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ON THE INTENTIONALITY AND IMPERFECT BUT MINIMAL RATIONALITY OF HUMAN SPEAKERS¹

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Abstract

I will criticize the current logical analysis of attitudes due to J. Hintikka (1971) according to which human agents are either perfectly rational or completely irrational. I will present the principles of a general logic of first level attitudes and actions that accounts for our intentionality and imperfect but minimal rationality. First level attitudes and actions are attitudes and actions of individual agents at a single moment of time. In my approach psychological modes of propositional attitudes have other components than their basic Cartesian category of cognition and volition. I will formulate a recursive definition of the set of all psychological modes. I will also analyze the nature of complex first level attitudes such as conditional attitudes and sums and denegations of attitudes which are irreducible to propositional attitudes. My primary purpose here will be first to explicate inductively conditions of possession and of satisfaction of all first level attitudes and to integrate my logic of attitudes within a general theory of first level actions explicating the primacy of intentional actions, their conditions of success and fundamental laws of action generation. For that purpose I will use a non classical predicative propositional logic and consider subjective as well as objective possibilities. Agents of voluntary actions and illocutionary acts have intentions and other first level attitudes. I will explain why logically equivalent propositions are not the content of the same attitudes and intentional actions and why human agents are neither logically omniscient nor perfectly rational but always remain minimally rational in the exercise of thought and the use of language. For more information see my next book *Speech Acts in Dialogue*.

As F. Brentano (1874) pointed out, agents of attitudes and intentional actions have *intentionality*: they are *directed at* objects and facts of the world. From a logical point of view, attitudes have logically related *conditions of possession* and of *satisfaction*. Whoever *possesses* an attitude is in a certain mental state: he or she must be able to determine what has to happen in the world in order that his or her attitude is satisfied. Just as beliefs are *satisfied* whenever they are *true*, desires are *satisfied* whenever they are *realized* and intentions whenever they are *executed*. So agents having beliefs represent how things are in the world according to them. Agents having desires represent how they would prefer things to be in the world. And agents having intentions represent how they should act in order to execute their intentions. By virtue of their possession and satisfaction conditions, propositional and complex attitudes are logically related in various ways. Certain attitudes are *incompatible* in the sense that no agent could simultaneously possess them. One cannot at the same time intend to do something and believe that one is unable to do it. Other attitudes cannot be simultaneously satisfied, for example beliefs

¹ A first draft of the part of this paper concerning propositional attitudes was read at the Meeting of the International Institute of Philosophy at Moscow in 2011 and published in A. Guseynov & V. Lektorsky (eds.) *Rationality and Its Limits. Proceedings of the Meeting in Moscow of the International Institute of Philosophy*, Russian Institute of Philosophy Print, Moscow, p.136-159, 2012.

whose propositional contents are relatively inconsistent. From a logical point of view, there are four different fundamental *relations of implication* between attitudes. First of all, certain attitudes *strongly commit* their agent to having others: he or she could not possess them without possessing the others. In order to enjoy something one must desire it. Some attitudes have more satisfaction conditions than others. Whenever an aspiration is fulfilled so is the corresponding hope. Thirdly one cannot possess certain attitudes unless others are satisfied. Whoever knows something has a true belief. Conversely, some attitudes cannot be satisfied unless others are possessed. Whoever executes an intention possesses the intention of executing that intention. The single most important objective of an adequate logic of attitudes is to formulate a recursive unified theory of attitudes that can prove all fundamental valid laws governing their conditions of possession and satisfaction. Because agents *a priori* know by virtue of linguistic competence to which attitudes they are strongly committed, the relation of strong psychological commitment has to be decidable in the logic of attitudes.

Propositional attitudes are attitudes of the form $M(P)$ which consist of a *psychological mode* M with a *propositional content* P . They are the simplest kinds of individual attitudes directed at facts. Their analysis is very important for the purpose of illocutionary logic founded by J.R. Searle and D. Vanderveken (1985) and D. Vanderveken (1990-1991) which aims to analyze the felicity conditions of speech acts called by J.L. Austin (1962) *illocutionary acts* which are the primary units of meaning and understanding in the use and comprehension of language. For all illocutionary acts (assertions, promises, requests, refusals, permissions, gifts, etc.) are by nature intrinsically intentional actions. Whoever attempts to perform an illocutionary act intends to perform that illocution and believes that he or she is able to perform it. Moreover in performing elementary illocutions of the form $F(P)$ with a *force* F and a *propositional content* P speakers always *achieve an illocutionary point on the propositional content* and they *express propositional attitudes* of the form $M(P)$ *about the fact* represented by that content where M is a psychological mode determined by the sincerity conditions of force F . In making an assertion one represents a fact as being actual in the world and one expresses a belief in the existence of that fact. In making a request one makes a linguistic attempt to get the hearer to do something and one expresses a wish that he or she does it. In making a promise one commits oneself to do something and one expresses an intention to do it.

My first objective here will be to explicate adequately *possession and satisfaction conditions of all propositional attitudes* and to characterize the intentionality and rationality of agents who have such basic attitudes. According to J. Hintikka's (1962) epistemic logic, human agents are either perfectly rational or totally irrational. I will advocate an intermediate position compatible with contemporary philosophy of mind and psychology according to which human agents are not perfectly but minimally rational. In my logical approach, one can formulate adequate laws of psychological commitment and avoid current epistemic and volitive paradoxes. In order to account for *minimal rationality*² I will exploit the resources of a non classical propositional *predicative logic* that distinguishes propositions with the same truth conditions that do not have the same cognitive or volitive value. I will explain my logical analysis of propositional contents in the first section. Next I will analyze components of psychological modes and explicate possession and satisfaction conditions of propositional attitudes. I will analyze in the third section the logical form of conditional attitudes and denegations and sums of first level attitudes. Examples of complex attitudes are conditional intentions, disbeliefs and doubts. Such complex first level attitudes are important for illocutionary logic because they are the sincerity conditions of *complex illocutionary acts* like conditional illocutionary acts (offers, conditional requests), acts of illocutionary denegation (refusals, permissions) and conjunctions of illocutions (warnings, alerts). The aim of *acts of illocutionary denegation* of the form $\neg F(P)$ is to make explicit the non-performance by the speaker of the illocution $F(P)$. A permission is the illocutionary denegation of an act of forbidding. The aim of *conditional illocutionary acts* of the form $(P \Rightarrow F(Q))$ is to perform an illocutionary act $F(Q)$, not categorically, but on the condition that a proposition P is or turns to be true. An offer is a conditional promise that is conditional on the hearer's acceptance. The aim of *conjunctions of illocutionary acts* of the form $(F_1(P_1) \& F_2(P_2))$ is to perform simultaneously the two illocutionary acts $F_1(P_1)$ and $F_2(P_2)$.³

I will present the principles of my logic of first level actions in the last section. I will briefly criticize standard skepticism against the logic of practical reason and enumerate important valid laws of my logic that show the imperfect but minimal rationality of human speakers. From a logical point of view first level attitudes are our simplest attitudes. They are part of our *higher level* individual or collective *attitudes* like plans and consensus that we can possess during an

² The term « minimal rationality » was first introduced by C. Cherniak (1986).

³ For an analysis of felicity conditions of elementary and complex illocutionary acts see my paper "Success, Satisfaction and Truth in the Logic of Speech Acts and Formal Semantics" of 2004.

interval of time, just as our first level actions are constitutive of our *higher level* individual or collective *actions* like games and deliberations. As I have pointed out in Vanderveken (2001), discourses like descriptions, debates, negotiations, classifications and protestations which are provided with a proper conversational goal are *higher level illocutions* that contain first level capital illocutions.

1. Analysis of propositional contents of attitudes

Propositions with the same truth conditions are not the contents of the same attitudes and illocutions. Moreover 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. By *essential property* of an object I mean a property that it *really* possesses in any possible circumstance. It is an essential property of each human agent to have certain parents. But some of us do not know their parents. Others are wrong about their identity; in that case they have necessary false beliefs. However when agents are inconsistent, they remain paraconsistent (Newton da Costa 2005); they never believe nor desire everything.

