You cannot vivisect a moral agent

Francis Ysidro Edgeworth, New and Old Methods of Ethics, 1877, 20

Introduction

In a letter to J.M. Clark of 1 March 1951 Lionel Robbins wrote that “the Nature and Significance was always intended to be a sort of preliminary manifesto designed to forestall the criticism that I did not know where the borderline between the different disciplines really lay” (quoted from Howson 2004, 417). The disciplines Robbins referred to were “history, psychology, and political philosophy” which he studied at LSE under the influence of the left-wing political theorist Harold Laski, and “economic theory” which he followed “as an outsider” in Edwin Cannan’s class. This paper will focus on how Robbins used Max Weber in his Essay in managing the boundaries between economics and psychology. It was not so much psychology as such, I will argue, but one particular version of psychology Robbins was concerned with, namely that kind of psychology that reduced (or considered) psychological to physiological states, as exemplified in German psychophysics. In his dismissal of physical
reductionism Robbins explicitly referred to Max Weber’s well-known essay on the relevance of psychophysics for economics, in which Weber had sufficiently “refuted” this view.

This paper will first sketch why psychophysics became such a promising psychological theory for economists at the end of the nineteenth century, not only in England, but also in the German speaking world. It will then show how psychophysicists in Germany came to direct their attention to questions that early marginalists such as Stanley Jevons had articulated as of special interest to economists. Just as economists became attracted to psychophysics, psychophysicists, in their turn, came to ask questions that were first raised by economists. I will look at one example in more detail, which was extensively criticized by Max Weber, the work of the psychiatrist and psychophysicist Emile Kraepelin. I will then investigate Max Weber’s criticism of psychophysics more in general to then return to Robbins’s Essay. That is where I will close off.

My final concern is not so much to answer the historical question whether Robbins knew all details of the skirmishes over the merits of psychophysics for economics in Germany. Rather it is my aim to show that his acceptance of Max Weber’s criticism effectively closed borders between two disciplines, where these borders had become so much fluid at the turn of the century. There was an important consequence: following Max Weber, Robbins’s successful demarcation of economics and psychology also successfully degraded the experimental method as of no importance to economics as a discipline.

Both their arguments hinged not so much on psychology, as on the structure of human action; that is its intentionality in terms of means and ends. While Robbins considered this structure still a psychological theory of sorts, Weber argued that this particular structure of
action had become *historically* dominant in the modern western world. For Weber, goal-oriented rationality was at no point a psychological theory – it was an ideal-type characteristic of capitalist society.

**Robbins’s verdict on Jevons and Edgeworth**

Robbins addressed the “borderlands” between economics and psychology explicitly in Chapter IV, section 4.¹ The chapter as a whole addresses the “nature of economic generalisations”. Section 4 is about economics and psychology and invokes Max Weber on two central occasions. First, to dismiss the relevance of psychophysics to economics; Second, to affirm the distinction between what we now commonly call positive and normative statements in economics. Both distinctions are closely related. I will mainly concentrate on the first statement.

Robbins argued as follows. After delineating the subject of “pure Economics” as being about “relative valuations”, he went on to question those who argue that relative valuations are dependent upon “the validity of particular psychological doctrines”. He straightforwardly dismissed such arguments as resting on inexact thought. Unfortunately, these “borderlands of Economics are the happy hunting-ground” of all those who advanced the one or the other psychological theory as providing the foundations for the economic “assumption of relative valuations”. Those susceptible to this were very willing to make the foundations of economics dependent upon current fancies in psychology that shift “every five years or so” and were not willing to confront economics’ subject proper, that is “the implications of choice in a world of scarcity”. The result was to be “bamboozled into believing” that “fashionable” psychology matters, while economics really has nothing to do with it.

¹ Unfortunately, the first edition was not to my disposition while writing this paper.
It was the economists’ own fault, unfortunately. Robbins gave instances of economists who illegitimately crossed the border. The fault was with the English mainly, in particular with Jevons and Edgeworth, whose names were “a sufficient reminder of a line of really competent economists who did make pretensions of this sort.” The Austrians (Menger, Böhm-Bawerk) carefully avoided “this kind of misconception”. What was this misconception precisely? Robbins referred to this in two different ways, as “psychological hedonism” and as “a theory of pleasure and pain”. These are by no means the same, since almost any psychological theory from Locke onwards (if not before) in one or the other way was about pleasures and pains, without necessarily being “hedonistic”. Robbins interchangeable use of both labels was understandable enough, however, because Edgeworth in particular persistently referred to his own theory of pleasures and pains as hedonic psychology, for example when he discussed the possibility of a “hedonic barometer”. One may thus guess that it is Edgeworth in particular Robbins had in view.

Robbins’s use of “hedonistic” spills over to the second issue treated, namely the distinction between “objective” and “normative” judgements. In this context, hedonism refers rather to Bentham’s theory of pleasure and pain, and its normative principle of the greatest good for the greatest number, which was considered to entail cardinality of preferences. Robbins used Pareto to argue that economics really was about ordinal preferences only, and this would become the foundation for his well-known distinction between “objective” and “normative” judgements, though his precise argumentation invoked, as he explicitly acknowledged, Max Weber’s thesis on this distinction as well.
I think it is fair to say that economists and historians of economics have commonly picked up on Robbins’s label of “psychological hedonism” as being identical, or similar enough, to a “theory of pleasure and pain”. I would like to emphasize the difference to begin to understand how much Robbins was indebted to Max Weber in drawing the boundary between economics and psychology. If we read on we get our most important clue in this regard. Robbins quotes from Edgeworth’s *Mathematical Psychics*, where Edgeworth compares the human agent to a “pleasure machine”. And he makes note of attempts to “exhibit the law of diminishing marginal utility as a special case of the Weber-Fechner Law”. These attempts were also made by Edgeworth, particularly in his *New and Old Method of Ethics* of 1877 that preceded *Mathematical Psychics*. Robbins then gives a footnote to Weber’s famous dismissal of attempts to identify marginalism in economics with marginalism in psychophysics. Weber’s dismissal was in its turn prompted by the German economist Lujo Brentano’s review article on developments in marginalist theory in which Brentano showed himself enthusiastic for such attempts to connect marginalism to psychophysics (Brentano 1908).

Very different issues, then, are convoluted in Robbins’s rejection of the relevance of psychology for economics. Without claiming to give an exhaustive summary of all issues treated so far, we touched upon the following ones: (1) Economics needs stable foundations; these cannot be found in psychology, because “fashionable psychology” changes once in five years; (2) hedonic psychology is wrong anyway, because it confuses value judgements with scientific, “objective” judgements; (3) a theory of pleasure and pain rests on “hedonic postulates”; (4) it is wrong to consider man as a pleasure machine; (5) diminishing marginal utility has nothing to do with psychophysics; (6) the problem of economics is logically independent of fancy psychological theories.
Given these strong claims, it comes as a surprise that Robbins goes on to argue that if we are to do our “job as economists” right, we “must include psychological elements” in our explanations. But the psychology Robbins now thinks of is not one of those “fashionable” theories; it’s psychology as far as it deals with “purposive conduct”. This concept has an inherent psychological meaning that cannot be fully captured by the methods of the natural sciences. There is a point then were economics does depend on psychology, but not in terms of a specific kind of theory, that is not in terms of psychological theories that try to explain mental states in terms of physiological states. Rather, this point is to be sought in the structure of the kind of behaviour that economists are interested in. In its most general terms this structure can be characterised as “means-ends” behaviour. This structure is sufficient to enter as a causally explanatory term – to enter “in the chain of causal explanation”. And this structure is “psychical, not physical”: to see an action as serving a purpose means however something different than measuring it physically, it is to understand what “choice” really means, and this understanding goes into an economist’s explanation of it. Also here, Robbins relies on Max Weber to make his argument.

