HAUNTED THOUGHTS OF THE CAREFUL EXPERIMENTALIST:

PSYCHICAL RESEARCH AND THE TROUBLES OF EXPERIMENTAL PHYSICS

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1. INTRODUCTION

The relationship between psychical research and the established sciences has been disputed ever since the controversial field of enquiry was put together in the early 1880s (Bensaude-Vincent & Blondel, 2002; Brower, 2010; Coon, 1992; Gauld, 1992; Mauskopf & McVaugh, 1980; Sommer, 2012; Sommer, 2013; Wolffram, 2009). The perceived relevance of psychical research to different scientific disciplines was powerfully illustrated by the membership of the earliest psychical research organisations — notably, the British and American branches of the Society for Psychical Research and the French Institut Générale Psychologique — which included many distinguished psychologists, physicists, chemists and biologists. One of the reasons why psychical research appealed to different kinds of scientific practitioner was because the psycho-physical phenomena defining the field of enquiry appeared to be relevant to, and promise new ways of extending, different sciences. The phenomena included those most relevant to psychology (telepathy, hallucinations and automatism), to physics (telekinesis and various optical, acoustical, electrical and thermal effects), and to physiology (materialised spirits, ectoplasm and externalised vital forces). But the complexity of psychical phenomena caused at least as much difficulty as excitement for scientific practitioners: many of them appeared to defy widely-held conceptions of space, time and matter and, as spectacularly suggested by those effects ascribed to spirits of the

dead, directly linked secularising scientific enquiries to profound metaphysical and religious questions. These latter problems fuelled the far larger controversy about psychical research's scientific status. Its methods were drawn from a host of intellectual enterprises including historical criticism, jurisprudence, medicine, physics, and the new sciences of psychology, but for many late nineteenth and early twentieth century scientists, these neither ruled out fraud, self-deception and other major sources of experimental error, nor seemed to give repeatable results under acceptable conditions. These were among the reasons commonly given for the perceived indifference or hostility of 'official science' towards the subject (Anon., 1926a; Murchison, 1927). Mauskopf & McVaugh (1980) showed that even by the 1930s, when some psychical researchers had strategically redefined their field of study 'parapsychology' and enjoyed modest recognition by professional psychologists, these methodological problems remained and left psychical research an 'elusive science'.

Much historical analysis of the relationship between psychical research and the established sciences has focused on the ways in which theories and ideas in psychology, biology, and physics flowed to and, occasionally, from psychical research: this literature shows how, in the nineteenth and twentieth centuries, psychical research was shaped by and sometimes helped shape psychological and psychiatric theories of mental dissociation and the unconscious; how conceptions of electricity, energy and ether offered possible physical explanations of telepathy, telekinesis and disembodied souls; and how ectoplasm and evidence of mind independent of body extended biological theorising about protoplasm and 'guided' evolution respectively.[1] However, since the 1990s, historians have turned

[1] On the relationship between psychical research and psychological sciences see Bensaude-Vincent & Blondel (2002); Crabtree (1993); Gauld (1992); Gyimesi (2012); Hacking (1984); Le Maléfan (1999); Lamont (2013); Koutstaal (1992); Lachapelle (2011); Plas (2000); Sommer (2012); Sommer (2013); Takasuna (2012); Valentine (2012) and Brancaccio's contribution to this issue. For biology see Bowler (2001), pp. 181-184; Brain (2013); Kottler (1974); Smith (2008); Turner (1974), pp. 68-103 and Marazia & de Sio's contribution to this issue. For physics see Collins & Pinch (1982); Kaiser (2011), pp. 65-95; Noakes (2004a, 2005, 2008); Oppenheim (1985), pp. 326-390; Raia (2007); Staubermann (2001); Wilson (1971).

increasingly to the procedural aspects of psychical research and shown how expertise and instruments from such fields as experimental psychology, electrical engineering and physics were used in a bid to achieve greater control over the notoriously capricious effects and to reduce the possibility of fraud and observational error (Blondel, 2002; Bordogna, 2008, pp. 91-136; Brower, 2010, pp. 45-74; Chéroux, 2005; Noakes, 1999; Noakes, 2002; Wolffram, 2009, pp. 131-189). All of these studies emphasise how difficult it was for psychical research to secure the credibility of séance spaces transformed into laboratories. These hybrid spaces needed to create the conditions that would persuade scientific critics that fraud and experimental error had been eliminated but these conditions often conflicted with those that the chief instruments of research — the mediums — insisted were required for producing the effects under investigation.

Continuing this focus on the procedural aspects of psychical research, this paper argues that psychical research prompted many nineteenth and twentieth century physicists to reflect critically on practices commonly used in the fields with which they were professionally associated. Indeed, their tolerance of the practical problems in psychical research owed much to what they perceived to be comparable issues in an established scientific field. Their explicit comparisons of psychical research to experimental physics were not merely rhetorical strategies designed to give scientific credibility to psychical research: they reflected a genuine conviction that these apparently divergent areas of enquiry shared many experimental problems and might share solutions. The focus on British physicists arises principally from the fact that, more than most professional scientists involved in psychical research in the decades around 1900, they volunteered some of the most illuminating insights into the shared problems of experiment in established and psychical sciences. It is not surprising that the same individuals feature in much recent work on the problems of experimental practice in nineteenth century sciences. They were among

those who, in their pursuit of accurate measurement and the stabilisation of novel, transient and unruly effects, went to extraordinary lengths to avoid, measure and investigate environmental disturbances, and to master recalcitrant apparatus (Dörries, 1994; Gooday, 1997, 2004; Morus, 2010; Ramalingam, 2012; Schaffer, 1992, 1995, 2012). Schmidgen (2003) has shown that similar problems were faced by late nineteenth and early twentieth century experimental psychologists who transformed their laboratories to reduce the auditory and other disturbances made by the very instruments used to measure reaction times of the psychological subjects using the instruments. These psychologists included figures such as Hugo Münsterberg who, as Coon (1992) and Lamont (2013) have argued, defined the emergent science of psychology in opposition to psychical research. But while experimental psychologists believed their use of instruments and techniques of experimental physics helped them make clear distinctions between 'scientific' psychology and the 'unscientific' approaches of psychical researchers, the physicists analysed here believed some aspects of experimental physics blurred this distinction.