According to standard logic of attitudes, relations of psychological compatibility with the truth of beliefs and the realization of desires are modal relations of accessibility between agents and moments, on one hand, and possible circumstances, on the other hand. Possible circumstances are compatible with the truth of agents' beliefs 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 of that agent at that moment. On Hintikka's view, an agent *believes a proposition at a moment* when that proposition is true in all possible circumstances that are compatible with what that agent then believes. Given such a formal approach, human agents are *logically omniscient*. They believe all necessarily true propositions and their beliefs are closed under logical implication. Moreover, human agents are either *perfectly rational* or *totally irrational*. They 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 believes all propositions according to the standard approach. But this conclusion is clearly false. As the Greek philosophers pointed out, it is paradoxical to believe every proposition (this is the so-called paradox of sophism).

One could introduce in logic so-called *impossible circumstances* where necessarily false propositions would be true. But this move is very *ad hoc* and neither necessary nor sufficient. In

my approach, all *circumstances* remain *possible*. So in my view objects keep their essential properties (each of us keeps his real parents) and necessarily false propositions remain false in all possible circumstances. In order to account for human inconsistency, we have to consider *subjective* in addition to *objective possibilities*. Many subjective possibilities are not objective. So we need a non classical logic. My propositional logic (Vanderveken 2005a, 2015) is *predicative* in the general sense that it takes into account acts of predication that agents make in expressing and understanding propositions. In my view, each proposition has a finite *structure of propositional constituents*. It predicates *attributes* (properties or relations) of *objects subsumed under concepts*. We understand a proposition when we understand which attributes objects of reference must possess in a possible circumstance in order that this proposition be true in that circumstance. As G. Frege (1918-23) pointed out, we always *refer to* objects by subsuming them under senses. We cannot directly have in mind *individual objects* of the world like material bodies and persons. When we think we rather have in mind *concepts* of individuals and we *indirectly* refer to them through these concepts. So our attitudes are directed towards *individuals under a concept* (called by R. Carnap (1956) an *individual concept*) rather than towards pure individuals. Most attitudes directed towards an individual under a concept are not directed towards the same individual under other concepts. By recognizing the indispensable role of concepts in reference, predicative logic also accounts for attitudes directed towards inexistent and even impossible objects (the fountain of youth).

In addition to an analysis of the structure of constituents of propositions, logic also needs a *better explication of their truth conditions*. We understand most propositions without knowing in which possible circumstances they are true, because we ignore *real denotations* of most attributes and concepts in many circumstances. One can refer to a friend's wife without knowing who she is. However we can always in principle think of persons who could be his wife. 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* of classical logic which associates with each propositional constituent its actual denotation in every possible circumstance. They are functions of the same type that associate with each individual concept a unique individual or no individual at all in every possible circumstance. According to the real denotation assignment, my friend's wife is the woman with whom he is really married when he has a wife. According to other possible denotation assignments, his wife is another person or

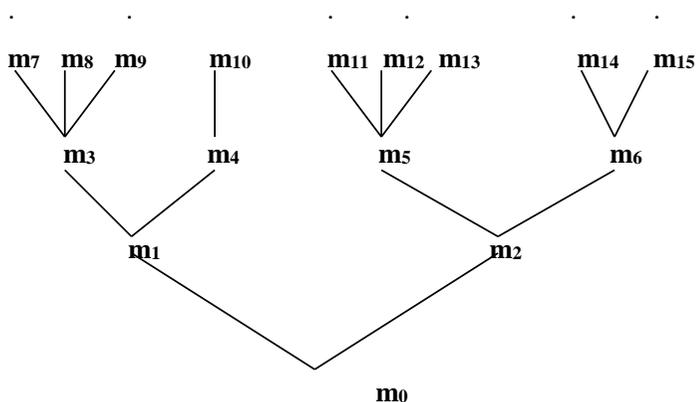
even he is not married. In spite of their differences, all possible denotation assignments respect so called *meaning postulates* that speakers have internalized in learning their language. According to any, a wife is a woman. We ignore the real denotation of most concepts and attributes in many circumstances. But we can think of denotations that they could have. When we have in mind concepts and attributes, only some possible denotation assignments to them *are then compatible with* our beliefs. Suppose that according to you my friend's wife is less than 30 years old. In that case, possible denotation assignments according to which he is married to an older woman are then incompatible with your beliefs. Possible denotation assignments rather than possible circumstances are compatible with the beliefs of agents. So my logic accounts for subjective possibilities.

In my approach, the truth definition is relative to both possible circumstances and denotation assignments. An elementary proposition predicating an extensional property of an individual object under a concept is true in a circumstance according to a denotation assignment when according to that assignment the object which falls under that concept has that property in that circumstance. Otherwise, it is false in that circumstance according to that assignment. In understanding propositions we in general do not know whether they are true or false. We just know that their truth in a circumstance is compatible with certain possible denotation assignments to their concepts and attributes, and incompatible with all others. Most propositions have *a lot of possible truth conditions*. 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, its *real Carnapian truth conditions* correspond to the set of possible circumstances where it is true according to the real denotation assignment.

In my view, propositions are *identical* when they make the same predications and they are true in the same circumstances according to the same possible denotation assignments. Such a finer criterion of propositional identity explains why many logically equivalent propositions have a different cognitive or volitive value. Propositions whose expression requires different predications have a different structure of constituents. So are necessarily true propositions that mothers are women and that erythrocytes are red. One can have in mind one without having in mind the other. My identity criterion also distinguishes propositions that we do not understand to be true in the same circumstances: these are not true according to the same possible denotation assignments to their senses. Few necessarily true propositions are *obvious tautologies* that we

know *a priori*. In order to be *necessarily true* a proposition has to be true in every possible circumstance according to the real denotation assignment. In order to be *obviously tautological*, that proposition has moreover to be true in every circumstance according to every possible denotation assignment to its constituent senses. Unlike the proposition that Oedipus' mother is a woman, the necessarily true proposition that Oedipus' mother is Jocasta is not an obvious tautology. It is false according to possible denotation assignments. We now can explicate subjective and objective possibilities. 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* it has to be true in a circumstance according to the real denotation assignment. Few subjective possibilities are objective.

The logic of attitudes and actions requires a *ramified conception of time*⁴ compatible with indeterminism. Attitudes and actions of human agents are not determined. When they do or think something, they could have done or thought something else. 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. There is a single causal route to the past. However, there are multiple future routes. Consequently, the set of moments of time is 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*. Some histories have a first and a last moment. According to these histories

⁴ See A.N. Prior *Past, Present and Future* (1967) for more information on the ramified conception of time.

the world has a beginning and an end. As Nuel Belnap (1992, 2001) pointed out, each *possible circumstance* is a pair of a moment m and of a history h to which that moment belongs. Thanks to histories temporal logic can analyze important modal notions like settled truth and historic necessity. 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. So are past propositions and propositions according to which agents possess propositional attitudes. Whoever desires something at a moment then 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 such moments. It depends on which historical continuation of that moment is under consideration. When there are different possible historic continuations of a moment, its actual future continuation is not then determined.

However, as William of Ockham (1321-23) pointed out, if the world continues after a moment, it will continue in a unique way. The actual historic continuation of each non final moment is unique even if it is still undetermined at that very moment. Indeterminism cannot prevent that uniqueness. According to philosophy of mind human agents, who are directed by virtue of their intentionality towards things and facts of the world, are intrinsically oriented at each moment of their life towards the real continuation of the world. We all ignore now how the world will continue but we are intrinsically oriented at each moment towards the real continuation of that moment and we always distinguish conceptually that real from other possible continuations whenever we act or think. Whoever foresees or wishes future facts foresees or wishes that these facts come into existence in the real future. So in my approach⁵ our elementary illocutions and propositional attitudes at each moment have or will have a certain satisfaction value, even if that satisfaction value is still undetermined when they have a future propositional content. In order to keep a present promise and execute a present intention to do things later, an agent must do these things in the real continuation of the world. Other possible historic continuations do not matter.

