

Commentary

Micromotives and Macrobehavior

Thomas Schelling
W.W Norton and Company, 1978

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My goal is not so much to provide a summary of Thomas C. Schelling's *Micromotives and Macrobehavior*, but rather to try to clarify some of the issues that Schelling deals with from a philosophical point of view. Two questions immediately arise. First, What sort of perspective do we have in mind when we speak of providing a philosophical analysis of *Micromotives and Macrobehavior*? Second, is this perspective adequate for offering an account, as far as possible complete, of a book with such content?

Indeed, *Micromotives and Macrobehavior* seems nothing but an informal introduction to formal methods in social sciences. Such formal methods are the tools used to analyse the main subject matter of the book: the interrelationship between the individuals and the social aggregate they comprise. In particular, Schelling's project is the theoretical explanation of how individual purposive behaviour (micromotives) can determine group equilibrium or a disequilibrium process (macrobehavior). In other words, the book «explores the relation between the behaviour characteristics of the *individuals* who comprise some social aggregate, and the characteristics of the *aggregate*».¹

Both these concepts, individuals and aggregate, deserve some words of clarification. On the one hand, Schelling's individuals are goal-directed, namely, they behave in a way that we might call purposive: «they have preferences, pursuing goals, minimizing effort or embarrassment or maximizing view or comfort».² Rarely do people care about the outcome of the aggregate; typically their own decisions and their own behaviour are motivated by their own interest. In this perspective, the entire book can be read as a sort of generalized Prisoner's Dilemma: behind any action there is a utility-based reason to act. This is a purely game-theoretical assumption. Schelling argues that, even if it is sometimes misleading, it is indispensable for the analysis of the relationship between individual goals and aggregate behaviour.

Once the game's scenario is fixed, some interesting consequences follow. One is that privately optimized decisions might lead in aggregate to outcomes that are undesirable for everyone. As Schelling says at the beginning, «there are several reasons we might interest ourselves in what it is that those people [are] doing, or [think] they [are] doing, or [are] trying to do [...]. One is that we do not like the result».³

On the other hand, the aggregate, which results from goal-directed individual behaviour, is not merely an extrapolation from the individual. Of course, there are some easy cases in which

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¹ Thomas C. Schelling, *Micromotives and Macrobehavior*, W. W. Norton and Company, 1978. p.13. Italics in original.

² Thomas C. Schelling, *cit.*, p. 17.

³ Thomas C. Schelling, *cit.*, p. 12.



this happens, e.g. the case in which I choose an action no matter what the others decide to do. For instance, if we know that every driver turns his lights on at sunset, it is easy to guess what the features of the aggregate are: all the car lights in a local area will turn on at about the same time. But the most interesting situations are those in which people's behaviour depends on the behaviour of other people, that is, when their behaviour is not (or not only) constrained by some kind of external resource but also by the behaviour of other individuals. For instance, in the example above, it is no longer trivial to derive the features of the aggregate if we know that every driver turns his lights on only when the oncoming cars have already done so. The aggregate is now a sort of system of interactions in which individuals respond to an environment, which include other people's responses to their own environment.

Another important feature of the micromotives underlying individual actions is the fact that they are not market motivations. Schelling writes that quite a number of activities operate almost entirely outside the purview of the market, so they cannot even be expected to receive market-like benefits or treatment. Some examples are the languages we choose to speak, the person we decide to marry, whom we live near, which games we like to play, etc.

Schelling claims that the behaviour he is concerned with is not economical *strictu sensu*. His interest is in aggregate behaviour when market mechanisms are not operating, namely, in all those situations in which those who are involved are not voluntary participants: traffic jams, sex-distribution in campus dining hall, sending of Christmas cards, membership in bridge or tennis clubs, racial composition of neighbourhoods, and so on.

A very illuminating example of this kind of behaviour is the one Schelling begins his book with: the commonly observed seating pattern in a public lecture hall, where the audience is packed into the back rows leaving four, five or six rows in front of the lecture hall completely empty. Any attempt to explain such a situation using the techniques of economics will fail; not because these techniques are inadequate, but because the explanation is, in a sense, incomplete.