Even though understanding this structure entailed a psychological claim, this claim was better characterised in terms of “consistency” of choice, rather than in terms of pleasure and pain. Hence, it was rather a logical than a physiological characteristic of choice behaviour. Robbins explained this with the almost trivial example of transitivity of choices. Robbins wrote that his psychological theory involved the “assumption that each final choice is consistent with every other” this seemed trivial indeed and to perfectly make sense. Robbins’s dismissal of

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2 I think it is misleading to draw a distinction here between “specific” and “general” psychological theories, as for example in (Giocoli 2003, 86). There is nothing general about means-ends behaviour vis-à-vis psychophysical theories; the differences really is one of kinds, namely whether one uses bodily states to measure mental states, or whether one thinks bodily states are of no relevance to states of mind. It is this last position that Robbins defends.
the relevance of specific psychological theories was to embrace another specific psychological theory that hinged on a logicistic explanation of means-ends rationality. After Robbins, most twentieth century economists have fallen into a Kantian dogmatic slumber over this example, before having been awakened by systematic violations of the trivially easy ranking of A over B over C at the end of the twentieth century. Let me stop my discussion of Robbins’s text here and let me first see why economists like Stanley Jevons and Francis Ysidro Edgeworth favoured naturalistic versions of psychology in the first place.

The “physical groundwork” of economics

My concern in this and in the following section will be with psychophysiology (that is the hedonic calculus) and the idea that man is, just like any other animal, some kind of pleasure machine. Elsewhere, I have dealt extensively with Jevons’s adaptation of Bentham’s hedonic calculus (Maas 2005a, Maas 2005b). The upshot of my argument was that it was not so much Bentham’s hedonic calculus, but developments in what was referred to as psychophysiology in Britain that underscored Jevons’s theory of pleasure and pain. The label suggests more precision than there actually was; psychophysiology captured all attempts to reduce states of mind to physiological states.

Let me briefly summarize this history here. In the second half of the nineteenth century, attempts to search for what Jevons called the "physical groundwork" of political economy became increasingly popular once again, after a period in which political economists, largely following John Stuart Mill, maintained strict boundaries between the natural sciences and the science of mind, including political economy, though this did not mean that they denied political economy the lawlike character they so much admired of the natural sciences, rational mechanics in particular. Well-known is Mill's resolute negative answer on the "vexed question" whether mental states are reducible to physiological states. This denial enabled him
to ascribe causal power to mental motives and to maintain freedom of the will as well. Thus Mill could uphold the lawlike character of political economy - a science of motives - and freedom of the will because an individual could always resist to act upon a motive. Mill's delicate squaring of the circle in moral philosophy explains the puzzled, if not straightforwardly dismissive reactions to sparse attempts to ground the principles of political economy in "the afferent trunks of nerve-fibre" as pursued, for example, by an outsider to political economy like Richard Jennings ([1855] 1969). According to the Irish political economist John Elliot Cairnes, such attempts would turn "political economy into a wholly different subject than the world has hitherto known it" - reason enough to think this alien to the business of the political economist (See also White 1994a).

In the second half of the century, two developments gave increasing credibility to such attempts to ground economics in man's physiology.

The first were developments within psychophysiology itself. (Psycho-)physiologists like Thomas Laycock, William Carpenter and Henry Maudsley with increasing confidence questioned the existing boundaries between the phenomena of mind and matter that lay at root of Mill's solution to the scientific character of political economy, though not all of them went as far as Laycock in claiming that all mental states were, after all, just emanations of brain states, turning consciousness into an epiphenomenon.3

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The second development was the development of thermodynamics that, rightly or wrongly, gave credibility to the idea that mental phenomena were a particular manifestation of energy, just like electricity or mechanical force. These last ideas can be found widely in the nineteenth century, not only in very different intellectual groups in Britain, but all through Europe. The idea that the human body was no more than a heat engine was expressed in France, Germany, and Britain alike and physiologists ardently attempted to discover the precise mechanism of how the human body converted food into useful effect (Rabinbach 1992).

Even John Stuart Mill considered the idea of a conversion of energy into different forms, including mental states, in an exchange of letters with his close friend, the psychologist Alexander Bain, though Bain (a former adherent of phrenology) was more sanguine about this than Mill. William Carpenter's "correlation of forces" was a particular instance of this idea that aimed to salvage a non-reducible status for mental states, and so would save freedom of the will as well. Thomas Huxley by contrast was much more sympathetic to the "shibboleth of materialism" that "thought is a secretion of the brain" and famously expressed this in his essay in the *Fortnightly Review* in 1874 in which he compared man to a machine.

The unifying concept was the concept of work: Just as heat could be measured by its mechanical equivalent in units of work, so we could measure the mechanical equivalent of the work of the mind. Precision measurement by means of experiments turned mere speculations

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of a “convenient science”, which in Jevons’s dismissive words about Mill, did not need any “instruments” or “apparatus” to measure its object of study, into matters of fact that could be observed.

An example of such an attempt to measure the work of the mind is Angelo Mosso's so-called *ergograph*, developed around 1890 [see slide 1]. The experimental subject was given a mental task and asked to lift the weight of the ergograph while performing the task. Bob Brain writes about this experiment as follows: "By limiting the whole of bodily activity to one tiny degree of freedom, and thus eliminating the interference of other bodily organs and functions, the invisible labor of the mind recorded itself in a measure of mechanical equivalence." Mosso explicitly compared his measurement procedure with the measurement of the mechanical equivalent of heat.

The best examples of political economists in Britain who were clearly inspired by developments in psychophysics and thermodynamics are William Stanley Jevons and Francis Ysidro Edgeworth, just the two economists Robbins explicitly referred to as mistakenly relying on “fancy psychological theories”. Rather than arguing my case here, I will show some slides to convince you that both these economists were heavily influenced by these developments.5

The first slide [show slide 2] is a copy of a page from Edgeworth's *New and Old Methods of Ethics* of 1877, in which he translated German psychophysics into the “hedonic” language of pleasure and pain. You can also see how he identifies Laplace's notions of "fortune physique" and "fortune morale" - that is the spheres of matter and mind - for measurement purposes. Also, note that Edgeworth, and quite consistently so, speaks of a "sentient being" rather than a "human being", and how this "sentient being" is some sort of heat engine:

"He is not to be considered as throwing all his fuel at once on one furnace, but as lighting up the same furnace, or others, at different times" [- these furnaces are the "different organs of sensation".]

