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Abstract. Once upon a time, the free will was an exclusive province of philosophy. The problem is whether, concerning some action A at time t, an agent can be in control of his action in such a way that he can act otherwise; namely, to do *not-A* at t, though he did action A at t, in the same antecedent conditions which obtain prior to performing action A. (I shall assume here that forming intentions and will are also types of action, notably of psychological nature.) Incompatibilists argue that freedom and determinism could not be reconciled – either there is freedom or there is determinism, but not both. Compatibilists in the free will debate argue that we can be free and, at the same time, fully determined in our deliberations, will and action; according to compatibilists, agents are free if they successfully translate their intentions and will into intended action, regardless of the fact that even our beliefs, intentions and will, and hence our actions, are determined in a unique way by factors which are out of control of any agent. For compatibilists, all that is important is that we are not coerced into some action by other agents, or that there are no overwhelming obstacles for agents to perform the willed and intended action.

Today we can arm ourselves with powerful tools which come from mathematics, physics and neuroscience in order to try to solve the problem of free will with much more precision and effectiveness. One important tool comes from chaos theory. In this text I shall examine a specific kind of compatibilism regarding free will and determinism. I shall critically assess some claims made by Marius Usher in his attempt to establish compatibilism. He uses notions of chaos theory and properties of dynamical systems such as convergence, divergence, attractors and bifurcations to argue for a specific compatibilistic position regarding the free will problem.

I shall try to show that, since chaos theory is deterministic, then, if we can successfully apply it to describe and explain human deliberation, forming intentions, will and performing an action, then we are determined and there is no free will and free action in any sense. Such a claim is incompatibilistic because it assumes that the concepts of "freedom" and "determinism" cannot be reconciled: either we are free or we are determined. I shall speculate a bit about what would be, perhaps, required, concerning chaos theory, for genuine freedom in the libertarian way. This paper will also show the great importance of Usher's way of thinking about the traditional philosophical free will problem, using the toolbox of mathematical and physical chaos theory.

Keywords: free will, compatibilism, incompatibilism, convergence, divergence dynamics, chaos theory, determinism, attractors, Usher.

4.1 Introduction

Mathematical and physical chaos theory has proved to be successful in numerous fields. Apart for being mathematically interesting in itself, a wide range of phenomena across sciences can be explained by using chaos theory or its parts. It has application not only in natural or technical sciences and engineering, but in social sciences as well. Of course, it does not mean that everything in our universe is, or will be, explainable by chaos theory or by chaos theory only. But, since many natural, technical and social structures are very complex, it is natural to expect that they exhibit such a kind of behavior that could be analyzed, described and explained successfully by chaos theory. On the other hand, perhaps chaos theory could itself profit if, for example, phenomena in need of explanation are such that they would require new mathematical tools. This could motivate researchers in the field to discover new mathematical structures in chaos theory that are not yet known.

Even if chaos theory turns out to be inapplicable to a range of phenomena for which it was thought applicable, we can still consider why it is not applicable and implications thereof, in order to see more clearly what an adequate explanation would be for such a range of phenomena.

Let us now jump from mathematics to philosophy. One of the most intriguing problems in philosophy is the "free will problem" (see for example [Balaguer (2010), Baumeister, *et al.* (2010), Campbell, *et al.* (2004), Clarke (2003), Kane (2002-2005), Lumer & Nannini (2007, part III), Mele (2006-2009), O'Connor (2000), Pereboom (2001), Spence (2009), Timpe (2008), Waddel-Ekstrom (2000)]). We are interested whether we, as human beings, are free or not. In one way human beings see themselves as free. This means that we have an intuition that we can do this or that, i.e., different things under the same conditions and in the same situation. It seems to us that at time t we can move our hand or keep it still; it seems to us that we can go to the cinema or that we can go to play tennis instead, etc. It seems to us that what we decide and what we do is "up to us"; and even if we think that this is not always the case, we certainly think that most of the time in our lives it is so. It seems that we, as subjects, are in control of our decisions and actions. On the other hand, we are physical beings and our brains are physical entities also, so they should function ultimately according to physical laws. Looking that way, and to simplify a bit, physical laws should in principle suffice for describing and explaining functionings of the brain and motions of the body. Since our behavior consists in moving our bodies in a proper way, our behavior should ultimately be explainable by invoking and applying physical laws. If it is so, it does not imply, however, that we are already in possession of all the knowledge that would be necessary to carry out this task. But if it is so that physical laws and principles suffice to explain human deliberation and action, then it seems there is no genuine freedom of the will and action. Why? Because it is natural to expect that physics, which appropriately describes functioning of the brain and body, is deterministic. So we have a problem. How to resolve a conflict between freedom and determinism?

