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Julian Trevelyan, Walter Maclay and Eric Guttmann: drawing the boundary between psychiatry and art at the Maudsley Hospital

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Abstract. In 1938, doctors Eric Guttmann and Walter Maclay, two psychiatrists based at the Maudsley Hospital in London, administered the hallucinogenic drug mescaline to a group of artists, asking the participants to record their experiences visually. These artists included the painter Julian Trevelyan, who was associated with the British surrealist movement at this time. Published as 'Mescaline hallucinations in artists', the research took place at a crucial time for psychiatry, as the discipline was beginning to edge its way into the scientific arena. Newly established, the Maudsley Hospital received Jewish émigrés from Germany to join its ranks. Sponsored by the Rockefeller Foundation, this group of psychiatrists brought with them an enthusiasm for psychoactive drugs and visual media in the scientific study of psychopathological states. In this case, Guttmann and Maclay enlisted the help of surrealist artists, who were harnessing hallucinogens for their own revolutionary aims. Looking behind the images, particularly how they were produced and their legacy today, tells a story of how these groups cooperated, and how their overlapping ecologies of knowledge and experience coincided in these remarkable inscriptions.

Introduction

Hallucinogenic drugs have attracted the attention of a diverse cross-section of society: from academics to religious shamans, from Oliver Sacks to Lewis Carroll, and from scientific researchers to New Age hippies.[1] Popular culture reflects this diversity, with the likes of Jim Morrison, lead singer of the Doors, singing 'break on through to the other side …' with imagery directly appropriated from Aldous Huxley's scientific treatise

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1 Hallucinogenic drugs (also referred to as hallucinogens) are substances which act on the brain to alter perception, mood and cognitive processes, often with accompanying somatic symptoms. The term itself is a misnomer, as their defining characteristic is not 'hallucino-genesis'. Rather, their primary action is to alter consciousness, often in the absence of hallucinations. Hallucinogens are thought to act via the serotonin (5HT subtype 2A) receptor in the central nervous system. Other drugs that also cause hallucinations (amphetamines such as MDMA), but act via different mechanisms, and lack the same perceptual effects, are not classified as hallucinogens. There are two broad subtypes: the tryptamines (DMT, LSD and psilocybin) and phenethylamines (mescaline) which are thought to act on the 5HT2A receptors via different binding mechanisms. See D. Nichols, 'Hallucinogens', *Pharmacology & Therapeutics* (2004) 101, pp. 131–181.

on the use of mescaline.[2] This article examines one such cross-cultural meeting, mediated by hallucinogens, that took place at the Maudsley Hospital in London in 1938.

Doctors Eric Guttmann and Walter Symington Maclay worked together as clinical psychiatrists and researchers at the Maudsley Hospital from 1934 until 1939. In the autumn of 1938 they invited a group of artists to participate in one of their studies. The participants received an injection of mescaline and were asked to visually record what they saw and felt. Guttmann and Maclay were interested in mescaline as a 'psychotomimetic'; that is, a drug used in scientific research to model psychosis. Building on prior endeavours in the field, these researchers hoped that mescaline-induced psychosis in a group of healthy adults could be used as an experimental model for schizophrenia, one of the most enigmatic mental illnesses.

Guttmann and Maclay specifically chose visual artists to document their experience of mescaline. An average man or woman might have had profound or disturbing revelations from the drug, but often felt unable to articulate their thoughts and visions. For this reason, Guttmann and Maclay turned to people whose very vocation depended on the ability to draw or paint. They reasoned that the artists' representational capabilities would allow themselves the best possible insight into mescaline-induced psychosis. The evidence produced, either sketched or painted, might even be reprinted for the wider scientific community to evaluate with their own eyes. The paper, entitled 'Mescaline hallucinations in artists', was published three years after the experiment and included many of the original drawings as primary evidence.[3]

Particular attention will be paid to the participant Julian Otto Trevelyan (1910–1988), whose images are by far the most numerous and best preserved at the Bethlem Museum.[4] Only one of Trevelyan's drawings was included in the published paper; it was in pencil rather than ink, resembling a sketch rather than a finished piece. The three images reproduced here did not feature in the paper. This is an opportunity for them to be given exposure they have hitherto been denied. Discussion of these drawings remains largely absent from historiography of both science and art. But such an intersection of psychiatry and art warrants analysis. Recent scholars in science and technology studies (STS) emphasize the importance of looking back to re-examine the historical role of images within science. Art historian Caroline Jones and historian of science Peter

2 A. Huxley, *The Doors of Perception*, London: Chatto & Windus, 1954.

3 E. Guttmann and W. Maclay, 'Mescaline hallucinations in artists', *Archives of Neurology and Psychiatry* (1941) 45(1), pp. 130–137.

4 Julian Otto Trevelyan was born in Surrey, England, in 1910. Trevelyan initially read English at Trinity College, Cambridge, but left in the summer of 1931 to pursue a career as an artist. In Paris he became a student of surrealism, attending Léger and Ozenfant's Académie moderne, then the Grande Chaumière, and studying etching and engraving at the printmaker S.W. Hayter's *atelier*, where he worked alongside surrealist artists such as Max Ernst, André Masson and Joan Miró. In 1934, he returned to London. Trevelyan was officially associated with the British surrealist movement from 1936 to 1938. He contributed five artworks to the International Surrealist Exhibition at the Burlington Galleries in June 1936. He also attended meetings and wrote for surrealist journals, such as Eugene Jola's *Transition*. He later went on to lecture at Chelsea School of Art and taught etching at the Royal College of Art. For further biography see Philip Trevelyan, *Julian Trevelyan: Picture Language,* Farnham: Ashgate, 2013.

Galison have demonstrated the breadth and utility of such case studies.[5] As a productive collaboration between artists and psychiatrists, this study adds to recent scholarship refuting the once-held narrative of art and science existing as opposing spheres, instead focusing on how artists and scientists can effectively work together.[6] The two parties involved possessed profoundly different aims. However, they came to meet at a common ground with a shared interest in the psyche.

For this reason, the works produced under mescaline function as a 'boundary object', a scientific specimen satisfying the concerns of multiple groups. Star and Griesemer intended this concept as a 'heuristic methodological category for STS work *to think with* as much as an ontological category of objects'.[7] Their theories have proved useful for the study of a wide range of topics, starting with the study of zoology specimens in the Berkeley Museum. As Griesemer emphasizes, it is both a tool and an entity, giving the researcher a method to negotiate the objects produced by collaborations as well a category in which to place them. Naming this group of artefacts also provides a language when terminology can become problematic. For instance, are these pictures 'evidence' or 'artworks'? The reproductions here have been named and signed as artworks, but also labelled as scientific specimens. In this article the term 'boundary object', or simply 'image', will be used to avoid privileging one role over another.

The experiment 'Mescaline hallucinations in artists' did not occur *de novo*. I will describe the environment responsible for the generation of pieces within the 'ontological category' of boundary objects. This includes the development of the Maudsley Hospital and how it was influenced by different strands of psychiatry. Similarly, I will outline the concerns of the surrealist movement and its interest in psychopathology and psychoactive drugs. I will then describe the experiment itself in more detail: how it came to happen, the logistics of carrying out such an endeavour, and the incorporation of the images into a published paper. The final section will demonstrate just how important the 'heuristic methodological category' of boundary objects is to the historical researcher, as I will show what can be gained when we examine both parties together.

The Maudsley Hospital

From the outset the Maudsley was to be a *hospital*, for innovative treatment, rather than an *asylum*, for refuge. Plans were first proposed in 1907 by psychiatrist Henry Maudsley (1835–1918) and neuropathologist Frederick Mott (1853–1926). The former provided the initial funds of £30,000 in December of the same year on three conditions: the hospital must admit informal patients, in the early and thus potentially curable stages of

5 C. Jones and P. Galison, *Picturing Science, Producing Art*, New York: Routledge, 1998.

6 C. Sleigh and S. Craske, 'Art and science in the UK: a brief history and critical reflection', *Interdisciplinary Science Reviews* (2017) 42(4), pp. 313–330.

7 J. Griesemer, 'Sharing spaces, crossing boundaries', in G.C. Bowker, S. Timmermans, A.E. Clarke and E. Balka (eds.), *Boundary Objects and Beyond: Working with Leigh Star*, Boston, MA: MIT Press, 2016, p. 207, original emphasis.

disease, and its doctors must not only provide treatment, but also conduct scientific research into mental disorders.[8]

Inspired by the work of Emil Kraepelin (1856–1926), Mott wanted to uncover the physical aetiology of mental illness. In a step to facilitate research, Mott relocated the Central Pathological Laboratory of the London County Council (LCC) into the new hospital buildings. The Maudsley was to be a flagship institute for British psychiatry, on par with globally recognized centres of excellence. Edward Mapother (1881–1940) was appointed medical superintendent and Lucien Golla (1877–1968) succeeded Mott as medical director. In 1917 Julius Wagner-Jauregg (1857–1940) successfully cured neurosyphilis with malaria-induced fevers, securing the Nobel Prize in physiology in 1927.[9] Such discoveries supported attempts to rebrand psychiatry, hitherto the 'ugly sister of general medicine', as a legitimate branch of clinical and academic work.[10] Efforts were made to gain the Maudsley medical credibility. Mapother required all psychiatrists either to have membership of the Royal College of Physicians upon their appointment, or else to obtain it within a year or two of working at the Maudsley.[11] The matron, Miss Walker, had both general and medical training and reportedly exerted significant influence.[12] In 1924, a diploma in psychiatric medicine was introduced, designed by the London County Council as akin to medical qualifications in other specialities, such as the diploma of public health.[13] Academic posts were created; for instance, in 1936 Mapother was appointed the first professor of psychiatry at the University of London.