Also, we see that the energetic discourse that Edgeworth links with psychophysics gives rise to a discussion of the functional form of the "sentient being's" "pleasure curve". According to Edgeworth, economics searched for explanations in terms of self-interest, and such explanations pointed to a theory that was based on man's physiology. Because "the necessary cerebral investigations" were impossible (Newman 2003, 197), we needed to take recourse to other, indirect methods of measurement that could provide evidence on the relation of man's physiology to his behaviour. Edgeworth considered the new experimental practices of psychophysics of Helmholtz, Fechner, Wundt, and Delboeuf in particular as indirect methods of investigation that were to be preferred over the "introspective marks of brain activity" that were favoured by John Stuart Mill and others. Rather, bodily states could

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Cambridge University Press. Chaigneau's analysis of the relation of Edgeworth to Fechner is no doubt the best available to date.
be used to indicate mental states, as the thermometer was used to measure temperature. As Alfred Barratt, the author of Physical Ethics (1869), put it, there was no more circularity in the last measurement procedure, than in the measurement of pleasures and pains by the actions of an individual agent (quoted in Edgeworth 1877: 6). In his New and Old Methods of Ethics, or "Physical Ethics" and "Methods of Ethics" (1877) a highly intriguing work that he published on his own account, Edgeworth made a term-for-term translation of the Weber-Fechner "law" into the hedonic calculus, and in Mathematical Psychics 1879 he programmatically suggested that economists should develop a "hedonic barometer" to measure pleasure and pain.

The second slide [show slide 3] is about Jevons's experimental study into the "natural laws of fatigue" in which he made three different experiments, the one throwing weights, the second, lifting weights with pulley and block, the third, holding a weight on a stretched arm. On his own saying, Jevons made these experiments to show that exact mathematical laws could be found that threw light on the "physical groundwork of economics".

Jevons published this study in Nature of 1870 and referred to it in the Theory of Political Economy as well as in his Principles of Science as an example of how “rational laws” might be found in the sciences. In the Theory Jevons gave the examples of the determination of exact numerical relations between work load and fatigue, the relation of different lengths of breaks to recovery time and work efficiency. Jevons's experiments thus were clear examples

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6 Edgeworth did not distinguish between the physiological reductionist experiments of the Helmholtz School, and Fechner who emphasized the functional parallelism of mental and physiological states (and so not their reducibility to physiological states). British marginalists like Jevons and Edgeworth considered pleasure and pain in terms of intensity and duration. Measuring an intensive magnitude would encounter the same problems as the measurement of temperature. The historical and philosophical intricacies of measuring temperature have been recently spelled out in Hasok Chang's magnificent book Chang, H. (2004). Inventing temperature: measurement and scientific progress. New York [etc.], Oxford University Press.

7 Edgeworth also considered other formulae for measuring sensations, like that of Delboeuf.
of the science of work that became so prominent in the last quarter of the nineteenth century (Rabinbach 1992). [It may be noted that Gustav Fechner performed a similar type of experiment, but I have not investigated the details of this]. The graphics are from Samuel Haughton, an Irish physicist whom we now would call a biometrician. Haughton argued that Jevons "unconsciously" was following the "principle of least action" in these experiments, and so a purely mechanical explanation could be found for them.

The third slide [show slide 4] shows a diagram of Jevons's theory of labour. How to get from the labour experiments to this diagram is far from obvious and perhaps just impossible. But there was a similar reasoning to this last diagram. Jevons argued on its basis that the workman was optimising a mental balance of pleasure and pain, in accordance with his initial "energetic disposition".

Let me close this part off. From these examples, I hope it is clear that Jevons and Edgeworth looked at the economic agent as an energetic system that optimises pleasures and pains. Anson Rabinbach aptly refers to this system as “the human motor”; man was some sort of engine converting food into useful effect. The lack of direct methods to investigate the “human motor” made Jevons and Edgeworth search for indirect methods of research. Edgeworth found such an indirect method precisely in the German discourse of (experimental) psychophysics. There was a clear aim to mathematize, to think about agency in functional form and in terms of optimisation. For both Jevons and Edgeworth to link the principles of political economy to man's biological frame entailed the introduction of new tools of research, that had been considered alien to the field before then: mathematics, diagrammatic expositions, and, eventually, experiments. To think about the relation of mind and matter in terms of “energy” and “correlation” was present in neurophysiological research at least up to
the fifties, as is witnessed from the following quote from the neuroscientist and Nobel laureate Sir Charles Scott Sherrington: “… we find that the energy-system with which we correlate the mind has of course extension and parts.”

In 1932 (the same year Robbins’s Essay appeared) Sherrington received the Nobel Prize for uncovering the exact mechanism of the motor system. It was from Marshall Hall’s early nineteenth century theory of the motor system that speculations about conversions and/or reductions of mental to physiological states all started. So in a sense we are full circle here. I know of no references of Robbins to Sherrington, but it should be clear that Sherrington was building on similar sets of ideas as Jevons and Edgeworth. These were not just “psychological fancies”, but ideas that could get you the Nobel Prize. But they were clearly far removed from the means-ends discourse that Robbins felt comfortable with. It is now time to investigate this discourse more closely. Robbins’s reference is to Max Weber, and so we will turn to Max Weber’s assessment of the irrelevance of psychophysics for economics to see where means and ends come in.

**The German context: Max Weber versus psychophysics**

My much truncated examples of the previous section also served to undermine the idea that rationality always has been on the agenda of political economists, as contemporary economists certainly are inclined to think. The historical record tells a different story. Early Victorian marginalists searched to convey to their audiences the somewhat uncanny message that man, after all, was perhaps nothing more than a heat engine, conversing food into useful effect. John Stuart Mill’s struggles with the theories of his father and Bentham on the one hand, and the free will issue on the other, were also about how to reconcile political economy with the higher moral purposes in life: better to be Socrates dissatisfied, than a fool satisfied.
Against this view, Edgeworth dryly repeated Bentham’s remark about pushpin and poetry. Against Mill's recourse to introspection to salvage political economy as a science and free will as a moral fact, Jevons and Edgeworth took recourse to physiological research in Britain and Germany to gain insight in the functional form of the driving forces of human conduct: pleasure and pain. There were clear political implications as well; for Jevons, and I am inclined to think for Edgeworth as well, economic problems presented themselves as problems of social engineering. For them economics was a science of control that was quite at odds with the type of liberalism en vogue with the Millians.

Keeping this in mind, let me now turn to Max Weber. For the purpose of this essay I will focus on three interventions that all, as will be seen, gravitate around the importance of the notion of instrumental, or goal-oriented rationality for economics as a science. These interventions are (1) Weber’s critique of the German Historical School; (2) his critique of psycho-physical studies in work and fatigue; (3) his critique of the importance of psycho-physics more generally for economics. Weber's interventions run through the first decade of the twentieth century, and his criticism of psycho-physics can be seen as its end-result.

The immediate background for these interventions is the famous Methodenstreit between the Austrians and the German Historical School. The remote background is concerned with Weber's more general ideas on the differences and similarities between the natural and the social sciences. With respect to the last, Weber clearly drew upon the work of his philosophy teachers Heinrich Rickert and Wilhelm Windelbandt, and on Wilhelm Dilthey's emphasis on instrumental rationality.

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the role of understanding as a hallmark distinction between natural and social explanations. Following Georg Simmel, Weber aimed to show that explanations in terms of understanding are consonant with causal explanations as pursued in the natural sciences – this is a theme that is picked up by Robbins in his essay as well.