Compatibilists try to show that freedom and determinism are compatible. *Incompatibilists* argue, on the contrary, that freedom and determinism cannot both be true. Incompatibilists who think that there is freedom are *libertarians*, those who think that determinism is true are *hard determinists*.

In this text, I would like to examine some points we can draw from chaos theory for the free will problem. In fact, I shall narrow my discussion to specific kind of *compatibilism*, i.e., to specific compatibilistic position regarding freedom of the will, freedom of the action and determinism. My main target here will be some claims of the compatibilist probabilistic

view of freedom of the will and action proposed by Usher in [Usher (2006)]. He uses notions of chaos theory and properties of dynamical systems such as convergence, divergence, attractors and bifurcations to argue for a specific compatibilistic position regarding the free will problem. Further special feature of this view is that Usher thinks that his notion of (compatibilist) freedom is independent of whether determinism or indeterminism is true.

In the first part I shall explicate briefly some fundamental general issues about the free will problem in order to get a better insight into the more specific subject of this text. I shall also briefly explicate notions such as "attractor", "convergence", "divergence", "dynamical systems" and "initial conditions". In the second part, I shall set out the main arguments for compatibilistic view as presented by Usher in [Usher (2006)]. In the third part, I shall try to show that they cannot establish compatibilism. In the fourth, I shall lead things towards conclusion.

4.2 Part One

Two main general positions are incompatibilism and compatibilism. Incompatibilists argue that concepts of freedom and determinism exclude each other so they cannot be reconciled in any way. Compatibilists argue, on the contrary, that concepts of freedom and determinism are compatible and hence can be reconciled. They claim that an agent can be fully determined, yet at the same time some of the agent's actions can be free; and some compatibilists even argue that freedom, in some way, *requires* determinism or determination. Let me explicate the standpoints of compatibilism and incompatibilism.

Compatibilists may agree that freedom requires an ability to do otherwise than someone in fact did. Then they say the following. We can use the so-called *conditional analysis* which provides us with a reason for thinking that determinism and freedom can both be true. We can say that an agent is determined to choose to do action A and thus determined to do action A. But, he could have done otherwise had he chosen otherwise. Of course, under the thesis of determinism he could not have chosen otherwise and could not have done otherwise, but he *would* if some initial conditions that determine his action were different then. According to compatibilists, this shows that though an agent is fully determined what to choose and what to do at time t, he nevertheless retains, at t, an *ability* to do otherwise. If, for example, an agent is fully determined to go to the cinema at t_1, and at a later time t_2 the same agent is fully determined to go to play basketball, then it seems evident that at t_1 he had an *ability* to go to play basketball. He would go to play basketball at t_1 if initial conditions were different then they were, so it means for compatibilists that our agent was free though determined at t_1 to go to the cinema.

But, I don't think that this kind of argument is sound. Namely, it requires that something over which an agent has no control should be different in order for him to do otherwise than he in fact did. That something are the initial conditions which obtained before the agent even came into existence. So, in fact if it is fully determined what the agent chooses and does, so he does not really have an ability at t_1 to do otherwise. Under the truth of determinism, the initial conditions and laws of nature *deprive* the agent of the ability to do otherwise at t_1. At t_1 the agent has precisely one ability; namely, to choose and do what has already been determined by the initial conditions and laws of nature. It means that even his intentions, choices and deliberations are not processes that are his products, but are produced by the initial conditions and laws of nature. So it only seems from the "inside" of the agent as if the situation is such that he by himself forms

his intentions, choices and will, though all of these are in fact products of factors over which he has no control. He is more like a passive observer for whom it only seems that he is active in the production of his intentions, will and action.

Note also that there is a strong intuition that a requirement for freedom is that the agent can do otherwise, or have an ability to do otherwise, under *the same* conditions up to time t. It is not a question about freedom whether under a different set of conditions someone would do something different from what he in fact did. For these reasons I think that compatibilism is untenable. Later in the text I shall argue that even if we use chaos theory, as Usher [Usher (2006)] does, in support of compatibilism, this move could not save it.

