

# SCIENCE RULES: HINTS FOR SOCIAL SCIENCE<sup>1</sup>

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What makes science, science? Theory. A theory in the natural sciences expresses the relationship between two or more idealised concepts. Idealisations are pure, perfect representations of real things; they are theoretical, not real, yet chosen by nature, not the scientist. The corresponding real phenomena can be measured, objectively, with instruments. Science theory cannot deal with a single concept and does not depend on definitions. Concepts understandable without definitions are distinct, not nuanced. A science theory is falsifiable.

The concepts of social science are subjective perceptions. Their only measurable, objectively real existence is as nerves firing in brains. Natural science theory interrelates measures of concepts (not frequencies of occurrence). Lacking units of measure, a scientific social theory can only interrelate extremes of presence and absence.

## INTRODUCTION

By ‘science’ I mean the natural sciences such as physics and geology and medicine, not the social sciences, such as psychology, sociology, and political science. No slight is intended by the terminology.

The point of the distinction is that the sciences have transformed human life in recent centuries and the social sciences have not. Despite an intense academic effort over the last century or so, no social laws have been found.<sup>2</sup> With the partial exception of economics, and perhaps of linguistics and jurisprudence, the social sciences have failed to build a body of theory.

It is not that the social sciences don’t know anything; human beings have always known lots of things; for thousands of years they knew how to make bridges and multi-story buildings and weapons but the invention of science 400 years ago dramatically enhanced bridges, buildings and weapons. What is it about science that makes it so effective? In a word: *theory*, a way of understanding which turns away from reality and considers theoretical concepts relating to each other in theoretical ways.

In view of the success of science, thinkers have long advocated the use of scientific methods in social science.<sup>3</sup> Others assert that the science approach

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<sup>2</sup> We have ‘Duverger’s law’ on proportional representation in democracy and Michels’s ‘iron law of oligarchy’ (and probably others) but ‘law’ here is a figure of speech.

<sup>3</sup> Complaints about the failure of social science to be a science have a long history. From philosopher Auguste Comte (*Positive philosophy*. Tr. Harriet Martineau. London: George Bell and Sons, 1896 [1853], p 181) who called for a ‘physics’ of society: ‘there is no chance of order and agreement but in subjecting social phenomena, like all others, to invariable natural laws,’ to sociologist Harry Eckstein (‘Social science as cultural science, rational

does not suit social science,<sup>4</sup> some that it has been tried and has failed.<sup>5</sup> I contend that it has not been tried (so we cannot know whether it suits) and that one reason for this is lack of clarity about what makes science scientific.

What must one do, to do science? Scientists themselves just get on with it, more or less unreflectively. The question of what is special about science was a major philosophy question through the twentieth century. The literature is enormous but not read by non-philosophers.

This paper sets out some characteristics of science and explains what social science must do to conform. They are rules science unwittingly obeys and which the social sciences, except economics, almost never obey. They are:

1. Science proceeds from *theory* because observations need a basis for selection.
2. A scientific hypothesis or theory is *a relationship between two or more concepts*. Science theory cannot deal with a lone concept.
3. Science concepts are *idealised*, i.e., pure, perfect, extreme forms of imperfect reality.
4. Idealisations, like the reality they represent, are *dictated by nature*, not by man.
5. Idealised concepts represent *real things*, which exist independent of the observer.

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choice as metaphysics.’ in *Culture matters: essays in honor of Aaron Wildavsky*, edited by Richard J Ellis and Michael Thompson. Boulder, Colorado: Westview Press, 1997, p 29): ‘Conceivably, we may at some time in the future have a scheme for characterising the elements of culture patterns (and also social structures) analogous to the periodic table... We have nothing of this kind yet, not even a primitive beginning.’

<sup>4</sup> Many thinkers claim it is not possible to apply the scientific approach to social science. Examples are philosopher Charles Taylor (‘Interpretation and the sciences of man.’ *Review of Metaphysics* 25(1): 3-51, 1971, p 48): ‘a valid science of man [is] impossible,’ and Oxford sociology professor, Bent Flyvbjerg (‘Social science that matters.’ *Foresight Europe* October 2005: 38-42, p 38): ‘The natural science approach simply does not work in the social sciences. No predictive theories have been arrived at in social science, despite centuries of trying. This approach is a wasteful dead-end.’