2. THE METHODOLOGICAL PROBLEMS OF PSYCHICAL RESEARCH

In 1884 the British psychologist and co-founder of the Society for Psychical Research (hereafter SPR) Edmund Gurney explained that the way in which psychical researchers arrived at truths

> has often no relation at all to the ordinary rules of experimental procedure; and the right attitude to new facts depends here on something which is both more and less than laboratory and hospital experiences. The method is wider but less precise, more various but less technical; and the application of it demands disengagedness rather than any specialised aptitude (Gurney, 1884, p. 472).

He was not the only early proponent of psychical research who held that the methods of the nascent field of enquiry could be legitimately regarded as scientific, but that they drew only incidentally on examples from established scientific fields such as psychology, psychiatry, physics and physiology.[2] The SPR's approaches to the abnormal psychological states of spiritualist mediums and mesmerised individuals borrowed directly from those used to study hypnosis at the Salpêtrière Hospital in Paris and the Medical School in Nancy (Gurney, Myers and Podmore, 1886). Likewise, some of the most widely-cited studies of the capacity of mediums to move objects at a distance exploited the techniques and instruments in experimental physics for detecting and measuring subtle physical forces.[3] But so much else in psychical research relied on skills not associated with medicine and the physical sciences: increasingly, from the 1880s leading SPR members held that the expertise of a conjuror was at least as important as someone trained in the sciences to establish whether mediums played tricks, and agreed that evidence for a telepathic faculty depended on the careful staging of card-guessing experiments and the critical analysis of written and oral testimony of people whose apparent experience of apparitions coincided closely with the time of the death or crisis of the persons represented in the ghostly manifestations. It was precisely because telepathy proved to be the least controversial of all the SPR's claims that by the early twentieth century some SPR members would have agreed with the French philosopher Henri Bergson who defined the organisation's principle 'method' to be 'midway between that of the historian and the magistrate' (Bergson, 1913, p. 160).

The methodological problems articulated by Gurney and Bergson sparked much conflict within the early SPR although these merely continued disagreements that had plagued study of psychical phenomena for decades (Cerullo, 1982, pp. 57-87; Williams,

[2] See, for example, Sidgwick (1882-3), pp. 246-247.
[3] For example, Crookes (1874), Zöllner (1880).

1984). Recent studies of nineteenth century mesmerism and spiritualism have shown that controversies over the existence and interpretation of puzzling psycho-physical effects were also controversies over the forms of expertise and procedures judged appropriate for solving these problems (Barrow, 1984; Cerullo, 1982; Lamont, 2013; Noakes, 2004b; Sommer, 2013; Williams, 1984; Winter, 1998, pp. 276-305). Many agreed with the British pioneer of physiological psychology William Benjamin Carpenter who, throughout the mid-nineteenth century, argued that the phenomena of mesmerism and spiritualism were largely manifestations of mental mechanisms well-known to physiologists and physicians, and that these practitioners represented the foremost scientific authorities on the issue (Carpenter, 1853, 1871, 1877b). Conversely, there were many who were convinced that mesmeric and spiritualistic phenomena could not be explained by existing scientific theories and correspondingly held that the true experts were simply people with greater experience of the phenomena in question, and these included the humble mesmeric practitioner and participant in domestic séances whose minds had not been blinkered by specialist scientific training (Sargent, 1869; Townshend, 1854; Wallace, 1875).

Central to most of these disputes were profound disagreements over the conditions under which psychical phenomena were witnessed and subjected to 'scientific' investigation. Few developments in the early history of psychical research provoked more debate on this question than the experimental tests of spiritualistic phenomena published in the 1870s by distinguished scientific savants such as the English naturalist Alfred Russel Wallace, the English chemist William Crookes, and the German astrophysicist Johann Carl Friedrich Zöllner. All three declared their belief in the objective reality of a range of phenomena frequently observed in séances: Wallace asserted that the invisible intelligences that rapped out messages in the presence of mediums were genuine spirits of the dead, and that such spirits could be captured on photographic plates; Wallace and Crookes vouched that mediums

could move objects without contact and materialise denizens of the spirit world; both Wallace and Zöllner claimed that in the presence of a medium, disembodied spirits produced writing between enclosed slates; and Zöllner published experimental evidence that the American medium Henry Slade could tie knots in continuous pieces of string by exploiting a power to access a fourth dimension.[4]

Wallace, Crookes and Zöllner convinced only a minority of scientific peers of their particular verdicts or allayed long-held doubts about séance procedures. Typical was the popular scientific periodical *English Mechanic and World of Science* which, in the wake of Crookes's investigations of the early 1870s, carped that most of the 'alleged phenomena' of spiritualism remained 'for the most part exhibited under conditions either plainly suggestive of imposture, or clearly consistent with delusion. Stipulations for a dark room, concerted arrangements of furniture, and a company predisposed by credulity to the reception of impressions are not terms likely to commend themselves to the students of physical science' (Anon., 1873). Even those not normally regarded as being 'predisposed by credulity', such as trained scientific observers, could be seen as the victims of tricks played by mediums and their accomplices, and powerful illustrations of the limits of particular forms of scientific expertise. One of Carpenter's most damaging criticisms of Wallace, Crookes and other scientific practitioners who declared that spiritualistic phenomena were objectively real and due to some invisible intelligent agency was that their scientific education was simply too specialised and had not given them the capacity to guard against self-deception, mediumistic fraudulence and other pitfalls in enquires beyond their normal areas of expertise (Carpenter, 1871). As he warned in 1876, the trouble with physicists who made forays into spiritualism was their 'ignorance of *the nature of their instruments of research*; putting as much faith in

[4] The publications consolidating these scientific practitioners' key investigations into spiritualism are Crookes (1874a); Wallace (1875); Zöllner (1880).

tricky girls or women, as they do in their thermometers or electroscopes'.[5] The argument was developed by the eminent German psychologist Wilhelm Wundt who, during a scathing attack on Zöllner, argued that since scientific practitioners were trained to have an 'unshakeable confidence' in nature's honesty and uniformity then they had no authority in experiments where the object of enquiry was potentially deceptive and had control over the experimenters themselves: the true authorities on mediumship were conjurors who also understood the 'scientific scope of this question'.[6]

The foundation of the SPR and other psychical research organisations was partly an attempt to establish investigative methods that would withstand the criticism that had been levelled at spiritualism, mesmerism, thought-reading and related practices for decades, but which would not also upset the conditions under which psychical phenomena appeared. Balancing these objectives proved enormously difficult: the SPR's painstaking approach to the question of telepathy and its exposure of mediums such as Helena Blavatsky and William Eglinton certainly helped raised its intellectual profile, but alienated it from spiritualists and theosophists who judged such methods to be callous, hasty and altogether unscientific.[7] In many ways the leading physicists at the SPR found themselves torn between the methodological positions that emerged within the organisation, especially those relating to the investigation of the physical phenomena of spiritualism. On the one hand, they agreed with Eleanor Sidgwick and other leading SPR members that psychical research's scientific credibility hinged on how well its methods could safeguard against mediumistic trickery and the errors of observation, manipulation, recording and memory often made by investigators

[5] Carpenter (1876), p. 1282. Emphasis in original.