One of the most powerful arguments for incompatibility of freedom and determinism is so-called "Consequence argument". Lamb in [Lamb (1977), p. 20] nicely summarizes: "Suppose that determinism is true in the sense that for each event or state E that occurs there is a set of previous events and states such that it is a law of nature that if they occur then E occurs. Let S be any person and A any of his actions. Being either an event or a state, A is lawfully determined by a set of events and states antecedent to it. Like A, each of these is in turn determined by a set of previous events and states; likewise for the members of this set, and so on back before S came into existence. There is, then, a set of events and states occurring before S came into existence that lawfully determines the occurrence of A. However, S can refrain from A only if he can prevent the occurrence of at least one element of this set. Obviously, though, this is impossible since at the time they occur S is not yet in existence. Thus, S cannot refrain from A. Thus it is that if determinism is true then the thesis of freedom, in the minimal sense that at least one person performs an action from which he can refrain, is false; the two theses, that is, are incompatible."

If someone is an incompatibilist, he can take a neutral stance - namely, he can decline to explore further which alternative is true of our universe; but most incompatibilists are further either libertarians or hard determinists. Hard deterministes think that determinism is true, so there is no freedom. According to the thesis of determinism, every event in a universe is already determined by the initial state of the universe and the laws of (nature of) that universe which govern the evolution of that universe in a unique way. According to hard deterministes, there is only one possible evolution of the universe. "Determinism claims that there is at every instant exactly one physically possible future" [Waddell-Ekstrom (2000), p. 25]. Since actions and deliberations of human beings are events in the universe, they fall under this scheme, so they too are fully determined by the initial states and laws of nature. It follows, for hard deterministes, that what human beings do is determined by factors completely external to them, and over which they do not have any control over, so freedom does not, in fact, exist.

Libertarians argue not only that we have a strong intuition and feeling of being free – because that can be an illusion – but that our universe is such that, for human beings, in most cases, under exactly the same circumstances we can do action A or action *not-A* (that is, we can refrain from doing action A). For libertarians, this means that we have alternative possibilities at our disposal, and it implies that, at least when (some) human actions and consequences are considered, the future evolution of the universe in this sub-domain is open.

We can use the language of possible worlds and say that if in this actual world agent X does A at time t, then there is a possihle world with the same initial states, laws of nature and overall history up to time t as the actual world, but in which, at t, agent

X does *not-A* (refrains from doing A). Since deliberating, the agent's deciding and the agent's willing are types of action as well (see for example [Pink (1996)]), regarding these, human beings also have alternative possibilities. In other words, libertarians think that we have control over our actions. We have control over doing action A or doing action *not-A*. Nothing else except the agent is such that it determines the occurrence of A or *not-A*; no external factors, concerning the agent, should be determinants of the action actually performed. If an external factor over which the agent does not have control determines what will be done, then the action is determined and there is no possibility for the agent to do otherwise, and hence there is no free will and free action.

In this way libertarianism stresses the condition that the very agent has to he the *genuine source* of his or her own actions in a special and appropriate way; or some would say that the agent has to be the *ultimate source* of the actions undertaken.

Libertarians may differ on where they would put their emphasis in arguing for their position, but in all variants they agree that if causal determinism obtains, then there is no freedom, i.e., that causal determinism undermines free will and free action.

Let us now say something about *chaos theory*. Chaos theory studies dynamical systems which show complicated patterns of behavior and have some interesting properties (see for example [Hilborn (2001), Williams (1997)]). Chaotic dynamical systems have, for example, a property of showing so-called "sensitive dependence". These systems seemingly behave in a non-regular way and they seem often to us as random, but in fact they behave regularly in a complex way and follow rules that can be exactly mathematically formulated. Mathematical formulation means that we can use difference and differential equations, in most cases systems of equations, which are often relatively simple, but which generate behavior which is fairly complex and which does not repeat itself. A system exhibits *sensitive dependence on initial conditions* if just a small difference in initial conditions leads to great differences as systems develop over time. So, later stages of the evolution of the systems are not proportional to the magnitude of the initial difference. There are also occurrences of *bifurcations* in dynamical and chaotic systems. They happen when small smooth difference of a certain parameter causes abrupt change in the behavior of the system. Systems may show a series of bifurcations.

Chaotic systems have *attractors*, also described hy chaos theory. States which are repeatedly approximated form a set of attractors of a system. It may be said that an attractor is a set to which a system tends in its evolution over time. An attractor is a manifold that can be a point, curve, surface or volume.