Carl Menger's theory of human economizing behaviour was for Weber as a particular instance where the understanding of economic agency in terms of rationality produced such causal explanations. In this context Weber introduced the notion of instrumental, or goal-oriented rationality as identical to Menger's economizing behaviour. On this notion, Weber argued, there was no need to explain man's economic behaviour from his biological or psychological frame. The labour studies of psychophysicists of the school of Wilhelm Wundt (on which more anon) served to galvanize Weber's thoughts on this issue, and he expressed them most explicitly in his famous article on psychophysics marginal utility theory, first published 1908.9

From my discussion of Weber it will transpire how he reframed topics that had been of concern to John Stuart Mill in a new setting, replacing Mill's recourse to a categorical split between the realms of matter and mind by a categorical split between understanding natural causal relations and understanding the causal structure of human actions as fundamentally intentional and goal-oriented. For Weber, intentionality and rationality were highly related concepts. On the macro-level rationality served to distance his own "interpretative" approach in the social sciences from the irrationalism of the Historical School; on the micro-level rationality served as the foil against which to understand individual human conduct. Thus, Weber could deny physiological research relevance to the concerns of economists, and he

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could substitute goal-oriented rationality as its simple and effective alternative. In economics, no recourse needed to be made to either the physiology of mankind, or to any psychological theory; instrumental rationality was the panacea to all.

**Weber's criticism of the Historical School**

Histories of economics commonly reckon Weber to the German Historical School. But it is well known that Max Weber fits in uneasily. In the *Methodenstreit* Weber sided with the Austrians. Weber succeeded Knies in 1896 as professor of economics at the University of Heidelberg. His *Roscher und Knies und die logischen Probleme der historischen Nationalökonomie* emerged from a planned *Festschrift* (in 1902) to honour the university. The end result was a collection of essays that contained a crushing criticism of the approach of the German Historical School to economics.

In its most general terms, Weber denied the German Historical School coherency. On the one hand, and following on ongoing debates in Germany at the time over the distinction between the natural sciences and history, Roscher and Knies claimed for political economy a separate route to truth, distinct from that of the so-called nomological or nomothetical sciences - like mechanics. Economics focused on the full complexity of historical events, and because of this focus was unable to present its results in the form of general causal laws. On the other hand, Roscher and Knies took general assumptions about human nature as their point of departure. These general assumptions were considered universally true, and only expressed themselves differently under different institutional arrangements.

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Weber's most explicit concerns were directed against the irrationalist assumptions and overtones of the approach of the Historical School. Weber contrasted this approach with that of Dilthey and others, who searched for "meaning" in history; that is, who aimed to "understand" the actions of individual agents as "intelligible". The approach of the Historical School was clearly in opposite direction. Roscher and Knies "hypostatized the concept of an essentially irrational and unique 'Volksgeist'", and they even made this "Volksgeist" the "individual" that transformed through history (Weber 1975a, 61). Such a monolithic approach to history fitted within the conservative and nationalistic agenda that had come to dominate in Germany after the unification of the German Reich. This agenda was one of the major concerns of social scientists in a liberalist tradition, many of whom made part of the Verein für Sozialpolitik of which Max Weber was an important member. The Verein tried to distance itself from radical socialist ideas on the one hand, and political conservatism on the other, and attempted to redress the incivility, authoritarianism, and intolerance they increasingly found after 1871 with adherents of both sets of ideas, in favour of a more liberalist politics, without becoming involved in party politics (Sheehan 1966, Hagemann and Rösch 2004, Goldman 2005). The difficulty of such a balancing act was in fact contained in the very name of the Verein.

In line with his liberalist agenda Weber argued against the Historical School that it overlooked the "fundamental and substantive problem of economics" that was posed "before and after Roscher." That was to find an answer to Bernard Mandeville's fundamental question: "How are the origins and persistence of the institutions of economic life to be explained, institutions which were not purposefully created by collective means, but which nevertheless - from our point of view - function purposefully?" (Weber 1975a, 80).\footnote{We hear Hayek's assessment of Mandeville in these words. See F. A. Hayek. 1966. Dr Bernard Mandeville: Lecture on a Mastermind. In: Proceedings of the British Academy, Vol. 52. Reprinted in:}
posed by Mandeville, in his notorious *Fable of the Bees*, and "many of his successors, consciously or unconsciously agreed with [his] view: economic self-interest is that power which ... 'always wills evil but does good'' (Weber 1975a, 83). But Weber diverged from the way Mandeville phrased the issue of economic self-interest, as we will see presently.

Weber showed particular concern with the weak empirical and theoretical underpinnings of Roscher's strong psychological claims of man's universal nature. Although Roscher generally disagreed 'with Mandeville and the Enlightenment", he followed Mandeville in considering self-interest as an "instinct" on which man inevitably acted. Weber argued that both historical development and the actions of the individual were thus conceived as fundamentally irrational, because instinctive. According to Weber, Roscher's simplistic psychology bypassed the very complexity of different and counteracting motives that determine human conduct.

The emphasis on the irrationality of individual human agency was even heightened in the work of Knies. As Roscher, Knies distinguished between nomological and historical sciences. History was excluded from the domain of the nomological sciences just because individuals act out of free will and were therefore "irrational-concrete" (Weber 1975a, 96) According to Knies, the fact of free will itself implied that individual actions could only be considered as irrational. Knies, so Weber argued, conceived of "irrationality" as synonymous with "unpredictability" or "incalculability", and rationality apparently meant the opposite (Weber 1975a, 97, 120). In his criticism of Knies's overly simplistic argument, Weber introduced his main argument for thinking about human behaviour as categorically different from natural

processes. The difference resided in the fundamentally intentional character of human agency. That was to say, in its inherent possibility to be interpreted rationally.

Apart from the fact that properties of unpredictability and incalculability were no different for many natural processes, and so human action was no more, no less "irrational" than natural, law-like processes, Knies (and Roscher) ignored the distinguishing feature of human actions, namely that we "can attempt to 'understand' it", that human actions are susceptible to "a meaningful interpretation". If only for that reason, Weber considered "individual human conduct ... intrinsically less irrational" than "the individual natural event", unpredictable or not (Weber 1975a, 125). Weber derived this argument from his reading into Rickert and Dilthey, but according to Weber it was best formulated by the German philosopher and sociologist Georg Simmel and in his critique of Knies, Weber included an extensive discussion of Simmel's ideas.

For Rickert, Dilthey, and Simmel, then, the possibility of understanding human actions rationally was the distinction between events in the natural and in the social realm. In the realm of nature we can search for causal explanations, but we cannot ask for a reason. And to ask for a reason was to ask for the intentions of the individual agent. To understand individual human conduct was to ascribe "a 'rational' interpretation in terms of intentions and beliefs" to it (Weber 1975a, 127). This did not exclude causal explanations. Rather, as Simmel had argued, to ascribe rationality to an action was to causally explain this action from a reason.\(^\text{12}\)

In his criticism of the Historical School Weber exemplified this with one important type of

rational ascription that was of particular use in economics, namely the "'rational' interpretation which employs the categories of 'ends' and 'means'" (Weber 1975a, 186). From the sequel, it was clear that Weber had Carl Menger's theory of economizing behaviour in view (On the relation between Weber and Menger, see Caldwell 2003).

Weber added an important proviso to this claim. It was only in pathological cases - that is cases for which the interpreter was unable to find a rational interpretation -, that we judge an action to be irrational. For "normal" cases however ascription of rationality was the rule, rather than the exception. Thus, Weber used the notion of "understanding" as a methodological device in different regards. Firstly, it served to distinguish between explanation in the social and the natural realm. Secondly, it served to squeeze out "irrationality" as a useful concept for historical and social causal explanations. Thirdly, it served to focus on the intentions of individuals, rather than on their psychology, when searching for social explanations. Fourthly, focusing on rationality served as a heuristics to explain deviations in concrete cases. Understanding, intentionality, and rationality were micro and macro related concepts in causal social explanations.