Whilst research carried out in the 1920s and 1930s at the Maudsley largely focused on linking physical parameters to mental illness, projects were remarkably heterogeneous in character. Golla measured galvanic skin responses to identify malingerers, and investigated changes in respiratory rate upon inhalation of carbon dioxide in psychotic patients.[14] Sargent recalled investigations into vitamin B12 deficiency and menopausal flushing. New physical treatments for severe mental illness were trialled, including chemically and electrically induced convulsions and leucotomy.[15] In addition, although very

8 J. Edgar and S. Rahman, 'The Maudsley Hospital and the Rockefeller Foundation: the impact of philanthropy on research and training', *Journal of the History of Medicine and Allied Sciences* (2009) 64(3), pp. 273–299.

9 F. Allerberger, 'Julius Wagner-Jauregg (1857–1940)', *Journal of Neurology, Neurosurgery & Psychiatry*, 2002 (72), p. 105.

10 E. Guttmann used the phrase 'ugly sister' in his textbook *Psychological Medicine*, Edinburgh: E. & S. Livingstone (1946), p. 59. Efforts made to rebrand psychiatry are described in J. Stewart, 'The scientific claims of British child guidance, 1918–45', *BJHS* (2009) 42(3), pp. 407–432.

11 W. Sargent, *Writing Naturally: A Memoir*, London: University Press of New England, 2006, p. 35.

12 Unfortunately Edgar Jones did not include Matron Walker's full name. I would like to apologize for this and would welcome any further information from readers. E. Jones, 'Aubrey Lewis, Edward Mapother and the Maudsley', *Medical History Supplement* (2003) 22(3–38), pp. 3–38, 2.

13 E. Jones, S. Rahman and R. Woolven, 'The Maudsley Hospital: design and strategic direction, 1923–1939', *Medical History* (2007) 51(3), pp. 357–378.

14 F. Golla, S. Mann and R. Marsh, 'The respiratory regulation in psychotic subjects', *Journal for Mental Science* (1928), pp. 443–453; and F. Golla, 'The organic basis of the hysterical syndrome', *Proceedings of the Royal Society of Medicine* (1923) 16, pp. 1–11.

15 Sargent, op. cit. (11), p. 36. Please note, 'leucotomy', the surgical severing of neural connections, is also known as 'lobotomy'.

vocal in his personal dislike of psychoanalysis, Mapother permitted therapists to be employed as part of the medical staff, reasoning that any potential avenue should be trialled.[16]

Historian Rhodri Hayward goes as far as describing the Maudsley ethos in the inter-war years as exhibiting an almost 'gung-ho' approach of 'unconstrained experimentation'.[17] Reminiscing on his time working at the Maudsley, psychiatrist William Sargent described a stimulating environment where he felt actively encouraged to volunteer new theories, no matter how foolish. Psychiatrist Aldwyn Stokes recalled that Mapother 'would be delighted and intrigued by a new approach, but would never instruct in research design … Ideas were given a free rein so long as they had a reasonable quality and were supported by objective enquiry'.[18]

Research could not take place without funding. Due to lack of provision, in 1924 most clinicians had to conduct projects in their spare time. Even senior members such as Golla had only four assistants.[19] The Medical Research Council Sub-committee for Mental Disorders funded studies on a small scale but their awards were in the realm of hundreds, never exceeding three hundred pounds.[20] Mapother turned to a philanthropic body in the United States, the Rockefeller Foundation, which seemed to share the Maudsley's vision of progress through scientific research. The foundation's overarching mission was 'to promote wellbeing of mankind' and it regarded psychiatry as an ideal vessel for this as 'the most backward, the most needed' and potentially the most 'fruitful field in medicine'. Alan Gregg was the medical director from 1919 to 1951. Over his career, Gregg was responsible for investing millions of dollars in research institutes and psychiatric departments to 'create a new generation of neuropsychiatrists grounded in the latest science'. In 1934 the foundation funded scholarships for German émigrés moving to the Maudsley. The first direct investment in the hospital itself was nine thousand pounds in 1935, disbursed over three years, and in 1938 an additional five thousand.[21] Plans were ongoing in 1939, with Mapother writing of 'the agreement of the [London County] Council to the provision of a neuropsychiatric wing and definite agreement by the Rockefeller Foundation to provide a large endowment (£100,000 or £200,000) for salaries for research personnel'.[22]

16 Mapother was critical of psychoanalytical theory and its institutions, but employed the likes of John Sutherland, later director of the Tavistock Clinic. The full relationship between psychoanalysis and psychiatry at this time is beyond the scope of this article and has been addressed in more depth elsewhere. For an exploration of the complexities of this relationship see A. White, 'The science of selection to psychologising civvy street: the Tavistock Group, 1939–1948', PhD thesis, University of Kent, 2016.

17 R. Hayward, 'Germany and the making of "English" psychiatry', in Volker Roelcke, Paul J. Weindling and Louise Westwood (eds.), *International Relations in Psychiatry: Britain, Germany, & the United States to World War II*, Rochester, NY and Woodbridge: University of Rochester Press, 2010, pp. 67–91, 81.

18 A. Stokes, 'The teacher', *Bethlem Maudsley Hospital Gazette* (1960) 3(1), p. 13, quoted in Jones, op. cit. (12), pp. 3–38, 276.

19 Jones, op. cit. (12), pp. 17, 20.

20 Edgar and Rahman, op. cit. (8), p. 278.

21 Rockefeller Foundation, appropriation RF 38061, 15 January 1934, Folder 247, Box 18, Series 401A, RF1.1, RFA, cited in Edgar and Rahman, op. cit. (8), pp. 273–299.

22 Jones, op. cit. (12), pp. 20–21.

The Rockefeller Foundation sculpted the type of research that took place at the Maudsley. In the United States, Gregg had embraced the outlook of Adolf Meyer (1866–1950), Swiss-born psychiatrist in chief at Johns Hopkins Hospital from 1908. He was the founder of the 'psychobiological' school of psychiatry, which encouraged the unification of clinical psychiatry and research. Meyer disliked the gulf separating clinicians, whose primary job was to diagnose patients and provide shelter for them within asylums, from researchers, who spent their time examining pathological specimens under the microscope.[23] At Johns Hopkins, Meyer established university-based psychiatric research in a clinical, rather than a laboratory, setting. This interaction was made possible by creating direct links between the academic institute, the teaching hospital and a training centre for psychiatrists. Meyer's psychobiological model focused on the multifactorial aetiology of mental illness. Historians Jones and Rahman argue that the 'Meyerian' approach was emulated at the Maudsley in London in order to gain approval and thus funding from Gregg at the Rockefeller Foundation.[24]

The Rockefeller Foundation endowed its researchers with remarkable intellectual freedom. Not all projects were expected to be laboratory-based, or confined to one realm of knowledge. Rockefeller-funded psychiatrist Aubrey Lewis's (1900–1975) initial research was anthropological in character and Meyer's psychobiology was strongly linked to the social sciences. Researchers were aware that they needed to please the foundation but could extend their work in any direction they chose.

The Heidelberg school

I have outlined how the Maudsley model was founded under Kraepelin's biological psychiatry and later influenced by Meyer's psychobiological school via the Rockefeller Foundation. Subsequently, during the 1930s, German psychiatrists were sponsored to move to the Maudsley. For the Rockefeller Foundation, the hope was that these new psychiatrists would not only continue their own research, but also share their expertise with British psychiatrists. 'Mescaline hallucinations in artists' was penned not only by Guttmann, a German émigré, but also by a British psychiatrist, Walter Maclay. This joint project exemplifies the channels of education that the Rockefeller hoped to foster.

These Jewish psychiatrists did not leave Germany by choice, but had been removed from their posts under the Nazi regime and now fled persecution.[25] With them they brought the conceptual framework of the phenomenological school of Heidelberg, which had already engaged with both mescaline experiments and artistic expression. Phenomenology can be defined as the study of consciousness as experienced from the

23 T. Lilz, 'Adolf Meyer and the development of American psychiatry', *Occupational Therapy in Mental Health* (1985) 5(3), pp. 33–53, 37.

24 K. Angel, 'Defining psychiatry: Aubrey Lewis's 1938 report and the Rockefeller Foundation', *Medical History Supplement* (2003) 22, pp. 39–56, 50.

25 C. Hilton, 'A Jewish contribution to British psychiatry: Edward Mapother, Aubrey Lewis and their Jewish and refugee colleagues at the Bethlem and Maudsley Hospital and Institute of Psychiatry, 1933–66', *Jewish Historical Studies* (2007) 41, pp. 209–229.

first-person perspective. Rather than observing human behaviour, this school of psychology focused on the detailed study of patients' self-descriptions of their pathology.[26]

The Rockefeller Foundation first sponsored Konrad Zucker from Hanover, followed by William Mayer-Gross from Heidelberg, Eric Guttmann from Breslau, Alfred Meyer from Bonn, Adolf Beck from Marburg and Eric Wittkower from Berlin. Mayer-Gross (1889–1961) was well respected in Germany and remains the best known of the émigrés.[27] He initially studied under Kraepelin but later departed from researching only physical causes of mental illness. Instead he led a new generation of psychiatrists who, like Meyer, wanted a more multifaceted understanding of the mind. Mayer-Gross cofounded the journal *Nervenarzt* in 1928 with Kurt Beringer (1893–1949) and was made professor at Heidelberg in 1929.[28] Phenomenological psychiatrists wanted to understand 'the soul from the inside'.[29] This quest for understanding required meticulous attention to detail, so much so that Sargent recalls being encouraged to take over thirty pages of medical history under the German psychiatrist's instruction.[30]

Psychotomimetic drugs were popular at Heidelberg. The group was not the first to use drugs for this purpose, but Beringer had coordinated one of the largest studies in the field, with sixty participants.[31] His evidence was mostly verbal; one subject was a fine-arts painter, but did not produce anything visual during his session.[32] Beringer's emphasis was pedagogical, enrolling doctors and medical students, as he believed psychotomimetic drugs could simulate the experience of their patients first-hand. Schizophrenia presented the ultimate phenomenological challenge as, 'according to Jaspers, the gift we have for human empathy and the attempt that one human being makes to establish contact with another, encounter a more complete frustration with the schizophrenic than with the sufferer [of] any other psychiatric disorder'.[33] By artificially inducing psychosis, hallucinogenic drugs allowed students the opportunity to understand states which were impossible to communicate or comprehend vicariously.