Chaos theory is deterministic [Hilborn (2001), Lorenz (1993)]). *Determinism* in general means that a system evolves in a unique way. Later states of the system develop uniquely from earlier ones according to exactly specified law(s) or rule(s). We can also say that, from any state of the system we choose and fully specify, together with the laws or rules (mathematically formulated, i.e., sets of equations), other states of the system follow exactly and uniquely.

Convergence dynamics is dynamics of convergence systems (see for example [Pavlov, *et al.* (2004)]). It obtains when solutions for a system tend towards each other. After a certain period of development of a system, it can be said that different initial conditions became "neglected", and solutions, i. e. behaviors, of the system converge. Convergence systems also tend to converge despite some perturbations that can happen in their evolution.

4.3 Part Two

Let me now explicate a very interesting compatibilistic theory and its main points, following [Usher (2006)]. Usher is a compatibilist in the sense that he thinks that if determinism is true, agents are free if they have teleological intentional systems that can be described by convergence/divergence dynamics which appears in chaos theory. Occasionally, I shall call this kind of compatihilism "chaotic compatibilism". Of course, Usher's arguments are by no means chaotically expressed: He put forward very clear, elegant and persuasive arguments for a theory. Nevertheless, I shall try to argue that incompatibilistic deterministic interpretation is preferable over his compatihilism. I shall also speculate a hit about what might be required for genuine freedom in the libertarian way. I start by briefly stating the main points Usher makes.

In the opening, Usher [Usher (2006), pp. 188-189.] says that he "...argue(s) that the control needed for exercising the type of free will required for responsibility and autonomy does not depend on whether determinism or indeterminism is true. Instead, (he) will try to show that the critical element for the presence of responsihility and autonomy is a more complex dynamical property involving a succession of convergence and divergence dynamics. The convergence dynamics (attractors) will be shown to enahle teleological (goal directed) behavior, while the divergence dynamics involve bifurcations in choice and in character formation."

Teleological behavior is a type of behavior directed towards fulfilling a certain end or goal, and it allows an intentional explanation. Such an explanation involves *reasons*, and what is done by an agent is done for these reasons; reasons, under some interpretations, are, or may be, causal factors from which an action proceeds (when hehavior is really teleological).

For Usher [Usher (2006), pp.198-199], any intentional action is teleological, and goal oriented, and a necessary condition for it is a deployment of the control which is dubbed *teleological guidance control* (hereafter TGC for short). To illustrate what is TGC, Usher relies on an example given by Kapitan [Kapitan (1996), p.423]. Consider the following situation. The pilot of an airliner suddenly dies during the flight, so the flight attendant takes his seat to try and land the plane safely. Of course, the flight attendant does not know how to fly a plane. Landing a plane consists in pressing several buttons, pulling the stick and some levers in a certain order. Pressing buttons, pulling the stick and some levers is something which the flight attendant is certainly ahle to do. The flight attendant tries his best, "fiddling madly" over the buttons, the stick and levers in the cockpit, but all of that ends in a hard landing which, unfortunately, is not safe, and kills all the passengers and the rest of the crew die - except the flight attendant.

TGC is now explained drawing on the difference between the pilot and the flight attendant in their attempts to guide the plane. Usher [Usher (2006), p. 199] says that "the way in which the action is issued needs to be *reliably* determined (or ensured) by what the agent has done. While the pilot has *guidance* control over the landing of the plane (she was able to ensure its landing), the flight attendant did not (even if by luck he stumbled over the correct sequence of movements that landed the plane safely)."

"Teleological systems require a property that is stronger than determinism and which involves *counterfactual* type of determination, called an *attractor*. TGC systems (or agents) generate stahle behavioral patterns, in which events (or states of the world) are being determined by a goal state of the system (agent), in a set of possihle worlds similar to (and including) the actual one; the fact that the event is determined to take place in a set of counterfactual situations (similar to the actual one) reflected the requirement

of being *reliably* determined. Critically, neither determinism nor indeterminism is sufficient or necessary for TGC, which is typically manifested at a macro-level of description, involving collective states" [Usher (2006), pp. 201].