<sup>5</sup> Arguing over how social science is done is a *social science* preoccupation—scientists do not discuss how science is done. Norman Blaikie (*Approaches to social enquiry*. Cambridge, UK, Polity Press, 1993.) reviews the many positions which amount to claims that social science is somehow different (e.g. that there do not exist general social laws and such laws cannot exist). It smacks of special pleading. Every science is different but the sciences are not engaged in a century-long expatiation of their differences and explanations of why they should, or should not, use the same methods.

Not everyone agrees that social science does not respect natural science practice. Liah Greenfeld (‘The trouble with social science.’ *Critical Review* 17(1/2):101-116, 2005, p 101) complains that, ‘Unlike biology and physics, both of which have left the conclusions of 1901 light-years behind, the social sciences have not progressed.’ The cause? ‘The social sciences have modeled themselves on physics.’ I agree they have not progressed but argue they have *failed* to model themselves on physics.

6. Science's idealised concepts *do not depend on definitions*. Understanding is via *context*, i.e., via relationships *between* concepts.
7. Science theory is *not subtle*. Its idealised, undefined concepts are quite distinct from one another.
8. A science theory cannot be proved but it is *falsifiable*.
9. To test or apply a theory science *measures*; it does not count. In social science, the only idealised measures are presence and absence.

## SCIENCE THEORY CHARACTERISTICS

### **1. Science proceeds from *theory* because observations need a basis for selection.**

The 'theory dependence' of observations has been recognised at least since Kant. Without some sort of theory, no observations of reality can be made. A theory, even if it is merely an assumption or a hunch, must exist so an observer can decide what to observe. Science formalises this everyday requirement by observing in response to an *explicit* theory. Observations test the theory or apply it.

Where does the theory come from? A theory comes from a human mind. Whether it got there via induction from observations, or a discussion with a colleague, or reading an article, or a dream while dozing before the fire, is immaterial. A theory is produced by a mind, probably one steeped in the relevant field.

### **2. A scientific hypothesis or theory is a *relationship between two or more concepts*. Science theory cannot deal with a lone concept.**

For example, the force of gravitational attraction between two bodies is given by multiplying their masses together and dividing by the square of their distance apart ( $F = m_1 m_2 / d^2$ ). Given the masses and the distance, the formula predicts the strength of attraction. Before the scientific concept of gravity, objects were thought to possess a 'downward tendency' (flame had an upward tendency). But science theory does not concern the properties of an object. 'Downward tendency' is just another term for weight and predicts nothing.

Since a science theory is a relationship between two or more concepts it cannot deal with a single concept. 'All swans are white' is not a scientific statement.<sup>6</sup> Science does not say what something is. What is copper? For thousands of years the answer has been: a metal. A scientist might answer in terms of relationships of electrons orbiting a nucleus. A science concept is never alone.<sup>7</sup>

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<sup>6</sup> Most philosophy of science discussion sooner or later discusses white swans, black ravens, mortal Socrates or unmarried bachelors. To which science do these apply? No one says. Conceptually, they predate science by millennia. Why use them? Are there no genuine science examples?

<sup>7</sup> Psychologist Kurt Lewin wrote a paper in 1931 saying science was not about intrinsic

The question ‘What is time?’ exercises some thinkers. No answer satisfies. Yet there is no problem. Time, fundamental to physics, is routinely applied without dithering or dispute. This indicates the question does not concern science; it indicates it is not scientific to ask, ‘What is X?’ Science asks: ‘How does X relate to...?’ Science notes a relationship before it names concepts. Phlogiston was named in order to fulfil a relational need. The same for the aether. Scientists did not specify these concepts and then look to see how they might fit. It is the theory—the relationship—and not the concept, which is prior.

The explosion of scientific knowledge in recent centuries is not knowledge of what things are but of what things do. It follows that if scientific understanding of an object is only possible as a component of a relationship, then absent a relationship to a second entity, that object does not, scientifically, exist. Except in economics, almost all social science concepts would qualify.

### **3. Science concepts are *idealised*, i.e., pure, perfect, extreme forms of imperfect reality.**

That formula for gravitational attraction interrelates two bodies. This relationship is ‘idealised,’ meaning it is a sort of purification of reality. There are never just two bodies; there are always others which influence the attraction. The formula is for bodies which are perfectly spherical and of uniform density—which is never the case.