With the benefit of hindsight it is remarkable how many of the themes Weber discussed more extensively in his famous 1908 article on marginal utility and psychophysics were already there: the rejection of psychological and physiological explanations of human conduct as irrelevant to economics, the use of instrumental rationality as an "idealtyp", the possibility to making causal explanations by using instrumental rationality as an organizing term, the conformity rather than opposition of law-like explanations in terms of instrumental rationality with the notion of free will. Before investigating Weber’s more general dismissal of psychophysics in terms of these themes, it will be useful to examine Weber's detailed
criticism of psychophysical experiments of work and fatigue. As extensively documented by Robert Brain (2001), the Verein undertook an extensive series of social surveys to show how work should actually be studied. Even though Weber was member of the Verein, Weber did not follow suite in considering the social survey as the preferred alternative to the psychophysics of work when it came to question that economists were concerned with. Rather, from the perspective of the economist neither experiments, nor the survey were relevant tools in framing their explanations.

**Weber and the Psychophysics of Work**

The beginning of the twentieth century saw a flourishing of studies into the efficiency of industrial work. As described in detail in (Brain 2001) and (Rabinbach 1992), experimental psychologists considered that their investigations into the measurement of reaction time or the measurement of fatigue could be made to bear on more mundane and policy relevant subjects like the measurement of the efficiency of work in the factory. Experimental psychologists in Germany in particular extended the relevance of their experiments under the highly stylized conditions of the laboratory to the "extra-mural" conditions of the factory (Brain 2001, 651). In these experiments we see that psychophysicists came to consider questions that earlier had been addressed by political economists.

German psycho-physicists essentially asked similar questions as Jevons, for example, had hinted at in his *Theory*, only in a much more detailed fashion. Jevons mentioned the "many interesting questions" in the theory of labour that might be solved if we had "a determination of the exact relations of time, space, and fatigue" (Jevons [1879] 1970, 216). Psychophysicists investigated these relations in a great many studies on the exact numerical relations between

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work load and fatigue, the relation of different lengths of breaks to recovery time and work efficiency, and so forth. In these studies, learning an array of numbers or another similar task was taken as a proxy for (mental) work done under real conditions.\textsuperscript{14}

One of Weber's criticisms, repeated in different forms throughout the article, was directed at the artificial constraints set on the experimental subjects within such experiments. Though taken from a very different type of experiment, the following image from James McKeen Cattell's *Journal and Letters from Germany and England, 1880-1888*, may serve as an illustration. [slide 5 here] The experiment was about reaction time measurement. The experimental subject (on the left) is shown a word. The lip-key arrests the chronoscope of the experimenter (to the right) as soon as the experimental subject starts reading. One of Weber's concerns with regard to the psychophysical experiments on work was whether the experimenters were not only measuring their own constructed artefacts.

Weber had already noted the "extraordinarily important" (1975a, 111) psychophysical experiments of Wundt, Münsterberg and others in his essays on Roscher and Knies, but now the writings of these experimental psychologists served Weber to critically exemplify his worries with this type of investigations when applied to the extramural world of the psychological laboratory. Weber chose the psychiatrist Emile Kraepelin's study on the "work curve" as representative of such experimental studies. As Jevons and Edgeworth before him, Kraepelin considered the pattern of work and fatigue of an individual workman indicative of his "energetic disposition" and so in the last instance reducible to his physiological frame. The "work curve" traced the expenditure of energy of body and mind over time.

Kraepelin's experimental studies were designed to shed light on how to adapt the conditions of the factory as good as possible to the energetic disposition of the workforce, and vice versa. The practical importance of such studies can be gathered from heated debates about what was called the "labour" or "social question" in Europe, that concerned issues like the (moral) habits of the workforce, the length of the working day, and more generally was about how to integrate the newly emerging working class within the tissue of society. Kraepelin's (and his similars) "work curves" promised to be an instrument to decide on some of the more practical issues, like the length of the working day or the optimal length of a break. Indeed, as an outcome of some of such studies a German entrepreneur reduced working hours to eight hours a day (without reducing wages) to enhance productivity.\footnote{See (Rabinbach 1992, chapter 6).}

Weber granted the psychophysicists the "theoretically of course indubitable point of view" that it should be possible "in principle" to gain insight in industrial conditions of work and labour efficiency from "physiological, experimental-psychological and perhaps also anthropological insights" (1988, 62) and he ask the reader some patience with a "complete layman" in experimental psychology as he is. Nevertheless, his criticism does not leave much in doubt about his final opinions on the value of such studies.

Weber's criticism of studies like those of Kraepelin was that they tacitly assumed that the constrained situation of the experiment effectively mimicked working conditions in the factory. However, according to Weber, factory conditions of work contained an "array of built-in conditions which are alien to the laboratory", such as housing conditions, sanitary conditions, financial needs, the wage system, to mention just several of them (Brain 2001, 668). Weber's criticism of the laboratory experiments' undercomplexity was enforced by a
"showcase article" (Brain 2001, 664) Kraepelin published in a *Festschrift* for Wundt. In this article “Die Arbeitscurve” Kraepelin (1902, 489) decomposed the observed simple "labour curve" into several components, thus showing its "truly complex composition" (eine recht verwickelte Zusammensetzung). Kraepelin’s meta-study discussed several experiments in which the experimental subjects were given a certain task, for example adding numbers. The length of the task was then varied, or intermixed with shorter or longer breaks, to then measure the effect of such variations on task performance. Kraepelin's diagram in the *Festschrift* (see figure 6, after a study of Lindley) decomposed the labour curve into the training, fatigue, excitement, habit, and will-enforcement curve. According to Weber, Kraepelin thus only showed that it was not at all clear what the simple initially observed "labour curve" measured in the first place. Also, it was not clear how the labour curve could be made to relate to the psychological and physiological conditions of an individual factory worker, and *a fortiori* it was not clear how such a curve could give insight into issues of economic valuation involved in factory work.

Weber's criticism of the undercomplexity of the approach to work of the psycho-physicists pointed in two very different directions. The one was that investigations into factory work should investigate in detail all (causal) factors involved in factory work to show their complex interrelations. This was the direction sociology was to take. As an example, the *Verein für Sozialpolitik* initiated social surveys into industrial work. These surveys made extensive use of questionnaires to gain insight into the *complexity* of conditions of factory work. Though nowadays generally seen as a failure (with the exception of Marie Bernay's study of a textile factory in Gladbach), these survey studies were generally in *accordance* with the methods of research propagated by the German Historical School, and designed to gain insight into laws governing the social domain from an as wide and varied collection of data as possible.
Given Weber's criticism of Kraepelin's psychophysics of work, one may be inclined to concur with Robert Brain (2001, 670) that Weber moved into the direction of "discursive analysis developed by the German historical economists." But this was not quite so. We have already seen Weber's tensioned relations to the historical school. Even in Weber's discussion of Kraepelin, it transpires that Weber defended an explanatory strategy that was much closer to Austrian economics and actually at right angles with German historicism. Given the tremendous difficulties encountered by the problem of the undercomplexity of psychophysical studies into industrial labour, Weber asked himself if in view of this "disappointing state of affairs", there might perhaps be another point of view that might come to the rescue. And here Weber turns "naturally" to economics, because economics is, apart from physiological, psychological and hygienic disciplines, concerned with issues of labour efficiency.