According to my temporal logic every moment m has a *proper history* h_m in each model. Whenever a moment m is the final moment of a history h , that history h is its proper history h_m . Whenever it is not final, all moments m' that belong to its proper history have of course the same

⁵ See my paper of 2013 «Towards a Formal Pragmatics of Discourse» in the *International Review of Pragmatics*.

historic continuation. Thus $h_{m'} = h_m$ when $m' \in h_m$.⁶ A proposition is *true at a moment* m according to a denotation assignment when it is true at moment m in the history h_m of that moment according to that assignment. Two moments of time m and m' are *coinstantaneous* when they belong to the same instant. Coinstantaneous moments are on the same horizontal line in each tree-like frame. One can analyze *historic necessity* by quantifying over coinstantaneous moments. The proposition that *P is then necessary* (in symbols $\Box P$) is true at a moment when P is true at all coinstantaneous moments according to all histories. The notion of historic necessity is stronger than that of settled truth. The represented fact is then not only established but inevitable. According to traditional philosophy there are no inevitable actions and intentions. Moreover the possible causes and effects so to speak of actions of any agent at a moment are limited to those which are possible outcomes of the way the world has been up to that moment. As N. Belnap pointed out, in order to explicate *historical relevance* we must consider coinstantaneous moments having the same past that I will call *alternative moments*. Thus m_{14} and m_{15} are alternative moments in the last figure. Logical or *universal necessity* is stronger than historic necessity. The proposition that *P is universally necessary* (in symbols: $\blacksquare P$) is true in a circumstance when P is true in all possible circumstances. In that case the fact represented is always objectively inevitable. A proposition P is *obviously tautological* when it is true in every possible circumstance according to any possible denotation assignment. The notion of *obvious tautology* is the strongest modal notion. The represented fact is then analytically inevitable subjectively as well as objectively.

2. My new approach in the logic of propositional attitudes⁷

As I said earlier, propositional attitudes of human agents are about objects that they represent under concepts. Each agent has consciously or potentially⁸ in mind a certain set of attributes and concepts at each moment. That set of propositional constituents is of course empty when the agent is physically unable to think or does not exist. In my view, no agent can have a propositional attitude without having in mind all attributes and concepts of its content. Otherwise, he or she would be unable to determine under which conditions his or her attitude is satisfied. As

⁶ N. Belnap, M. Perloff and Ming Xu (2001) reject the idea that each moment of utterance has a proper history.

⁷ See my papers "A General Logic of Propositional Attitudes" of 2008a, « Beliefs, Desires and Minimal Rationality » of 2009 and "Neither Logically Omniscient nor Completely Irrational Agents: Principles for a Fine-Grained Analysis of Propositional Attitudes and Attitude Revision" of 2011a.

⁸ We have unconsciously in mind at most moments of our existence a lot of concepts and attributes that we could in principle express at that moment given our language.

Wittgenstein (1953) and Searle (1992) pointed out, an attitude with entirely undetermined satisfaction conditions would be an attitude without content. So it would not be an attitude at all. In order to desire to become bishop one must understand characteristic features determined by meaning of the property of being bishop.

Secondly, possible denotation assignments to propositional constituents rather than possible circumstances are compatible with the satisfaction of agents' attitudes. So there corresponds to each agent a and moment m 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 of that agent at that moment. When the agent a has no attribute or concept in mind at the moment m , $Belief(a,m)$ is the entire set Val of all possible denotation assignments to senses. In that case, that agent has then no attitudes. Otherwise, $Belief(a,m)$ is always a *non empty proper* subset of Val . For whoever has in mind senses respects meaning postulates governing them in his possible use and interpretation of language. So there always are possible denotation assignments to these senses compatible with what that agent then believes. In my view, an agent a *believes a proposition* at a moment m when he or she has then in mind all its concepts and attributes and that proposition is true at that moment according to all possible denotation assignments of $Belief(a,m)$ compatible with the truth of his or her beliefs at that moment. We all now have beliefs directed at the future (previsions, expectations). Such beliefs are true when things will be as we believe in *the real future continuation* of the present moment. Other possible historic continuations do not matter.

Similarly, 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 realization of all desires of that agent at that moment. There is however an important difference between desire and belief. Agents can believe, but they cannot desire, that objects have properties or entertain relations without believing that they could be otherwise. For any desire contains a *preference*. Whoever desires something distinguishes two different ways in which represented objects could be in the actual world. In the preferred ways, objects are in the world as the agent desires, in the other ways, they are not. The agent's desire is realized in the first case, it is unrealized in the second case. Thus in order that an agent a *desires the fact represented by a proposition P* at a moment m , it is not enough that he or she has then in mind all attributes and concepts of P and that the proposition P is true at that moment according to all

denotation assignments of *Desire(a,m)* compatible with the realization of his or her desire at that moment. That proposition must moreover be false in at least one circumstance according to that agent. Otherwise that agent would not prefer the existence of the represented fact.

My explication of belief and desire is compatible with philosophy of mind. It accounts for unconscious and conscious attitudes. Whoever has a conscious belief or desire has consciously in mind all attributes and concepts of its propositional content. Whoever has an unconscious belief or desire has unconsciously in mind some of its attributes and concepts. But he or she could then express these senses thanks to his or her language. My approach also accounts for the fact that *human agents are neither logically omniscient nor perfectly rational*. Agents do not have in mind all expressible concepts and attributes. They ignore the meaning of certain words of their mother language. Moreover our natural languages have limited expressive capacities. We sometimes discover new concepts and attributes and enrich our language in order to express them. So agents *ignore* the truth of a lot of obvious tautologies and of necessarily true propositions. Our knowledge is limited: we ignore which objects possess many properties in a lot of circumstances especially in future 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 the real denotation assignment is sometimes incompatible with the satisfaction of our beliefs and desires. Possible denotation assignments compatible with our beliefs and desires can moreover violate essential properties of objects. In that case we have necessarily false beliefs and unrealizable desires. My analysis explains why we are often *inconsistent*.

Predicative logic also explicates why propositions true in the same circumstances can have a different cognitive or volitive value. Some have different structures of propositional constituents. So are logically equivalent propositions that mothers are women and that mothers are women but not erythrocytes. Their expression requires different *acts of predication*. Others are not true according to the same possible denotation assignments. So are necessarily true propositions that whales are whales and that whales are mammals. We do not understand them as being true in the same conditions. Thus we can assert or believe necessary truths without asserting or believing others. Among all necessary truths, few are *obvious tautologies* like the proposition that whales are whales which are true in all possible circumstances according to all possible denotation assignments. We believed in the past that whales were fishes.

However *human agents always remain minimally rational: they cannot be totally irrational*. First of all, in my approach, agents cannot believe nor desire everything since in every model some possible denotation assignments are compatible with the satisfaction of their beliefs and desires. Moreover, whoever possesses certain beliefs and desires is *eo ipso* committed to possessing others. Indeed all possible denotation assignments compatible with our beliefs and desires respect meaning postulates. Human agents are therefore *minimally logically omniscient*: they cannot have in mind an obvious tautology without knowing for certain that it is necessarily true. Represented objects could not be otherwise according to us. Similarly, obvious contradictions (negations of obvious tautologies) are false in every possible circumstance according to any agent. We can neither believe nor desire obviously contradictory things. Some hope that arithmetic is complete (a necessarily false proposition if Gödel's proof is right). But agents could never believe or desire both the completeness and the incompleteness of arithmetic (an obvious 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. When the logical form of such attitudes is fully analyzed, they are not categorical desires whose propositional content is an obvious contradiction. Because the reasons why they have each of these desires is part of their content.