The reason for this failure is that the individuals are not involved in that situation in virtue of the fact that they want to be involved, but it simply so happens that they are. Schelling's aim is then to enlarge the scope of social science beyond the analysis of economic behaviour and to show us that «economics [is] a large and important special case, rather than a model for all social phenomena».⁴

Let me sketch in short the sequence of the book's topics.

CHAPTER ONE is a sort of synopsis of the entire monograph and it is definitely the most interesting part for the purpose of giving, as we said above, a philosophical account of Schelling's work. The Chapter presents what is to be considered the main question of the book: if the individuals act purposively but the behaviour of others either constrains what the individuals can do or is part of the individuals' preferences, what kind of aggregate behaviour will result?

CHAPTER TWO develops the models of nine situations where the behaviour of the aggregate is a logical necessity, unaffected by the specific goals or behaviour of the individuals. Indeed, they do not even merit the appellative of "models"; they are merely "definitional statements": their being true does not depend on the way individuals act or on what their goals are; the truth of such statements derives directly from the definition of the terms that occur within such statements.

⁴Thomas C. Schelling, *cit.*, p. 27.



For instance, telephoning is a typical activity through which one can influence the behaviour of other people. Now, surely it is true that none of us ever makes just as many calls as he receives, but it is also true that if the system of calling people on the phone presupposes a sender and a receiver, then the number of incoming calls is equal to the number of outgoing ones. Therefore, in the aggregate, it is true that the total number of received calls equals the total number of made calls, although it could happen (and in a large number of cases it really does happen) that we individually receive more calls than we make, or vice versa.

This example illustrates an important feature of a large class of statements, which the economists are very interested in: «propositions that are true in the aggregate but not in detail, and are true independently of how people behave».⁵ The reason of the emphasis on such statements is that economics is mainly concerned with exchanges of equivalent values.

Although we don't need any mathematical tool to recognise that the example of telephoning is true, Schelling points out that even in this case one finds surprises in the relationship between the micromotives level and the macrobehavior level. «Considering how banal these propositions sound, it is astonishing how many hours of committee meetings have been spent on proposals to mix men and women in dormitories, or blacks and whites, or freshmen and sophomores, in ways that violated the simple arithmetic principle that no matter how you distribute them, the numbers in all dormitories have to add up to the numbers that there are».⁶ When the social situations become even a little more complex, intuition is not enough to realise that there are very simple and inescapable mathematical laws, like the one mentioned above, which underlie these situations.

CHAPTER THREE introduces some models, or families of models, in which individual goals and behaviours do affect aggregate behaviour. Schelling's analysis primarily focuses on such models.

One family is that of the “critical mass” models. Critical mass models describe a large number of phenomena that become self-sustaining once the level of activities passes some minimum level. «What is common to all [critical mass situations] is the way people's behavior depends on *how many* are behaving a particular way, or how much they are behaving that way».⁷ Schelling gives the academic example of a “dying seminar”, i.e. the seminar whose popularity depends on its popularity; it will live or die, depending upon whether the sufficient condition is satisfied, namely, upon whether those taking part in it consider the number of other participants sufficient, relative to some standards. In other words, if enough other people are doing something, we will make the same choice. No one wants to be the only person at a club. So we go to a club only if we expect enough other people to be there to make it enjoyable.

The most important subclasses of critical mass models are “lemons” and “tipping” models. The former involve buyers and sellers who respond in different ways to the actual proportion of bad used car, i.e. the “lemons”, in the terminology of Akerlof.⁸ If lemons are rare, the market will be stable because of exchanges will mutually advantageous for both buyers and sellers. By contrast, when the number of lemons increases and when it exceeds the critical number, the entire market may disappear. The latter models describe the instabilities in the racial composition of neighbourhoods. «It was observed that the entrance of a few members

⁵ Thomas C. Schelling, *cit.*, p. 49.

⁶ Thomas C. Schelling, *cit.*, p. 59.