What is the role of the *attractor*, Usher [Usher (2006), pp. 202-204], explains by considering a teleguided rocket. "The mechanism that enables the rocket to display teleological behavior by "pursuing" the target (seen here as a goal) is based on a feedback loop and an error correction mechanism. This mechanism stabilizes the rocket's trajectory towards the target despite external perturbations. If a gust of wind makes the rocket deviate from its planned trajectory, the correction mechanism will bring it closer to it. This confers a teleological behavior on the rocket: it has a type of purpose or finality. When the rocket is launched repeatedly at the same target, the actual trajectory and the forces applied may vary, but the convergence upon target prevails. ...the rocket mechanism is characterized by an attractor. This means that it reaches its target not only in the world corresponding to the actual situation, but also in similar possible worlds (say, when its trajectory is subject to wind perturbations or when the target attempts to escape). This makes such control mechanisms highly effective in achieving their goal, and although their action is purely causal, they generate appearance of a teleological, purpose-oriented process."

Let us see also what is said about psychological states and their realization in the brain. Consider the following. "It is important to note that ...bifurcations, at the level of mental (psychological) states are possible even if physical determinism holds. Consider the situation where at time t_1 the mental macrostate of the agent is close to the boundary between the two choice attractors... Even if physical determinism is true (all tokens of the same type of brain state , B_1 at t_1, evolve into tokens of another type of brain state, B_2 at t_2) psychological determinism does not need to hold (different tokens of the same type of psychological macrostate, M_1, at t_1 may evolve into tokens of multiple types of mental states at $t_2 - M_2$, M_3, and so on). This is due to the fact that there are alternative brain microstates at t_1 (for example, p_1, p_2) that are equally sufficient for the mental macrostate M_1 (at t_1) but, at bifurcations, the dynamics are sensitive to the differences between the microstate tokens. For example, these microstates can deterministically evolve from t_1 to t_2 as: $p_1 \rightarrow q_1$, $p_2 \rightarrow q_2$ with q_1 and q_2 sufficient for different psychological macrostates (M_2 and M_3, respectively)." Thus spake Usher [Usher (2006), p. 207].

4.4 Part Three

I shall make my commentaries in reverse order. I will start with comments about the brain's micro-realization of mental macrostates and their evolution.

If one macromental state can be realized by various physical brain microstates, it means that Usher in fact subscribes to a kind of multiple realizability thesis regarding mental states (see for example [Heil (1999), Shapiro (2000)]). The thesis states that one and the same mental or conscious state (or process) can he realized in different physical states (or processes) in the brain. For some authors it is likely that this is so, because, for example, if we take the concept of paying, paying can be realized in several various ways. Someone can take paper banknotes out of the wallet and give them to the saleswoman; another way is that you can pull out your check-book, write some numbers on a check, sign it and give it to the saleswoman; or, you can give your credit card which is then swiped through a machine, or you press some buttons on it, etc. All of these processes are very different, yet there is nothing over and above successive *physical* processes involved in each one of them. All of them constitute paying, but paying could not be reduced to a single physical process – there are several different processes. If this holds for a simple thing like paying, it is very likely, for some authors, that our mental states or processes, which are far more complicated, will be like that.

But it does not have to be like that. There is empirical evidence and good philosophical reasoning in favor of the so-called type-identity thesis regarding mental states or processes. Namely, this thesis states that the same type of mental or conscious state or process is *always* realized in *the same* way. For example, the mental state of seeing a green meadow, according to this thesis, should always be realized in the same physical state or process in the brain. Bickle [Bickle (2003), chapter 2] gives a powerful example from neuroscientific research about memory, which shows that neural processes which underlie memory consolidation, a mental process, always happen in the same way. Memory consolidation can be reduced to cellular and molecular processes of long term potentiation. Of course, it is a long way ahead in neuroscience and philosophy to reliably conclude that the most or all mental states and processes can he reduced in such a manner, and here I shall not go into this any further. But, if the type-identity thesis is true, then it one and the same mental state or process cannot be realized in different physical states or processes. This would mean that if physical determinism is true, then psychological determinism is true. Since chaos theory is a deterministic theory, it would not matter at all how an agent's deciding, will and behavior can be represented, even hy successions of many convergences, hifurcations and divergences, because all of these, once a dynamical system is set in motion, are determined. It is determined uniquely by the initial states and laws of nature; moreover, the very intentions which compose the agent's teleological system would be then determined hy the states (together with the laws of nature) which precede them. So, there is no room for the agent's freedom. The agent does not have any control or power over states which ohtain before forming his intentions and does not have any control or any power over the laws of nature. Since these factors would be sufficient for describing and explaining the agent's will, his "teleological" system and his behavior, there would be no need to introduce the concept of "freedom" here, so plain determinism as an interpretation of that situation would he sufficient; if this were the case, there would be no place for making determinism compatihle with "freedom", hecause this concept would not have be applicable here in the first place.