In sharp contrast with mass sociological investigations and in sharp contrast with detailed psychological experimental research, the economists' point of view is the most elementary. It is only concerned with problems of profitability, that is, with questions of choosing the best course of action on the basis of calculations of means to ends. From this perspective, the capacities of the workman come only into view as a possible profitable means of production.

A manager made systematic, that was rational, use of labour and means of production for a given end. That is, managers used means of production efficiently. Weber argued that "we can [rationally] decide upon the rules [Maxime - HM]" that guide such "pragmatic inferences" by calculating their "utility effects." (Weber 1988, 132, 31) Such "pragmatic inferences" were about choosing the best means out of a given number of alternatives to an end. According to Weber, the simple calculations involved in this choice made it "evident"
that these were "far off the methods of measurement that we find in the laboratory of the experimental psychologists" (1988, 128). Because psychophysics was concerned with the "functioning" of the "psychophysical apparatus" (that is the workman), while this functioning was taken as given in economic calculations of choosing the best means to an end, the calculations of the economist were even to be contrasted [entgegengesetzt - HM] with the methods of measurement of the psychophysicist (1988, 130).

After the publication of the results of the studies of the Verein into industrial work, Alfred Weber, somewhat unjustly, complained that his brother ignored their results (Rabinbach 1992, 201). If we focus on Max Weber's juxtaposition of the methods of psychophysics and economics, it does not seem likely that the extensive survey research of the Verein could provide a better method to proceed in economics. Economics was just as little in need of the complex survey research of the Verein as it did not need the complex experiments on the (psycho-) physiology of a workman; it was concerned with given means and a given end, which in the case of business was its profitability. Let me now turn to Max Weber's more general refutation of the relevance of psychophysics to economics, written in the same years as his criticism of Kraepelin's psychophysical studies into work efficiency.

**Weber on psychophysics and marginal utility theory**

In his criticism of Knies, Max Weber had emphasized that historical explanation was not at all the sort of irrationalist enterprise Knies, and the Historical School, made of it. By contrast, every interpretation of human action proceeded on the assumption that this action was *intelligible*. Weber singled out one particular type of behaviour to illustrate this interpretative procedure in more detail, that is, behaviour that could be interpreted in terms of *means* and *ends*. 
Weber gave the following explanation of the "logic" that could be used to evaluate goal-oriented behaviour. Given a certain intention or goal \( x \), an actor needs to select a means \( y \), rather than \( y' \) or \( y'' \), as the best means (on the basis of existing empirical evidence) to obtain that goal. Though such judgments were evaluative, they were empirical in the sense that, for example, \( y \) rather than \( y' \) was more appropriate in terms of sacrifices. Weber emphasized there was nothing "subjective" in such estimations; everybody would come to the same conclusion and so nothing hinged on one’s psychological dispositions. Hence, in such evaluations no assessment needed to be made of the psychology of the individual in making this judgement. The only assumption to be made was that an individual was able to rank the objectively given means in regard to the given end. But that was trivial in terms of logic, not in terms of psychology. Note that no recourse was made here to the notion of preferences or to any similar notion. In case of a manager deciding on labour input, this decision was made in view of its profitability - that is the situation of the previous section. Though evaluative, such an analysis was completely "objective" in the sense that the different possible courses of actions could be assessed by anyone. Also in this case, the choice of the best course of action was not dependent upon the psychology of the manager. In the sense of being the “best” choice, such an evaluation could be called "rational".

Weber emphasized the "self-evident" character of such evaluations. As an outcome they produced a causal account of action, though not nomological in the sense as was used in the natural sciences. There might easily be deviations from the "best", that is "rational" course of action, and such deviations might be explained as the "nonrational elements of actual economic action" (Weber 1975a, 190). For that reason, Weber called such explanations "idealtypical", to distinguish them from the causal nomological accounts of the natural
sciences; we don't infer actual actions from them, but only the "objectively possible" courses of action (1975a, 190).

This was how rational explanations were used in economics. In economics, the assumption of "pure rationality" served to "theoretically" deduce the consequences of "economic situations". Similar to the use of rational explanations in history, these deduced consequences could be compared to their real world counterparts to distinguish the rational from the nonrational aspects of concrete actions. Though lawlike, rational explanations differed from natural law explanations in that they provided only interpretations of events, as opposed to a "law of nature" that "must be true in concrete cases" (Weber 1975a, 190). Means-ends interpretations thus implied the rationalization of empirical reality, but it did not imply that reality itself was rational. They served to circumvent the concrete complexity of empirical, real-world given situations by proceeding on the assumption that these situations were the result of intentional optimizing actions.

Thus, economic explanations in terms of rationality differed from sociological explanations in that no attempt was made to collect inductively the full complexity of causal social factors, and their relations, involved in concrete social settings. Nor did economics claim that individuals, in their actions, really were behaving rationally. Rather, goal-oriented rationality functioned as a hypothesis; as a methodical principle the economist could use to make sense of individual actions in the first place. Goal-oriented rationality served to shield economic explanations from the concrete complexity of social reality, as it served to shield economics from making any substantial assumptions about the psychological motive powers of individual agents. Rationality served as an "interpretative scheme" to make economic agency of individuals understandable. In doing so, economists only relied on very
rudimentary, and from the viewpoint of the experimental psychologist, unsatisfactory psychological notions. Weber emphasized time and again that it would be contrary to the theoretical interests of the economist, and contrary to our common sense observations on economic agency, to proceed otherwise.

Economists, so Weber argued, were not interested in the psychological intricacies of "needs" or any other psychological factors *per se*. They were only interested in the way individuals valued such needs in the light of possible means to fulfil them. In his earlier criticism of Knies Weber had pointed out that the image of man as being *instinctively* driven by self-interest, or selfishness, as Knies had assumed, and "Mandeville and Helvetius" before him (Weber 1975a, 201), was of no help in explaining *how* man proceeded to fulfil this basic instinct. If such a "simplistic" psychology was abandoned for a more complex search into mankind's psychology this proved of as little help. To examine the "truly complex composition" of the work curve, for example, did not teach us anything about questions of valuation of either the workman or the entrepreneur, and those were the questions of interest to the economist. For the purpose of economics, the only thing we needed to assume, so Weber argued, was that such valuations were performed *rationally*. That is, that individuals in their search to fulfil their needs could chose the best means to do so.

According to Weber "common experience" gave sufficient grounds to proceed on this assumption. "Common experience" taught us that "men ... are motivated by 'needs'". Common experience taught us also that people made a ranking of needs according to their "urgency". And common experience taught us that men were able to act "expeditiously", that is on the basis of "prior calculation" (Weber 1975b, 29). Weber claimed that these assumptions did not implicate any more detailed search into the psychological complexity of these needs. On the
basis of these "entirely trivial, but undisputable facts of everyday experience", the economist could "theoretically conceive of a relatively large number of people" each of whom used his available resources "for the sole and exclusive purpose of peaceably achieving an "optimum" of satisfaction of his various competing needs" (Weber 1975b, 29).

