are essential components of psychological modes. But they divide into other components that we must take into consideration.

The general category of cognition and volition

All propositional attitudes are cognitive or volitive. Among cognitive attitudes, there are conviction, faith, confidence, knowledge, certainty, presumption, pride, arrogance, surprise, amazement, stupefaction, presupposition, prevision, anticipation and expectation. All of them contain beliefs in the truth of their propositional content. Among volitive attitudes, there are wish, will, intention, ambition, project, hope, aspiration, satisfaction, pleasure, enjoyment, delight, gladness, joy, elation, amusement, fear, regret, sadness, sorrow, grief, remorse, terror. All of them contain wishes. Like Searle, I advocate a very general category of volition applying to all kinds of desires directed towards the past (shame), the present (lust) as well as the future (aspiration), even to desires known or believed to be satisfied (pleasure, joy) or unsatisfied (disappointment, regret) including desires directed at past actions that the agent would wish not to have done (remorse).

In philosophy of mind, *beliefs* have the proper *mind-to-things direction of fit*. Whoever possesses a cognitive attitude intends to represent how things are in the world. Such an attitude is satisfied when its propositional content corresponds to things as they are in the world. On the other hand, *desire* has the opposite *things-to-mind direction of fit*. Volitive attitudes are satisfied when things in the world are or become as the agent desires them to be. Things in the world must then fit the propositional content of the attitude. Each direction of fit between mind and the world determines which side is at fault in case of dissatisfaction. When a belief turns to be false, it is the agent who is at fault, not the world. He should have had other ideas about the world. In such a case, the agent easily corrects the situation in changing his ideas. He adopts another belief. On the contrary, when a desire turns to be unsatisfied, it is not the agent but the world which is at fault.

Things should have been different. The agent then rarely corrects the situation in changing his ideas. Most often, he keeps the same desire and remains unsatisfied. He then feels a disappointment and sometimes regret.

I have explained in the preceding section how to analyze beliefs and desires. In my view, the two traditional categories of cognition and volition correspond to the two families of compatibility relations $Belief_m^a$ and $Desire_m^a$ that exist between agents and moments, on one hand, and possible denotation assignments, on the other hand. In a general theory, compatibility relations $Belief_m^a$ and $Desire_m^a$ are indexed with respect to possible denotation assignments. We of course have real attitudes about objects at certain moments in this actual world. But we could have had other attitudes about the same or even about other objects. Often other agents attribute to us attitudes that we do not have. So agents' attitudes can differ according to different possible denotation assignments. First of all, in each model, every agent a has in mind at each moment m a *certain set* $val(a,m)$ of *propositional constituents* according to any possible denotation assignment val . When this set is not empty, the agent then possesses beliefs and desires according to that assignment.

By definition, $Belief_m^a(val)$ is the non empty set of all possible denotation assignment that are compatible with the truth of beliefs that agent a has at moment m according to denotation assignment val . Similarly, $Desire_m^a(val)$ is the non empty set of all possible denotation assignments that are compatible with the satisfaction of desires that agent a has at moment m according to assignment val . Of course, $Belief_m^a(val)$ and $Desire_m^a(val)$ are the whole set Val of all possible denotation assignment when the set of propositional constituents $val(a,m)$ is empty. In that case, the agent has then no attitude at all. In my approach, an agent a *believes* or *desires* a proposition at a moment m (no matter what is the history) according to a possible denotation assignment val when firstly, he then has in mind all its concepts and attributes (they belong to the set $val(a,m)$) and secondly that proposition is then true at that moment according to all possible assignments of the set $Belief_m^a(val)$ or $Desire_m^a(val)$. In the case of desire, the desired proposition must moreover be false in a circumstance according to the agent a at the moment m .

One can characterize the proper nature of attitudes by determining the formal properties of psychological compatibility relations that correspond to them. Whoever has a belief believes that

he has that belief. The relation $Belief_m^a(val)$ is then transitive in each model. On the contrary, we often feel desires that we would wish not to feel. So the relation $Desire_m^a$ is not transitive. Some of our beliefs are false; many of our desires are unsatisfied. The compatibility relations $Belief_m^a(val)$ and $Desire_m^a(val)$ are then not reflexive. They are also not symmetric.

Different ways of having cognition or volition

Our beliefs and desires can be more or less strong and we feel them in a lot of ways. Certain psychological modes require a special *cognitive or volitive way* of believing or desiring. *Knowledge* is a belief based on *strong evidence*. Sometimes the agent has a real perception of what he knows. Sometimes he is sure of it because of his conceptual network or background. With such kind of sensorial or analytic evidence, whatever is known has to exist. Agents only know true propositions. Whoever has an *intention* feels such a strong desire that he is disposed to *act* in the world in order to satisfy that desire. Agents always intend to do something. Whoever is *pleased* feels a satisfied desire whose very satisfaction puts him in a state of pleasure. Whoever *enjoys* is in a conscious state of enjoyment. In the case of *lust* he is in a state of sensual enjoyment. On the contrary, whoever is *sad* feels an unsatisfied desire whose dissatisfaction puts him in that sad state, whoever is *terrified* is in a worst conscious state of terror. Language distinguishes many psychological modes with different cognitive or volitive ways. Thus regret, sadness, sorrow and terror are volitive ways that put the agent in more and more unpleasant states.

In a logical point of view, a volitive or cognitive way is a function f_μ which restricts compatibility relations $Belief_m^a$ and $Desire_m^a$ corresponding to the basic psychological categories. Whoever feels a belief or desire in a certain way has of course that belief or that desire. So by definition, in each model, $f_\mu(a,m,val) \subseteq Belief_m^a(val) \cup Desire_m^a(val)$. The set U_μ of cognitive and volitive ways is a *Boolean algebra*. It contains the neutral way $1_\mu: 1_\mu(a,m,val) = Belief_m^a(val) \cup Desire_m^a(val)$. And it is closed under the operation of conjunction. The psychological mode has the conjunction $f_\mu^1 * f_\mu^2$ of two ways when it has each of them. $f_\mu^1 * f_\mu^2(a,m,val) = f_\mu^1(a,m,val) \cap f_\mu^2(a,m,val)$. A psychological mode M has a special way when its way f_M is not neutral.