Galileo said any given pendulum has a specific, predictable period (swing-time) irrespective of the size of the swing. His friend and patron, Guidibaldo del Monte, experimented, collected data, and said it was not true. Galileo replied that his pendulum had a pivot with no friction, a string that weighed nothing and a weight of no size. Guidibaldo made fun of this unrealistic theory but it is Galileo’s theory which applies. Had he been realistic, he would be as famous as Guidibaldo.<sup>8</sup>

Newton’s first law states that a body moves in a straight line at a constant velocity forever. There is not one example in the whole universe yet the law is essential to predict the movement of everything from raindrops to galaxies. A scientific theory abstracts from the reality, expressing a pure relationship between pure concepts. Theory is *despite* the data, rather than because of it.

In idealising, science formalises something familiar, for idealisation is how we understand and learn things. Textbooks and instruction manuals contain idealising diagrams. An anatomy text, for example, may contain photographs but probably has more diagrams because a diagram can emphasise the salient

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properties. I know no other discussion. (‘The conflict between Aristotelian and Galilean modes of thought in contemporary psychology.’ *Journal of General Psychology* 5:141-177, 1931)

<sup>8</sup> Michael R Matthews, ‘Constructivism and science education: some epistemological problems.’ *Journal of Science Education and Technology* 2(1):359-370, 1993. Pendulums were of great interest in those days but no one saw what Galileo saw.

features. A street map is an idealisation of reality. The cartoonist exaggerating the politician's ears and double chin makes the face recognisable through idealisation. Idealisation attends to the immediately relevant, simplifying and so facilitating understanding.

Idealisation tidies messy, multi-tasking reality; the idealised form is what the reality would be if reality were clean, perfect, one thing at a time. The ideal is an extreme. It is not average, not usual, not typical. It is archetypal and it never occurs in reality. Idealisation is of the essence of the scientific method. Galileo explicitly recognised this, as did Newton.<sup>9</sup> For a theory to be scientific, the scientist must identify an idealised relationship between idealised concepts.

For social science to be science it must discover idealised social concepts and theorise relationships between them. Currently, social sciences which quantify do not test theories expressing extreme relationships between extreme concepts; usually they survey reality, counting concepts the researcher thinks are relevant and then computing averages and correlations. This is not the process which generated the scientific knowledge of recent centuries. Rather than extremes, it emphasises the typical. The gravity formula is obeyed by cannon balls, helium balloons and comets. No data statistics of these will produce the formula yet the formula is essential to predict their data.

#### **4. Idealisations, like the reality they represent, are *dictated by nature*, not by man.**

It is widely recognised that science theory uses idealised concepts<sup>10</sup> but it is commonly thought its purpose is to simplify. This implies that the theorist should choose idealisations in order to simplify. That is a mistake; though idealisation usually does simplify, idealised concepts are set by nature and not for our convenience. The formula for gravitational attraction quoted above *requires* the masses and the distance; there is no choice; nothing else will do.

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<sup>9</sup> Michael R Matthews ('Idealisation and Galileo's pendulum discoveries: historical, philosophical and pedagogical considerations' in *The pendulum: scientific, historical, philosophical and educational perspectives*, eds. Michael R Matthews, Colin F Gauld and Arthur Stinner. Dordrecht, Netherlands: Springer, 2005, p 219) quotes Galileo with regard to the law of parabolic motion of projectiles: 'I grant that these conclusions proved in the abstract will be different when applied in the concrete and will be fallacious to this extent, that neither will the horizontal motion be uniform nor the natural acceleration be in the ratio assumed, nor the path of the projectile a parabola.' Matthews also quotes (p 221) Newton's *Principia*: 'in philosophical disquisitions, we ought to abstract from our senses, and consider things themselves, distinct from what are the only sensible measures of them.' And he quotes (p 223) Michael Scriven: 'The most interesting thing about laws of nature is that they are virtually all known to be in error.' Philosopher Nancy Cartwright is famous for her 1983 paper *How the laws of physics lie*.

<sup>10</sup> Pioneer social scientists, Montesquieu and Weber, thought idealisation necessary for social analysis but their ideal-types were ad hoc. Among philosophers, Mach and Kaufmann thought idealisation to be universal in science theorising and Hempel and Schütz thought it important. It seems less discussed in recent times.