Weber was well aware that from the viewpoint of a psychologist, concepts like "purposive action", "experiencing", or "prior calculation", were all highly complex. But this was simply irrelevant to the economist. The economist could understand economizing behaviour from these "trivial facts of everyday life". To think of such trivialities as the "foundations" of economics was perhaps dazzling, but "yet this is the situation". Weber emphasized that the economist did not need to recast these everyday facts "to make them susceptible to the psychologists' usual work with revolving drums or other laboratory apparatus!" (Weber 1975b, 30). He could even obtain "mathematical formulations for his theoretically conceived course of economically relevant action" without taking recourse to any refined psychological theories, because his concern was not an investigation into man's psychology, but an evaluation of given means to an end.

Interestingly, Weber added an historical note to his discussion in which he claimed that the notion of goal-oriented behaviour had gained increasing empirical validity in the "capitalist epoch". To think about the agent as optimizing the use of limited means for a given end was exactly the situation of "an agent who constantly carries on 'economic enterprise,' and it treats his life as the object of his 'enterprise' controlled according to calculation." (Weber 1975b, 32). In so far as the economist assumed anything about the individual’s "psyche", he assumed a "merchant's soul" (32). The economist theorised on the "increasingly true assumption" that "everyone were to shape his conduct towards his environment exclusively
according to the principles of commercial bookkeeping - and, in this sense, 'rationally.'"
(1975b, 32-33). For Weber, rationality was "an approximation to reality that has implicated
the destiny of ever-wider layers of humanity. And it will hold more and more broadly, as far
as our horizons allow us to see" (1975b, 33). Economics rested on the truth of this historical
fact, not on the truth of the psychophysics of Fechner and others.

**Back to Robbins's Essay**

Let me here return to Robbins’s Essay. If we compare the very different stances of Jevons
and Edgeworth on the one hand, and Weber on the other, on the relevance of psychophysics
to economics, we see that they entail very different views of the economic agent. For Jevons
and Edgeworth, economics was concerned with an analysis of how individuals, considered as
pleasure machines, behave in the market. Their explanatory strategy was to turn to man's
biological frame and to consider how this behaviour flows from an alleged optimisation
process of man's energetic dispositions. Balancing pleasures and pains, Jevons considered
economic man (a “trading body” not a self-conscious individual) as an energetic system
following the principle of least action. This was not a social, but a natural fact - pleasures and
pains governed the individual by necessity and in accordance with rules of optimisation. For
Edgeworth something similar can be said.

Things look very different for Max Weber. His focus was the business man, the
"merchant" who used "double book-keeping" to decide on the best course of action. There
was no assumption needed about his biological frame, whether such assumptions were about
"instincts" or "self-interest" or whatever. Rather, our economic agent acted in a specific
historical (and social) context that put one specific goal, profit maximisation, upfront. *Given*
this goal, *everyone* could assess the best means to obtain this end. But that was not a natural
law; it was a rational assessment that nevertheless provided a causal explanation for economic action. For Weber, it was no different for other economic agents, and for that reason no assumptions were needed about mankind's biological or psychological constitution. For Weber the emergence of a market economy was a social, not a biological fact.

I should refrain from making any definitive claims about the *Wirkungsgeschichte* of Weber's essay, but I think it is undisputable that if forced to the choice, it is Weber's view of rationality, rather than Jevons and Edgeworth's view of man as an energetic system, that carried the day in twentieth century economics, and this despite the economists' use of the doubtlessly psychologically loaded notion of "preferences" - absent in Weber.

Lionel Robbins’s *Essay* serves as an important example, certainly because economists read Robbins, not Weber. In his famous essay on the nature and significance of economics, Robbins explicitly chose Weber's side. Robbins argued that "unfortunately ... certain of the founders of the modern subjective theory of value" had claimed "the authority of doctrines of psychological hedonism as sanctions for their propositions." Robbins mentioned "Jevons and Edgeworth, to say nothing of their English followers" as a "reminder" of "really competent economists who did make pretensions of this sort" (Robbins 1984, 84). Jevons's theory of pleasures and pains, and Edgeworth's description of man as a "pleasure machine", as all attempts to "exhibit the law of diminishing marginal utility as a special case of the Weber Fechner Law" (85), all went in the wrong direction.

Just as Weber, Robbins argued that the only thing an economist needed was to "realise that the foundation of the theory of value" resided in the “elementary fact of experience" that

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16 The original essay was published in 1932. The second edition of 1935 was considerably revised.
"different things that an individual want to do have a different importance to him, and can be arranged in a certain order," just like the merchant, we can add, is able to arrange means to an end. "Purposive", "goal-oriented", "intentional" action did not reduce the individual’s act of choice to his biological frame.

Though for a full history more needs to be said, I think it is undeniable that twentieth century economists by and large followed Robbins' line of argument. They did, I think, subscribe to the basic tenet of Robbins' (and hence Weber's) reasoning: economic valuations are not difficult: everyone can rank A over B over C, and hence A over C, and we do not need much more, as an economist, to build up our theories. And that is not that different from Weber's ranking of y as compared to y' and y" as the best course of action.

That's logical, or "common sense" knowledge, rather than psychological or physiological. Robbins and Weber also agreed in using this goal-oriented type of behaviour as a crucial causal element in economic explanations. They differed in the – call it – ontological status of means-end rationality. For Weber it was an “ideal-type” that became increasingly true historically in contemporary capitalist society. Robbins, by contrast, argued that this basic tenet was about psychology. Why limit goal-oriented behaviour only to capitalist society? Every means-end decision has the same structure, whether here or there, now or then, and such a decision does assume that an individual is able to order these means. In contemporary terms, this is "folk psychology".

One can read as much of Robbins as of Weber in this basic instinct of economists to take rationality as a logical, rather than psychological fact, and yet as an important causal factor in social explanations. Way up into the 1970s, means-end rationality was what rationality meant
to an economist. In his Fels lectures Arrow wrote that an economist “by training thinks of
himself as the guardian of rationality, the ascriber of rationality to others, and the prescriber of
rationality to the social world”. At the end of the day, rationality was about means and ends:
“Rationality, after all, has to do with means and ends and their relation” (Arrow 1974, 16-17).

It was only once it became increasingly indisputable from psychologists’ experiments that
even very simple choice situations are really not that simple, that economists gradually
became convinced that the almost tacit assumption that individuals can rank alternatives for a
given end, should, perhaps, be exchanged for a reinvestigation of how individuals do or do
not optimize in concrete situations. That does mean, for an increasing growing community of
economists, that one needs to reinvestigate the "physical groundwork of economics". I think
Robbins would have agreed with Cairnes that an investigation in the “afferent trunks of nerve-
fibre” would turn economics into a very different science as the world has known so far.
Against his dismissal of attempts to investigate the physiological basis of concepts like
“preferences” and “expectations” as intractable or even unnecessary, one might use Jevons’s
words of the Theory: “In matters of this kind, those who despair are almost always invariably
Illustrations