Certain ways are *stronger than* others. Whoever is certain of something knows it. Whoever has a project has an intention. Thus $f_{certainty}(val) \subseteq f_{knowledge}(val)$. Because every knowledge is true, the proper cognitive way of knowledge is reflexive: $val \in f_{knowledge}(val)$. Whoever has an intention intends to execute that intention. So the volitive way of the intention mode is transitive : if $val' \in f_{intention}(val)$ et $val'' \in f_{intention}(val')$ then $val'' \in f_{intention}(val)$. Agents can feel more or less strong beliefs and desires. So we must distinguish different degrees of beliefs and desires. The two primitive relations of psychological compatibility are then indexed by the set Z of integers. Whoever believes or desires with a degree of strength believes or desires with weaker degrees. Thus $Belief_m^a(val)(k+1) \subseteq Belief_m^a(val)(k)$ and similarly for $Desire_m^a$. Certain particular cognitive or volitive ways require a minimal degree of strength. Any knowledge contains a strong belief, any intention a strong desire. $f_{knowledge}(val) \subseteq Belief_m^a(val)(1)$ et $f_{intention}(val) \subseteq Desire_m^a(val)(1)$.

Propositional content conditions

Like illocutionary forces, psychological modes have propositional content conditions. The propositional content of attitudes with certain modes has to satisfy certain conditions. Thus we can only at a moment *foresee*, *anticipate* or *expect* a fact that is future with respect to that moment. Whoever possesses an *intention* at a moment desires to carry out a present or future action in the proper history of that moment. Propositional content conditions of attitudes depend on the moment of such attitudes. I can have today the intention to wake up early tomorrow morning. The day after tomorrow I cannot anymore have that intention, because the intended action will then be past. The propositional content of certain attitudes concerns the very person of the agent. We can be *disappointed* or *sorry* about something that has nothing to do with our person. But we can only feel *shame* or *remorse* for something that is personal.

From a logical point of view, a *condition on the propositional content* is a function f_θ from the set $Agent \times Time$ into the power set $\mathcal{P}(U_p)$ of the set U_p of all propositions that associates which each agent and moment a set of propositions. By definition, the propositional content conditions of a mode M is the function θ_M which associates with each agent a and moment m the set of propositions that could be the propositional content of an attitude of that mode of that agent at that moment. As one can expect, illocutionary forces have propositional content conditions of

all attitudes that enter into their sincerity conditions. Thus the illocutionary force of *prediction* and the psychological modes of *prevision*, *anticipation* and *expectation* have the condition that their propositional content represents a future fact. Similarly, the illocutionary force of promise and the modes of *intention* and *project* have the same condition that their propositional content represents a present or future action of the agent. The set U_θ of propositional content conditions is also a *Boolean algebra*. It contains the *neutral propositional content condition* $1_\mu : 1_\theta(a,m)$ is the whole set U_p of propositions. And it is closed under the operation of *intersection*. The psychological mode has the intersection $(f_\theta^1 * f_\theta^2)$ of two ways when it has each of them. $(f_\theta^1 * f_\theta^2)(a,m) = f_\theta^1(a,m) \cap f_\theta^2(a,m)$. A mode M has a *special* propositional content condition when its condition θ_M is not neutral. Certain psychological modes M' have more propositional content conditions than others M. Thus a *prior intention* is an intention with the additional condition that its content represents a future action of the agent. In that case, $\theta_{M'}(a,m) \subset \theta_M(a,m)$.

Preparatory conditions

Like illocutionary forces, psychological modes also have *preparatory conditions*. Whoever possesses an attitude or performs an illocutionary act *presupposes* certain propositions. His attitude and his illocutionary act would be *defective* if these propositions were then false. Thus the force of *promise* and the mode of *intention* have the preparatory condition that the agent is able to do the action represented by the propositional content. When this is not the case, the promise and the intention are defective. This defect shows itself in the fact that it is quite paradoxical to promise an action and to deny simultaneously that one is able to do it. In the illocutionary case, the speaker can lie. Sometimes he does not believe what he presupposes in order to mislead the hearer. In the psychological case, however the agent cannot lie to himself. He must both presuppose and believe that the preparatory conditions of his attitudes are fulfilled. Whoever has an intention really believes that he is able to execute it. Otherwise, he would not have that intention. The volitive attitude of *fear* has the particular preparatory condition that the propositional content is then possible. Whoever fears something believes that it could then happen while desiring the contrary. The attitude of *deception* has two preparatory conditions: the truth of the propositional content and the prior agent's belief in its falsehood. Whoever is disappointed with something believes it, desires the contrary and previously believed that the

thing would not happen. On the other hand, the volitive mode of *hope* is a belief with the double preparatory condition that the agent is uncertain of the desired fact but that it is then possible. The volitive mode of *will* has the preparatory condition that agent has means. Any *intention* contains a *will*. In the case of wish, on the contrary, that satisfaction of the desire of the agent is independent of his own will. All depends on the course of nature or on the good will of some other agent.