But what is in fact the psychological macro mental state M_n? Usher nowhere specifies what that would be. The best and the simplest interpretation is that a psychological macrostate is in fact the content of the state which can he consciously present to the suhject (or what the subject introspects). If we work in a reductionist framework regarding mental states and processes, as Usher does, then they are realized by physical states or processes in the brain.

So, even if it would be true that mental states or processes could be multiply realized, i.e., that one and the same mental macrostate M_1 could he realized by different microstates of the brain p_1, p_2, etc. that would not mean that we have free will and freedom of action in some sense, and that freedom is reconcilable with determinism. Under the hypothesis of determinism, as Usher says, hrain state p_1 deterministically evolves into hrain state q_1, and brain state p_2 deterministically evolves into brain state q_2. Q_1 and q_2 are different physical microstates of the hrain and they can he sufficient for different mental macrostates M_3, and M_4 [Usher (2006), p. 207]. Infinitesimally small physical difference between p_1 and p_2, due to sensitive dependence of chaotic dynamical systems, is enough for bifurcation to occur, is sufficient for a difference to occur in the development. But then it seems that macromental state M_1 does not play any role in the development of the system,

since only physical properties of the brain microstate are the properties which cause (deterministically) further state q_n! So, if the psychological macromental state M_n is in fact the content of the state, that content does not play any causal role to develop a system into a further macromental state M_n. As psychological subjects, and hence as agents, we introspect and have access to the *contents* of our mental states. We do *not* introspect and we do *not* have access from the first-person perspective to physical and chemical properties and structures of the brain states and processes which are realizers of the macromental states. That would mean that we are driven by physical processes and physical properties of the brain, not by what we consciously think and (only seemingly) deliberate. If this were so, then we would be, in fact, only passive conscious observers of what happens to us. But that could not be freedom even if the contents of our intentions are aimed at some goal and thus form a "teleological system". It only seems to us that we achieve a goal because of the content of our intentions, but we achieve the goal only because physical properties of the brain, independently of the content of our will or intentions, guide us there deterministically – if physical determinism is true. In this case, the aim is achieved due to the physical properties of the physical states of the brain over which we have no influence or control. Tiny physical difference in the brain states is enough for a bifurcation to occur, so bifurcation is a product of a factor over which there is no control of the supposed agent. Moreover, these differences are tbe products of the initial states and laws of nature, over which we also have no influence. We can also say, *contra* Usher, that reasons are not causal factors then, because reasons are embodied as a system of beliefs, desires and intentions – they are psychological macrostates, i.e., the contents of these states, but it is said that only physical brain microstates and their physical properties are those which are important for bifurcations to occur and cause divergence. It means also that different later states q_1 and q_2 in fact deterministically follow from two different microstates p_1 and p_2 *due* to tbeir *physical* properties, and a small difference in these properties is sufficient for bifurcation to occur. This is enough for an explanation. It does not matter that physically different microstates $p_1$and p_2 are sufficient for one macrostate. Macrostate is then a state at a different level than microstates. But only properties at the level of physical microstates determine what will happen. Higher level – macrostate – does not contribute to the occurrence of hifurcation.

So, if the development of what an agent does depends on the factors which are beyond the agent's control, as infinitesimally small physical difference between the brain's microstates is, we can hardly say that the agent is free.

Now, I would like to comment on the example of (tele-) guided rockets. Such a rocket has only *derived* intentionality and teleology. It is a *derived* teleological system. A rocket, of course, does not posses real intentions and real intentional states which aim at some target that would mean something to a rocket itself (as contents of mental states mean something to their possessors in case of human beings). A rocket does what its programmer tells it to do. Namely, it has what is implanted in it, and it is in a form of a complicated program (which, of course, *can deal* with many different obstacles the rocket can face on its trajectory), stored data and what its sensors read off during the flight – but all of these are what the programmer wrote and implanted into it. So, a rocket (mostly) reflects and exhibits intentions of the programmer (or what generals or commanding officers want and tell the programmers to achieve).

Consequently, what the rocket does is fully imposed and implanted in advance and from the outside, externally. This can be explained by factors which are totally external to the rocket. It behaves according to the laws of nature which operate in situations in

which the rocket finds itself and according to the implemented program. But the program too was made completely externally to the rocket. These factors, though they are very complex causal factors, are causal factors which guide the rocket. Convergent dynamical system which describes various paths that rocket can take, in various environmental circumstances, reflects these causal factors - but still the rocket is determined by factors entirely external to itself.