26 K. Jaspers, *General Psychopathology*, translated from German by J. Hoenig and W. Hamilton, Baltimore: Johns Hopkins University Press, 1997.

27 For Konrad Zucker see Hayward, op. cit. (17), p. 78. For William Mayer-Gross see A. Lewis, 'William Mayer-Gross: an appreciation', *Psychological Medicine* (1977) 7, pp. 11–18. For Eric Guttmann see anon., obituary, *BMJ*, 8 May 1948, p. 908. For Adolf Beck see Jones, Rahman and Woolven, op. cit. (13), p. 374. For Eric Wittkower see Hilton, op. cit. (25), p. 213.

28 H. Freeman, 'Gross, William Mayer (1889–1961), psychiatrist', *Oxford Dictionary of National Biography*, Oxford University Press, 2004, at https://doi.org/10.1093/ref:odnb/51731, accessed September 2019.

29 K. Jaspers, *Allgemeine Psychopathologie* (General Psychopathology), Berlin: Springer, 1913 (translated into English 1963).

30 Sargent, op. cit. (11), p. 36.

31 Mayer-Gross described the of use of psychotomimetic drugs by the French psychiatrist Jacques-Joseph Moreau de Tours in 1845 and emphasized the importance of Kraepelin's more recent research in the introduction to W. Mayer-Gross, 'Experimental psychoses produced by drugs', *BMJ*, 11 August 1951, pp. 317–321. For details of Beringer's sixty-patient study see K. Beringer, *Der Meskalinrausch: Seine Geschichte und Erscheinungsweise*, Berlin: Julius Springer, 1927.

32 R. Stuart, 'Modern psychedelic art's origins as a product of clinical experimentation', *Entheogen Review*, March 2004, pp. 12–22, 165.

33 W. Mayer-Gross, E. Slater and M. Roth, *Clinical Psychiatry*, 1954, p. 270.

For similar reasons, mescaline became popular at the Maudsley under the rationale that 'doctors should go through some of the experiences of their patients'.[34] Guttmann comforted one of the participant's psychoanalysts: 'I can assure you I did not start giving Mescaline light heartedly or without adequate preliminary investigation. I have myself taken it in larger doses than I have given it to Mr. Beaumont, as have nearly all my senior colleagues at the Maudsley'.[35] Mayer-Gross's interest in hallucinogens continued into subsequent decades. A psychiatrist who joined in the 1950s even describes being brought to his office for a 'statutory dose of LSD' as part of his induction.[36]

Psychotic art was also an important aspect of psychiatric research at Heidelberg. Hans Prinzhorn (1886–1933) had trained as a psychiatrist and art historian in Vienna and spent 1919–1921 working at the Heidelberg Psychiatric Clinic under Karl Wilmanns (1873–1945). Prinzhorn extended the already existing teaching-material collection to become the largest in Europe, with 4,500 pieces by the end of 1920.[37] He made the collection open to the public via a Museum of Pathological Art. After his departure, he published case studies in *Bildnerei des Geisteskranken* (usually translated as *Artistry of the Mentally Ill*) and his successor Hans Gruhle toured 150–330 pieces around Europe.[38]

Prinzhorn's collection of psychotic art was later apprehended by the Nazi Party, and was put on display at the Mannheim Chamber of Horrors exhibition in 1933 which was followed most notably by their 1937 Degenerate Art show in Munich. Art created by mentally ill patients was displayed side by side with works from the European avant-garde. While this comparison had been made before, often cultivated by the artists themselves, here their similarity was used to draw negative conclusions:

> All the startling similarities and affinities between lunatic art and the excesses of the modernist movement do not in themselves entitle us to dismiss the painters of such pictures as mentally ill. But the affinity in individual traits – lack of inhibition, perfunctoriness, technical roughness, absence of self-criticism, bezzarrerie, unclear symbolism, fantastic grimaces … betokens a deviance from the paths of normal thinking and feeling, a degeneracy that means, in our unhealthy and troubled age, that the dignity of man sinks lower than ever.[39]

34 Anon., 'Reversible nightmare', *Bethlem and Maudsley Hospital Gazette* (1956) 2(5), Bethlem Archives, Mescaline Experiment Files, London.

35 E. Guttmann, 'Letter to Dr Stephen' (31 October 1936), Bethlem Archives, Mescaline Experiment Files, London.

36 Full quote from Ronald Arthur Robinson (nickname Sam) in interview with C. Hilton: 'Mayer-Gross was a warm ebullient pyknic with a sparkling eye. A week or two after my arrival he invited me to come to his office at nine o'clock in the morning. My colleagues warned me that this would be for my statutory dose of LSD – and so it turned out; no ifs or buts. After the colourless and tasteless drink my reactions and sensations were monitored for the next four hours by MG, Robert Klein and (I think) John Raven, Director of Psychological Research. Among the various procedures was an EEG. My peers had regaled me the previous evening with expectations of vivid visual and tactile hallucinations, pictures sliding down walls and multiple delusions. To my disappointment none of these occurred; it was for me a complete non-event'.

37 J. Macgregor, 'Hans Prinzhorn and the German contribution', in Mcgregor, *The Discovery of the Art of the Insane*, Princeton, NJ: Princeton University Press, 1989, pp. 185–205. See also B. Brand-Claussen, I. Jádi and C. Douglas, *Beyond Reason: Hayward Gallery Exhibition Catalogue*, London: Hayward Gallery, 1995, p. 8.

38 H. Prinzhorn, *Die Bildnerei der Geisteskranken*, Berlin: Springer, 1922. For details of Gruhle's tour see Brand-Claussen, Jádi and Douglas, op. cit. (37), p. 15.

39 W. Weyglant, 'Kunst und Wahnsinn' (Art and race), *Die Woche* (1921) 22, pp. 483–485. Quoted in Brand-Claussen, Jádi and Douglas, op. cit. (37), p. 17.

Prinzhorn's colleague Willmans was removed from his post at Heidelberg for insulting Hitler and was replaced by Schneider, later director of the Nazi Party mental patient extermination programme. Many of Prinzhorn's 'schizophrenic masters', such as Franz Karl Buhler, Paul Goesch and Josef Heinrich, were later murdered as part of this programme.[40]

Phenomenological émigrés at the Maudsley were aware of these events. Guttmann and Maclay themselves noted how 'the products of modern schools of art have been compared with those of the insane' in order to 'criticise surrealism and other modern schools'.[41] British intellectuals including Julian Huxley, Virginia Woolf, Roland Penrose and John Harrison protested against attacks on modernist art by organizing the First Exhibition of Twentieth Century German Art at the New Burlington Galleries in London in July 1938.[42] This displayed over three hundred works by German artists who were now in disrepute in their home country. Headlines in British newspapers included 'Hitler calls this work degenerate', and over ten thousand members of the public are estimated to have visited.[43]

'Mescaline hallucinations in artists' was carried out only months later. Guttmann's continued celebration of psychotic art therefore acted as a mode of defiance against what was occurring in Germany at this time. The Jewish psychiatrists had been deprived of their liberty in many ways. They were forced to flee their country and live in exile with their careers disrupted, but they were still free to continue avenues of research brought to a halt by the fascist regime. This was particularly the case at the Maudsley, under the funding of the Rockefeller Foundation, where émigrés were granted creative freedom and respected for their expertise. Here, scientists could branch out into drugs and art to extend their web of connections outside the traditional scientific realm.

Surrealism, 'madness' and the mind

> Can there be revolutionary science/technology in the absence of revolutionary change in other spheres? To the extent that one believes in the interpenetration of spheres and science as a social institution of its historical time and place, the answer must be no.[44]

In defiance of the popular narrative that art and science exist as opposing spheres, developments in the field of psychiatry in 1938 were inextricably linked to broader cultural revolutions.

Surrealism was a literary, philosophical and artistic movement with an interest in the inner workings of the mind. Their leader, poet and writer André Breton (1896–1966),

40 Brand-Claussen, Jádi and Douglas, op. cit. (37), p. 20.

41 E. Guttmann and W. Maclay, 'Clinical observations on schizophrenic drawings', *British Journal of Medical Psychology* (1937) 16, pp. 184–205, 184.

42 *The Twentieth Century German Art Exhibition*, catalogue and exhibition flyer, 1938, Weiner Library, London.

43 British press response to *Twentieth Century German Art*, newspaper and date unknown, private collection, on loan to Weiner Library, London.