[6] Wundt (1879), pp. 581-582. For discussion see Sommer (2013), 214-229; Staubermann (2001); Wolfram (2009), 37-41.

[7] . For the internal splits see Cerullo (1982), pp. 57-87 and Williams (1984). John Tyndall, the Irish physicist and notable exponent of scientific naturalism, was a notorious critic of spiritualism and 'no admirer' of the SPR but, following the Blavatsky 'exposure', was pleased that the organisation had 'done the service of unmasking an impostor': John Tyndall to El Medini, 23 August 1889, f. 30, Add. 41295, Department of Manuscripts, British Library.

(Sidgwick, 1886-7). On the other hand, physicists were more anxious than many SPR members that an overly hostile and impatient approach to mediums was destroying opportunities to test and establish what one notable physicist member upheld as 'certain remarkable and valuable facts wholly new to science', and in particular physical science (Barrett, 1886-7b, p. 231). As we shall see in the next section, one of the ways in which they sought to legitimate this balance was by comparing their proposed solutions to the problems of mediumship to those they had developed to handle the tricky instruments of the physical laboratory.

3. TRICKY PHYSICS AND PSYCHICS

In 1876, during a heated debate on spiritualism at the year's meeting of the British Association for the Advancement of Science, William Benjamin Carpenter prompted applause when he proclaimed that '[w]e scientific men accept Mr. Crookes's statements upon the radiometer and upon the whole series of beautiful researches by which he has brought the instrument to its present position. Why do we accept them? Because these can be reproduced at any time, and by any person'. If Crookes could achieve this result with the spiritualistic manifestations, Carpenter added, or other scientists could do same with the abnormal psychological phenomena they reported, then 'we could give them exactly the same attention' (Carpenter cited in Anon., 1876, p. 93). Carpenter thus drew a sharp contrast between Crookes's physical researches, which had resulted in an instrument displaying the mechanical action of heat and light, and his spiritualistic investigations. Like so many nineteenth century contrasts between physical and spiritualistic science, Carpenter's hinged on the ease with which asserted 'facts' could be witnessed: the extraordinary 'statements' that Crookes made about the power of heat and light to move delicate material objects in an

extremely rarefied atmosphere were easier to accept because copies of his radiometer instrument could now be purchased and studied by anybody with the money and interest; the extraordinary statements he made about materialised spirits and 'psychic' forces exuded by mediums, however, were much harder to accept because they were so capricious and contingent on a plethora of conditions.

Crookes, who participated in the debate, would have repudiated Carpenter's stark contrast between his physical and spiritualistic research. The contrast underplayed the extent of the controversy over Crookes's 'statements' about the radiometer, and glossed over the amount of painstaking and often frustrating work that, over the previous six years, Crookes and his laboratory assistants had put into making the radiometer an instrument that was robust enough to work in laboratories, lecture theatres, shop windows and private studies across the world.[8] The radiometer was only the more conspicuous result of a long series of investigations showing that, even in the absence of convection currents, heat and light could exert a considerable mechanical force. Stabilising what was originally a capricious effect had not been easy owing to such difficulties as producing a good vacuum, suspending delicate indicators in glass vessels, and excluding the action of body heat and stray vibrations.[9] Reflecting on his radiometer labours in 1877 Crookes argued that it required a 'man of disciplined mind and of finished skill' to tackle apparently anomalous, 'residual' and 'unanticipated' phenomena of the 'laboratory and of nature', but within 'nature' he implicitly included the 'new forces' of spiritualism.[10] He evidently believed that anybody with the skill to build a delicate indicator of a new radiation force had some of the skills required to study the capricious forces flowing from the bodies of spiritualist mediums. For some of his

[8] For Crookes's radiometer see Brock (2008), pp. 155-178, 211-224; DeKosky (1983).
[9] See, for example, Crookes (1874b), p. 523; Crookes (1875), p. 532.
[10] Crookes (1877), p. 886. This was a response to another attack from Carpenter: Carpenter (1877a).

scientific peers, taming the subtle forces of the radiometer did indeed constitute a 'qualification' for investigating spiritualism (Anon., 1877, p. 88).

One of the reasons why Crookes's 'statements' on the radiometer were taken so seriously by many physicists was because he fulfilled a widely-held expectation that, in research involving novel effects and accurate measurements, experimenters needed to go to extraordinary lengths to show that they had identified, measured, eliminated or otherwise managed sources of experimental error.[11] Among those who faced similar challenges in their own scientific researches were many British physicists who also shared Crookes's interests in psychical research, including William Fletcher Barrett, Oliver Lodge, the Third and Fourth Barons Rayleigh and J. J. Thomson. As we shall see, their physical investigations gave them extensive experience of the same kinds of practical problems that had taxed Crookes: many physical effects were often difficult to see or to reproduce at will, apparatus behaved unpredictably, and some instruments were very sensitive to environmental conditions.[12] Significantly, these physicists often discussed the problems of experimental physics in the context of psychical research, and this was invariably an implicit argument for the relevance of expertise in the former field to that in the latter. Most of them agreed that even the physical phenomena of spiritualism — the most 'physical' aspect of all the complex psycho-physical phenomena associated with psychical research — were problematic for physics because they exhibited the very mental and vital qualities that put them beyond the formal boundaries of physics and made them more appropriate subjects for psychology and physiology.[13] However, perceiving that psychologists and physiologists were reluctant to properly study the subject, they were prepared to lead an extension of physics into these

[11] On this expectation see Brock (2008), pp. 155-178; Gooday (1997).

[12] See, for example, Lodge (1893); Lodge (1893-95); Rayleigh and Schuster (1881); Rayleigh (1930); Thomson (1890); Thomson (1893).

[13] See Lodge's remarks in Lodge (1909a), p. 339.

borderlands (Barrett quoted in Anon., 1876b; Lodge, 1892, p. 555). The remainder of this section examines some of the rhetorical strategies by which they sought to legitimate their ability to handle a transition from the purely physical effects of the laboratory to psycho-physical effects of the séance.