From a logical point of view, a preparatory condition is a function from the set $Agent \times Time \times U_p$ into the set $\mathcal{P}(U_p)$ associating with each agent, moment et propositional content a set of propositions. The illocutionary forces have the preparatory condition of attitudes which are their sincerity conditions. Thus the preparatory condition $\theta_{intention}$ common to the mode of *intention* and to the force of *promise* associates with each agent, moment and propositional content a set containing the proposition that that agent is then able to do the represented action. The set U_θ of preparatory conditions is also a *Boolean algebra*. It contains the neutral preparatory condition $1_\Sigma : 1_\Sigma(a,m,P) = \emptyset$. And it is closed under the operation of *union*. A psychological mode has the union $(f_\Sigma^1 \cup f_\Sigma^2)$ of two preparatory conditions when it has each of them. $(f_\Sigma^1 * f_\Sigma^2)(a,m,P) = f_\Sigma^1(a,m,P) \cup f_\Sigma^2(a,m,P)$. A psychological mode M has a special preparatory condition when its condition Σ_M is not neutral. Many volitive or cognitive ways determine special preparatory conditions. The cognitive ways of the modes of certainty and knowledge and the volitive ways of the modes of pleasure, joy, happiness and enjoyment all determine the preparatory condition that the represented fact exists.

Criterion of identity for psychological modes

On the basis of my analysis, one can distinguish with precision different psychological modes whose attitudes apparently reduce to the same sums of beliefs and desires. They have special cognitive or volitive ways, special propositional content conditions or special preparatory conditions. One can also proceed to a lexical systematic analysis of many verbs or terms naming propositional attitudes. Two psychological modes M_1 and M_2 are identical when they have the same basic psychological categories, the same cognitive and volitive ways, the same propositional content conditions and the same preparatory conditions. So $M_1 = M_2$ when $Cat_{M_1} = Cat_{M_2}$, $f_{M_1} = f_{M_2}$, $\theta_{M_1} = \theta_{M_2}$ and $\Sigma_{M_1} = \Sigma_{M_2}$. As we will see later, attitudes with the same propositional content whose modes divide into the same components have the same conditions of possession and satisfaction. Such modes play then the same role in psychological life.

Conditions of possession of propositional attitudes

Each component of a mode determines a particular necessary condition of possession of attitudes with such a mode, all the components together possession conditions that are both necessary and sufficient. By definition, an agent *a* possesses a cognitive (or volitive) attitude of the form $M(P)$ at a moment *m* when he then believes (or desires) the propositional content *P*, he feels at that moment a belief or a desire that *P* in the cognitive or volitive way f_M proper to the psychological mode *M*, the proposition *P* then satisfies the propositional content conditions $\theta_M(a,m)$ and finally that agent then presupposes and believes all the propositions determined by the preparatory conditions $\Sigma_M(a,m,P)$ of its mode *M* with respect to the content *P*. For example, an agent *intends that P* at a moment when the propositional content *P* then represents a present or future action of that agent, he then feels such a desire that he is disposed to carry out that action and moreover he then presupposes and believes that he is able to carry it out. As one can expect, the basic psychological cognitive or volitive category of every attitude determines its primary condition of possession. One can desire without having an intention. But one could not have an intention without a desire. From a logical point of view, the proposition according to which the agent *a* possesses the attitude $M(P)$ (in symbols: [*aPossesses* $M(P)$]) is true in a circumstance *m/h* according to a possible denotation assignment *val* iff (1) each propositional constituent of $P \in val(a,m)$, (2) *P* is true at moment *m* according to all denotation assignments of $(Cat_M)_m^a(val) \cap (f_M)_m^a(val)$, (3) $P \in \theta_M(a,m)$ and (4) for each proposition $Q \in \Sigma_M(a,m,P)$, *Q* is true according to all denotation assignments of $Bel_m^a(val)$ and moreover *a* presupposes *Q* at the moment *m*.

Definition of strong and weak psychological commitment

An attitude strongly commits an agent to another at a moment when he could not then have that attitude without having the second. For example, whoever believes that it will rain tomorrow then foresees rain tomorrow. For the propositional content is then future in respect to the moment of the attitude. Let us say that an attitude strongly commits the agent to another when it strongly commits any agent to that other attitude at any moment. In that case, whoever possesses the first attitude *eo ipso* possesses the second. Thus certainty contains knowledge. Certain attitudes strongly commit the agent to another at a moment, but not at others. Whoever believes now that it will rain tomorrow foresees rain tomorrow. The day after tomorrow the same belief won't be a prevision. It will just be a belief about the past.

As Searle and I pointed out in *Foundations*, one must distinguish in speech act theory between the *overt performance of an illocutionary act* and a simple *illocutionary commitment to the act*. For example, whoever asserts that every man is mortal is weakly committed to asserting that if Nabuchodonosor is a man then he is mortal, even if he has not made any reference to Nabuchodonosor and if he has not overtly made the second assertion. The same holds in the theory of attitudes. One must distinguish between the overt possession of an attitude and a simple psychological commitment to that attitude. There are strong and weak psychological commitments just as there are strong and weak illocutionary commitments. Some attitudes *weakly commit* the agent to others at certain moments: the agent could not then possess these attitudes without being committed to the others. For example, whoever believes that every man is mortal is weakly committed to believing that if Nabuchodonosor is a man then he is mortal, even if he has not Nabuchodonosor in mind and if he does not then possess the second belief. Such a weak psychological commitment shows itself in that fact that no one could simultaneously believe that the first universal proposition is true and that the second is false. So there is a general parallelism between illocutionary and psychological commitments. When an illocutionary act weakly or strongly commits the speaker to another, the attitudes that the speaker expresses in performing the first act weakly or strongly commit him to the attitudes that are sincerity conditions of the second act.