44 S. Star, 'Revisiting ecologies of knowledge: work and politics in science and technology', in Bowker *et al.*, op. cit. (7), pp. 13–46, 19.

formalized their aims in the *First Manifesto of Surrealism* (1924). Surrealist artists had come of age in Paris during the First World War and came to blame rational society for the events they had lived through. The group utilized the concept of madness for its philosophical implications. They were fascinated with inpatients of asylums, as those excluded from daily life, not permitted to participate in 'rational' society. Hysterical states were fetishized as 'convulsive beauty'; Hélène Vanel's *Unconsummated Act*, performed on the opening night of the 1938 International Surrealist Exhibition at the Galerie Beaux-Arts, reportedly involved her impersonating Jean-Martin Charcot's hysterical patients at the Parisian Salpêtrière hospital.[45] Breton had in fact worked as a medic, studying in Saint-Dizier under Dr Raoul-Achille Leroy, who encouraged him to read the psychiatric treatises of Jean-Martin Charcot and Sigmund Freud.[46] Breton's interaction with 'shell shock' patients, experimenting with Freudian psychoanalytic techniques, went on to form the core of surrealist ideology, as he later reflected:

> The time I spent there [Saint-Dizier during the Second World War] and what I saw was of signal importance in my life and had decisive influence in the development of my thought. That is where I could experiment on my patients, seeing the nature of diagnosis and psychoanalysis, and in particular, the recording of dreams and free association. These materials were from the beginning at the heart of surrealism.[47]

Surrealists manipulated Freudian concepts in a variety of ways. 'Psychic automatism' involved entering into trance-like states and either writing or drawing direct from the unconscious, supposedly devoid of any calculation or interference. Automatism was surrealism's very definition in the *First Manifesto of Surrealism* and was used to create the well-known abstractions of Joan Miró and André Masson. Breton describes how

> I resolved to obtain from myself what we were trying to obtain from them [patients], namely a monologue spoken as rapidly as possible without any intervention on the part of the critical faculties, a monologue consequently unencumbered by the slightest inhibition and which was, as closely as possible, akin to spoken thought.[48]

Surrealists used this technique to put themselves into the patient's psyche. Breton and Paul Eluard even co-wrote the automatic text *Des possessions* (1930), in which they attempted to mimic the speech of 'a madman'. The article was accompanied by automatic illustrations of Robert Desnos.[49] The patient's linguistic inventiveness was

45 'Beauty will be CONVULSIVE or not at all' is the closing passage of A. Breton, *Nadja*, tr. R. Howard, St Ives: Grove Press, 1999 (first published 1928). For photography of Charcot's hysterical patients see P. Régnard, *Les attitudes passionelles*, 1878 (tr. as *Postures of Passion*), originally in *Iconographie de la Salpêtrière*, reproduced in the surrealist journal *La révolution surrealiste* (1928) 11, pp. 20–22.

46 J. Haan, P.J. Koehler and J. Bogousslavsky, 'Neurology and surrealism: André Breton and Joseph Babinski', *Brain* (2012) 135(12), pp. 3830–3838.

47 A. Breton, *Entretiens (1913–52)*, Paris: Nouvelle revue française, 1952, translated as *Conversations: The Autobiography of Surrealism* (1913–1952), 1993, New York: Paragon, pp. 20–21.

48 A. Breton, *Manifestoes of Surrealism* (trans. R. Seaver and H. Lane), Ann Arbor: University of Michigan Press, 1969, pp. 22–23.

49 K. Conley, 'Surrealism and outsider art: from the "automatic message" to André Breton's collection', *Yale French Studies* (2006) 109, pp. 129–143, 132.

appealing on a poetic as well as a political level. Breton noted how schizophrenic patients tend to join together chains of phonologically related words, often creating neologisms.[50]

The 1928 exhibition at the Galerie Max Bine entitled Manifestations artistiques des maladies du cerveau included over two hundred patient artworks gathered by psychiatrists in both France and Russia, the Prinzhorn Collection and a 'drawing by a patient based on an old print', dated 1763, from the Bethlem Royal Hospital in England.[51] Max Ernst (1891–1976) had taken classes in psychiatry, experimental psychology and psychology of speech at the University of Bonn, visiting a local asylum during his time there. It was Ernst who returned to Paris with a copy of Dr Hans Prinzhorn's *Artistry of the Mentally Ill*, which was widely circulated in the group, becoming an underground bible for surrealist artists.[52]

The surrealist's awe of insanity extended beyond France. Trevelyan noted the inclusion of 'arrangements of objects by acute schizophrenics' in the International Surrealism Exhibition in the Burlington Galleries in London in 1936.[53] Themes of madness were especially evident in the art of Conroy Maddox. He explored female hysteria, both in poems and in painting, inspired by a meeting in his early life. Works such as *Rue de Seine (The House of George Hugnet)* (1944) even depict a dream-like scene set in the corridors of an asylum. Trevelyan himself explored the theme of mental disorder in his surrealist work. For instance, *Untitled (Devastated Buildings)* (1937) comprises a cityscape created from newspaper cuttings with headlines relating to mental health.[54]

Whilst Breton celebrated madness, he did not envisage hallucinogens or other drugs as a route for the artist to mimic such states.[55] Instead of advocating the use of narcotics, Breton used the lexicon of such substances to describe surrealism, as if it replaced the need for them:

> Surrealism does not permit those who have indulged in it to drop it when they please … In many ways surrealism looms as a *new vice* … Like hashish there is enough there to satisfy the most delicate systems … The case of the surrealist images is very much like that of the images of opium that man no longer evokes because they are offered spontaneously, despotically. He cannot dismiss them; for free will no longer has any power and does not govern his faculties.[56]

Here, Breton quotes Baudelaire's *Artificial Paradise* (1860), equating the spontaneous and passive nature of drug-induced states with the surrealist mindset. Breton testified to the power of his technique, negating the need for drugs. He wrote that if automatic writing were performed with enough enthusiasm, then this alone was sufficient to

50 D. Lomas, *The Haunted Self: Surrealism, Psychoanalysis, Subjectivity*, New Haven, CT and London: Yale University Press, 2000, p. 63.

51 T. Röske (ed.), *Surrealism and Madness*, exhibition catalogue, Heidelberg: Prinzhorn Gallery, 2009, p. 154.

52 Macgregor, op. cit. (37), p. 281.

53 J. Trevelyan, *Indigo Days*, Aldershot: Scolar, 1996, p. 68.

54 A. Jemison, 'From deserted terrains to chaotic vistas: Julian Trevelyan's representations of British interwar urban and industrial decline', *Photography and Culture* (2009) 2(1), pp. 7–29.

55 A. Balakian, 'Breton and drugs', *Yale French Studies* (1974) 50, pp. 96–107.

56 Breton, op. cit. (47) quoted in Balakian, op. cit. (55), p. 99.

generate visual hallucinations.[57] Nevertheless, Breton's anti-drug doctrine was not followed by all surrealist artists. Literary scholar Anna Bakalian describes quarrels that occurred between Breton, Antonin Artaud and Robert Desnos because of Breton's disapproval of Artaud and Desnos's drug taking. Artaud was known to suffer from narcotic addiction before his psychotic breakdown.[58] Poling describes how Masson referred to taking drugs in the period before the development of his automatic drawings (1924–1927) and to being 'as though semi-mad'.[59] Furthermore, the fifth and final section of the aforementioned Manifestations artistiques des maladies du cerveau exhibition (1928) was entitled 'Drugs from the perspective of a normal artist'.[60] Such exhibit titles suggest that experiments akin to Julian Trevelyan's had already taken place elsewhere in the 1920s, and had been presented as art to a surrealist audience. Clearly, whilst Breton might have disapproved of the use of drugs, instead championing surrealist techniques, his view was not universal. It is difficult to fully assess the extent to which psychoactive substances were used by the group. Historians may have downplayed certain individuals' drug-taking activities.[61] In addition, biographies of British surrealists are often by the artists' children, who may have remained ignorant of their parents' drug-taking behaviour.[62]

'Mescaline hallucinations in artists'

Artists were invited to the Maudsley Hospital to receive their injection of mescaline under the supervision of Guttmann and Maclay. Participants were encouraged to produce drawings or paintings whilst intoxicated as well as afterwards. The latter pieces are referred to by the scientists as 'after-images'. In the archives, the pictures are labelled either 'Phase I' or 'Phase II' accordingly. We know from his memoirs that Trevelyan did produce some Phase I drawings, as he described how he 'drew and wrote with a shaky hand, and yet while it lasted I could not put a line wrong; the line was no longer on the paper but quivering in space like a wire'.[63] However, of Trevelyan's five artworks remaining in the Bethlem archive, only one is labelled 'Phase I'. Even without the labels, the steadiness of line in Figures 1, 2 and 3 certainly supports the notion that Trevelyan was sober at the time of their production. Within other

57 Breton: 'I have personal experience of the fact that automatic writing undertaken with any enthusiasm leads directly to visual hallucinations', in A. Breton, P. Eluard and P. Soupault, *The Automatic Message* (tr. D. Gasgoyne), London: Atlas Press, 1997 (first published 1933), p. 30.

58 Macgregor, op. cit. (37), p. 282.

59 C.V. Poling, *André Masson and the Surrealist Self*, New Haven, CT: Yale University Press, 2008, p. 43.

60 Röske, op. cit. (51), p. 156.

61 For instance, Lindsey Waters, executive editor at Harvard University Press, stated, 'we are very interested in publishing translations of [Walter] Benjamin's work, but we can not undermine Benjamin's reputation by making him appear to be a drug addict'. This is discussed in more detail in Stuart, op. cit. (32), pp. 12–22.

62 A. Penrose, personal correspondence, 2018: 'I recall he had no interest in drugs although he tried a sniff of cocaine which he described as too much like the dentist and smoked marijuana on one occasion. I don't believe it went further and he said he did not like the feeling of being interfered with by a chemical. Whiskey and wine was all he needed. His friend Julian Huxley was I believe known to experiment with LSD and I recall mescaline being talked about but not in the context of use by Roland or others close to him.'

63 Trevelyan, op. cit. (53), p. 75.

Figure 1. Julian Trevelyan, *Stage II (Mescaline Drawing with Cones)*, 1936, ink on paper. Image from the Bethlem Archives, Ref. LDBTH19.

participants' files, there are also some simple drawing exercises, such as puzzles or copies of simple shapes. These may have been easier to execute during the early, intense stages of mescaline intoxication. Most likely Trevelyan produced similar pieces which were later discarded. What remains now is those images which were deemed worth preserving.