As I said earlier, agents believe all obvious tautologies that they express or understand. However they could not desire the existence of facts represented by obvious tautologies. In order to desire facts they must believe that these facts could not occur. One can desire to drink sake; one can also desire not to drink sake. But no one can desire to drink or not drink sake. My predicative logic explicates a new *strong* propositional *implication* that is much finer than C.I. Lewis (1918)' strict implication and important for the analysis of strong and weak psychological and illocutionary commitments. A proposition *strictly implies* another when it is logically necessary that it implies that other proposition. A proposition *strongly implies* another when whoever expresses that proposition is able to make all predications of the other and it cannot be true in a circumstance according to a possible denotation assignment unless the other proposition is also true in that circumstance according to that assignment. *Strong implication* is *finite*, *tautological*, *paraconsistent*, *decidable* and *a priori known*. Whoever believes a proposition *P* does not believe many propositions containing new senses that *P* logically implies. But he or she believes all the propositions that *P* strongly implies because he or she knows that *P* could not be

true otherwise. All rules of elimination of natural deduction generate strong implication because all the senses of their conclusion are expressed by their premises. However rules like the rule of introduction of disjunction do not generate strong implication when their conclusion expresses a new sense. So a desire to drink does not contain a desire to drink or die.

3. Analysis of psychological modes and propositional attitudes

Descartes (1649) in his treatise on *Les passions de l'âme* analyzed a large number of propositional attitudes. Contemporary logic and analytic philosophy only consider a few paradigmatic attitudes such as belief, knowledge, desire and intention. Could we use Cartesian analysis to develop a larger theory of all propositional attitudes? Searle (1983) in *Intentionality* criticized Descartes who tends to reduce all such 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 (e.g. conviction, faith, confidence, knowledge, certainty, presumption, pride, arrogance, surprise, amazement, stupefaction, prevision, anticipation and expectation) are beliefs and all volitive attitudes (e.g. wish, will, intention, ambition, project, hope, aspiration, satisfaction, pleasure, enjoyment, delight, gladness, joy, elation, amusement, fear, regret, sadness, sorrow, grief, remorse, terror) are desires.

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 then in the world. Such an attitude is or will be satisfied when its propositional content corresponds to things as they are or will be in the world. On the other hand, *desires* have the opposite *things-to-mind direction of fit*. Volitive attitudes are or will be satisfied only if things in the world fit their propositional content. Each direction of fit between mind and the world determines which side is at fault in case of dissatisfaction. When a belief turns out to be false, it is the agent who is at fault, not the world. He should have had other thoughts about the world. In such a case, the agent easily corrects the situation in changing his beliefs. On the contrary, when a desire turns out to be unsatisfied, it is not the agent but the world which is at fault. Objects should have been different. The agent sometimes corrects the situation in abandoning or changing his or her desire. Most often, he or she keeps that desire and remains then unsatisfied.

But psychological modes divide into other components than the *basic categories of cognition* and *volition*. Let me now present these new components. Many complex psychological

modes have a *proper way* of believing or desiring, proper *conditions on their propositional content* or proper *preparatory conditions*. We feel our beliefs and desires in a lot of ways. Many modes require a special *cognitive or volitive way* of believing or desiring. Thus, *knowledge* is a belief based on strong evidence that gives confidence and guarantees truth. Whoever has an *intention* feels such a strong desire that he or she is disposed to *act* sooner or later in order to satisfy that desire. Sometimes the agent has a *prior intention*: he or she intends to act at a posterior moment in the real future in order to satisfy the desire. Sometimes the agent intends to act at the very moment of the intention. He or she has then an *intention to act in the present* (what Searle (1983) calls an *intention in action*). Whoever has the *intention to act in the present* forms his or her intention at the very moment of that intention. So an intention in action is both a mental state and a mental act.

From a logical point of view, a *cognitive or volitive way* is a function f_{ω} which restricts the basic psychological categories of cognition or volition. Like illocutionary forces, psychological modes also have *propositional content* and *preparatory conditions*. *Previsions* and *anticipations* are directed towards the real future. *Intentions* are desires to carry out a present or future action. From a logical point of view, a *condition on the propositional content* is a function f_{θ} that associates with each agent and moment a set of propositions. Any agent of an attitude or of an illocution *presupposes* certain propositions. His or her attitude and illocution would be *defective* if these propositions were then false. Thus *promises* and *intentions* have the preparatory condition that the agent is then able to do the action represented by their propositional content. In the illocutionary case the speaker can lie in order to mislead the hearer. However no agent who has an attitude can lie to him or herself. So whoever has an attitude both believes and presupposes that its preparatory conditions are fulfilled. A preparatory condition is a function f_{Σ} associating with each agent, moment and propositional content the set of propositions that the agent would presuppose and believe if he had then an attitude with that preparatory condition and propositional content. The sets of cognitive and volitive ways, of propositional content and of preparatory conditions are *Boolean algebras*. They contain a *neutral* mode and a *neutral* preparatory and propositional condition and they are closed under the operations of *union* and *intersection*.

On the basis of my analysis, one can formally distinguish different modes of attitudes which apparently reduce to the same sums of beliefs and desires. Thus prevision, expectation and

anticipation have different cognitive ways. Identical psychological modes have the same components. Possession conditions of propositional attitudes are entirely determined by components of their mode and their propositional content. By definition, an agent *a* possesses a cognitive (or volitive) attitude of the form $M(P)$ at a moment *m* when he or she then believes (or desires) the propositional content *P*, he or she feels that belief or desire that *P* in the cognitive or volitive way ω_M proper to psychological mode *M*, the proposition *P* then satisfies propositional content conditions $\theta_M(a,m)$ and finally that agent then presupposes and believes all propositions determined by preparatory conditions $\Sigma_M(a,m,P)$ of mode *M* with respect to the content *P*. Thus an agent intends that *P* at a moment when proposition *P* then represents a present or future action of that agent, he or she desires so much that action that he or she is committed to carrying it out and moreover that agent then presupposes and believes to be able to carry it out. An attitude strongly commits an agent to another at a moment when he or she could not then have that attitude without having the second. Thus whoever believes that it will rain tomorrow then foresees rain tomorrow. Some attitudes strongly commit the agent to another at particular moments. 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 be a belief about the past. An attitude contains another when it strongly commits any agent to that other attitude at any moment.

There are strong and weak psychological commitments just as there are strong and weak illocutionary commitments. In illocutionary logic, an illocution strongly commits the speaker to another when he or she could not then perform that illocution without performing the other. All predictions contain an assertion but not conversely. Assertions about the past are not predictions. As Searle and I (1985) pointed out, speakers are also weakly committed to illocutions that they do not overtly perform. Whoever promises to be kind to every man is weakly committed to promising to be kind to you, even if he or she does not make any reference to you and does not overtly make the second promise. There is a Brouwerian reflexive and symmetrical relation of agentive compatibility in the logic of action of illocutionary logic.⁹ Two moments are compatible as regards an agent when that agent could simultaneously perform all actions that he or she performs at these two moments. In my approach (Vanderveken 2004, 2013) a speaker is weakly committed to a first level illocution at a moment of utterance when he or she could perform that

⁹See my papers "Attempt, Success and Action Generation: A Logical Study of Intentional Action" of 2005b and "Intentionality and Minimal Rationality in the Logic of Action" of 2014.

illocution at any moment that is compatible with that moment as regards that agent. In that case he or she could perform that illocution in any context which is illocutionarily compatible with the context of utterance. For two contexts with the same speaker are *illocutionarily compatible* when all illocutions that he or she performs in one could be performed in the other, that is to say when their moments of utterance are compatible as regards that speaker.