Nature dictates them. She dictates the concepts and she dictates the relationship. She specified them 13.8 billion years ago and if there are other technical civilisations in the universe, they will have found the same formula. Idealisations have to be discovered.

If there are rules of social interaction they, too, are written by nature. Like the rules of physics and the rules for organic life, the rules for social relations will also apply throughout the universe. For social science to be science, the idealised forms that apply to social relations must be discovered, not invented.

### **5. Idealised concepts represent *real things*, which exist independent of the observer.**

A scientific theory is an idealised relationship between idealised concepts. The idealisations are of real things, things ‘out there’ in nature, independent of any observer. If the things interrelated by a hypothesis or theory were to depend on the subjectivity of the theorist, experiments could not be repeated by different theorists.

A real entity can be measured using an instrument. Provided a relationship between that entity and another entity is known, an instrument can be fabricated which will move a needle, flash a light, or trip a computer record. Is temperature a real thing? Its relationship to the expansion of mercury is known, so an instrument to measure it can be made. Temperature is therefore a real thing. As far as scientists are concerned, if it can’t be detected by an instrument (at least in principle) it can’t exist for science.

The real thing can appear very different from the idealised theory. Galileo theorised gravity with a perfect sphere rolling on a perfectly flat plane. Nature gives us landslides. To understand landslides the idealised theory is required. If theories interrelating social phenomena differ from the real world as the sphere on the plane differ from a landslide, there is no chance of discovering idealisations by surveying social reality and noting things which seem relevant. Max Weber was doing this a century ago and since the advent of computers, social scientists have been practising it on an industrial scale. It has not delivered theory.

No instruments can detect social phenomena. There is no prospect of developing an instrument which, when pointed at a building, will indicate whether it is a government department, a university, or a mental asylum. No device will ever decide whether a piece of metal is money or not. The asylum and the money are facts but they are social facts. They are in people’s minds, agreed upon through social communication. The social scientist’s problem, then, is to objectively measure subjective phenomena—and the only way to measure them is to interrelate them.

Subjective phenomena—perceptions, moralities, emotions—have an objective existence within bodies, where nerves and electrical discharges are real. If relationships of brain measurements to perceptions are known, then objective,

repeatable measures of perceptions become possible.<sup>11</sup> Otherwise, perceptions can only be inferred from words and actions.

A scientific approach must interrelate two or more theoretical, idealised perceptions and so predict individual attitudes and social relations. Is that hard? Predicting people's reactions is part of everyday social interaction. The task of social science (as science) is to formalise this theoretically, as *idealised relationships between extreme perceptions*.

**6. Science's idealised concepts do not depend on definitions. Understanding is via context, i.e., via relationships between concepts.**

Social scientists yearn for agreed definitions of concepts.<sup>12</sup> This may stem from a misunderstanding that science defines things. As philosopher Alan Chalmers points out,<sup>13</sup> a scientific concept cannot depend on a definition because the words of the definition would themselves need defining—which is an infinite regress.

A definition is a decree, or an opinion; if nature is independent of observers, then it is she who decrees. Newton's second law,  $F=ma$ , says that force is given by multiplying mass by acceleration. If this relationship has operated everywhere in the universe for 13.8 billion years it cannot depend on human opinions of mass and acceleration. Nature's decree,  $F=ma$ , is itself not a definition of  $F$  because the 'definition' of mass is  $m=F/a$ . So nothing is defined; there is just a circular relationship. Nature does not define; she interrelates.

Definitions are for legislation and contracts. Definitions are bureaucratic, rather than scientific. They are required in applied science for denominating cut-off points to decide what real phenomena to include but for science theory there can be no dependence on definitions. How do scientists know the meaning of

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<sup>11</sup> 'In this fMRI study individuals played a specially designed computer game, according to a set of predefined rules, either in cooperation with, or in competition against, another person. The hemodynamic response during these conditions was contrasted to that of the same subjects playing the game independently... ..distinct regions were found to be selectively associated with cooperation and competition, notably the orbitofrontal cortex in the former and the inferior parietal and medial prefrontal cortices in the latter. This pattern reflects the different mental frameworks implicated in being cooperative versus competitive with another person.' (Jean Decety, Philip L. Jackson, Jessica A. Sommerville, Thierry Chaminade, and Andrew N. Meltzoff, 'The neural bases of cooperation and competition: an fMRI investigation.' *NeuroImage* 23:744-751, 2004, p 744).