The first example is Crookes who was a good deal more explicit about the similarities between physical and psychical experiment in private than in public. In early 1909 he was alarmed to find that Simon Newcomb, the distinguished American astronomer and one-time president of the American branch of the SPR, had recently published a scathing attack on the achievements of psychical research. Newcomb spoke for many when he charged that twenty-five years of painstaking analysis of the evidence for telepathy had yielded 'scientifically, nothing at all' (Newcomb, 1909, p. 131). He contrasted this to Crookes's investigations into cathode ray phenomena in the 1870s which, in his opinion, had paved the way to such revolutionary discoveries as X-rays and radioactivity. The reason for the SPR's comparative failure was because psychical effects were so difficult to replicate and 'laws and general facts' about them so hard to establish.[14] What annoyed Crookes was that Newcomb's contrast elided the observational and replication problems that often beset branches of physics well known to both of them. As he explained to Oliver Lodge in a private memorandum:

> There are some people so constituted that nothing psychic will take place in their presence. Prof. [Henry] Sidgwick was one. In spite of repeated trials he never witnessed anything. I myself have often tried to see lines beyond the line H in the solar spectrum, but have failed.

[14] Newcomb (1909), p. 135. This compares well to the verdict of the American experimental psychologist Granville Stanley Hall who in 1895 insisted that telepathy had 'yet to find a single fact that can be demonstrated regularly in laboratory courses that proves or even illustrates it with certainty' and that none of the experiments reported in the SPR's publications were held under scientific conditions: Hall (1895), p. 137.

Am I to say that others with sharper eyes who say they can see beyond that line are suffering under a hallucination?'[15]

Lodge's reply is unknown but given his acquaintance with Sidgwick, he would have known that the track record of the distinguished moral philosopher and the SPR's first president in spiritualistic séances was much better than Crookes remembered (Lodge, 1931, pp. 270-281). Nevertheless, Lodge would have found Crookes's argument compelling: the chemist had built his scientific reputation partly on the capacity to distinguish genuine from spurious lines in the spectroscope, and therefore had legitimate grounds for insisting that the problem of capricious and potentially illusory phenomena arose in both physical and psychical research, and that experience of such problems in the physical laboratory furnished a more tolerant scientific attitude towards equivalent problems in the séance.[16] This was not the first time Lodge had heard this kind of argument. A decade earlier his laboratory assistant at University College Liverpool, Benjamin Davies, responded to a letter in a local newspaper arguing that since spirit manifestations contradicted most people's experiences, then Crookes's claims regarding materialised spirits should be dismissed as delusory unless he exhibited a spirit form before scientific witnesses. For Davies a similar charge could be levelled at spectroscopy, a technique in which he too had considerable experience. It was difficult for most people to see bright emission lines beyond the violet but this did not mean that the lines were an hallucination: the 'unanimous opinion of mankind', he urged, was 'useless' here because the 'experience of the majority is narrower than that of the individual who perceives the ultra-violet band' (Davies, 1899). For Crookes and Davies, deference to

[15] William Crookes, typescript memorandum to Oliver Lodge, [circa. 1909], SPR.MS.35/366, Oliver Lodge Papers, Society for Psychical Research Archive, Cambridge University Library (hereafter SPR-CUL).

[16] On Crookes and spectroscopy see James (1988).

more experienced or sharper-eyed observers was critical in questions of both spectra and spectres.

The Third and Fourth Barons Rayleigh would have sympathised with Crookes's and Davies's defences. In their presidential addresses to the SPR they utilised comparisons between the experimental problems of psychical and physical research to challenge what they saw as unscientific attitudes towards psychic phenomena. In 1919 the Third Baron used the cases of meteorites and ball lightning to illustrate scientists' eventual acceptance of capricious physical phenomena that they once deemed impossible and to warn 'those scientific men who are so sure that they understand the character of Nature's operations as to feel justified in rejecting without examination reports of occurrences which seem to conflict with ordinary experience'.[17] Twenty years later his son responded to the charge that psychic phenomena not reported to have occurred in the light must have only manifested themselves under the more suspicious circumstances of darkness. 'We could easily make mincemeat of many of the classics of scientific investigation', he pointed out, 'if we allowed ourselves to criticise in this way' (Rayleigh, 1939, p. 4). Both Rayleigh spoke from experience of their own physical researches being vulnerable to the kinds of criticism often levelled against psychical research, but which had nonetheless gained acceptance by scientific peers: the Third Baron Rayleigh's experimental evidence for the inert gas argon initially proved difficult to replicate and had been challenged in many scientific quarters because it conflicted with the 'ordinary' conceptions of chemical and physical properties of atoms based on Mendeleev's periodic table and the kinetic theory of gases respectively; and the Fourth Baron's published studies of the faint luminous glows of gases and metallic vapours, the light

[17] Rayleigh (1919-20), p. 285. Barrett had made similar use of the ball lightning case several decades earlier: Barrett (1886-7a), p. 38.

of the night sky, and the 'green flash' at sunset could all have been turned into 'mincemeat' because they involved effects that could not be observed under bright light..[18]

For other British physicists it was experience of the waywardness of laboratory instruments, rather than of the caprice and evanescence of natural effects, which made them especially tolerant of the experimental problems of psychical research. In late 1894 Lodge published, in a periodical circulated exclusively to SPR members, the results of his recent investigations into the most powerful but controversial spiritualist medium of the period, Eusapia Palladino. In the early 1890s Palladino's apparent abilities to move objects at a distance had astounded most of the people whom she allowed to test her, and these included the Italian criminologist Cesare Lombroso and the French physiologist Charles Richet. Lodge shared Richet's conviction that Palladino's feats were difficult to attribute to trickery, self-delusion and the operation of a power known to science, but had to confront mounting suspicions that on many occasions she had resorted, either consciously or unconsciously, to fraud. He accepted that it was appropriate to harbour doubts about her honesty, but thought it poor scientific practice to make 'unfair accusations' (Lodge, 1893-4, p. 324). Levelling such accusations against Palladino could make her unwilling to cooperate and therefore ruin an opportunity to study a potentially genuine ability to manipulate mechanical force and energy at a distance. To avoid this disastrous outcome, Lodge counselled fellow psychical researchers on the use of instruments in experimental physics. This seemed to be an unusual strategy for someone who explicitly acknowledged that since the 'chief instrument of research' in psychical investigations was a human being, then they required 'humane and cautious treatment of a kind quite different from that accorded to ordinary apparatus' (Lodge, 1893-4, p. 357). Making experimental physics relevant to psychical research was also