Similarly one must distinguish between the overt possession of an attitude and a simple psychological commitment to that attitude. Whoever believes that every man is mortal is weakly committed to believing that Nebuchadnezzar is mortal, even if he has not Nebuchadnezzar's concept in mind and if he or she does not then overtly possess the second belief. No one could simultaneously believe the first universal proposition and the negation of the second. One can explicate weak psychological commitments of agents at every moment by quantifying over the set of moments that are psychologically compatible with their attitudes at that moment. Two moments m and m' are *psychologically compatible as regard an agent a* in a model when that agent could have all the attitudes that he has at both moments. In that case he or she could of course make at one moment all actions that he or she makes at the other moment. The relation of *psychological compatibility* between moments of time is identical in any model of the logic of attitudes with the reflexive and symmetric relation of *agentive compatibility*. By definition an agent is *weakly committed* to a first level attitude at a moment when he or she could have that attitude at any moment that is psychologically compatible with that moment as regards that agent. As one would expect, there is a parallelism between illocutionary and psychological commitments. When an illocution weakly or strongly commits the speaker to another, the attitudes that the speaker expresses in performing that illocution weakly or strongly commit him or her to the attitudes that are sincerity conditions of the other.

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. 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 that agent is then able to carry out that action. My logic of propositional attitudes formulates a *recursive definition of the set of all psychological modes*. The two primitive modes of *belief* and *desire* are the simplest cognitive and volitive modes. They have no special cognitive

or volitive way, no special propositional content or preparatory condition. All other more complex modes are obtained by adding to one primitive mode finitely many special cognitive or volitive ways, new propositional content conditions or new preparatory conditions. Thus the mode of *prevision* $M_{foresee}$ is obtained by adding to the 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. $M_{foresee} = [\theta_{future}]Belief$. 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. $M_{expect} = [\omega_{expectation}]M_{foresee}$. 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 *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. Because all operations on modes add new components, they generate stronger modes. Attitudes $M(P)$ with a complex mode *contains* attitudes $M'(P)$ whose modes have less components. Thanks to my componential analysis of psychological modes one can make a systematic reasoned lexical analysis of terms and verbs of natural languages naming propositional attitudes and explicate why certain name psychological modes that are stronger or weaker than others. I will draw two semantic tableaux in the appendix in order to show comparative strength. Incidentally from a logical point of view, propositional attitudes are not pairs of a mode and a proposition. For attitudes with the same propositional content and conditions of possession fulfill the same role in psychological life. So propositional attitudes with different modes can be identical. The *belief* that it will always be the case that $2 + 2 = 4$ is a *prevision*.

The general notion of *satisfaction condition* in logic is based on that of *correspondence*. Agents of propositional attitudes and elementary illocutionary acts are directed towards facts of the world represented by their propositional content. Most often they establish a correspondence between their ideas and things in the case of attitudes and between their words and things in the case of illocutions. Their attitudes and illocutions have for that reason *satisfaction conditions*. In order that the attitude or illocution of an agent at a moment is *satisfied*, there must be a correspondence between that agent's ideas or words and represented things in the world in the

history of that moment. Agents live and persist in an indeterminist world. Their future is open. At each moment where they think and act they ignore how the world will continue. However, their attitudes and actions are always directed toward the real historic continuation. In order that a present wish 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 real future. So the *satisfaction* of propositional attitudes and elementary illocutionary acts of an agent at a moment requires the *truth at that very moment* of their propositional content in its proper history. The notion of *satisfaction* is a generalization of the notion of *actual truth* that covers attitudes and elementary illocutions with a not empty direction of fit.¹⁰ Just as a *belief* and an *assertion* are *satisfied* at a moment when they are *then true*, a *wish* and a *desire* are *satisfied* when they are *then realized*; a *directive* when it is *then followed*, a *prevision*, an *expectation*, a *hope* and an *aspiration* are satisfied when they are *then fulfilled*; an *intention* and a *project* when they are *then executed*; a *promise* when it is *then kept* and a *fear* and a *fright* when the thing that is feared does not *then* 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 illocutionary acts, *cognitive attitudes* have the *mind-to-things direction of fit*. In order to be *satisfied* their propositional content must be *true* at the moment under consideration or turn to be *true* in the real historic continuation of that moment. The agent's ideas have to correspond to things as they are then or will turn to be in the world. In the cognitive case, when the agent realizes that there is no correspondence, he immediately changes his ideas. This is why the *truth predicates* characterize so well *satisfaction* and *dissatisfaction* in the case of *cognitive attitudes* and *assertive illocutions*. However, such truth predicates do not apply to *volitive attitudes* and *commissive* and *directive illocutions* whose direction of fit goes from things to ideas or to words. For the world and not the agent is at fault in the case of dissatisfaction of volitive attitudes. In that case, the agent can keep his ideas and remains dissatisfied. Most often, agents having a *volitive attitude* *desire* the existence of *the fact* represented by the propositional content *no matter how that fact turns to be existent in the world*. So most volitive attitudes that agents have at a moment are or will be *satisfied* when their content is or turns then to be true, no matter for which reason. Things are then such as the agent desires them to be, no matter what is the cause of their existence. In the

¹⁰ We need an actuality connective for a right account of satisfaction conditions. A proposition of the form *ActuallyP* is *true* in a circumstance *m/h* when it is true at the moment *m* according to its history *h_m* of that moment.

case of wish, the satisfaction of the agent's desire depends on the course of nature or on the good will of someone else.

The only exceptions to this rule are *volitive attitudes* like *will*, *intentions*, *projects*, *pretensions* and *ambitions* whose proper volitive way requires that things fit the agent's ideas because he or she wants them in that way. The volitive modes of *will* and *intention* have the preparatory condition that the agent has *means* in order to satisfy his or her desire. In the case of wish, on the contrary, the satisfaction of the agent's desire is independent of his own will. Such attitudes and illocutionary acts (orders, commands¹¹, pledges and promises) that express them have *self-referential satisfaction conditions*. Their satisfaction requires more than the existence of the fact represented by their propositional content. It requires that that fact turns to be existent in order to satisfy the agent's attitude or illocution. For example, in order to execute a prior intention, an agent must do more than carry out the intended action in the real future; he or she must carry out that action because of that previous intention. If the agent does not act for that reason, (if he or she has forgotten the intention or does not act freely), that agent does not then execute his or her prior intention. Like illocutionary logic, the logic of attitudes can explain such a self-referential satisfaction by relying on *intentional causation*. The agent's attitude is then a *practical reason* why the represented fact turns to be existent. Similarly, when a speaker obeys a command, that command is then a *practical reason* why he or she carries out the commanded action.

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 to establish a correspondence between their ideas and things in the world. They just take for granted either correspondence or lack of correspondence. In the case of *joy*, *gladness*, *pride* and *pleasure*, the agent believes that the desired fact exists. In the case of *regret*, *sorrow* and *shame*, he or she believes on the contrary that it does not exist. The first attitudes have the special preparatory condition \sum_{Truth} that their propositional content is then true. The second attitudes have the opposite preparatory condition $\sum_{\text{Falsehood}}$ that their content is then false. Volitive attitudes with such special *preparatory condition* have the *empty direction of fit* because their agent could not intend to establish a correspondence. This is why they do not have

¹¹ Unlike requests which express wishes, commands have a peremptory mode of achievement of the directive point. In commanding speakers do not give any option of refusal to the hearer: they invoke a position of authority and they express their will that he or she carries out the commanded action.

satisfaction conditions. Instead of being satisfied or dissatisfied, they are just *appropriate* or *inappropriate*. They are inappropriate when their preparatory condition of actual truth or falsehood is wrong or when their proper psychological mode does not suit the fact represented by their content. No agent should be ashamed of an action that he has not made or that is exemplary and good for all. As Candida de Sousa Melo (2002) pointed out, declaratory acts of thought have the *double direction of fit between mind and things*. In making verbal and mental *declarations*, the speaker changes represented things of the world just by way of thinking or saying that he or she 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, an act of the mind brings about the represented fact. Because *attitudes are states and not mental actions*, they could not have the double direction of fit.¹²