So if that should be an analogy with human beings as agents, it does not provide us with a means of seeing how agents can have freedom despite full determination, despite manifesting convergence behavior.

Tbe rocket cannot by itself change to aim at a different target. It could do that only if it is externally programmed to do so. But it seems that human beings can do this – when they are on route to some target, they can switch to pursue some other target. I do not deny that in most cases people also show convergence behavior, nevertheless tbey can change targets, or tbey can by themselves give up pursuing some target. So it seems that we have more room than in an example with rockets. And this is what is required for having metaphysical freedom – to be in a position to do action A or action *non-A* in tbe same set of circumstances. In tbe same set of circumstances, the rocket will always do the same. It does not matter if in repeated launches, when parameters are slightly changed, behavior of the rocket changes, perhaps greatly and still it will converge on the target. The question of freedom is whether *under the same circumstances* behavior can be different! The question of freedom is not whether *under different conditions* behavior can be the same!

Namely, if we can trace an origin of an agent's teleological guidance system to be externally imposed on him, no matter how teleological it is and what convergences in behavior the agent displays, he or she is not free – because he or she cannot do otherwise and is not the ultimate source of his or her behavior.

Let us say that a certain action of a human agent is such that it can be described as a dynamical system by a set of differential equations, which would yield some attractor, say, the Lorenz attractor, where Rayleigh numher is 28; so this system will exhibit chaotic behavior. This means that this behavior will exhibit abrupt changes which will be represented in the plotted diagram as changes that suddenly go from tbe left side to the right side of the diagram, up or down and at certain angles, etc.; this kind of system evolves over time in a non-repeating pattern. This attractor is a fractal structure that represents evolution of the Lorenz oscillator. But Lorenz oscillator is fully deterministic in 3 dimensions. If this is all, then the action is fully determined and is not compatible with any sense of the word "freedom".

But let me now speculate a bit what would be required for libertarian freedom and what role chaos theory could have in this topic.

The question for a human agent and his actions is then wbether the agent is the ultimate source of such an action. If the answer is affirmative, as libertarianism would require, then the agent really is the starting point of his action in a such way that this behavior is not fully and uniquely determined by earlier states and processes and external factors. Neither his intentions would be fully and uniquely determined by earlier and completely external factors over which the agent has no control.

I do not think that freedom of the will and action would consist only in slips between convergence and divergence dynamics. They are deterministic. I think that if chaos theory would have a role in describing human deliberation and action, then – speaking in terms of trajectories, orbits and attractors – an agent should be in position to change from one orbit

to another. This is impossible for purely physical systems. How could that be possible for human beings? Perhaps we can invoke Ginet's proposals regarding libertarianism [Ginet (2007), p. 245]. He believes that there could be actions which are both uncaused and up to the agent as to whether they would be performed at the time of performing them. In [Ginet (2007), p.247], Ginet says that all an agent have to do to satisfy this claim is that an agent *simply performs* a decision and, further, *simply performs* an action.

So, *simply performing a decision or an action* could he basic facts which need not have a determinate causal explanation.

That would also mean two things, looking from the point of difference and differential equations that describe a dynamical system. It would mean that an agent by himself, simply by performing an adequate action, sets all the important parameters. In our example, the most important parameters would be, I presume, Rayleigh number and Prandtl number. Of course, an agent does not consciously set Rayleigh number and Prandtl number; he does not say to himself: let's have Rayleigh number 28! He *simply performs* a decision or some other action, according to Ginet. That decision or that action would be such that they have the right parameters which were not set before performing a decision or action, nor does anything else determine or cause that decision or an action.

The other thing could be the following. If an agent can *simply* start to perform an action, then the case may be that the action should be described hy a different set of difference or differential equations than an action which has been performed just before.