This was not Guttmann and Maclay's first experiment with mescaline. They had both taken the drug themselves and by 1938 had begun experimenting on volunteers. The first

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published example of this was Guttmann's analysis of verbal accounts.[64] In the same year he collaborated with Maclay in the exploration of mescaline and depersonalization, where the authors declared their interest in the psychotomimetic properties of the drug.[65] They aligned themselves with their Heidelberg colleagues, citing Beringer, Zucker, Klüver, Mayer-Gross and Stein. Zador is also credited for using nitrous oxide instead of mescaline.[66] Clearly Guttmann's background was important not only for awareness, but also for understanding these studies, as many were published exclusively in German. Guttmann and Maclay also cited Marshall's English papers, as well as French studies by Claude and Ey, who had used mescaline intoxication.[67]

'Mescaline hallucinations in artists' differs from Guttmann and Maclay's other mescaline experiments. The project combined psychotomimetics with another of their research interests, the visual image. Asylum doctors had historically collected art from their patients and the use of creative media in psychiatry was gaining popularity. Guttmann and Maclay credit Cesare Lombroso (1835–1909) as the first known collector of patient art, although the practice certainly pre-dates this.[68] They were inspired by Prinzhorn's recent 'schizophrenic masters' and sought to create a similar line of enquiry. The Guttmann–Maclay Picture Collection of artworks is extensive and is preserved in the Bethlem archive, along with approximately three hundred books on the topic donated to King's College Library.[69] Guttmann and Maclay published one paper on schizophrenic drawings and then worked with Mayer-Gross to publish another in 1938.[70] They also helped other scientists in this field. Dr Francis Reitman

64 E. Guttmann, 'Subjective experiences caused by mescaline (written on Saturday March 14th 1936)', reprinted as E. Guttmann, 'Artificial psychoses produced by mescaline', *Journal of Mental Science* (May 1936) 82(338), pp. 203–221.

65 E. Guttmann and W. Maclay, 'Mescaline and depersonalization: therapeutic experiments', *Journal of Neurological Psychopathology* (1936) 16, pp. 193–212, 202.

66 K. Beringer, *Der Meskalinrausch: Seine Geschichte und Erscheinungsweise*, Berlin: Julius Springer, 1927, is cited in Guttmann and Maclay, op. cit. (65), p. 2. K. Zucker, 'Versuche mit Meskalin an Halluzinanten', *Zeitschrift für die gesamte Neurologie und Psychiatrie* (1930) 127(1), pp. 108–161, is cited in Guttmann and Maclay, op. cit. (65). H. Klüver, *Mescal: The 'Divine' Plant and Its Psychological Effects*, London: Kegan Paul, 1928, is cited in Guttmann and Maclay, op. cit. (3). Further of his works include H. Klüver, *Mescal and Mechanisms of Hallucinations*, Chicago: The University of Chicago Press, 1966. W. Mayer-Gross and J. Stein, 'Psychopathologie unter Klinik der Trug-Wahrnehmungen', in O. Bumke, *Handbuch der Geisteskrankheiten*, Berlin: Julius Springer, 1928, pp. 205–247, which is cited in Guttmann and Maclay, op. cit. (3). See also J. Zador, 'Dr Lachgas (NO2) Rausch in seiner Bedeutung fur Neurologie und Psychiatry', *Archiv für die gesamte Psychologie* (1928) 84(1).

67 C.R. Marshall, 'An enquiry into the causes of mescal vision', *Journal of Neurology and Psychopathology* (1937) 17, pp. 289–304, 289, cited in Guttmann and Maclay, op. cit. (3). See also H. Claude and H. Ey, 'La mescaline, substance hallucinogène', *Comptes rendus des séances et mémoires de la Société de Biologie* (1934) 115, pp. 838–841. Cited in Guttmann and Maclay, op. cit. (65).

68 Cesare Lombroso was the most prominent exponent of the 'genius–insanity theory' in the nineteenth century. See 'Cesare Lombroso: the theory of genius and insanity', in MacGregor, op. cit. (37), pp. 91–102. For discussion of collections that pre-date this see Röske, op. cit. (51), p. 154.

69 Library Services Institute of Psychiatry reorganization of pre-1992 book stock discussion document (September 2011), at www.kcl.ac.uk/library/transformation/IoPpre1992reorg.pdf, accessed March 2018.

70 Guttmann and Maclay, op. cit. (41). W.S. Maclay, E. Guttmann and W. Mayer-Gross, 'Spontaneous drawings as an approach to some problems of psychopathology', *Proceedings of the Royal Society of Medicine* (1938) 31(11), pp. 1337–1350.

(1905–1955) at the Netherne Hospital in Surrey later described the 'invaluable assistance' of Guttmann on his publication of 'Facial expression in schizophrenic drawings'.[71] However, Guttmann and Maclay had felt limited. They described how 'patients' drawings were used in studying schizophrenic symptoms of the visual type; but with patients the scope of the procedure is limited not only by their impaired mentality but also by their ability or inability to draw'.[72] Hence they turned to artists and combined their use of visual media with psychotomimetic experimentation.

When Guttmann and Maclay initially advertised for professional artists to participate in their research, they received little response.[73] Only when Lionel Penrose (1898–1972) suggested enlisting the help of surrealist artists did they succeed in finding a group of willing participants.[74] The psychiatrists had previously worked with Lionel on a doodle competition for *The Times* newspaper, where readers had submitted absent-minded drawings.[75] Prizes were awarded and the examples were published alongside Penrose's psychological interpretation.[76] Lionel's brother, Roland Penrose, was at the forefront of the British surrealist movement.

Julian Trevelyan was not merely a passive participant. As a surrealist he was invested in this mescaline experience. However, unlike Desnos or Masson, Trevelyan never explicitly referred to the psychotomimetic properties of the drug. As mentioned above, he was interested in mental illness but seemed unaware of Guttmann and Maclay's experimental model. In his memoir he describes mescaline as a potential treatment for schizophrenia rather than a means to simulate it.[77] For Trevelyan, the drug functioned more broadly as a 'psychoscope', a method with which to observe mental processes, not necessarily pathological in nature.

Like many surrealists, Trevelyan kept dream diaries, created automatic drawings, and reflected on the importance of hallucinations. He declared the importance of shedding conscious control in order to delve deeper into the mind:

> To dream is to create. In the state of dreaming or hallucination, the mind loses that self-consciousness, which in waking hours, it can never quite banish, and begins to move silently through a timeless, spacious world where neither Destiny or Chance have stopped.[78]

A search for the 'deeper self' underpins much of Trevelyan's work. He often returned to corporeal metaphors, uncovering blood vessels and cells which, for the artist, created the

71 C. Cummings, 'The science of therapeutic images: schizophrenia and postwar psychiatric art at the Maudsley and Netherne Hospitals', *History of the Human Sciences* (2017) 30(2), pp. 69–87.

72 Guttmann and Maclay, op. cit. (3), p. 130.

73 S. Roman, 'Art therapy and its relationship to clinical investigations', unpublished thesis, Goldsmiths College, 1986; along with personal communication with S. Roman.

74 D. Waller, *Becoming a Profession: The History of Art Therapy in Britain 1940–82*, London: Routledge, 1991, p. 28.

75 S. Hogan, *Healing Arts: The History of Art Therapy*, London: Jessica Kingsley, 2000, p. 166.

76 Maclay, Guttmann and Mayer-Gross, op. cit. (70), p. 1337.

77 Trevelyan, op. cit. (53), p. 74.

78 J. Trevelyan, quoted in Trevelyan, op. cit. (4), p. 44.

sprawling 'organism' of industrial cities.[79] Many of his artworks were one step removed from literal meaning, by developing what he called a 'picture language' of symbols. Such codes recur again and again in his art, and pervaded his life as well as his paintings. Painted keyholes, Islamic crescent moons, triangles, rectangles, and diamonds of colour marked doorways in his home at Durham Wharf.[80]

During 1937 and 1938, Trevelyan was involved with Tom Harrisson (1911–1976) in the anthropological research project Mass Observation, studying everyday life in industrial cities via a combination of psychoanalysis, anthropology and surrealism. They wanted to record typically neglected details of daily life in these towns. The group felt that these minor happenings were not insignificant, but related to events of national importance, such as the Munich crisis of 1938. Parallels can be drawn between the Mass Observation project and Trevelyan's project at the Maudsley. Both were 'experiments', with Trevelyan referring to Harrisson as a 'scientist', as he did Guttmann and Maclay. Trevelyan had reflected on the ability of mescaline to highlight previously unnoticed stimuli: 'I have, under Mescalin, fallen in love with a sausage roll and with a piece of crumpled newspaper from out of the pigbucket'.[81] Equally, Mass Observation wanted to celebrate the minute details of daily life, using unusual techniques to interrogate and subvert societal structures.

Trevelyan's circle of friends likely encouraged endeavours with hallucinogens. Aldous Huxley later wrote *Doors of Perception* (1954), a scientific and philosophical study adopted by the 1960s counterculture. Trevelyan knew Huxley well; the Trevelyan family were part of the 'intellectual aristocracy which ranked alongside (and sometimes married) the Darwins and the Huxleys'.[82] The friendship between Trevelyan and the two Huxley brothers, Aldous and Julian, is clear from their numerous informal postcards and dinner invitations.[83] Trevelyan was aware of Huxley's enthusiasm for mescaline, discussing the popularizing effect of Huxley's book in his memoir.[84] These friendships should not be overlooked when considering Trevelyan's enthusiasm for the mescaline project.

Boundary objects misdescribed

> [The] construction of [boundary] objects … is a community phenomenon, requiring at least two sets of actors with different viewpoints. Analysis of the use of such an object at one point in the system, or apart from its relationship to other nodes, will produce a systematic bias.[85]

Star argues that treating any historical artefact as part of a single, isolated domain will lead to biased accounts. Instead, objects ought to be analysed from the perspectives of

79 A. Jemison, 'When will we have sleeping logicians, sleeping philosophers? Julian Trevelyan in pursuit of a super-reality', *Visual Culture in Britain* (2008) 9(1), pp. 101–121.