<sup>12</sup> For example, Elinor Ostrom ('The 2005 James Madison Award lecture: converting threats into opportunities.' *Political Science & Politics* 39(1), 2006, p 4), president of the American Political Science Association and later Nobel winner in economics: 'Given the importance of language, a more serious threat to the future of our discipline than the lack of universal laws is our lack of common definitions for key terms we use including power, norms, and institutions.' This after a century of vainly seeking definitions. She has it back to front; the understanding of terms is given by the law—the relationship—not by definitions.

<sup>13</sup> A F Chalmers, *What is this thing called science? 2nd ed.* St. Lucia: University of Queensland Press, 1982

their concepts? In the same way everyone knows word meanings: from context. We do not learn our language from definitions. In the case of science the context is an explicit, precise relationship:  $F = ma$  until the end of the universe and scientists' various opinions on how to define its parts are irrelevant.

The sort of concepts interesting to social scientists are values such as cooperation, heroism, honesty, optimism, rank, along with emotions or mental states such as anger, curiosity, disappointment, insanity. To do science these must be interrelated without agreed definition. Concern for definitions misunderstands understanding. Definitions are needed for testing and applying a theory because reality is untidy, however the theoretical concepts themselves are for nature to know and *the only way a scientist can understand them is from their relationships*, in idealised form, to other idealised concepts.

Definitions do not, and cannot, lead to theory. After more than a century, no progress has been made toward fulfilling social science's wish for agreed definitions.<sup>14</sup> There is no getting around it: theoretical relationships must be found.

### **7. Science theory is *not subtle*. Its idealised, undefined concepts are quite distinct from one another.**

In the social sciences, subtlety is prized but not in science. Concepts understandable without definitions will tend to be distinct and discrete. In social science concepts are often defined and supported with scholarly citations. Scientific concepts are not defined and what past scholars have said is seldom relevant. In the social sciences 'nuanced' is a compliment but science concepts are more likely to be thought obvious; no one confuses them with each another.

To be scientific the social scientist must come up with a relationship between two or more idealised concepts which everyone knows the meaning of without definitions. Just as scientists understand  $F = ma$  whatever their definitions of its parts, the concepts have to be so different from each other that imprecision in their meanings, and various opinions of their meanings, do not affect the relationship.

### **8. A science theory cannot be proved but it is *falsifiable*.**

This is the science rule to rule them all. No theory can be ever be proved true but scientific theories are open to being proved false. Falsifiability as an essential marker of science was suggested by philosopher Karl Popper in the 1930s. If a theory (hypothesis, conjecture) makes a prediction which is not borne out, then the theory is refuted. If there were no mistakes in the testing procedure, the theory is falsified.

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<sup>14</sup> Newton himself said, 'I do not define time, space, place, and motion, as being well known to all.' (Robert Rynasiewicz, 'Newton's views on space, time, and motion.' *The Stanford Encyclopedia of Philosophy* (Fall 2008 Edition) Edward N. Zalta (ed.) 2008).



There is much philosophical argument over ‘falsificationism’ but in the ordinary practice of science, new knowledge is published as a research paper and exposed to falsification by peers. In addition, every technological application—every engine started, every drug taken—has potential to falsify the theories which helped make it. Falsifiability is constantly operating on science. Nothing like it operates on social science.

With falsifiability, science is again formalising an everyday action. We hear or read some new claim and automatically think: ‘But what about such-and-such?’ If our objection is not met, the claim is false. Either way we learn something. The things said by social science are almost never testable in this way so are never falsified. In social science we have millions of learned papers, none of them wrong.

In science sometimes even established theories go down. Newton’s theories were thought true beyond question but after a century and half were found faulty and eventually corrected by a new theory from Einstein. For decades peptic ulcers were attributed to acid but Western Australian researchers won the Nobel Prize for showing they are caused by bacteria. A science theory is falsifiable: there is a test which could potentially show it to be incorrect.

Where a predicted effect is found, the theory is verified. If the effect could not have been predicted without the theory, that will be grounds for accepting the theory as true—until someone falsifies it.