[18] On the argon controversy see Guinta (2001). For the Fourth Baron's scientific work see Egerton (1949).

unusual for someone who, only few years later, would emphasise that excluding sources of vital activity from instruments and laboratories was critical to a 'definite and dependable physics' (Lodge, 1909a, p. 339). However, for Lodge even 'ordinary apparatus' often behaved in ways that threatened the prospects of a 'dependable physics' and this provided salutary lessons to the psychical researcher. Possibly drawing on the content and style of his physics lectures to Liverpool undergraduates, he advised SPR members to treat Eusapia Palladino

> not as a scientific person engaged in a demonstration, but as a delicate piece of apparatus wherewith they are making an investigation. She is an instrument whose ways and idiosyncrasies must be learnt, and to a certain extent humoured, just as one studies and humours the ways of some much less delicate piece of apparatus turned out by a skilled instrument maker.
>
> A bad joint in a galvanometer circuit may cause irregular and capricious and deceptive effects, yet no one would accuse the instrument of cheating. So also with Eusapia: it is obviously right to study the phenomena she exhibits in their entirety, so far as can be done with such a complicated mechanism, but charges of fraud should not be lightly and irresponsibly made — however justified such charges may have been in other cases.[19]

Lodge's insistence that Palladino should be treated more like an inanimate instrument that unconsciously and unintentionally mediated effects rather than a person who consciously 'demonstrated' them would not have convinced those who suspected that Palladino wielded far greater control over the effects and investigators than she insisted, and that her mediumship was accordingly a matter for psychologists or stage magicians rather than physicists.[20] Nevertheless, the sympathetic and patient approach to delicate instruments that

[19] Lodge (1893-4), p. 324. Bad electrical contacts were not the only sources of trouble in galvanometers: the silk fibre from which the needle pointers were suspended was sometimes blamed for causing unpredictable movements: see, for example, Bosanquet (1886).

[20] Importantly for Lodge, this view was shared by two of his closest colleagues: James Alfred Ewing to Oliver Lodge, 22 September 1894, Oliver Lodge Papers, University College London (hereafter OJL-UCL), MS.Add.89/33; Oliver Heaviside to Oliver Lodge, 11 January 1895, OJL-UCL, MS.Add.89/50, No. 91.

Lodge was advocating would have carried weight with some SPR members because they recognised him as an authority on precisely this aspect of the material cultures of physics. They would have known about his widely-publicised memorial lectures on the recently deceased German physicist Heinrich Hertz in which he explained how he had used 'bad joints' to develop detectors of electromagnetic waves.[21] Drawing partly on the work of French physicist Éduoard Branly, Lodge's 'coherers' comprised metallic contacts separated by small air gaps which were temporarily closed on exposure to the waves, and this completed an electrical circuit in which the detectors were placed. The capricious behaviour of electric currents through bad contacts was familiar to most physicists and electrical engineers, and Lodge was one of many who believed that patient study of them revealed intelligible physical causes rather than any inherent deceptiveness.[22] In one public lecture he modestly suggested that '[p]erhaps some of the capriciousness of an anathematised bad contact was sometimes due to the fact that it was responding to stray electric radiation' (Lodge, 1893-95, p. 343). By the same token, the patient study of Palladino and other mediums would accept the possibility that capricious behaviour might be due to obscure physiological and psychological causes over which they had no control rather than wilful deception.

Lodge was not the only academic physicist for whom lessons taught to physics students about instruments were of relevance to psychical research. When, in 1896, J. J. Thomson, reflected on the recent progress in university physics teaching he emphasised the challenge of maintaining the 'youthful enthusiasm' of a student faced with learning the 'pitfalls and errors to which all experiments are liable'. 'Any investigation in experimental

[21] Some may have known of Lodge's other experiments to detect the dragging effect of rapidly moving matter on the ether of space, experiments that required Lodge and his assistants to master a range of complex and recalcitrant instruments: Lodge (1893). For discussion of this research see Hunt (1986).

[22] See, for example, Heaviside (1892), vol. 1, pp. 181-190.

physics requires a large expenditure of both time and patience', added the director of Cambridge University's physics laboratory, 'the apparatus seldom, if ever, begins by behaving as it ought; there are times when nature seems to be against us: the instruments behave in the most capricious way, and we appreciate Coutts Trotter's saying, that the doctrine of the constancy of nature could never have been discovered in a laboratory'.[23]

Though not meant to be taken literally, Coutts Trotter's humorous remark captured not only the situation faced by Thomson's frustrated students, but by Thomson himself in the context of the physical and psychical researches he pursued in parallel during the 1890s. This was the period when he was investigating the mechanism by which electricity passed through gases, although his progress had been hampered by the 'capricious' results produced when using powerful electric fields and hot gases to facilitate the discharge.[24] A patient approach to the problem seemed to pay off since in 1896 the discovery of X-rays provided a new way of rendering gases more conducting and of producing stable effects that lent themselves to accurate measurement (Thomson, 1936, p. 325). The year before, Thomson exploited this solution to a difficulty in physical instrumentation, he had been wrestling with a far more complex 'instrumental' problem. With Lodge, the Third Baron Rayleigh and other leading SPR members, he participated in a series of séances with Palladino in Cambridge which led to the sensational discovery of her conscious trickery and the SPR's severance of its public association with a 'tainted' medium.[25] Yet the question of Palladino's powers was far from resolved. Many scientific investigators, including Lodge and Richet, maintained that their earlier evidence for her telekinetic abilities was not vanquished by new evidence of conscious

[23] Thomson (1897), p. 700. Coutts Trotter was a Vice-Master of Trinity College, Cambridge, and a major figure in the teaching of the natural sciences in Victorian Cambridge: see Foster (1887).

[24] See, for example, Thomson (1890), (1893). J. J. Thomson's own exasperation at the unpredictable behaviour of apparatus inspired lines in a comic song sung by his research students at the Cavendish Laboratory. "I've got a lot of two volt cells that sometimes need repair, / I've got some electrometers that sometimes make me swear": A. A. R[obb], 'J. J.', in Anon (1926b), pp. 8-9, p. 8.