⁷ Thomas C. Schelling, *cit.*, p. 94. Italics in original.

⁸ George A. Akerlof, The market of 'lemons': Quality uncertainty and the market mechanism, *Quarterly Journal of Economics*, 84:3, 1970.



of a minority into a neighborhood often causes some among the formerly homogeneous population to leave, or to sign of leaving. Their departure left openings, so more member of the minority could enter; the increase in new residents induced more of the old to leave [...] Some of the departure might be motivated by the minority entrants who have already arrived, some by the belief that the process, would continue [...]».⁹

Two other classes of models that are strictly related to critical mass models refer to, respectively, the “commons”-type of processes and the expectation-determined processes. More specifically, the former class refers to all those situations in which the individuals act purposively and, by doing so, produce an aggregate that is considered undesirable by everyone. The Prisoner's Dilemma is the most famous and clear example of one situation of this kind. J. Hirshleifer¹⁰ has pointed out that the juxtaposition of commons processes with the critical mass phenomena is quite misleading. Indeed Prisoner's Dilemma situations show cyclical structures that are typical of the class of phenomena described by critical mass models. Perhaps this is the reason why Schelling is interested these situations in this Chapter.

On the other hand, expectation-determined processes refer to a class of processes that has the structure of self-fulfilling prophecies: «the general idea is that certain expectations are of a such character that they induce the kind of behavior that will cause the expectation to be fulfilled. [...] For example, if a particular minority is considered incapable of holding responsible positions, they will not be hired for responsible positions; they will have no opportunity for responsible positions; and lacking any such experience, they may indeed be incapable».¹¹

CHAPTER FOUR and CHAPTER FIVE examine the application of the models presented above for two kinds of problems: segregation and integration. In particular, Chapter four deals with segregation and integration with respect to sex and race, which are considered discrete variables. Instead, Chapter five is dedicated to an analysis of segregation and integration when the variables of the system are continuous: age and income.

CHAPTER SIX is quite independent from the other chapters. It was published before then¹² and it could be read independently of the entire book. It considers a possible situation – one that might soon become a reality, in the author's opinion – where parents would have the opportunity of selecting their children's genes.

CHAPTER SEVEN is about Prisoner's Dilemma with coalitions; this Chapter gets rather technical, with the help of a lot of mathematics. As Piergiorgio Odifreddi pointed out in his introductory note to the first Italian edition of *Micromotives and Macrobavior*¹³, the difference between game theory as first pioneered by Nash, Selten and Harsanyi and the very same theory as developed by Schelling and Aumann is that while the first economists limited themselves to the analysis of conflicts in which two or more players have no possibility of making coalitions, Schelling and Aumann studied conflicts with coalitions. This is the reason why Schelling and Aumann received the Nobel Prize in Economics.

The result of a basic Prisoner's Dilemma situation is that privately optimized decisions (micromotives) lead to an aggregate (macrobavior) that is undesirable for everyone. Is this result inescapable? That is, is it always true that, if we play a Prisoner's Dilemma-based game,

⁹ Thomas C. Schelling, *cit.*, p. 101.

¹⁰ J. Hirshleifer, Review of *Micromotives and Macrobavior* by Thomas C. Schelling, *Journal of Economic Literature*, Vol 18, No. 3 (Sept., 1980), pp. 1092-1094.

¹¹ Thomas C. Schelling, *cit.*, p. 115.

¹² Choosing our children's genes, in Mack Lipkin and Peter T. Rowley (eds), *Genetic Responsibility*, Plenum Press, 1974.