One can explicate weak psychological commitments of each agent a at each moment m in the logic of attitudes by quantifying over the set $Compatible_m^a$ of moments that are psychologically compatible with his or her attitudes at that moment. Two moments m and m' are *psychologically compatible as regard an agent a* in a model according to a certain possible denotation assignment val [in symbols: $m' \in Compatible_m^a(val)$] when that agent could then have all the attitudes that he has at both moments according to that assignment. By definition, the relation of *psychological compatibility* between moments of time is Brouwerian. It is both reflexive and symmetric in any model for any agent. Every attitude that an agent possesses at a moment restricts of course the set of moments that are psychologically compatible with that moment as regards that agent. He or she could not then have any other attitude incompatible with that attitude. I will say that an agent *could have an attitude $M(P)$* (in symbols $\diamond[aPossesses M(P)]$) at a moment m when he has that attitude at a psychologically compatible moment m' . In my view, an agent a is *weakly committed*

to the attitude $M(P)$ at a moment m when he could possess that attitude $M(P)$ at each moment that is psychologically compatible with that moment as regard that agent. Let $[a \triangleright M(P)]$ be the proposition according to which the agent a is weakly committed to attitude $M(P)$. For short, $[a \triangleright M(P)]$ is true at a moment m (for any history) according to a possible denotation assignment val when the set $val(a, m) \neq \emptyset$ and the proposition $\diamond[a Possesses M(P)]$ is true according to that assignment at each moment $m' \in Compatible_m^a(val)$. My logic of attitudes contains a theory of weak as well as of strong psychological commitment.

Recursive definition of the set of psychological modes

Psychological modes are not a simple sequence of a basic psychological category, a cognitive or volitive way, a propositional content condition and a preparatory condition. For their components are not logically independent. As I pointed out, certain components *determine* others of the same or of another kind. Thus the volitive way of the mode of *intention* determines the propositional content condition that it represents a present or future action of the agent and the preparatory condition that the agent is then able of doing that action. That last preparatory condition determines another, namely that the action in question is evitable. The cognitive way of the modes of *pride* and *arrogance* determines the condition that the propositional content concerns the very person of the agent and the preparatory condition that the represented fact exists and is good for the agent. In my ideography, each formula of the form $[Cat_M, f_\mu, f_\theta, f_\Sigma]$ represents the psychological mode M having the four components $Cat_M, f_\mu, f_\theta, f_\Sigma$ as well as all other components which are determined by them. Such a mode has then often other ways than f_μ , other propositional content conditions than f_θ and other preparatory conditions than f_Σ .⁸

The two primitive modes of *belief* and *desire* are the simplest. They correspond to the two traditional fundamental categories of cognition and volition. Descartes was right to take them as primitive modes. They have no special cognitive or volitive way, no special condition on the propositional content and no special preparatory condition. According to my ideography $M_{belief} =$

⁸ Thus the cognitive or volitive way f_M of the mode M is the conjunction of all the ways according to which the agent believes or desires when he possesses an attitude of this mode. The propositional content condition θ_M of this mode is the intersection of all the propositional content conditions that satisfies each proposition that is the propositional content of an attitude of the mode M for an agent. Finally, the preparatory condition Σ_M of that mode is the union of every preparatory condition that the agent believes and presupposes to be fulfilled when he possesses an attitude of the mode M .

$$[\bigcup_{\langle a,m \rangle \in \text{Agents} \times \text{Temps}} \text{Belief}, 1_f, 1_\theta, 1_\Sigma] \text{ and } M_{\text{desire}} = [\bigcup_{\langle a,m \rangle \in \text{Agents} \times \text{Temps}} \text{Desire}, 1_f, 1_\theta, 1_\Sigma]. \text{ All other}$$

psychological modes are more complex. They are obtained by adding to primitive modes special cognitive or volitive ways, propositional content conditions or preparatory conditions.

In my logic, the set of all possible psychological modes is then *defined recursively*. It is the smallest set *Modes* containing the two primitive modes of *belief* and *desire* that is closed under a finite number of applications of the three Boolean operations of adding new cognitive or volitive ways, new propositional content conditions or new preparatory conditions. Thus the psychological mode of *prevision* M_{foresee} is obtained by adding to the primitive mode of belief the propositional content condition θ_{future} that associates with each agent and moment the set of propositions that are future with respect to that moment. In symbols $M_{\text{foresee}} = [\theta_{\text{future}}]\text{Belief}$. The mode of *expectation* is obtained from that of prevision by adding the special cognitive way that the agent is then in a state of expectation. $M_{\text{expect}} = [f_{\text{expectation}}]M_{\text{foresee}}$. The mode of **being sure** is obtained from that of belief by adding the special way that the agent is in a state of confidence because he has strong reasons. Whoever is *convinced* is sure while being in a stronger state of conviction (special cognitive way). Whoever has *faith* is convinced that God exists (propositional content condition). In the case of *knowledge* the agent has such strong evidence that he is sure of the existence of the represented fact (special cognitive way and preparatory condition).

The mode of *hope* is obtained from that of *desire* by adding the special cognitive way that the agent is then uncertain as regards the existence and the inexistence of the represented fact and the preparatory condition that that fact is then possible. The mode of *aspiration* is obtained from that of hope by adding the condition that the propositional content concerns the very person of the agent and the preparatory condition that it is a pursued goal, sometimes even an ultimate or ideal aim. The mode of *satisfaction* is obtained from that of *desire* by adding the *preparatory condition* that the desired fact exists. The mode of *pleasure* has, in addition, the *volitive way* that the satisfaction of the desire puts the agent in a state of pleasure and the preparatory condition that it is good for the agent. The mode of *enjoyment* is obtained from that of pleasure by adding the special way of being in a conscious state of enjoyment. *Lust* has the special additional volitive way that it is a *sensual* enjoyment. *Concupiscence* is a lust of the flesh (propositional content condition).

Because all operations on psychological modes add new components, they generate stronger modes. Each attitude with a complex mode *contains* modes with fewer components. Thus, the psychological mode $[f]M$ that is obtained by adding to mode M the special way f has the *conjunction* of f and f_M as proper way. Similarly the psychological mode $[\theta]M$ that is obtained by adding to mode M the propositional content condition θ has the *intersection* of θ and θ_M as proper propositional content condition. Finally the mode $[\Sigma]M$ that is obtained by adding to mode M the preparatory condition Σ has the *union* of Σ and Σ_M as a proper preparatory condition. Whoever has an attitude of the form $[f]M(P)$, $[\theta]M(P)$ or $[\Sigma]M(P)$ has *eo ipso* the simpler attitude $M(P)$. Thus whoever expects, knows, is certain or convinced of something believes that thing. Whoever hopes, is happy, satisfied or pleased of something desires it.