80 Trevelyan, op. cit. (4), p. 80.

81 Trevelyan, op. cit. (53), pp. 75–76.

82 José Manser, *Mary Fedden and Julian Trevelyan: Life and Art by the River Thames*, London: Unicorn Press, 2012, p. 7.

83 Trevelyan Trinity College Archives, Wren Library, Cambridge.

84 Trevelyan, op. cit. (53), p. 74.

85 S. Star, 'The structure of ill-structured solutions: boundary objects and heterogeneous distributed problem solving', in Bowker *et al.*, op. cit. (7), pp. 243–262, 256.

multiple actors. Here I will use Trevelyan's mescaline drawings to demonstrate the utility of this approach. First, I will do exactly what Star instructs us not to do. I will analyse them as if they were either scientific specimens or art objects, but not both. I will then describe the drawings as objects that live on the boundary between both spheres, psychiatry and surrealism.

Ten images are reproduced in the paper 'Mescaline hallucinations in artists'. The psychiatrists make several observations and demonstrate each point with an image produced by an artist. This leads them to postulate an overarching theory on the genesis of hallucinations. Guttmann and Maclay argue that hallucinations must originate from a mixture of what they refer to as psychological and physiological factors. By physiological, they mean caused by external stimuli, which tend to be stereotyped and similar in all participants. Psychological causes, on the other hand, come from the psyche and only relate to that individual person.

Remarkably, nearly a century later, a physiological–psychological model for hallucination is still upheld, albeit described in different terminology. Hallucinations are now thought to occur due to aberrant interactions between 'bottom-up' deficits in the processing of incoming stimuli and 'top-down' signals based on 'prior knowledge, perceptual expectations, attentional modulation and mental imagery'.[86] We now know much more about these pathways, for instance their location in the brain. Despite changes to some of the specific explanations, the fundamentals of the current model are in keeping with Guttmann and Maclay's account.[87]

However, although their conclusions were correct by modern standards, 'Mescaline hallucinations in artists' was not a seminal paper in the formation of this model. Guttmann and Maclay were not the first to propose this dual aetiology. They paraphrased what Mapother had already said a decade earlier: 'I wholly disbelieve in cases that are either psychogenic or physiogenic'.[88] That Mapother disliked theoretical dogmatism or absolutist theories was well known. Guttmann and Maclay were corroborating an established paradigm, rather than proposing a novel approach to the study of psychopathology.

Experiments using hallucinogenic drugs continued well into the latter half of the century. But very few cite Guttmann and Maclay's work. A recent scholar attempting to collate all research on mescaline warns that the literature on this topic remains fragmented as European scientists often remained ignorant of one another's work. This was largely due to language barriers and the multilingual nature of studies prior to

86 'It is probable that disturbances in cognitive processes as a result of cognitive deficits (i.e., bottom-up factors) and cognitive bias factors (top-down factors) are both responsible for hallucinations'. from S. Kumar, S. Subhash and C. Suprakash, 'Hallucinations: aetiology and clinical implications', *Industrial Psychiatry Journal* (2009) 18(2), pp. 119–125.

87 Not all their observations remain valid. One of the physiological stimuli Guttmann and Maclay describe is the visualization of one's own retinal vessels. In their paper they compare one of the artist's drawings with maps of retinal vessels. We know retinal vessels are unlikely to contribute to hallucinations, as shown by J.R. Smythies, 'The stroboscopic patterns', *British Journal of Psychology* (1960) 51(3), pp. 250–251.

88 Mapother quoted in A. Lewis, *The Later Papers of Sir Aubrey Lewis, 1900–1975*, Oxford: Oxford University Press, 1979, p. 148.

1938.[89] Many projects did take place between 1940 and 1970 in France, Switzerland and Germany, but their dissemination was incomplete. For instance, Richard Hartmann, conducting research at the Max Planck Institute for Psychiatry in Munich, only cited German-speaking contemporaries such as Leuner.[90] In England, Dr Francis Reitman certainly used mescaline as part of his research, but Reitman's legacy has been far more in the realm of art therapy than psychopharmacology.[91]

On a review of the literature, Guttmann and Maclay's 1941 paper has only two citations from the current century. These are from two papers in *Brain*, a high-impact neurology journal, which not only credit Guttmann and Maclay but also reproduce some of the original images from the paper. The *Brain* papers do not mention Guttmann and Maclay's physiological–psychological model of schizophrenia but instead credit something more fundamental: their use of drawings. In fact, in one of these, Ffytche and Howard even reprint one of the original mescaline drawings from Guttmann and Maclay's 1941 paper. Ffytche and Howard combine the drawings with new evidence from functional-imaging studies, linking zigzag patterns and 'latticework' hallucinations to the firing of cortical neuronal lattices, angled at forty-five degrees to each other, in the visual cortex.[92] Guttmann and Maclay's paper acts as a useful source of images to illustrate the phenomena that Ffytche and Howard wish to describe. A second paper by Ffytche and Howard, which is a review, makes a broader point by emphasizing the value of artistic drawings to aid hallucination research, as a 'little used but valuable tool' which can open 'an otherwise closed "window" to be opened on the transiently dysfunctioning brain'.[93] The review paper explicitly credits Guttmann and Maclay for their drawings as useful in the study of migraine auras, especially in relation to the notion of latticework. Neither of these papers refers to the scientific conclusions of 'Mescaline hallucinations in artists'.

This is as far as a purely scientific analysis of the images takes us. We learn about the origins of hallucinations and how contemporary neuropsychiatric studies investigate auras and hallucinations. However, this is limited. Star notes how 'most scientists write in a kind of encrypted voice' which hides emotional narratives, passions and dramas present in all human activity, including science.[94] This means we get little sense of any personal suffering. The three-year delay in the publishing of Guttmann and Maclay's paper was likely due to the outbreak of the Second World War. Guttmann was initially interned on the Isle of Man along with other German-speaking

89 J. Berge, 'Breakdown or breakthrough? A history of European research into drugs and creativity', *Journal of Creative Behavior* (1999) 32(4), pp. 257–276.

90 H. Leuner, *Die experimentelle Psychose*, Berlin: Springer, 1962, cited in R. Hartmann, *Malerei aus Bereichen des Unbewussten: Künstler experimentieren unter LSD*, Cologne: DuMont, 1974.

91 Cummings, op. cit. (71), pp. 69–87.

92 D. Ffytche and R. Howard, 'The perceptual consequences of visual loss: "positive" pathologies of vision', *Brain* (1999) 122(7), pp. 1247–1260.

93 G. Schott, 'Exploring the visual hallucinations of migraine aura: the tacit contribution of illustration', *Brain* (2007) 130(6), pp. 1690–1703, 1690.

94 S. Star, 'Living grounded theory: cognitive and emotional forms of pragmatism', in Bowker *et al.*, op. cit. (7), pp. 121–142, 121.

refugees and not permitted to work until 1941.[95] Guttmann and Maclay only briefly reunited at Mill Hill Hospital before separating permanently. Guttmann was restationed at the Radcliffe Infirmary in Oxford and Maclay at the Ministry of Health.[96] The Rockefeller Foundation also withdrew its funding of the émigrés on the same day the Second World War was announced.[97]

The stunted language of academic papers leaves out many of the emotions felt by clinicians. It seems that Guttmann and Maclay's legacy was in many ways more personal than scientific. British psychiatrists were later interviewed concerning the effect of the German émigrés on the Maudsley. Whilst many noted that Guttmann was 'brilliant clinically' in his interaction with patients, colleagues specifically praised him for his research.[98] At this time, the prognosis for psychotic patients was poor, as treatments were often ineffective. Performing any research gave hope to practising clinicians. Psychiatrists had few resources to work with and had to be inventive with their avenues of research. Mapother and the Maudsley encouraged unusual research, especially by the well-respected German émigrés. Turning to the modalities of psychotomimetic drugs and visual representations brought with it a hope of new discoveries.

In the scientific afterlife of Guttmann and Maclay's experiment, a final omission worth noting is that the participants are identified as professional artists, but not named. By leaving the artists anonymous we have no sense of their level of investment in the project or their reasons for participating. We do not know their background, training, genre, style or level of success; their previous use of narcotics; or their general outlook or philosophy on the world around them. Elsewhere Guttmann and Maclay do comment on the affinity between surrealism and patient art, but the paper 'Mescaline hallucinations in artists' makes no mention of surrealism's shared interest in the psyche.

I will now analyse these images from a separate sphere, as works of art. In many ways the artefacts possess the cardinal features of art objects, consisting of pencil, pen or paint on paper, sometimes even framed and inscribed with Trevelyan's signature in the bottom right corner. The pieces were likely named by the artist himself.[99] Figures 1, 2 and 3 bear a style that's reminiscent of the artist's other output at this time, such as *A Symposium* (1936), which is now part of the Tate collection. However, the exposure of Trevelyan's mescaline images as artworks has been limited. They have been displayed in the small-scale gallery on-site at the Bethlem as part of their Phantasmagoria exhibition in 2013 and the Briliant Visions show more recently in May–August 2019. Two of Trevelyan's drawings were shown at an exhibition in Nottingham's Djanogly Art Gallery entitled Art in the Asylum in 2013. Digital copies are now available on the Bethlem museum blog. Otherwise they have remained filed away in the archive.

95 F. Stahnisch and G. Russell (eds.), *Forced Migration in the History of 20th Century Neuroscience and Psychiatry*, Oxford: Routledge, 2017.

96 Anon., obituary, op. cit. (27). See also R. Trail, 'Walter Symington Maclay', *Munks Roll*, Royal College of Psychiatrists, at http://munksroll.rcplondon.ac.uk/Biography/Details/2879, accessed September 2019.