If a theory is not testable, if there is no way, even in principle, that a proposed theory could be disproved, then it is not science. In science, what would falsify a theory is usually self-evident. For the falsifiability of a relational theory in social science to be self-evident, the meanings of its concepts—their existence and their independence from definition—cannot be in dispute.

If the falsifiability rule is satisfied, it implies some other rules are obeyed. Falsification can’t occur if discussion bogs down over definitions or nuances. There is a rare social science example to illustrate this. When the relationship, ‘democracies never war against each other’ became well-known in the early 1990s, the literature consisted almost entirely of attempts to falsify it and attempts to falsify the falsifiers. There was no distraction defining democracy or war because variations in opinions made no difference. As an example this ‘democratic peace’ thesis is, however, somewhat faulty. It may be the soundest empirical relationship in all social science but it isn’t really a theory. Although it was theorised by Immanuel Kant 200 years ago (without empirical instances) the theory which would explain it is still disputed.

**9. To test or apply a theory science *measures*; it does not count. In social science, the only idealised measures are presence and absence.**

Most science theory interrelates extent or intensity, not a particular number of occurrences.  $F = ma$  says nothing about how many forces are applied or how often masses are accelerated. A few science theories do specify an integral

number. For example, the number of electrons in a shell, the incidence of different genotypes comprising an evolutionarily stable state. Where theory specifies an integer, science counts. Where it does not, the frequency of occurrence of a phenomenon is of bureaucratic, not scientific, concern.

Social scientists mistake counting for measuring. For example, they count the number of people showing defined phenomena—nationality, political allegiance, sexual inclination, holiday destinations, media preferences, and so on—for which there isn't, and can't be, a theoretically specified number. They then compute correlations between them. The interrelationships produced by this automated, theory-free induction are statistical, not social. Not only does this practice invert the scientific procedure by naming concepts before noting interrelationships, but it seeks relationships of frequency not function. The real relationships between the concepts, if any, remain unknown.

Could we understand gravity by counting whatever phenomena seemed interesting about landslides and calculating their correlations? That would be ludicrous. Correlations depend on popularity: the phenomenon that occurs a hundred times matters, whereas the one which occurs once or twice is not statistically significant. If geologists took this approach they would inform us the earth is made of soil and rock and indications of gold and diamonds are insignificant.

Statistics of counted phenomena have been vital to administration since before the time of Herod. But statistics don't lead to theory. A scientific theory of society would no more say how often its parts occur than the theory of gravity says how many apples fall. Prominent people have made this point. In 1931 Kurt Lewin railed against social science's 'Aristotelian' preoccupation with frequency of occurrences.<sup>15</sup> In 1967 FA Hayek said the statistical approach would never lead to understanding.<sup>16</sup> In 1980 Kenneth Boulding stressed that science begins with logic and without it, 'empirical regularity is little better than superstition.'<sup>17</sup> and there are some vocal present-day political scientists.<sup>18</sup> The few researchers who have actually *tested* the statistical approach using data

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<sup>15</sup> Kurt Lewin 'The conflict between Aristotelian and Galilean modes of thought in contemporary psychology.' *Journal of General Psychology* 5:141-177, 1931.

<sup>16</sup> F A Hayek, 'The theory of complex phenomena.' in *Philosophy of social science*, edited by Michael Martin and Lee C McIntyre. Cambridge, MA: MIT Press, 1994 [1967].

<sup>17</sup> Kenneth Boulding, 'Science, our common heritage' *Science* 4433:831-836, 1980.

<sup>18</sup> For example, Rein Taagepera, 'Predictive versus postdictive models.' *European Political Science* 6:114-123, 2007). J G Taylor, 'Experimental design: a cloak for intellectual sterility.' *British Journal of Psychology* 49:106-116, 1958. Josep M Colomer, 'What other sciences look like.' *European Political Science* 6:134-142, 2007. S Coleman, 'Testing theories with qualitative and quantitative predictions,' *European Political Science*, vol. 6: 124-133, 2007.

constructed from *known* relationships have found it *always fails to find those relationships*.<sup>19</sup>

Social researchers have taken no notice of these objections and statistical papers have flooded the social sciences since computers made the calculations easy. They have led nowhere. As Rein Taagepera says, ‘The profuse regression and correlation coefficients published in political science are mostly dead on arrival—once printed, no one uses them again for any purpose...’<sup>20</sup>

A science theory states a relationship not of frequencies but of magnitudes: a certain degree or intensity of one thing relates in a specified way to the strength of another thing. It means that to apply or to test a theory requires *measurement*, not counting. To compute gravitational attraction, for example, requires measurement of the sizes of the two masses and of the length of the distance between them. Then the quantities can be multiplied and divided.