[25] Lodge (1897), p. 166. Thomson's contribution to the Cambridge séances is documented in notes taken by Alice Johnson and other SPR members: Eusapia Palladino Collection, SPR-CUL, SPR.MS.41/1.

trickery, while others, such as Italian psychiatrist Enrico Morselli and the French psychologist Julien Ochorowicz, argued that evidence of Palladino's *unconscious* trickery still required further investigation and explanation (Lodge, 1895; Morselli, 1907; Ochorowicz, 1896). Thomson recollected the ambiguous situation when, in his 1936 autobiography, he agreed that while Palladino had deliberately cheated in the Cambridge sittings — by surreptitiously freeing her hands from the grasp of those around the séance table — Lodge, Richet and others had witnessed her powers under far better circumstances.[26]

One of the reasons why Thomson was more willing to tolerate Palladino's caprices was probably because she represented only a more complex form of an instrumental problem that he had often encountered in experimental physics. This is suggested by his application, in an autobiography of 1936, of the Coutts Trotter quip to the case of psychical research. He warned those who failed to detect the alleged telekinetic effects on their 'physical instruments of very great delicacy' to remember that the 'instrument' supposed to be producing the effects was 'very psychic and impressionable, and it may be as unreasonable to expect them to produce their effects when surrounded by men of science armed with delicate instruments, as it would for a poet to be expected to produce a poem while in the presence of a Committee of the British Academy'. Since a human being was capricious, and made even the 'most complicated physical apparatus' look like 'simplicity itself', then psychical researchers needed to be especially mindful of the experimental virtue of patience implied by Coutts Trotter's quip (Thomson, 1936, p. 153).[27]

For William Fletcher Barrett the delicate instruments of physics had a slightly different lesson for psychical research: self-restraint in the séance. He made the point during

[26] See Lodge (1893-4).

[27] A 'psychical' use of a form of Coutts Trotter's quip was being used in 1986 when the Irish physicist John Bell defended the unreliability of parapsychological experiments by pointing out that "electrostatics could never have been convincingly demonstrated in my own country – because of the damp". Quoted in Kaiser (2011), pp. 167-168.

a lecture in 1894 to the London Spiritualist Alliance, one of the largest British spiritualist organisations of the day. Many of Barrett's auditors would have been circumspect about involving any kind of scientist in séances because of their apparent tendency to treat mediums like relatively crude pieces of apparatus – apparatus that could be rudely prodded, tightly bound to chairs, or exposed to bright light. Barrett sought to reassure spiritualists that experience of *particular* kinds of laboratory instrument ought to make physicists a good deal more sympathetic to the potentially negative effect that their very presence could have on the outcome of séances. 'In every physical process we have to guard against disturbing causes', he explained

> If, for example, Professor S. P. Langley of Washington, in the delicate experiments he is now conducting – exploring the ultra red radiation of the sun – had allowed the thermal radiation of his assistants to fall on his sensitive thermoscopes [bolometers], his results would have been confused and unintelligible. We know that similar confused results are obtained in psychical research, especially by those who fancy the sole function of the scientific investigator is to play the part of an amateur detective; and accordingly what they detect is merely their own incompetency to deal with problems the very elements of which they do not understand and seem incapable of learning.

Langley's bolometers helped Barrett justify a scientific and moral argument against aggressive 'detective' behaviour towards mediums. Such behaviour threatened to destroy the very conditions under which the claimed effects could be seen and smacked of 'vulgarity' and 'inappropriateness' (Barrett, 1894, p. 584). Barrett's rhetoric extended a common spiritualist analogy between mediums and photographic plates, which saw both as instruments whose capacity for registering invisible phenomena would be seriously undermined by an inappropriate use of light. Lending authority to Barrett's argument would have been his well-known public demonstrations and popular articles on the extraordinary sensitivity of physical instruments to the human body, including the sensitive flame (which

responded to inaudible sounds) and Thomas Alva Edison's tasimeter (another highly sensitive detector of heat) (Barrett, 1879a, 1879b).

The value of experimental physics to psychical puzzles was appreciated beyond the small group of psychical physicists explored above. Attempts to use the hardware of the physical laboratory to control mediums and to detect psychic effects were often praised by spiritualists and psychical researchers, while the 'delicate' conditions under which much physical research was done was used by some non-physicists to show how physics represented an important stepping stone from the scientific investigation of inert bodies to that of highly sensitive living beings.[28] But in these quarters the step from 'delicate' physics to psychical research was still seen to be enormous and it was with this that psychical physicists had increasingly to contend in early twentieth century.

4. THE LIMITS OF PHYSICS IN PSYCHICAL RESEARCH

Barrett's analogy between spiritualist mediums and sensitive instruments was much more radical in its objective than those drawn by Lodge or Thomson. He wanted to illustrate that bodily *and* mental self-control were necessary to the successful demonstration of psychic effects. While accepting that the nature of the 'psychical state' enabling mediums to commune with the spirit world remained a mystery, he judged it very probable that the psychical state of those present 'will be found to react on the medium' (Barrett, 1894, p. 585). This would hardly have been news to most of his spiritualist auditors who had long understood that the attitudes and temperaments of spiritualistic enquirers partly determined the success or failure of séances.[29] For Barrett, it was a plausible inference to draw from the

[28] Burns (1875); Carrington (1921), pp. 82-92; Rochas (1906), pp. 471-504Sargent (1881), pp. 141, 180-181. Citation from Joire (1916), p. 548.

[29] See, for example, 'M. A. (Oxon.)' (1890).

evidence for telepathy that he and his SPR colleagues had been amassing and analysing since the 1870s. Moreover, the 'profound' differences that appeared to exist between physical and psychical experiment prompted him to gloomily anticipate that even the physical phenomena of spiritualism might 'never be demonstrated by purely physical methods of investigation'.[30]

There is no evidence that other psychical physicists shared Barrett's concern about the possible telepathic effect of investigators on psychic subjects, but by the early 1900s they too had accepted that expertise in physics, including that gained through experience of tricky instruments, was not as important to psychical research as they had first envisioned. The shift in attitude is clear when considering the changing ways in which Crookes and Lodge defined scientific approaches to psychic phenomena. In the 1870s Crookes accepted that the physical phenomena of spiritualism depended on 'rare physiological and psychological conditions' but maintained that purely physical expertise – in particular the ability to manipulate accurate measuring instruments – constituted a major attribute of scientific investigator in this field enquiry and made him 'more than a match' for a conjuror.[31] Forty years later, however, he had conceded much ground to the psychologist and conjuror. Addressing the British Association for the Advancement of Science in 1898 he defined psychical research as a branch of 'Experimental Psychology' that 'unites the difficulties inherent in all experimentation connected with *mind*, with tangled human temperaments and with observations dependent less on automatic record than on personal testimony' and which had benefitted from the 'detective genius' of the SPR's Richard Hodgson, whose exposures of mediums and studies of conjuring had furnished a 'convincing demonstration of the narrow limits of human continuous observation'.[32] Like Crookes, Lodge had long located

[30] Barrett (1903-4), p. 331; Barrett (1886-7a), p. 42. Barrett reiterated this in later publications such as Barrett (1920-21), p. 28.