¹³ Piergiorgio Odifreddi, *Nota introduttiva a Thomas C. Schelling, Micromotivazioni della vita quotidiana*, Bompiani, 2008.



the cooperative choice is strictly dominated by the non-cooperative one? Schelling's answer is negative. His concern now is to extend the definition of the basic version of the game (i.e. the two-player version), in order to «[catch] the spirit of the Prisoner's Dilemma»¹⁴, when it is played by more than two persons. Schelling makes two hypotheses: first, an individual is always better off, the more other people choose their unpreferred alternative; second, the individual's own preference is constant no matter how many among the others choose one way or the other. These assumptions lead to the definition of Uniform Multi-Persons Prisoner's Dilemma (MPD), namely a situation in which:

1. There are n people, each with the same binary choice and the same pay-offs.
2. Each person has a preferred choice regardless of what the others do and everybody prefers to make the same choice.
3. Whichever choice a person makes, the more people among the others choose their unpreferred alternative, the better off that person is.
4. There is a number k , greater than 1, such that if the number of the individuals choosing their unpreferred alternative is equal or higher than k , then these individuals are better off than if they had all chosen their preferred alternative; but if the number of the individuals choosing their unpreferred alternative is less than k , then this is not true anymore.

In this scenario, the central issue is the parameter k . What is it, exactly? It represents «the minimum size of any coalitions that can gain by abstaining from the preferred choice. It is the smallest disciplined group that, though resentful of the free riders, can be profitable for those who join (though more profitable for those who stay out)».¹⁵

The rest of the Chapter is a sort of diagrammatic variation on this basic theme, namely the possibility of coalitions in Prisoner's Dilemma contexts.

Let me now try to offer the philosophical analysis that I have mentioned at the beginning.

The first consideration is a methodological one. Schelling's approach, as he himself states, is not a market approach. The attention to market-free contexts leads immediately to a series of methodological reflections about the consequences of such an analysis, i.e. the divergence of the 'equilibrium' from the 'optimum'.

An equilibrium is a situation in which several things that have been interacting are eventually in balance, at rest. Typically, and in spite of Prisoner's Dilemma situations, from equilibrium analysis economists derive the conclusion that self-interested micromotives often lead to surprising and socially useful coordination in the aggregate; a system in equilibrium is thus a good one. This is the old and fascinating idea by Adam Smith of an invisible hand.

Schelling does not try to assess whether a Smithian approach to economic phenomena is right or wrong; what he does is simply to argue that, when a Smithian approach is applied to non-market contexts of behaviour, it is surely wrong. One can still believe that something in the idea of an invisible hand is true, but one has also to admit that this is true only in situations different from those that Schelling considers.

Schelling insists on the fact that equilibria are simply convenient theoretical results; «there is nothing particularly attractive about an equilibrium».¹⁶ Not every situation that is in equilibrium is a just or an optimal situation; the body of a hanged man is in equilibrium when it

¹⁴ Thomas C. Schelling, *cit.*, p. 217.

¹⁵ Thomas C. Schelling, *cit.*, p. 218.

¹⁶ Thomas C. Schelling, *cit.*, p. 26.



finally stops swinging, but it is hard to acknowledge that someone could say that the man is all right. From this methodological point of view, *Micromotives and Macrobbehavior* can be considered as an attempt to provide a large number of formal tools for all the situations where reaching the equilibrium is not the general and definitive purpose that we are trying to achieve. However, in order to recognise the asymmetry between equilibria and desired aggregate results, we need to look beyond a purely market-oriented approach. This is the goal of Schelling's book.

The second consideration concerns the Prisoner's Dilemma. Schelling shows how we can extend this class of games in such a way that to join a coalition is no more the kind of choice we do not prefer to make. The failure of cooperative choice in the basic version of Prisoner's Dilemma is due to the fact that individuals act solely to promote their own interests and to the fact that this behaviour is rational. From this perspective, it is irrational to join a coalition and to keep the agreements. The rational micromotive is to free ride. Even if everyone recognised that the aggregate resulting from rational micromotives is not the desirable aggregate, this acknowledgment would not constitute a sufficient reason for choosing the unpreferred alternative of cooperating.