5. Analysis of possession and satisfaction conditions of complex attitudes

There are more *complex individual attitudes* than propositional attitudes. So are *denegations of attitudes* like discontent and discord, *conditional attitudes* like intentions to defend oneself in the case of an attack and *sums (or conjunctions) of attitudes* like doubt. An agent *possesses* the *sum* of two attitudes when he or she possesses both. In performing a conjunction of two illocutions of the form $(F_1(P_1) \ \& \ F_2(P_2))$ speakers express *the sum* of attitudes that enter into the sincerity conditions of these illocutions. An alert is the conjunction of an assertion that some danger is imminent and of a directive suggestion to the hearer to react to that danger. Whoever makes an alert expresses both a belief that there is imminent danger and a desire that the hearer reacts. One possesses the *denegation of an attitude* of the form $\neg M(P)$ like a disbelief or a discontent when one feels that one does not possess the denegated attitude e.g. the belief or contentment. In performing acts of illocutionary denegations of the form $\neg F(P)$ speakers express *psychological denegations of attitudes* of denegated illocutions. Whoever refuses a gift expresses discord. A discord is the psychological denegation of the state of agreement, just as a refusal is the illocutionary denegation of an acceptance. One possesses a *conditional attitude* of the form $(P \Rightarrow M(Q))$ when one feels that one would possess the attitude $M(Q)$ if the antecedent proposition were or turned to be true. In performing conditional illocutions of the form $(P \Rightarrow F(Q))$ speakers express *conditional attitudes* of the form $(P \Rightarrow$

¹² For further development of my logic of propositional attitudes see my paper "Formal Semantics for Propositional Attitudes" in the special issue *Science, Truth and Consistency* of *Manuscrito*, Volume 24, n°1, p 323-364, 2011b.

$M(Q)$) where $M(Q)$ is an attitude that is a sincerity condition of illocution $F(Q)$. In offering help a speaker expresses a conditional intention to help the hearer if he or she accepts to be helped.

The psychological operations of denegation and of conditional on attitudes are not truth functional. The possession of the denegation of an attitude like a disbelief requires more than the non-possession of that attitude. In order to be incredulous about something, one must think about it and feel that one does not believe it. Similarly, the possession of a conditional attitude of the form $(P \Rightarrow M(Q))$ requires more than the falsehood of the antecedent proposition P or the possession of attitude $M(Q)$. In order to have the conditional intention to defend oneself if one were attacked, one must have in mind how one would execute the intention to defend oneself if one were attacked. One can define inductively the conditions of possession of denegations of attitudes and conditional attitudes by quantifying over the set of moments that are psychologically compatible with attitudes of agents. In my view, an agent *possesses the denegation* $\neg M(P)$ of an attitude *at a moment* m when firstly, that agent has then in mind the denegated attitude $M(P)$ and secondly, he or she does not possess that denegated attitude $M(P)$ at any moment that is psychologically compatible with the moment m as regards him or her. Similarly, an agent *possesses a conditional attitude* $(P \Rightarrow M(Q))$ *at a moment* m when firstly, that agent has then in mind both the antecedent proposition P and the attitude $M(Q)$ and secondly, he or she possesses attitude $M(Q)$ at each moment compatible with that moment m as regards him or her where he or she believes the antecedent proposition P . Whoever possesses a conditional attitude of the form $(P \Rightarrow M(Q))$ possesses categorically the attitude $M(Q)$ in case he or she believes in the truth of the antecedent proposition P . So when the antecedent proposition is an obvious tautology like an instance of the law of non contradiction $\sim(P \ \& \ \sim P)$, one cannot possess the conditional attitude $(\sim(P \ \& \ \sim P) \Rightarrow M(Q))$ without possessing categorically the attitude $M(Q)$.

As one would expect, a *conjunction* of two attitudes is satisfied when the two attitudes are satisfied. The *denegation* $\neg M(P)$ of an attitude $M(P)$ of an agent is satisfied when the agent does not possess the denegated attitude $M(P)$. So any possessed *denegation* attitude $\neg M(P)$ is satisfied. A *conditional attitude* $(P \Rightarrow M(Q))$ is satisfied *at a moment* if and only if the attitude $M(Q)$ is or will be satisfied in case the antecedent proposition is or turns to be true in the real historic continuation of that moment.

6. Intentionality and rationality in action

Contemporary philosophers like M. Bratman (1992), A. Goldman (1970) and J.R. Searle (1983, 1992) have overall studied *intentional actions* that agents *attempt* to perform in the world. However, logicians of action like N. Belnap and M. Perloff (1992, 2001) have tended to neglect the intentionality proper to human action. Thanks to my logic of attitudes one can revise the standard logic of action and take into account the intentionality and rationality of agents. I have integrated my logic of attitudes within a general theory of action where intentional actions are primary as in philosophy of action.¹³ In my next book *Speech Acts in Dialogue* I integrate first level illocutionary logic within a logic of the logical structure and dynamics of discourses with a proper conversational goal which are higher level illocutions containing higher level attitudes, and actions.

In my approach *intentional actions* are actions that agents *attempt* to do. Unlike intentions which are attitudes, attempts are actions of a special kind: they are personal, intentional, conscious, free and successful actions. Each agent can only make his or her attempts. When two agents succeed in doing the same action (the same illocution), they do it thanks to different personal attempts (different utterances). There are no involuntary attempts. Each attempt is undetermined. Moreover whoever attempts to make an attempt makes it. Direct attempts by an agent to move parts of one's body are real basic actions in the sense of A. Goldman (1970). When an agent forms the present intention to make a direct movement, an attempt is caused by the very *formation* of that intention. Attempts are means to achieve ends. Whoever makes an attempt makes that attempt in order to achieve an objective. The agent can succeed or fail to reach his or her objective. When the agent succeeds, his or her attempt is then *satisfied*. Otherwise the attempt is unsatisfied. In order to make a satisfied attempt, one must of course make a good attempt in a right circumstance.

Agents can repeat individual actions of the same type at different successive moments in a possible course of the world. They can also perform individual actions of the same type at alternative moments. When a player is in a checkmate position at a moment in a chess game, that player loses the game at all alternative moments where he or she makes a move in that game. Moments of time are logically related by virtue of actions of agents. To each agent *a* and moment *m* there corresponds in each model of my logic of action the set *Actions(a,m)* of coinstantaneous moments *m'* which are *compatible with all the actions* that agent *a* performs at the moment *m*.

¹³ See my papers "Attitudes, tentatives et actions" of 2008b and "Intentionality and Minimal Rationality in the Logic of Action of 2014 for the logic of first level actions.

They are all, as Brian Chellas (1992) says, "under the control of - or responsive to the actions of" of that agent at that moment. In my view, the relation of *compatibility with actions* is reflexive, symmetric and transitive. So when a moment is compatible with all actions of an agent at another moment, that agent performs exactly the same actions at these two moments. Of course the same actions of that agent can have different physical effects (that are not actions) in the world at different moments which are compatible with what he or she does at that moment. What an agent does at a moment depends on how the world has been up to that moment. This is why the relation of compatibility with actions satisfies the so called *historical relevance condition*. Only alternative moments having the same past as m can belong to $Actions(a,m)$. In order that the proposition that *agent a sees to it that P* be true in a circumstance m/h according to a model the truth of proposition P must be established at all alternative moments $m' \in Actions(a,m)$ compatible with the actions of agent a at m . Moreover, the proposition P must be historically contingent. No agent could bring about a fact whose existence is historically impossible or necessary. Historically inevitable facts exist at a moment no matter what we do.