[31] Crookes (1870); Crookes (1871), p. 347; Crookes quoted in Anon. (1876a), p. 89.

[32] Crookes (1899), p. 32. Emphasis in original. Crookes's identification of psychical research with experimental psychology would have infuriated American psychologists who defined their emergent field in

spiritualistic phenomena in the borderland of physics, physiology and psychology, but in the early 1890s he could still confidently proclaim that the investigation of the region could be spearheaded by physicists (Lodge, 1892, p. 555). But by 1910s he too had conceded ground to the conjurors. In a debate with the SPR's Research Officer Alice Johnson he agreed that training in both the sciences and conjuring, as well as long experience of psychic effects, were useful in psychical research, although he maintained that 'learning by direct observational experience' was a good reason to believe that the 'man of science has an undeniable advantage' over the 'man of letters or a philosopher' in this enquiry (Lodge, 1909-10, pp. 254-55).

Crookes's and Lodge's later positions were clearly designed to placate audiences that would have been ambivalent at best about the general competence of a physicist confronting human subjects of experiment. Their remarks also spoke from direct and indirect knowledge of the 'tangled human temperaments' of psychic subjects and the perils of treating them as even the trickiest instruments of physics. From the mid-1870s Crookes and Lodge, and those SPR physicists closest to them, had to cope with powerful, widely-publicised and professionally embarrassing evidence that the psychic subjects they claimed had produced genuinely inexplicable effects had deceived them and other investigators. Since most of the mediums in question were women then these arguments were often underpinned by suspicions that investigators had fallen victim to feminine charms. Crookes faced the problem in the mid-1870s with Florence Cook, Annie Eva Fay and other 'physical' mediums; Barrett faced it in the 1880s with the Creery sisters for whose thought reading powers he had

opposition to what they saw as the dilettante, methodologically sloppy and excessively speculative approach of psychical research: see Coon (1992); Lamont (2013), pp. 198-241; Sommer (2013).

earlier vouched; and, as we saw in the last section, Lodge, the Third Baron Rayleigh and Thomson faced it in the mid-1890s with Eusapia Palladino.[33]

This was grist for the mill of spiritualism's and psychical research's fiercest critics. In 1899 the revelations about Palladino prompted the eminent German-American experimental psychologist Hugo Münsterberg to declare that the psychical researches of all kinds of scientific practitioner, including the physicist Crookes and the physiologist Richet, 'do not impose on me in the least; for their daily work in scientific laboratories was a continuous training of an instinctive confidence in the honesty of their co-operators'. Doubtless to the delight of many 'anti-spiritualist' conjurors of the day, Münsterberg urged that the scientist should be 'at once dismissed from the jury, and a prestigitator substituted' (Münsterberg, 1899, p. 78). In contrast, some of Münsterberg's younger colleagues reiterated the argument that some kinds of scientist remained critical to psychical research, but not those represented by the likes of Crookes, Lodge and Richet. Writing in 1927 the American psychologist John Coover concluded that Crookes's investigations of spiritualism were among many showing the woefully poor control that some kinds of scientific practitioner wielded over their psychical 'experiments' and the need to defer to experts in the psychology of deception – i.e. experimental psychologists.[34] These were only the more predictable quarters from which psychical physicists would receive criticism: of greater consequence to them would have been physicist colleagues who maintained that physics simply could not deal with 'instruments' that cheated, or who relayed concerns that psychical research had tainted their reputations.[35]

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[33] For Crookes and mediums see Brock (2008), pp. 179-209; Medhurst and Goldney (1964) and Owen (1989), pp. 204-235. For Lodge see Gauld (1968), pp. 221-245. An idiosyncratic analysis of Barrett's troubles is Oppenheim (1985), pp. 359-361.

[34] Coover (1927), p. 254. A similar argument was made several years earlier by the British psychiatrist Ivor Tuckett: Tuckett (1912-1913).

[35] Physicist Edward Da Costa Andrade cautioned Oliver Lodge about cheating psychic 'instruments' in Andrade to Lodge, July 1928, OJL-UCL, MS. Add 89/3. In 1913 Silvanus Thompson warned Lodge that his

In private, Crookes, Lodge and other physicists with psychical interests maintained that *some* aspects of mediumistic performances they had investigated could not be conclusively put down to self-delusion, trickery or experimental error, but in public they were sufficiently mindful of their professional reputations that they largely avoided, or only cautiously referred to their most controversial psychical cases.[36] Both their public and private statements showed an equally strategic acceptance of the more widely-held view that psychical researchers needed collectively to combine the observational, manipulative and interpretative skills associated with a range of sciences, but also expertise in conjuring, jurisprudence and literary criticism (Carrington, 1931, pp. 24-25; Lodge, 1906, p. 474; Lodge, 1930, p. 107). When physical instruments were proposed as tools for investigation they sometimes showed a predictable insistence on physicists being involved.[37]

However, well into the twentieth century there remained an ongoing argument that psychical research and physics shared experimental problems and that physicists' experiences of capricious effects and wayward laboratory instruments made them more important to psychical research than Münsterberg and others claimed. This is evident when, in his debate with Alice Johnson, Lodge appealed to the notorious case of N-rays. In 1903 the French physicist René Blondlot had caused a scientific sensation by publishing evidence of a form of radiation that he claimed marginally increased the brightness of electric sparks and phosphorescent screens (Nye, 1980). There were telling parallels with the physical

'dealings with Eusapia' were a 'continual stumbling block' to bids to secure him the Nobel Prize for Physics, while Crookes's 'spooks' were judged a 'serious ground of objection' to electing him the President of the Royal Society: Thompson to Lodge, 4 January and 21 November 1913, OJL-UCL, MS. Add 89/104.

[36] Crookes made this strategy clear in Crookes to Lodge, 5 July 1909, Oliver Lodge Papers, SPR-CUL, SPR.MS.35/357. This was Crookes's response to Finch (1909) which included a letter alleging that Palladino's 'erotic nature' was the principle way in which she charmed and eventually 'conducts' the scientific 'experimenters'. For examples of Barrett's and Lodge's strategies for coping with 'fraudulent' psychic subjects see Barrett (1911), pp. 61-63; Lodge (1912-13), pp. 335-336.