97 Hogan, op. cit. (75), p. 184.

98 E. Slater in G. Wilkinson (ed.), *Talking about Psychiatry*, London: Gaskell, pp. 8, 15.

99 Colin Gale (director of the Bethlem Museum of the Mind), email correspondence, November 2018.

The images are not included in any retrospective exhibitions or major anthologies on British surrealism. They do not factor into more academic literature either. More personally to Trevelyan, they are mentioned in his personal memoir and autobiography but the images themselves are not reproduced. They are only mentioned briefly in recent scholarship on Trevelyan by art historian Jemison.[100]

Philosopher George Dickie has defined 'art' as '(1) an artefact (2) upon which some society or some sub-group of a society has conferred the status of candidate for appreciation'.[101] Mostly this is done by the art industry, made up of galleries, museums, academies, curators, auction houses, collectors, scholars and the artists themselves. Often, new movements build in reference to those before them, requiring the viewer to possess prior knowledge for the process to make sense. As Danto argues, 'To see something as art requires something the eye cannot decry – an atmosphere of artistic theory, a knowledge of the history of art: an artworld'.[102] The fact that Trevelyan's images in 'Mescaline hallucinations in artists' received such scant attention means that they remain excluded from accounts of 1930s surrealism. It is therefore very difficult to analyse them as art objects alone.

Boundary objects properly described

These images never were, and never will be, simply 'science' or 'art' specimens. They were jointly created by artists and psychiatrists in an attempt to understand the mind. Both groups were invested in this underlying idea, meaning that the images embody both voices. It is now our responsibility to let them do so.

STS scholar Charlotte Sleigh argues that it is curation, the act of making space for an object, that is of utmost importance in the modern-day transdisciplinary practice of science and art, from mounting an image within a gilded frame to placing it within the cabinet of a science museum. As with Dickie and Danto's artworld, these implicit signals, along with the explicit explanations offered on the label or plaque, direct the viewer in how to engage with the object. While art can be displayed in science museums and science in art galleries, or reciprocally in academic journals, we must be aware that such instances often fall prey to certain pitfalls, detracting from the potential power of the viewer–object encounter. This may be due to a lack of critical appraisal systems or dominance of one sphere over another, often with science holding hegemony. Artists' work may be hijacked for the purpose of science communication, at worst becoming an artless piece of propaganda. Craske and Sleigh advocate the creation of neutral educational spaces, uncontaminated by the associations of science or art.[103]

100 A.J. Jemison, 'Barrenness and abjection? The iconography of the wasteland in the photographs and collages of Julian Trevelyan, 1937–1938', *Visual Resources* (2009) 25(3), pp. 169–191. Jemison, op. cit. (54) pp. 7–29. A.J. Jemison, 'Photographing the everyday surreal: Julian Trevelyan's portrayals of British ritualistic behaviour 1937–39', *History of Photography* (2011) 35(3), pp. 296–312. Jemison, op. cit. (79), pp. 101–121.

101 G. Dickie, 'Defining art', *American Philosophical Quarterly* (1969) 6(3), pp. 253–256, 254.

102 A. Danto, 'The artworld', *Journal of Philosophy* (1964) 61(19), pp. 571–584, 580.

103 S. Sheikh, 'Spaces for thinking: perspectives on the art academy', *Texte zur Kunst* (2006) 26, pp. 191–196, quoted in C. Sleigh, 'Contexts of encounter: how and where to criticise art and science', *Journal of Literature and Science* (2017) 10(2), pp. 106–112, 109.

Trevelyan, Guttmann and Maclay's images fell prey to lack of curation, much to the detriment of the viewers' engagement with these images over the past century. Here, I will try to rectify this, re-examining these mescaline images as at the boundary between the two spheres of science and art.

Turning to the artefacts themselves, on a purely descriptive level the images are ambiguous. Like a scientific figure from the era before colour printing, they are colourless, consisting of simple narrow black ink lines, on white cartridge paper, now slightly yellowed with age. The line is purposeful, lacking in any hesitancy or pentimento. Figure 2 appears as if it could have been created without lifting pen from paper, while Figure 1 seems to grow out from the top left corner. Figure 3 is the most complex of the images, with three separate figures arranged in a harmonious composition, connected by a line running at their the base. Trevelyan used minimal amounts of shading, with blocked-in shapes rather than any cross-hatching, and no attempt to mimic light falling on a three-dimensional structure. The artist furthers this abstraction by suspending all three forms in space, with no sense of perspective, foreground, background or gravitational forces.

The physical properties of these images alone do not answer the question of how to comprehend them. Are they diagrams or drawings? Passive inscriptions or active inventions? Mimesis of visual phenomena or a more abstract reflection on the multi-sensory mescaline experience? A snapshot or a recording over time? Or something else entirely? As boundary objects, images can function as malleable 'metaphors to bridge different worlds'.[104] As Star reminds us, each viewer can remain satisfied by their viewpoint, irrespective of whether it agrees with their neighbour's.

Visual sociologist Luc Pauwels overthrows the idea that visual representations in science pertain to optic stimuli alone. In *Visual Cultures of Science*, both Pauwel and STS scholar Michael Lynch argue that visual representation is embedded in the work of science, that 'observation, measurement, description, analysis, and demonstration' are often key to the knowledge-building process as well as downstream in public communication. Lynch highlights how we must pause to examine the very words used to describe the practice of developing visual representations in science, from 'index' to 'illustrate', 'depict' to 'demonstrate', as each example is made differently and intended or expected to be read differently, and often tied up in the process of conducting research. Lynch also notes how visualization is rarely 'well bounded' within science, often drawing from other realms of communication or pre-existing artistic or industrial crafts. In fact, he notes, 'what is most distinctive about visualization is its intermediary status' to cross boundaries between persons, material and symbolic, and to integrate projects.[105]

Trevelyan later drew comparisons between his mescaline works and the rest of his *oeuvre*. Whilst they lack his usual deployment of colour or paint, the fundamental

104 S.L. Star, 'Power, technology, and the phenomenology of conventions: on being allergic to onions', in Bowker *et al.*, op. cit. (7), pp. 263–290, 284.

105 M. Lynch, 'The production of scientific images: vision and re-vision in the history, philosophy, and sociology of science', in L. Pauwels (ed.), *Visual Cultures of Science*, Hanover: Dartmouth College Press, 2006, pp. 26–40, 37.

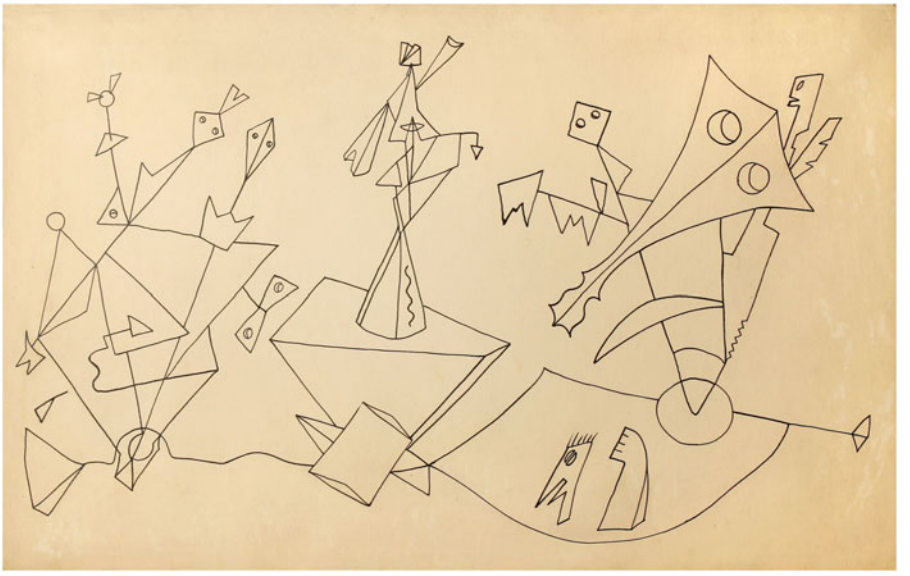

Figure 2. Julian Trevelyan, *Kite and Shapes*, 1936, ink on paper. Image from the Bethlem Archives, Ref. LDBTH18.

shapes are familiar. The figure on the far right of Figure 3 resembles a key or a kite, both symbols used by Trevelyan in his art and his writing. These motifs are present in works such as *Abstract (the Helicopter Is a Veritable Prince)* (1937) or *A Symposium* and were also littered around his home. For those unaware of Trevelyan's other works but cognizant of common traits of psychotic art, the viewer may be taken by the geometric style or presence of 'physiognomization', the appearance of facial features in unusual places, most obvious in Figure 3.[106] For those interested in surrealist automatic drawings, visual kinship can be identified with Miró's childlike forms in works such as *Figure, Dog, Birds* (1946), suspended in primordial space. Overall, the images appear to be in motion, indicating the dynamic properties of drug-induced hallucinations. These interpretations are not mutually exclusive or exhaustive, but simply demonstrate the range of associations a viewer may make depending on their sphere, or spheres, of knowledge.

One interpretation worth lingering on, as it would resonate with both surrealists and scientists, is that of the 'graphic trace'. Scholar Klaus Hentschel explores STS's preoccupation with instruments for creating and recording images, ranging from the microscope to modern positron emission tomography (PET) scanners. In particular, Hentschel notes how much work has examined kymographs, a class of instruments in which a measurable quality is continually recorded. From the mid-nineteenth

106 See Dr Leo Navratil's criteria in R. Cardinal, *Outsider Art*, London: Studio Vista, 1972. See also E. Guttmann and W. Maclay, 'Clinical observations on schizophrenic drawings', *British Journal of Medical Psychology* (1937) 16, pp. 184–205, for discussion of typical features of schizophrenic art.