My logic of action accounts for the minimal rationality of agents who are neither perfectly rational nor entirely irrational. We can intend and attempt to do impossible actions that we believe possible. In that case we necessarily fail. However there are subjectively impossible actions that we can neither intend nor attempt to do, just as there are subjectively impossible facts that we cannot desire. My logic of action represents in the same formal way satisfaction conditions of desires, intentions and attempts which are logically related in each model. To each agent a and moment m there corresponds in every model the nonempty set $Intention(a,m)$ that contains all possible denotation assignments to senses which are compatible with the execution of all intentions of that agent at that moment. Because all intentions are desires, $Intention(a,m) \subseteq Desire(a,m)$. Now attempts have both success and satisfaction conditions. So there is in each model a first set $id_1Attempt(a,m)$ that contains all possible denotation assignments compatible with the realisation of attempts of agent a at the moment m . And there is a second set $id_2Attempt(a,m)$ that contains all denotation assignments compatible with the satisfaction of his or her attempts at that moment. Only realized attempts can achieve their objectives and be satisfied. Consequently, $id_2Attempt(a,m) \subseteq id_1Attempt(a,m)$. Attempts like intentions and desires have the *world-to-mind direction of fit*. So $id_1Attempt(a,m) \subseteq Intention(a,m) \subseteq Desire(a,m)$ in each model. Moreover, because attempts are actions, each agent makes the same attempts at all moments

compatible with all his or her actions. Thus $id_1Attempt(a,m) = id_1Attempt(a,m')$ when $m' \in Action_m^a$. Because no agent can make the attempt of another agent, in every model $id_1Attempt(a,m) \neq id_1Attempt(a,m)$ when $a \neq b$. As one would expect the five illocutionary points are primary logical objectives that speakers attempt to achieve on propositions at moments of meaningful utterance in models of illocutionary logic.

In my approach, all actions of an agent are *generated* by the basic attempt of that agent. Consequently agents do not act when they do not make any attempt. Moreover unintentional actions are always *generated* by intentional actions of their agent and they could in principle have been attempted. So our mistakes and failures are not really actions that we make but rather events that happen to us. For our mistakes and failures could not be intentional. Moreover our actions are evitable. We cannot make utterances without agitating particles. Such inevitable agitations are not real actions but pure events in the world. The *basic individual action* of an agent at a moment is his or her primary direct attempt at that moment.

As Searle (2005) pointed out, the logic of desire and intention is very different from that of belief. Agents can both intend to do something and believe that their intended action will have a certain effect without *eo ipso* desiring and intending to cause that effect. One can intend to reject an offer and believe that one will irritate the hearer without desiring and intending to irritate him or her. So there are sometimes conflicts between the intentions and beliefs of an agent at a moment. My logic of action can represent such conflicts between volition and cognition. In that case, certain possible denotation assignments to senses compatible with the execution of the agent's intentions in a model are not compatible with the truth of his or her beliefs at the same moment. For the unwanted effect of the intended action does not occur according to the first assignments. Agents know that some of their beliefs could be false. These conflicts can even happen when an agent believes that it is settled or even inevitable that his or her action will have a certain unwanted consequence. M. Bratman (1987) and Searle (2005) have given a lot of convincing examples. A prior intention to do something and a belief that it is necessary that if one does that thing then one will also do something bad do not commit the agent to having the prior intention to do that bad thing. We know that we can wrongly believe that certain facts are inevitable. We would then be happier if such facts would not occur. As Searle (2005) pointed out, E. Kant's principle: "Whoever intends to achieve an end thereby will the necessary means or

effects that he or she knows to be part of the achievement of that end” does not apply to *prior intentions*.

However because we, human agents, are rational we have to minimally coordinate our cognitive and volitive states in trying to act in the world. So a restricted form of Kant’s principle “Any agent who wills the end is committed to willing the necessary means” applies to attempts which are intentions in action. In case the agent of an attempt knows that in order to succeed to reach a present objective, he or she has to do something else, that agent will then try to do that other thing. In other words, an attempt to reach a present objective and the knowledge that one could not reach it without intentionally doing now another action *commit the agent to* an attempt to do that other action. Such a restricted Kantian principle is valid in my logic of action. Let me give an example. Every agent knows that in order to supplicate a person he or she must make a very humble request to that person. So whoever tries to make a supplication always tries to make a very humble request. That attempted very humble request *constitutes* even his or her attempted supplication.

In his paper on « Desire, Deliberation and Action », Searle expressed skepticism about the logic of practical reason. Because of their things-to-mind direction of fit desires and other volitive modes have certain logical properties like indetachability and unavoidable inconsistency which complicate their formal explication. Agents can moreover revoke their intentions or not attempt to execute them. Whenever they attempt to execute them they can also fail. Searle is right on these issues. However my logic explicates formally all these important properties and it shows that attitudes and intentional actions with all directions of fit have logically related conditions of felicity. So I challenge Searle’s skepticism about the logic of practical reason. Let me add that according to the very principles of Searle’s philosophy of mind and action, any agent of an attitude and of an intentional action must have in mind the satisfaction conditions of that attitude and the success conditions of that action. So Searle, whether he likes it or not, has to admit the existence of logical relations of psychological and illocutionary commitments which are internalized by human agents. Just as one cannot have certain attitudes without having others one cannot make certain actions without making others and having constitutive attitudes.

As I have shown, there is a proper logic (a recursive theory of possession and satisfaction) for volitive as well as for cognitive attitudes, just as there is a proper logic (a recursive theory of success and satisfaction) for intentional actions and all illocutions including the commissive and

directive illocutions¹⁴ which have the things-to-mind direction of fit and the declaratory illocutions which have the double direction of fit. All kinds of attitudes and actions are logically related by virtue of their logical form. My logic explicates formally specific properties of attitudes and illocutions with the things-to-mind direction of fit. It also explicates why agents are imperfectly rational but always remain minimally rational. It moreover solves all forms of psychological and illocutionary paradoxes related to the paradoxes of the sophist, the sceptic and the liar.

Here are a few important valid laws of commitment for cognitive and volitive attitudes: Whoever believes P and believes Q believes their conjunction ($P \ \& \ Q$) and conversely. Whoever desires P and desires Q desires their conjunction ($P \ \& \ Q$) but not conversely. Any proposition P is indeed identical with the conjunction ($P \ \& \ (P \vee \sim P)$) of that proposition with the obvious tautology ($P \vee \sim P$) which is an instance of the law of excluded middle. But no agent who desires P could desire ($P \vee \sim P$). When a proposition P strongly implies another Q whoever believes P also believes Q . But this law of strong commitment for beliefs is not valid whenever it is only an obvious tautology that P implies Q or whenever the proposition P only logically implies Q . Indeed in the first case of tautological implication the agent could then not have in mind the second proposition Q and moreover in the second case of logical implication he or she might not know that it is necessary that P implies Q . When P strongly implies Q whoever desires P also desires Q except when the proposition Q is an obvious tautology. Whoever desires to drink red or white wine desires to drink wine but he does not desire to drink or not drink wine. Agents are not perfectly but minimally rational. They can believe and desire necessarily false propositions but they can neither believe nor desire obvious contradictions. Unlike beliefs, desires are detachable in my logic of attitudes. Now intentional actions and illocutions contain by definition attempts and intentions of their agent. Agents who express attitudes are sincere when they possess expressed attitudes. Otherwise they lie. Now a fundamental law of illocutionary logic is that speakers who attempt to perform illocutions could always at least be sincere. So all laws of minimal rationality relative to attitudes impose limits to language use and meaning that restrict possible attempts of illocutionary acts.¹⁵ Speakers cannot assert propositions that they could not

¹⁴ See Volume 2 *Formal Semantics of Success and Satisfaction* of my book *Meaning and Speech Acts*, Cambridge University Press 1991 and my paper "Success, Satisfaction and Truth in the Logic of Speech Acts and Formal Semantics" in S. Davis & B. Gillan (eds.), *Semantics: a Reader*, Oxford University Press, p. 710-734, 2004.

¹⁵ See Candida de Sousa Melo's paper « Intentionality and Meaning in Natural Languages » of 2014.

believe, they cannot commit themselves to doing actions that they could not intend to do and they cannot give directives that they could not desire to be followed.

APPENDIX: SEMANTIC TABLEAUX

My lexical analysis of terms and verbs for attitudes explains comparative strength between psychological modes. Here are two semantic tableaux¹⁶ showing relations of comparative strength between cognitive and volitive modes. The initial node of the first tableau is the term “belief” which names the primitive cognitive mode; the initial node of the second is the term “desire” that names the primitive volitive mode. Any immediate successor of a term names a stronger mode obtained by applying operations whose nature is indicating by symbols in the branch between the two terms. See my next book *Speech Acts in Dialogue* for more explanation.