[37] In 1924 Barrett defended the need for a physicist to be involved in the investigation of the puzzling temperature changes produced in séances with the British medium 'Stella C.': W. F. Barrett to Harry Price, [circa 1924], HPC/4B/10, Harry Price Collection, Senate House Library, University of London (hereafter HP-ULL). A similar view was expressed by London University physicist Guy Burniston Brown over a decade later: Guy B. Brown to Harry Price, 21 August 1935, HPC/4B/30, HP-ULL.

phenomena of spiritualism: N-rays were difficult to replicate, they were best seen under dim lighting conditions, and many of those who did see the effects ascribed them to subjective impressions. Indeed, by 1904 most physicists had accepted powerful evidence that the effects of N-rays were purely imaginary and induced by self-suggestion. Lodge was not the only psychical researcher who used this to illustrate how sensory hallucinations could occur even in established sciences such as physics, but he was one of the few to turn it into an argument for the experimental virtues of experienced physicists.[38] He explained that '[n]ovices brought in to see the effect of imaginary N-rays sometimes saw them. Skilled physicists from [Britain] did not'.[39] *Skilled* physicists better understood how deceptive their own senses and instruments could be, especially under dim light, and thus had the very qualities needed in the psychical researcher. The Fourth Baron Rayleigh, who participated in his father's unsuccessful attempt to observe N-rays, would have agreed (Rayleigh, 1924, p. 359). In his presidential address to the SPR in 1939 he challenged claims that the Austrian medium Rudi Schneider could have used simple mechanical vibrations to fake a genuine ability, evidenced by the French psychical researchers Eugene and Marcel Osty, to telekinetically interrupt an infra-red beam some distance from his body. Rayleigh explained that the deceptive effect of vibrations on the instruments was not unique to psychical research and was the 'sort of thing that constantly haunts the night thoughts of the careful experimentalist'.[40] As far as he was concerned the Ostys had more than adequately shown that they had heeded this key lesson from experimental physics and left the question of Schneider's genuineness entirely open.

[38] See, for example, Sidgwick (1908), pp. 12-16.

[39] Lodge (1909-10), p. 258. Lodge overlooked the number of non-British physicists who failed to replicate Blondot's results: see Nye (1980) and Stradling (1907).

[40] Rayleigh (1939), p. 14. For the Schneider investigation see Gregory (1985).

5. CONCLUSION

The reasons why the early SPR's highest ranks were populated by a significant number of physicists have been the subject of much analysis over the past few decades (Asprem, 2011; Bowler, 2001, pp. 87-101; Noakes, 2005; Oppenheim, 1985, pp. 326-390; Wilson, 1971; Wynne, 1979). What makes this fact especially unusual and worthy of historical enquiry is that psychical physicists themselves recognised psychical research as a problematic region to which the boundaries of physics might be extended, not least because they shared widely-held perceptions that physics was a discipline that formally excluded questions of life and mind, and whose experimental inquiries sought to eliminate vital action as far as possible. The phenomena of psychical research were, as Lodge declared in 1897, 'of a psychological character, none of them clearly and obviously connected with either the physical or the biological region as usually studied' (Lodge, 1897, p. 167). Nevertheless, Lodge was one of many psychical physicists who remained excited by the prospect of exploring a region of extraordinary or unusual physics that overlapped with extraordinary psychological and biological regions, and to which telekinesis, ectoplasm and other startling psycho-physical effects seemed to belong.

Similar to many people in the late nineteenth and early twentieth centuries, psychical physicists explored this region for various intellectual, religious, moral and emotional reasons. Barrett, Crookes, Lodge, the Rayleighs and Thomson, for example, were motivated by the possible discovery of new phenomena and laws hitherto unknown to the sciences; Crookes's and Lodge's interest in evidence for the spirit world took on new personal significance following the death of close relatives; Barrett, Lodge and Rayleigh regarded evidence of supernormal powers and a spirit world as a useful weapons to wield in the ongoing debate about the compatibility of scientific and Christian conceptions of the cosmos. For some, particular theories, concepts and phenomena in the physical sciences – notably the

ether of space and electrical discharge – made some psychic effects more plausible and psychical research scientifically more promising.[41] Taken individually, none of these factors is sufficient to explain physicists' interests in psychical research: there were many physicists who accepted the need for an ether, who sought to reconcile scientific and theistic interpretations of the cosmos, and who suffered bereavement, but who were also wholly indifferent to or actively hostile to spiritualism and psychical research. A combination of intellectual, religious, moral and emotional factors evidently motivated psychical physicists. This paper has suggested that among the 'intellectual' factors were not just the theories, concepts and phenomena of physics, but experiences of the difficulties of performing experimental physics. Again, this alone cannot explain why so many physicists became interested in psychical research, but it may well have contributed to the mix more than historians have assumed.

At the beginning of this paper we noted that historical analyses of the perceived congruence of psychical research and better established sciences such as psychology, physics and biology have tended to concentrate on the flow of concepts, models and theories from the sciences to psychical research. A small but growing number of studies have shown that this congruence also operated at the level of experimental procedure: techniques in psychiatry and experimental psychology were used by architects of psychical research and, moreover, parapsychology to raise the scientific profile of their fields of enquiry; but many professional psychologists recognised that solutions to the practical problems of psychical research were of relevance to a much wider range of scientific enquiries and this made psychical research intellectually more significant (Bordogna, 2008, pp. 91-136; Hacking, 1988; Lamont, 2013; Mauskopf & McVaugh, 1981; Sommer, 2013). Perceived congruences between the experimental problems of psychology and of psychical research are hardly surprising given

[41] For further discussion of these factors see Noakes (2004b), (2005); Oppenheim (1985); Raia (2007).

the close but fraught relationship between these enterprises in the decades around 1900. Those between the experimental problems of non-psychological sciences and of psychical research are more intriguing. This paper has tried to clear up some of this intrigue for the case of physics but much remains: there were some practitioners of the life sciences who, in the twentieth century, echoed the positions of Lodge, Rayleigh and Thomson when they compared the problems of 'instrumental' failure and self-deception in psychical research to those in biology and this appears to have made them more interested in the 'elusive' science (Hardy, 1953-56; Tillyard, 1926). If this paper encourages further analyses of the 'psychical' nature of established sciences then its purpose will have been fulfilled.

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