Semantic tableaux

A lexical analysis of terms for attitudes based on the decomposition that I advocate can systematically explain which name stronger psychological modes. One can even show comparative strength by drawing semantic tableaux having the form of trees whose nodes are names or verbs for attitudes. Here are two semantic tableaux showing relations of comparative strength between cognitive and volitive modes respectively. The initial node of the first tableau is the term “belief” which names the primitive cognitive mode, just as the initial node of the second is the term “desire” that names the primitive volitive mode. Any immediate successor of a term is another term naming a stronger psychological mode obtained by applying one or more operations whose nature is indicating by symbols in the branch between the two terms. I have already specified special components in examples that I have given. Here are additional remarks. To have *appetite* is to desire to eat (special propositional content condition). To be hungry is to desire to eat in feeling a strong need of food (special volitive way).

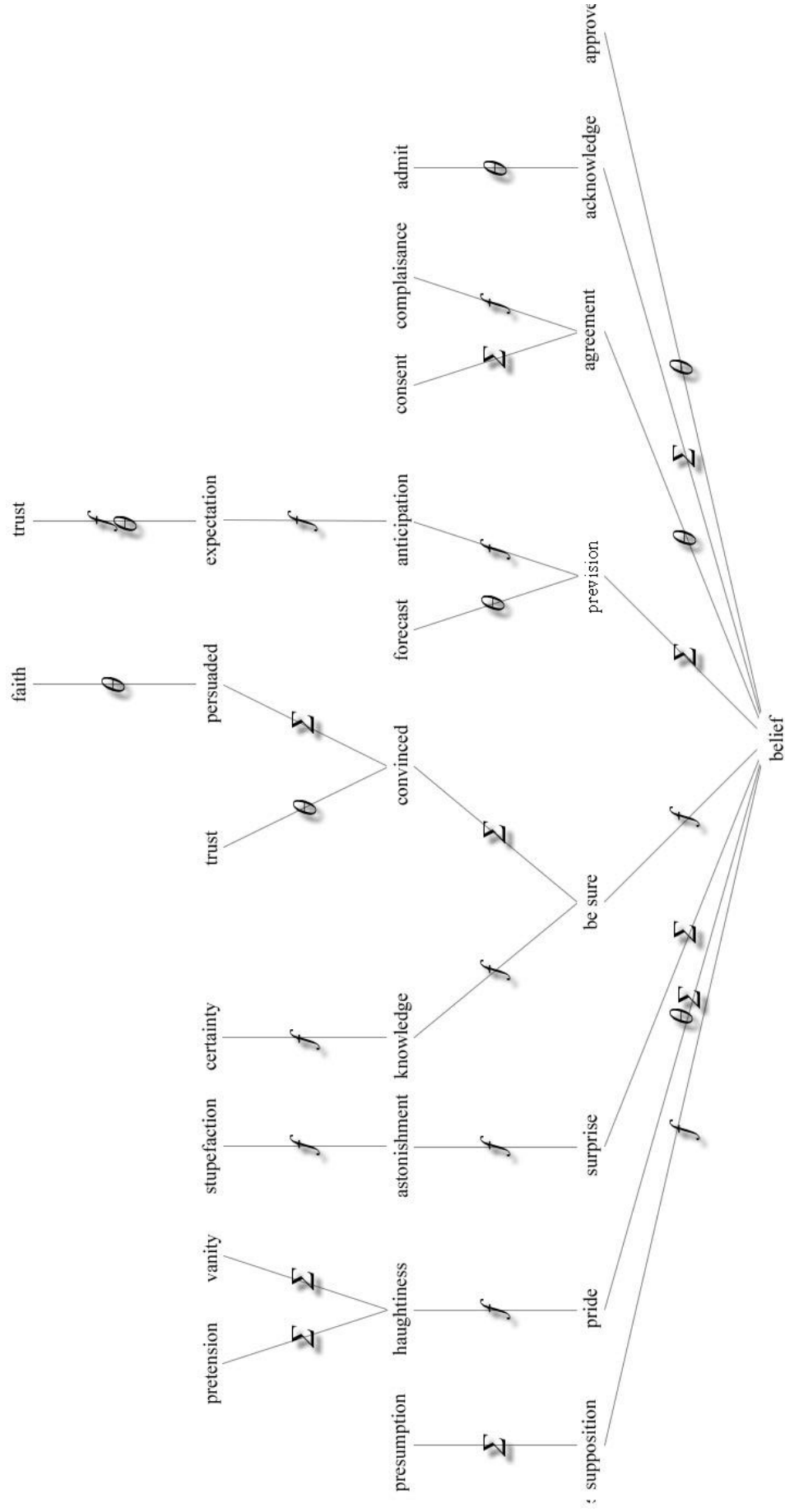


Figure 1. Cognitive modes

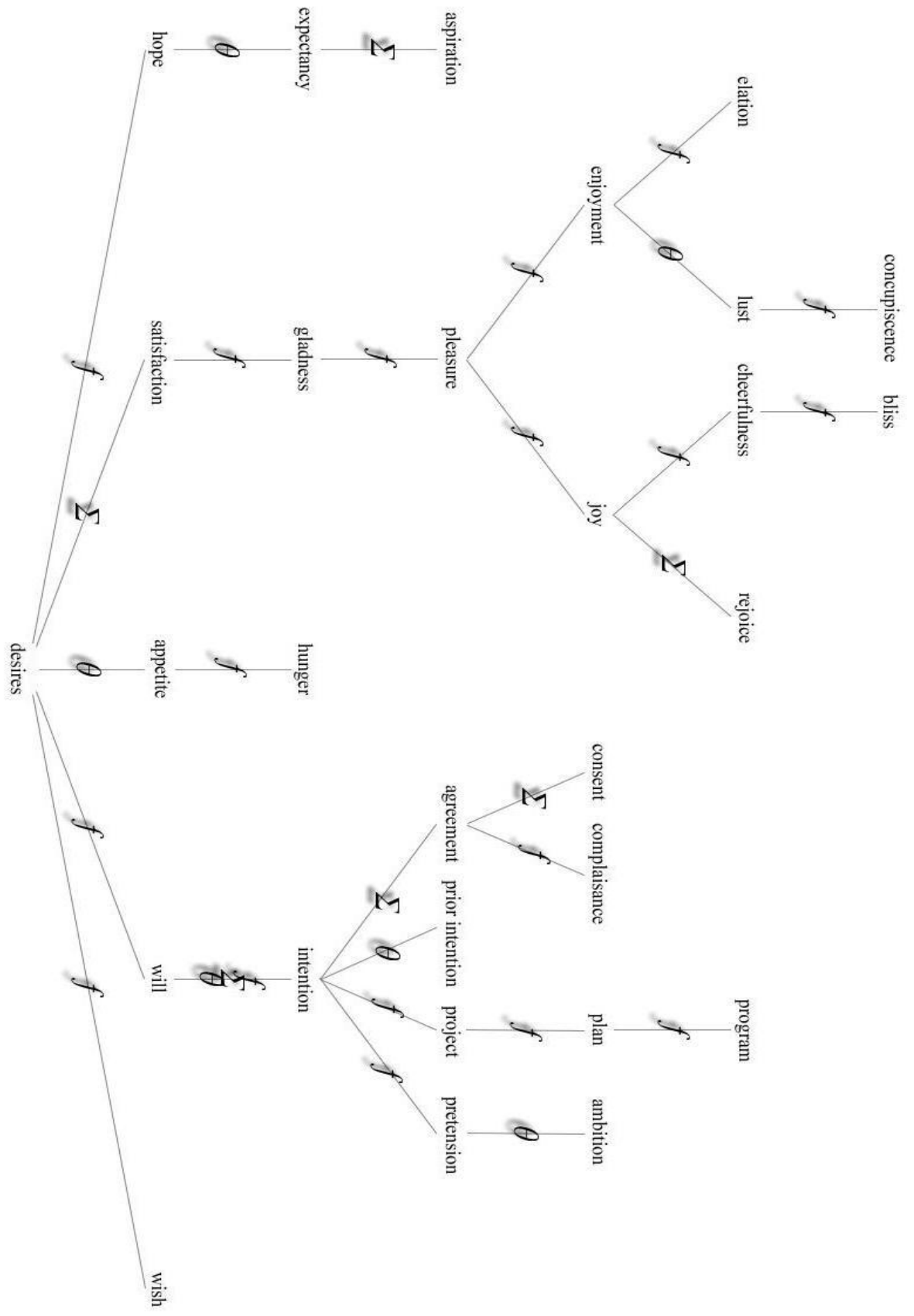


Figure 2. Volitive modes

Each term of a branch of a semantic tableau names a stronger psychological mode than terms that are lower in the same branch. Certain modes can be obtained by adding different components to modes named by terms occurring in other branches of the tableau. Whoever *trusts* someone is *convinced* that he is honest, that he will keep his word, etc. These are new propositional content conditions to add to the mode of *conviction* to get that of *trust*. Whoever *trusts* someone also *expects* him to behave in a certain way. This is a new cognitive way to add to the mode of *expectation* to get that of *trust*.

Ideography