But if that could be so, if an agent could "set parameters" of his will, intentions and actions (and so, of his behavior), then in principle it would be possible for the agent to change these parameters, as the ultimate source, at some later stage of evolution of his action. From the point of view of graphs representing a dynamical system, it would mean that an agent can "jump" from one trajectory to another. Or, an agent could switch to completely different dynamics which is described by a different set of differential equations. Both is impossihle for purely physical dynamical systems as atmosphere, oscillators, etc. When such systems start moving, they evolve deterministically whatever abrupt changes they may exhibit, however complex or chaotic they may be: they are fully deterministic. A purely physical dynamical system can behave very differently in *another* start if one or more of the parameters are, even slightly, changed hut could not start suddenly to behave differently under the completely same parameters and could not start *uncausedly* to behave differently. Possibility of "jumping" from one to another trajectory for one and the same agent under the same initial situation, perhaps *would be* a sign of genuine freedom, because even when the agent sets and hegins his action, it would mean that he can retain control over it to switch to another kind of action.

On the other hand, if we can trace that the forming of the agent's teleological system is caused by earlier states and events, and if we can go in this analysis far enough into the past and reach states that obtained hefore the agent came into the world, then his intentions, will and behavior are just a part of a larger "orbit", or else is just a part of a larger encompassing attractor, in terms of a graphic representation of a chaotic dynamical system. If this is the case, then an agent does not have any influence, so his hehavior is *fully determined* despite abrupt changes and bifurcations shown, and, on the other hand, despite that it converges at some aim, or whatever alterations between convergence dynamics and divergence dynamics there may be. This only seems to be done freely. *Seeming freedom* in not a real freedom.

If that is the case, then, there is no freedom and no free will, and hence there is no ground for compatibilism between freedom and determinism: this is a clear case of

determinism. Moreover, if that is so, then factors external to the agent and factors over which the agent has no control suffice to explain evolution of dynamical systems applied to describe behavior of human beings. Furthermore, if that is so, there would be no possibility for the agent to do otherwise, so there would be no room for any kind of freedom. If there is no freedom, you can not make determinism compatible with something that does not exist.

So, in the example of the pilot and the flight attendant, we can say the following. If determinism is true, then, simply, pilot is determined differently than the flight attendant. If their deliberations, will and actions could be described by convergence/divergence dynamics and chaos theory, it means that either different sets of differential equations describe the pilot and the flight attendant, or different initial conditions were operative for each one of them. Even if this kind of determinism, which is described by chaos theory, is true, then the flight attendant simply did not have an ability to press the buttons, stick and levers in the right order (hecause he was determined differently).

4.5 Part Four

According to what is said ahove, I think that we can say the following: At the beginning of his article, Usher says that what he proposes as a theory of free will does not depend on whether determinism or indeterminism is true. This would mean that we can have free will and freedom of action even if determinism is true.

I hope to have shown that, if determinism is true, even the teleological system of an agent is produced by states and events that are fully external to the agent, and their formation can be, in principle, traced to the time before the agent came into being. These external factors are, of course, the initial states of the universe and laws of nature. Convergence/divergence dynamics is deterministic, as well as developments of trajectories of dynamical systems (represented by orhits in diagrams). So, however you describe a certain chaotic dynamical system, however chaotic it is, it is a fully determined system. It follows that even a production of a teleological system is determined. The teleological system (psychological system of beliefs, desires, intentions, and deciding) only continues convergence/divergence dynamics itself. But it is a product of some dynamics which was active before that system or the agent even existed.

So let me repeat the powerful "consequence" argument against compatihility of free will and determinism given in [Van Inwagen (1983), p.16]: "If determinism is true, then our acts are the consequences of the laws of nature and the events in the remote past. But it is not up to us what went on before we were born, and neither is it up to us what the laws of nature are. Therefore, the consequences of these things (including our present acts) are not up to us."

I think that we can say from the considerations above that this is the case here, so "chaotic compatibilism" is not a viable option. It amounts to plain determinism.

4.6 Conclusion

It seems to me, then, that *straightforward* application of chaos theory to account for human deliberation and action ends in determinism. Alternating convergence and divergence dynamics could not provide for any sense of freedom, and hence "chaotic compatibilism"

cannot be a solution for the free will problem. We would simply have determinism without freedom.

A kind of *partial* application of chaos theory, if an agent could *simply perform* an action which is uncaused, and thus to change its dynamics either by changing parameters or that another set of differential equations would be needed to describe this new action, that may, perhaps, signal libertarian freedom.

Balaguer argues that the free will problem should boil down to an empirical scientific problem [Balaguer (2009-2010)]. If that is so, it seems that *the way* in which chaos theory could be applied (if at all) to describe human deliberation and action could have great importance for the traditional philosophical problem of free will. But again, compatibilism is not the option – we are either fully determined or we have freedom of the will and action.

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