Nevertheless, in observed real-life situations, coalitions do work. How can we explain that? The sceptic may suggest that the intrinsic limit of game theory is the incapability of giving an adequate definition of rationality. If we adopt a purely game theoretic concept of rationality, coalitions are irrational. The sceptic derives the conclusion that what we need is a sort of "conversion" of rationality.¹⁷ It seems that to make the cooperative choice rational we have to change our concept of rationality. In other words, if we want to capture the logic underlying coalitions we have to give up game theory. Otherwise, the expression "Prisoner's Dilemma with coalition" would be a logical contradiction like Quine's «round square cupola on Berkeley College».¹⁸

Is the sceptic right? Schelling might reply that it is certainly true that the Prisoner's Dilemma, in its basic version, does not capture the spirit of all those social contexts in which we have a preference to join a coalition rather than staying out. In other words, there is certainly a sense in which the Prisoner's Dilemma is not adequate to the facts. However, this does not mean that cooperative choices are irrational or that their rationality exceeds the resources of game theory. Joining a coalition can be rational not in the light of a different concept of rationality, but in the light of the very same idea of rationality that we find in the Prisoner's Dilemma. Thus, there is no need to abandon the game-theoretic framework. We just have to refine it.

Schelling's extension of the Prisoner's Dilemma in its MPD version has to count as a proof of the fact that it is possible to understand the rationality of coalitions from the perspective of the game theoretic notion of rationality. In MPD situations people act purposively like in the basic version of the game. What is different is the social context in which they act, and not the individual reasons leading them to perform in the way they do. In Schelling's terminology, what is new in MPD situations is the aggregate macrobehavior and not the individual micromotives. Individual micromotives are still self-interested and rationality is still goal-oriented; but the aggregate macrobehavior strictly depends on how many micromotives comprise the aggregate. From this perspective we can understand better the reason why Schelling considers the case of "commons" (typically categorized as Prisoner's Dilemma situations) in Chapter three while dealing with critical mass models. The parameter k

¹⁷ Jean Hampton, *Hobbes and the Social Contract Tradition*, Cambridge University Press, 1986.

¹⁸ W. v. O. Quine, On What There Is, in *From a Logical Point of View*, Harvard University Press, 1953.



mentioned above and representing the minimum number of people who have to choose their unpreferred alternative in order to make coalition the preferred choice is considered a point of critical mass. It seems that Schelling's is concerned, among other things, with a sort of new formulation of the Prisoner's Dilemma, that is, with the attempt to integrate the Prisoner's Dilemma within the large family of critical mass models.

Schelling's revisited Prisoner's Dilemma suggests a final consideration concerning the general methodology of game theory after the appearance of *Micromotives and Macrobehavior* in the late '70s and its role within the theory itself. There are several reasons why *Micromotives and Macrobehavior* was considered revolutionary. The friendly approach to the subject, which makes it «a book not just for the bookshelf or the doctoral seminar, but for the bedside table», surely counts as one of these reasons.¹⁹ It also seems to me that behind the author's intention to write a fun book to read, a clear position about the methodology of social sciences is active. Indeed, the real novelty of *Micromotives and Macrobehavior* was a completely different attitude towards the general methods that, in Schelling's perspective, game theory had to employ. We can highlight Schelling's change of perspective by asking the question: does individual behaviour cause systems, or do systems cause individual behaviour?²⁰ Or, in other words: what is the relationship between facts and model? Which one of these two elements – facts or model – has the priority? Does game theory derive facts from the formal model, or is the model derived from the facts?

Schelling's position is in favour of the priority of facts over the model. As Richard Zeckhauser claims, Schelling «studies a real-world problem and develops a conceptual model. He then takes that conceptual model back to a dozen real-world problems to see how it applies, and then ricochets back to refine the model. He keeps the process going until he is happy with his model, and satisfied with his insights into the problems that most interest him».²¹ What we want to do now is clarifying the philosophical motivation leading Schelling to this methodological attitude.

If we look at this topic from a philosophical point of view, we see that we face here the classical problem posed by the dichotomy between deductive and inductive methods. The philosophical debate about the distinction between deduction and induction is vast. Given the limited space available, it will not possible to analyse the matter in great depth. Nevertheless some words of clarification are needed.