Measurement requires units and the units are artificial. Nature invented mass and distance; humans invent kilograms and metres. Measurement units are arbitrary and must be agreed. With agreed units, instruments can yield objective measurements independent of the beliefs or preferences of the measurer. This allows anyone to test and apply a theory.

For social scientists to be scientists they must measure (not count) and since there are no agreed units the only measurement with a chance of agreement is total presence and total absence. *A scientific, idealised social theory must express a relationship between the all-or-nothing extremes of its components*. If this seems crude, there is no alternative. Economics does this with concepts such as homo economicus, market clearing, perfect information, and others<sup>21</sup>—and economics rules the world.

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<sup>19</sup> James P McGregor, ‘Procrustus and the regression model: on the misuse of the regression model.’ *PS: Political Science and Politics* 26(4):801-804, 1993. McGregor ‘took random data that fit perfectly three well-established laws in physics (Galileo’s law of falling objects, Boyle’s ideal gas law and Newton’s law of gravitational attraction) and analysed those data by regression. He concluded that ‘none of the regression equations comes even close to capturing the real form of the underlying relationship’.’ (Josep M Colomer, ‘What other sciences look like.’ *European Political Science* 6:134-142, 2007, p 138.)

John E Overall, ‘Note on the scientific status of factors.’ *Psychological Bulletin* 64(4):270-276, 1964. J Scott Armstrong, ‘Derivation of theory by means of factor analysis or Tom Swift and his electric factor analysis machine.’ *The American Statistician* 21(5):17-21, 1967. Mike Pepperday, *Way of life theory*, ANU dissertation, Appendix 9, 2009.

<sup>20</sup> Rein Taagepera, ‘Why political science is not scientific enough: a symposium’ *European Political Science* 6:111-113 2007, p 112.

<sup>21</sup> The only hope of measuring intensity of psychological concepts would be via nerve scanning. Since WW2, economics has tried to theorise with ‘imperfect competition’. It is not effective. ‘Together the assumptions of imperfect competition and Nash equilibrium imply almost nothing. ... [The Dixit-Stiglitz example] gave the impression that there were simple elegant results based on assuming imperfect competition similar to those based on assuming perfect competition. There aren’t.’ <http://rjwaldmann.blogspot.com/2015/09/paul-romer-has-3-questions.html>

## CONCLUSION

The achievements of the social sciences are practically invisible compared with those of natural science. Indeed, natural scientists view the social ‘sciences’ with contempt.

Since 1980, social scientists have been beguiled by computerised factor analysis of counted (not measured), defined phenomena. Right now, thousands of academics are hunched over their computer screens clicking the buttons, looking for correlations. They advance their careers but they don’t advance science.

To be genuinely scientific, social science must respect the rules. The social scientist, as a scientist, must propose a theory expressing a relationship between two or more social or psychological concepts. Since there are no agreed measurement units, the concepts must be idealised as extremes of presence and absence (as in economic theory) and must be so distinct from each other that the theoretical relationship is unaffected by opinions as to their definitions. The sort of information or test which would falsify the proposed theory should be clear.

Is it possible to construct social science theory that does not depend on the definitions of its concepts? The first thing to say is that there is no choice: it has to be done to make a scientific theory, to create the kind of knowledge that can progress. The second thing is that outside of economics no one has tried it. They aren’t aware of it. Social scientists know about falsification and know the social sciences lack falsifiable theories; this particular deficit in large part accounts for the pleas for social science to be exempt from the rules of science. They may not be aware that the falsifiability deficit is because of the insistence on definitions and they are surely not aware that freedom from definitions comes from relationships—testable, theoretical relationships.

There has been a century of dithering in the social sciences. The psychological and the social are surely part of the natural world and so subject to natural laws. To discover the laws it will be necessary to obey the rules of theory construction that have worked so effectively in the natural sciences.□

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