The object language of my logic of attitudes is *ideographical*. The apparent syntactic forms of formulas naming psychological modes show their logical form. My ideography shows in particular which modes are stronger than others and which are incompatible. Thus a mode-formula that contains another one names *eo ipso* a stronger psychological mode. We all know that an *expectation* is a *prevision* and a *prevision* a *belief*. That strong psychological commitment is visible in my ideography where $M_{foresee} = [\theta_{future}]Belief$ and $M_{expect} = [f_{expectation}]M_{foresee}$. But it is not shown by the graphic form of the verbs “expect”, “foresee” and “believe”. Notice also that there is *no one-to-one correspondence* between possible psychological modes and ordinary language names or verbs for attitudes. On one hand, certain modes are not lexicalized. On the other hand, certain terms for attitude are ambiguous. For example, “agreement”, “confidence” and “consent” name mental *acts* as well as mental *states*. One can *give* one’s agreement as well as *be* in agreement. In such a case, the state named by the verb is a sincerity condition of the speech act that the verb also names. Whoever performs the act expresses *eo ipso* the corresponding state. Notice also that verbs like “to be sure” and “to agree” are ambiguous between different modes. One can be *sure* of the existence of a fact (cognitive mode); one can also be *sure* that one will act (volitive mode). In that case, the cognitive and volitive modes have the same additional component (the special way of being in a state of *confidence*). Moreover terms like *fear*, *sorrow*, *regret* that have the same syntactical surface behavior do not name psychological modes but rather forms of propositional attitudes. Certain terms also name denegations (*dissatisfaction*) or conjunctions (*doubt*) of attitudes. My ideography clarifies the logical nature of attitudes. It also exhibits the deep structure of natural languages. Thus in my ideography, a *deception* with propositional content is *P* is not of the form $M(P)$. It the desire of

the negation of that content ($\neg P$) having the double preparatory condition that proposition P is true and that the agent previously believed that it would be false.