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Figure 3. Julian Trevelyan, *Abstract Kites*, 1936, ink on paper. Image from the Bethlem Archives, Ref. LDBTH22.

century, the 'graphic trace' appeared in multiple scientific disciplines, from seismography recording tectonic motion to the physiologist's myography of muscle contraction. Such instruments have attracted the attention of historical researchers of science and art for a number of reasons.[107]

107 K. Hentschel, *Visual Cultures in Science and Technology: A Comparative History*, Oxford: Oxford University Press, 2014.

https://doi.org/10.1017/S0007087419000463 Published online by Cambridge University Press

Science historians Lorraine Daston and Peter Galison are particularly interested in how such instruments add to our understanding of the notion of 'objectivity'. Daston and Galison argue that 'objectivity', rather than being a universal principle, is culturally defined and became a moral issue in the nineteenth century. Scientists identified human bias as potentially misleading in their quest to understand nature. Dalton and Galison describe the rise of 'mechanical' or 'noninterventionist' objectivity from the 1930s onwards as a means to expunge subjective bias in scientific research. The nineteenth-century physiologist Etienne-Jules Marey provides a prime example, creating the sphygmograph for heart rate measurement in 1860, which was previously taken by fingertip palpation alone. Such instruments differ from earlier inventions such as the microscope, which make the invisible visible, as they also created a direct translation of dynamic forces.[108] Art historian Joel Snyder characterizes such instruments as 'inscribers', existing in their own realm of the graphic to reveal an unknown world impenetrable by human senses.[109] Marey notes in *La méthode graphique*, 'Not only are these instruments sometimes designed to replace the observer, and in such circumstances to carry out their role with an incontestable superiority, but they also have their own domain where nothing can replace them'.[110]

In many ways, for Guttmann and Maclay, the artists became recording instruments, inscribing rather than representing their experience. Trevelyan and his peers were employed as the most accurate mechanism of recording mescaline-induced psychosis the scientists could identify. On the one hand, this highlights the limitations of modalities available to psychiatrists at this time. Guttmann and Maclay were struggling to find any means to understand the experience of psychosis. Without contemporary experimental tools or brain imaging techniques, they had no quantitative measures of these subjective experiences. On the other hand, an obsession with the 'graphic trace' was not confined to science.[111] In fact, a model of 'artist-as-machine' was not so much a weakness in Guttmann and Maclay's methodology as an important tenet of surrealism. From its birth with psychic automatism, surrealists sought to become mechanized recording instruments. This idea developed in tandem with instruments of scientific practice and attempts for surrealists to shed any 'conscious' input in their art.

Dror has described how the application of such technologies to the study of emotion in the late nineteenth and early twentieth centuries created a new 'psycho-mechanical relationship' linking the internal, subjective world to external, objective physiological measurements. These instruments opened a dialogue about the inner world, often overlapping with preoccupations of the arts. For instance, experimenters could find no difference in measurements such as heart rate during an emotional reaction to an imagined event versus the event itself, bringing into question our distinction between the

108 D. Lomas, 'Becoming machine: surrealist automatism and some contemporary instances', *Tate Papers* (2012) 18, at www.tate.org.uk/research/publications/tate-papers/18/becoming-machinesurrealist-automatism-and-some-contemporary-instances, accessed September 2019.

109 J. Snyder, 'Visualization and visuality' in Jones and Galison, op. cit. (5), pp. 379–397, 379.

110 E.J. Marey, *La méthode graphique dans les sciences expérimentales et particulièrement en physiologie et en médecine*, Paris: Masson, 1878, p. 108, quoted in Jones and Galison, op. cit. (5), p. 380.

111 Lomas, op. cit. (108).

real and the fantasy, the wakened and dreaming self – which was a distinctly surrealist question.[112]

In Paris, the Bureau of Surrealist Research was home to surrealist experiments to create such traces. Ernst used collage and frottage to create images akin to seismographs. Even Trevelyan portrays himself as a piece of 'quirky machinery' in *Hypnosis* (1935).[113] With this in mind, Guttmann and Maclay had found an artist who was happy to act as a recording instrument, a transcriber or transducer of mescaline experience. Guttmann and Maclay's approach, whilst apparently outlandish from today's scientific perspective, actually drew upon an established concept within surrealism.

Importantly, images produced in this manner, either in the scientific realm, or with surrealist 'automatism', or both, all possess a temporal dimension. Re-examining Figure 3 through this lens, we could in theory find the beginning of the experience and trace through to the end. Rather than following a typical x axis, the pen moves in an erratic manner around the image, making any progression difficult to discern. Similarly, Figure 1 begins in the top left corner and appears to expand to fill the image, creating a sense of progression up to a crescendo. Such interpretations differ significantly from any conception of these images as static after-images. Instead of a snapshot or mental photograph of mescaline hallucinations, they exist as a trace of a mental journey.

By conceptualizing these images as boundary objects we can also learn more about the environment in which they were created. Understanding the surrealist agenda informs us not just about art history but also about the scientific context. Importantly, Guttmann and Maclay felt able to use surrealist artists, known for their political rebelliousness. The Maudsley and the Rockefeller Foundation granted considerable freedom in the pursuit of scientific progress. Researchers felt able to collaborate with anti-establishment groups. The backdrop of events in Europe even made the use of surrealists a mode of political protest, countering increasingly doctrinal attitudes in Germany. And even when Guttmann was interned and prohibited from clinical work, they persevered with publishing their research. What can have felt more surreal than to have fled for one's life from a regime, only to be imprisoned for one's supposed loyalty towards it?

A joint analysis teaches us about the surrealist context. Historiography largely labels surrealist understanding of mental illness misinformed. Critics, such as Macgregor and Cardinal, do not question surrealism's enthusiasm for insanity, but they certainly doubt its success. Macgregor posits,

> The insane, totally serious and committed, were the true Princes of the imagination whom the Surrealists could emulate, but never equal. However much the later surrealists attempted to obscure the boundary between the products of insanity and their own work, it remains true that these very distinct states of mind of the madman and the Surrealist, belong to two distinctly separate realms of existence and experience.

The attempts made by healthy surrealists to simulate insane 'realms of existence and experience' have been deemed a failure, as the two states are thought of as fundamentally

112 O. Dror, 'The scientific image of emotion: experience and technologies of inscription', *Configurations* (1999) 7(3), pp. 355–401.

113 Jemison, op. cit. (79), p. 106.

different.[114] However, the psychotomimetic properties of mescaline counteract this argument. Even though Trevelyan appeared personally unaware of the psychotomimetic implications of the drug, it was thought to re-create psychosis, meaning that surrealists had taken steps – or were induced to do so – to enter the elusive inner realm of schizophrenia. As with recent studies on Leonora Carrington (1917–2011) and Unica Zürn (1916–1970), Trevelyan's experience of mental illness was more genuine than the group has previously been given credit for.

By examining the mescaline images as a joint venture, we focus not only on one closed realm of knowledge, but on an entire ecology of knowledge. In this case, the visual images allowed groups with different perspectives to successfully interact. The abstract nature of these images can lead to multiple simultaneous readings. One shared interpretation is that of a 'visual trace' of mescaline experience, with the artists functioning as recording instruments in this process. Perhaps this rids Trevelyan of his sense of agency, reducing him to a passive machine, but in the context of surrealist theory I doubt he would have taken offence. He might even have been rather pleased. Situated at the boundary of psychiatry and surrealism, what is delineated in these images turns out to be a vast web of international politics and displacement, disciplinary and personal connection, brains and minds, selves and others, phenomena and machines: the rational and the irrational.

Conclusion

In this article I have described how these images came to exist and argued that they should be treated as boundary objects. I have described how the Rockefeller's funding of German émigrés and the Maudsley promoted a space for 'unconstrained experimentation' and how the multifaceted approach of the phenomenological school brought an enthusiasm for both psychotomimetics and visual media. Mescaline was used both pedagogically and in research into the aetiology of hallucinations.

I have proceeded to the connections between psychiatry and surrealism in 1930s Britain. Surrealists wanted to use mental disorder to make the viewer question the illusion of sanity and insanity, rationality and irrationality, the real and the unreal. To this end, some members of the surrealist group found drugs useful in their attempts to explore alternate levels of consciousness, whilst others disapproved.

I have then shown how this particular experiment combined Guttmann and Maclay's prior work in psychotomimetics with their interest in visual media. Trevelyan was an interested participant, influenced by surrealism and the Mass Observation project to use mescaline as a psychoscope, conducting an enquiry into the 'deeper self'. Finally, I have discussed the respective limitations of the scientific legacy of the paper and the artistic exposure of the images, and shown that they are more informative of both psychiatry and surrealism if they are treated as boundary objects. The scientific concept of mechanical inscription is at once compatible and incommensurable with a surrealist artistic vision of automatism as the route to irrational 'truth'.

114 MacGregor, op. cit. (37), p. 290.

When Star wrote about ecologies of knowledge and boundary objects, the aim was to reveal interactions between groups hitherto excluded from science and technology studies. After all, science is not 'great men, great moments, great labs, and great accidents of Nature revealing herself', but is in reality made by 'lab technicians, sponsors, administrators, spouses (usually wives), and consumers' who carry out the 'grunt work' of research.[115] Despite their skills and sacrifices, the latter are rarely immortalized in the citations of scientific literature. This process occurs with accounts of artistic movements too, often focusing on the 'genius' figures, such as Breton or Picasso, rather than more minor players such as Trevelyan. I regret I could not include every individual who contributed to this project, but instead tried to give equal weight to the conductors and participants of this experiment.

In this article I have shown that the 'heuristic methodological category' of boundary objects remains useful to the researcher when encountering material created by multiple groups. By looking for shared ideas, agendas or approaches, the legacy of such artefacts becomes easier to negotiate, whilst undoubtedly more complex. Star's concept opens up the possibility that every scientific project, and perhaps every endeavour in human life, brings together multiple spheres of existence. Each person must inhabit different worlds at different times, an often difficult task to negotiate. By accepting this as an integral feature of life, historical accounts can draw together altogether richer and more comprehensive narratives.

115 S. Star, 'Revisiting ecologies of knowledge: work and politics in science and technology', in Bowker *et al.*, op. cit. (7), pp. 13–46, 18, 34, 126.