The concepts of deduction and induction remind us immediately of an old distinction. I am referring to the distinction that identifies deduction with the inference from statements referring to general concepts to statements referring to particular cases; and, conversely, induction with the inference from particular statements to more general statements. The development of probability theory and statistics allowed contemporary philosophy of science to refine this distinction²². According to it, when we talk about deduction and induction we talk about two different types of inference, namely, two ways to derive a conclusion from certain premises. If the conclusion follows from the premises with the force of logical necessity, we

¹⁹ Terry Connolly, Review of *Micromotives and Macrobehavior* by Thomas C. Schelling, *Administrative Science Quarterly*, Vol. 24, No. 3 (Sep., 1979), p. 504.

²⁰ Del Taebeel and Charles Elder, Does the Individual Behavior Cause Systems or do Systems Cause Individual Behavior? *Urban Affairs Quarterly*, Vol. 15 No. 2, Dec. 1979, pp. 229-235.

²¹ Richard Zeckhauser, Thomas Schelling, Ricochet Thinker, in Robert Dodge, *The Strategist: The Life and Times of Thomas Schelling*, Puritan Press, New Hampshire, 2006, pp. vii-xii.

²² See C.G. Hempel, P. Oppenheim, *Studies in the Logic of Explanation*, in «Philosophy of Science», 15, pp. 135-175, 1948; W.C. Salmon, *Four Decades of Scientific Explanation*, Minnesota 1989.



say that such an inference is deductive; otherwise, if the conclusion follows from the premises with a certain degree of probability, the inference is inductive.

It is my opinion that Schelling's revolutionary contribute to game theory can be appreciated only if we consider the latter way of conceiving the distinction between deduction and induction. Making this distinction in terms of logical deduction and deduction with a certain degree of probability, instead of the classical explanation in term of inference from particular to general (induction) and from general to particular (deduction), gives us the opportunity to reflect on the role of statistics within Schelling's work. Statistics is indeed the science that derives conclusions with a certain degree of probability. If we get an insight into Schelling's method of analysis, we see that conclusions about the macrobehavior in the aggregate are statistically – and not logically – derived from individual micromotives. The presence of statistical inferences in *Micromotives and Macrobbehavior* is in fact pervasive. Before *Micromotives and Macrobbehavior*, game theory, like any mathematical theory, was a deductive science. After fixing the models, statements concerning facts were thereby derived in a purely deductive way. The employment of statistical tools in *Micromotives and Macrobbehavior* radically changed the scenario. The model has now to be adjusted to the facts, and not vice versa. The formal apparatus is subject to a continuous process of refinement in order to adequately describe social phenomena that are essentially variable. Thus, Schelling's strategy is to start with individual micromotives and to derive, with a certain degree of probability, the resulting aggregate macrobehavior.

At this point we start to see the consequences of Schelling's inductive approach. Neither the features of formal models are considered immutable nor social phenomena are derived from them in a merely logical way. Formal models are subject to revisions. If the models are statistically determined, it is clear that the answer to the question about priority, if any, between model and facts is that facts have the priority over the model. But Schelling's preference for the inductive method would be a *petitio principii* if we did not focus on the fact that this preference is grounded on and justified by the use of statistics. The ground for adopting an inductive method is thus the employment of statistics.

In this scenario we can better understand the role of Schelling's examples. These are not only a didactic strategy to make the book fun to read, but they are part of a distinctive methodology. Historically, the endorsement of an inductive method is the element which distinguishes *Micromotives and Macrobbehavior* from the other game theoretical approaches to social phenomena. Recent contributes like Malcolm Gladwell's *The Tipping Point*²³ or *Freakonomics*²⁴ by Dubner and Levitt cannot be understood without the intermediate role of Schelling's *Micromotives and Macrobbehavior*.

²³ Malcolm Gladwell, *The Tipping Point: How Little Things Can Make a Big Difference*, Back Bay Books, 2002.

²⁴ Steven Levitt and Stephen J. Dubner, *Freakonomics: A Rogue Economist Explores The Hidden Side of Everything*, William Morrow/Harper Collins, 2005.