Conditions of satisfaction of propositional attitudes

The general notion of *satisfaction condition* in logic and analytic philosophy is based on that of *correspondence*. Propositional attitudes and elementary illocutions are directed towards facts of the world represented by their propositional content. Most often agents want a correspondence between their ideas and things in the case of attitudes and also between their words and things in the case of illocutions. These attitudes and illocutions have for that reason *satisfaction conditions*. In order that the attitude or illocution of an agent at a moment is *satisfied*, the ideas or words of that agent have *then* to correspond to represented things or represented things have *then* to correspond to his or her ideas or words. So the *satisfaction* of propositional attitudes and elementary illocutions of an agent at a moment requires the *truth at that very moment* of their propositional content. The notion of *satisfaction condition* is a generalization of the notion of *truth condition* that covers attitudes and elementary illocutions with a not empty direction of fit. Just as a *belief* is *satisfied* when it is *true*, a *wish* and a *desire* are *satisfied* when they are *realized*; a *prevision*, an *expectation*, a *hope* and an *aspiration* are satisfied when they are *fulfilled*; an *intention*, a *project* and a *plan* when they are *executed*; a *fear* and a *fright* when the thing that is feared does not happen.

There are four possible directions of fit between mind and things, just as there are four possible directions of fit between words and things. Like assertive illocutions, *cognitive attitudes* have the *mind-to-things direction of fit*. They are *satisfied* at a moment when their propositional content is *then true*.⁹ The agent's ideas correspond to things as they are then in the world. In the cognitive case, when the agent realizes that there is no correspondence between his ideas and the world, he immediately changes these ideas. This is why the *truth predicates* (to be true and to be false) characterize so well *satisfaction* and *dissatisfaction* in the case of *cognitive* attitudes. However, such truth predicates do not apply to *volitive* attitudes whose direction of fit goes from things to words. For the world and not the agent is then at fault in the case of dissatisfaction of such attitudes. In the volitive case, the agent in general keeps his ideas and remains dissatisfied. Most often, agents having a *volitive attitude* *desire the fact represented by the propositional content no matter how that fact turns to be existent in the world*. For that reason, most volitive

attitudes are *satisfied* when their propositional content is actually true, no matter for which reason. Things are then such that the agent desires them to be, no matter what is the very cause of their existence.

The only exceptions to this rule are *volitive attitudes* like *will, intentions, projects, plans* and *programs* whose volitive way requires that things fit the ideas of the agent because he wants them in this way. Such attitudes as well as corresponding illocutionary forces of command, pledge or promise have *self-referential satisfaction conditions*. It not enough that their propositional content then be true in the actual world, their propositional content must be true because of the agent's attitude. Thus in order to execute a prior intention, it is not enough that the agent later does the intended action; he or she must do that action because of that prior intention. If the agent does not do that action for that reason, (if, for example, he is obliged to do it), he does not then execute that very intention. One can explain in the logic of attitudes such more complex cases of self-referential satisfaction by relying on the notion of *intentional causation*. In such cases, the very attitude must be a *practical reason* why its propositional content turns to be true.

As Searle pointed out in *Intentionality*, certain *volitive* modes like *joy, gladness, pride, pleasure regret, sadness, sorrow, and shame* have the *empty direction of fit*. Agents who have such attitudes do not want a correspondence between their ideas and things in the world. They just take for granted that correspondence. Indeed all such volitive attitudes have the special *preparatory condition* that their propositional content is then true. So no agent can have such attitudes without believing in the existence of the represented fact. In the case of *joy, gladness, pride* and *pleasure*, the agent desires the existence of the represented fact. In the case of regret, sorrow and shame, he or she desires its inexistence. Now the two opposite directions of fit of the desire and of the belief in the propositional content of such attitudes prevent the agent to have any intention of achieving a success of fit. This is why such attitudes do not have proper *satisfaction conditions*. Instead of being satisfied or dissatisfied, they are just *appropriate* or *inappropriate*. They are inappropriate when the represented fact does not exist or when their proper psychological mode does not suit that kind of fact. No agent should be ashamed of an action that he has not made or that is exemplary and good for all.

⁹ Occam's conception of future is indispensable for a right account of satisfaction conditions of attitudes and illocutions.

As Candida de Sousa Melo pointed out¹⁰, certain acts of thought have the *double direction of fit between mind and things*. These are verbal and mental *declarations*. In making such declarations, the speaker changes represented things of the world just by way of thinking or saying that he is changing them. Whoever gives by declaration a new name to a thing acts in such a way that that thing has then that name. In such a case, the very act of the mind brings about the represented fact. Unlike illocutions, *attitudes are states and not actions of the mind*. So they could not have the double direction of fit.

Identity criteria for propositional attitudes

In my view, propositional attitudes are not pairs of a mode and a propositional content. Whoever possesses a propositional attitude of the form M(P) *applies* in a certain way its mode M to its propositional content P so as to determine the conditions of possession and of satisfaction of that attitude. In order that two propositional attitudes are identical, it is enough that they have the same propositional content and the same possession conditions. It is not necessary that their psychological mode be identical. What matters is that their content be the same and that their mode associates with the same proposition the same possession conditions. Such attitudes have then the same conditions of possession and satisfaction and they consequently fulfill the same function in psychological life. Thus the *belief* that it will always be the case that $2 + 2 = 4$ is also a *prevision* that it will always be the case. These two attitudes have the same content but different modes. Contrary to the mode of belief, that of prevision has a special propositional content condition, namely that the represented fact be future. However in this case the content of a belief is future with respect to any moment. So that belief is always a prevision.

Section 3 Analysis of complex attitudes

In illocutionary logic, some illocutionary acts have a more complex form than elementary illocutions composed of a force and a propositional content. So are denegations of illocutions, conditional illocutionary acts and conjunctions of illocutions. For example, a refusal is the denegation of an acceptance, an offer is a promise that is conditional on the hearer's acceptance and an alert is the conjunction of the assertion of a danger and of a directive to be cautious. Similarly, denegations of attitudes, conditional attitudes and conjunctions (or sums) of attitudes have a more complex form than propositional attitudes.