¹⁶ Such tableaux occur in my paper “Formal Semantics for propositional attitudes” of 2011b on pages 362-363.

Figure 1. Cognitive Modes

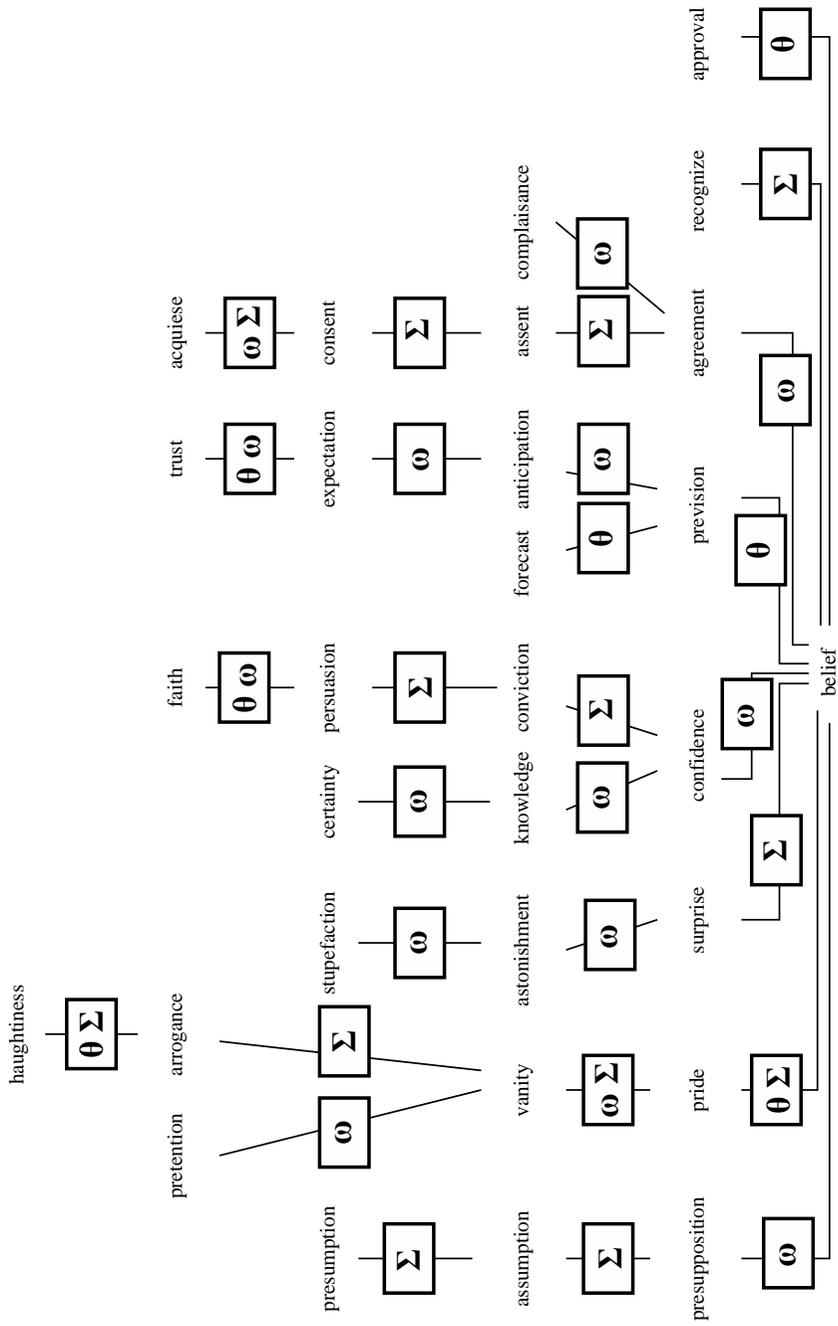
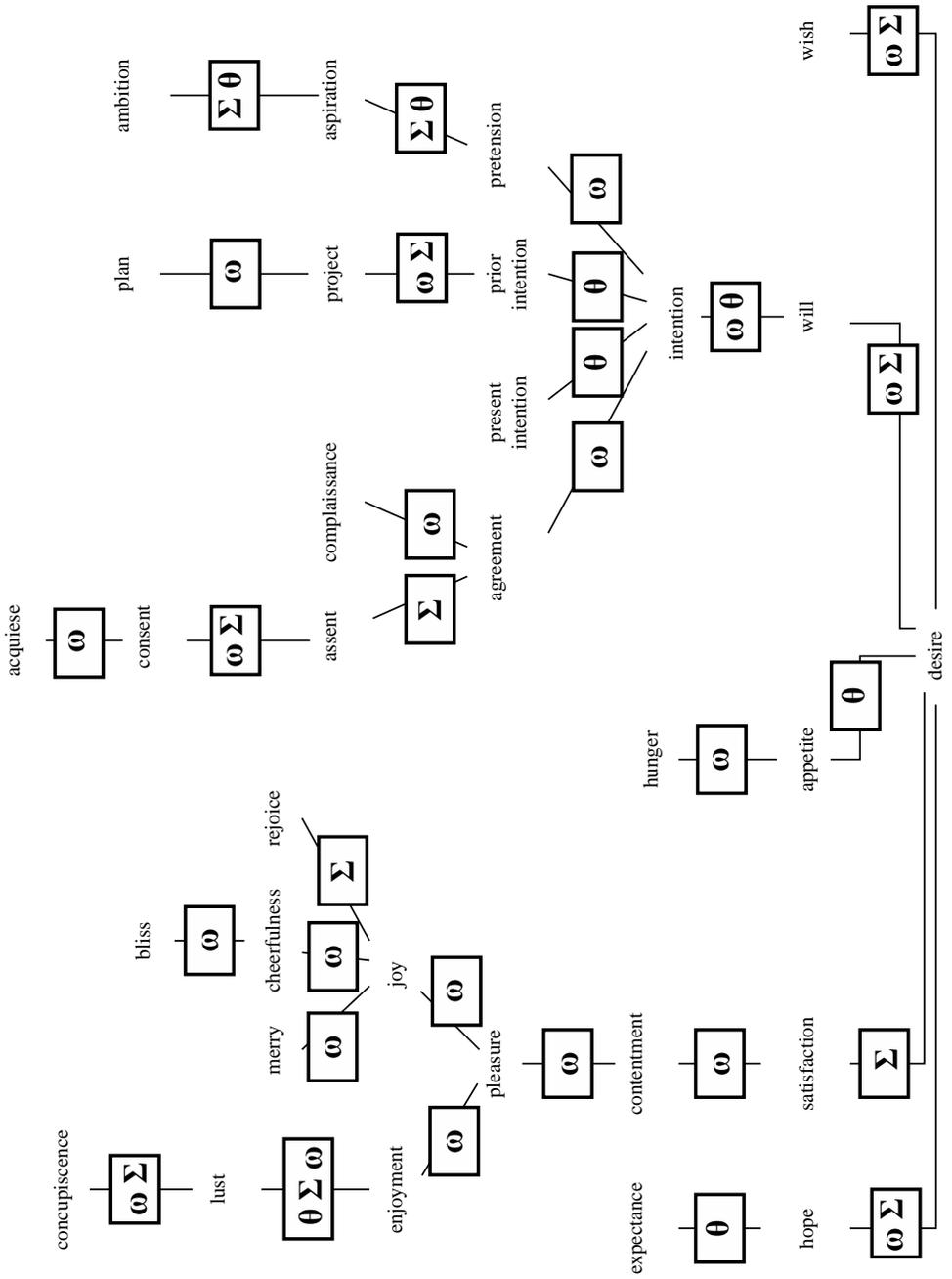


Figure 2. Volitive Modes



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