Illustration 1. Angelo Mosso. The ergograph curve plotted the rate of fatigue of different individuals. According to Mosso there was a correspondence between the rate of fatigue of mental and physical work. As Rabinbach writes: “ergographic tracings during arduous intellectual exertion showed that mental fatigue visibly diminished the efficacy of muscular contraction” (Rabinbach 1992, 135). The ergograph thus functioned as an indirect measuring instrument of mental work.
has been proposed to substitute for Fechner’s law, e.g. that of Helmholtz, \( \frac{a}{G - \gamma_0} \log \left[ \frac{\gamma_0 + \gamma}{G + \gamma} \right] + C \); and that of Delboeuf, \( k \log \frac{c + \gamma}{c} - k \log \frac{m}{m - \gamma} \). The properties of

the functions express the circumstances that for every increase of stimulus there tends to be some increase of pleasure (sensation), but that, as the stimulus increases, the sensation increases less rapidly (its rate of increase decreases). These circumstances appear to have been assumed by all, including Laplace, who have touched upon the relation of “fortune physique” to “fortune morale,” and they are sufficiently evidenced by every-day experience. It is obvious indeed to remark, that the increase of stimulus beyond a certain point destroys pleasure (and ultimately sensation); that in the curve of pleasure there is a “Wendepunkt,” as exhibited by Wundt (and compare Delboeuf’s theory of fatigue). But no error will be produced in the following reasonings, by considering the stimulus not to exceed that corresponding to the “Wendepunkt.” For where it is concluded that a sentient should have a greater share of stimulus, he is to be considered not as applying the whole stimulus at once to the organ of sensation, but at different times, perhaps to different organs, in appropriate subdivisions. He is not to be considered as throwing all his fuel at once on one furnace, but as lighting up the same furnace, or others, at different times. The first condition then, under proper reservations, may be assumed. As to the second condition, and the second differential of our function, I know of only one consideration which need give us pause, the form of the pleasure-curve as delineated by Wundt;1 which, after all, may be only a diagrammatical accident. This curve from the “Schwelle” up to the “Wendepunkt,” is not continuously concave to the abscissa, as our condition demands; the lower part is convex, the upper con-

1 “Physiol. Psychol.,” p. 432.
Illustration 2. Fragment of Edgeworth’s *New and Old Methods of Ethics* (1877). I highlighted several issues in this text. (1) the (almost) interchangeable use of pleasure and sensation; (2) the assumed relation between physical and mental states (fortune physique; fortune morale); (3) the relation with contemporary theories of work and waste, which in their turn were dependent on the idea that animals, including human beings could be seen as some sort of engine; (4) the use of “sentient” rather than “agent”, or “rational agent”. In particular this last phrase, “rational agent”, I am aware of being used by only two Victorians: Whately in the beginning of the nineteenth century, interestingly in direct relation with the concept of goal-orientedness and means-ends rationality, and Fleeming Jenkin, who used it to refer in a common sense way to agents in a market; (5) the analogy to a heat engine (fuel, furnace, in relation to this “sentient); (6) considerations of functional form in relation to psychophysical experimentation.
Mr Jevons' Experiments No 1
Throwing weights with arm.

\[ y = \frac{A \text{e}^{(\beta x + \alpha)\frac{1}{2}}}{(1 + \alpha)(3x + \alpha)} \]

\[ A = 302.2 \]
\[ \sigma = 8.4 \]

Mr Jevons' Experiments No 2
Lifting weights with pulley and cord.

\[ y = \frac{A}{1 + x} \]

Equilateral hyperbola

Mr Jevons' Experiments No 3
Holding weights on horizontal arm.

\[ y = \frac{A \text{e}^{(\beta x + \alpha)\frac{1}{2}}}{(1 + \alpha)(3x + \alpha)} \]

\[ A = 302.2 \]
Illustration 3. Jevons's experiment on work and fatigue. Jevons's primary objective with his experiments was to show how political economists could "make some commencement, however humble, of defining the mathematical relations upon which the science of economy is founded" (1870, 158). Jevons made three different types of experiments (with himself as the experimental subject): throwing weights, lifting weights with pulley and block, and holding weights on a stretched arm, that he clearly considered to mimic conditions of real work. According to Jevons, due to the "natural constitution of the muscles" a workman was only able to develop a "limited amount of force in a given time" that would at some point be offset by the increase in fatigue caused by the intensity and rapidity of the exertion. Thus, a "maximum efficiency" would be reached somewhere "in every kind of work" (1870, 158). A further analysis of Jevons's experiments by the Irish physicist Samuel Haughton showed that Jevons's experiments could be explained by invoking the principle of least action.
Illustration 4. Jevons's graphical representation of his theory of labour. *Theory of Political Economy*, 1871,168. At m pleasure and pain balance at the margin. Jevons’s description is in terms of a workman’s “energetic disposition”. This determines the form of the curves. The y-axis represents the pleasure and pain of labour (above and below the origin respectively). The x-axis represents the amount of the produce. The curve p-q gives the "utility of the produce". The curve a-b-c-d represents the variational law of labour. With the exception of the interval b-c in which pleasure is derived from the exertion of labour itself (relating to the "spontaneous energy" of the body), labour is considered as a pain. Only this arc of the curve was, Jevons made clear, relevant to the economist. Thus contrasting the "painfulness of labour" with the "utility of the produce", the workman's decision to supply labour was fixed at the point where marginal increments equalised at a given "day's wages". The workman "balanced" the increment of pleasure of the produce with the increment of the "irksomeness" of the exertion of work. Jevons considered the workman as if he was automatically following a strategy of maximising pleasure, while minimising pain, just as expressed in the principle of least action. The equilibrium was given at "some point" m, that is where the marginal increment of pleasure m-q equals the marginal increment of pain m-d (notice that both curves depict increments of pleasure and pain, not totals). Though the general shape of the curves in his diagram was for Jevons beyond doubt, their exact shape and numerical values differed among individuals, professions, races, and even nations. In general,
natural disposition and training were the determining factors in a person's "energetic disposition" to feel labour as a pain. In the second edition of the Theory Jevons emphasized that the linkages between someone's energetic disposition and his feelings of pleasure and pain could be modified by training, but could not be ignored. Even for "the highest kinds of labour, such as those of the philosopher, scientific discoverer, artist, &c." great success never came easily: "the mental powers must be kept in perfect training by constant exertion, just as a racehorse or an oarsman needs to be constantly exercised" ([1879] 1970, 197-8). The very comparison shows that for Jevons there was no difference between the use of the mental powers and those of the hands; both obeyed the same laws which in the end reduced to physiological mechanical laws. The labour supply decision was posited as a physiological problem, requiring a physical solution. In the Theory of Political Economy Jevons smoothly moved his arguments from a discussion of the physiology of a workman to his psychological motivational structure. Jevons described the labour potential of a workman as a fund of energy the use of which gave rise to "agreeable" or "painful" sensations. According to Jevons "a few hours" work per day might be considered agreeable. However, "so soon as the spontaneous energy of the body is drained off, it becomes irksome to remain at work. As complete exhaustion approaches, continued effort becomes more and more intolerable" (1871b, 166). As the steam-engine used coal in providing work, so the workman used his initial fund of energy over the day to end physically exhausted. For a given wage the workman would only supply such an amount of labour that would "leave a balance in his favour" (162).
Zusammensetzung der Arbeitscurv.

- Gebundene Curv.
- Übungscurv.
- Ernährungscurv.
- Anregungscurv.
- Gefährdungscurv.
- Willensgriff.
Illustration 6. Emil Kraepelin's Work curve, From *Philosophische Studien* (1902), table II (from a study of Lindley into the effects of work-time breaks on work performance). The horizontal axis measures time (each five minutes), the vertical axis measures the “found values” of performances of a task for one hour. The dotted line indicates a break of 30 minutes, after which the experimental subject (A) restarts the task. Since A does not have to perform for 30 minutes, the “will-curve” is interrupted for 30 minutes as well. The courses of the other curves are theoretical conjectures which Kraepelin argues for in his article. These are all subjected to intense scrutiny by Weber.
references