¹⁰ Candida de Sousa Melo « Possible Directions of Fit between Mind, Language and the World » in D. Vanderveken

In my ideography, $\neg M(P)$ is the *denegation of attitude* $M(P)$, $(Q \Rightarrow M(P))$ is the *conditional attitude* which consists in having attitude $M(P)$ on the condition that antecedent proposition Q is true and $(M(P) \& M'(P'))$ is the *conjunction* or *sum* of attitudes $M(P)$ and $M'(P')$. For example, *incredulity* is the denegation of a belief and *disagreement* is the denegation of an agreement. As one can expect, whoever performs the denegation of an illocutionary act expresses *eo ipso* the denegation of the attitude corresponding to the denied act. Whoever refuses expresses disagreement. Like illocutionary denegation, psychological denegation is irreducible to propositional negation. A refusal to do something is not an acceptance not to do it. Similarly, to disagree on an issue is not to agree on the opposite issue. An agent has a conditional attitude of the form $(Q \Rightarrow M(P))$ when he categorically has attitude $M(P)$ in case the antecedent proposition Q is true. Whoever performs a conditional illocutionary act expresses the corresponding conditional attitude. Whoever offers help to the hearer expresses a conditional intention to help in case that hearer accepts. An agent has the conjunction of two attitudes when he has both attitudes. Whoever *doubts* of a fact is both incredulous about the existence and the inexistence of that fact and moreover believes that it is then possible.

Conditions of possession of complex attitudes

The conjunction of attitudes is like truth functional conjunction. An agent *possesses at a moment the conjunction* of two attitudes if and only if he or she then possesses both. So $[aPossesses (M(P) \& M'(P'))] =_{\text{def}} [aPossesses M(P)] \& [aPossesses (M'(P'))]$. On the contrary, psychological denegation and conditional operations on attitudes are not comparable with truth functional negation and implication. Whoever does not believe something is not *eo ipso* incredulous about it. In order to disbelieve something, an agent must think about it. Similarly, in order to have a conditional attitude of the form $(Q \Rightarrow M(P))$ an agent must have in mind both the antecedent proposition Q and the satisfaction conditions of attitude $M(P)$. Denegation and conditional operations on attitudes are real *psychological modalities*. One can rigorously define possession and satisfaction conditions of denegations and of conditional attitudes in quantifying over the set of moments of time that is provided with a Brouwerian relation of *psychological compatibility* as regards each agent.

An agent *possesses the denegation* $\neg M(P)$ of an attitude $M(P)$ at a moment m when firstly, that agent has then in mind all propositional constituents of P et secondly, he or she does not possess denied attitude $M(P)$ at any moment m' that is psychologically compatible with attitudes that he or she possesses at that moment m . So proposition $[aPossesses \neg M(P)]$ is *true at a moment m* under any history according to a denotation assignment val when each constituent of $P \in val(a,m)$ and the proposition $[aPossesses M(P)]$ is then false according to this assignment val at each moment $m' \in Compatible_m^a(val)$. The law of non-contradiction is valid for psychological denegation just as it is valid for illocutionary denegation. No agent can simultaneously possess an attitude and its denegation. One cannot both be content and discontent of the same thing. However the laws of excluded middle and of elimination of double negation do not hold for denegation. In order that an agent possesses the denegation of an attitude it is not enough the he or she does not possess that attitude. Moreover, the denegation of the denegation of an attitude is not identical with that attitude. Whoever is discontent of being discontent of a failure is not *eo ipso* content with that failure. Clearly psychological denegation is very different from propositional negation: $\neg M(P) \neq M(\neg P)$. Whoever is incredulous about a fact does not *eo ipso* believes that it does not exist. He or she can doubt about it. However, there are relations of psychological commitment between such attitudes. Any attitude of the form $M(\neg P)$ *commits the agent to denegation* $\neg M(P)$. Whoever agrees that it is not the case that P disagrees with P . Similarly, an attitude of the form $M(P)$ *commits the agent to denegation* $\neg M(\neg P)$. Whoever believes in the existence of a fact is incredulous about its inexistence. Whoever is satisfied with a fact would be unsatisfied with its inexistence.

Similarly, an agent *possesses a conditional attitude* $(Q \Rightarrow M(P))$ at a moment m when firstly, that agent has in mind all propositional constituents of P and Q and secondly, he or she categorically possesses attitude $M(P)$ at each moment m' where he or she believes Q when that moment is psychologically compatible with his or her attitudes at the moment m . So proposition $[aPossesses(Q \Rightarrow M(P))]$ is *true at a moment m* according to a possible denotation assignment val if and only if each propositional constituent of P and $Q \in val(a,m)$ and the proposition $[aPossesses M(P)]$ est then true according to val at each moment $m' \in Compatible_m^a(val)$ where $Belief_m^a(val) \subseteq id_2 Q(m/h_m)$.

There is a law of *modus ponens* for conditional attitudes. Whoever simultaneously possesses a conditional attitude of the form $(Q \Rightarrow M(P))$ and a belief that Q then categorically possesses attitude $M(P)$. For example, any agent who has the conditional intention to defend himself in case of an attack has the categorical intention to defend himself if he simultaneously believes that he is attacked. One can axiomatize valid laws governing agents' commitments to complex attitudes. One of them is the following: a conditional attitude of the form $(Q \vee Q') \Rightarrow M(P)$ whose antecedent proposition is a disjunction is the conjunction of conditional attitudes $(Q \Rightarrow M(P))$ and $(Q' \Rightarrow M(P))$.

Conditions of satisfaction of complex attitudes

It is clear that a *conjunction* of two attitudes *is satisfied at a moment* when each of them is then satisfied. On the other hand, a *denegation* of attitude possessed by an agent at a moment *is satisfied* when the agent does not then possess the denied attitude. Any possessed denegation of attitude is then satisfied. Finally, a *conditional attitude* of the form $(Q \Rightarrow M(P))$ of an agent at a moment is satisfied when categorical attitude $M(P)$ is satisfied at that moment in case antecedent proposition Q is then true in the history h_m of that moment. I will study with more details complex attitudes in a next paper.