Chapter 3.
Social Feedback as a Creative Process

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Abstract. Arguably one of the most important activities of a university is to provide environments where students develop the wide variety of social and intellectual skills necessary for giving and receiving feedback. We are not talking here about the kinds of activity typically associated with the term "feedback" — such as that which occurs through individual course evaluation questionnaires or more universal systems such as the National Student Survey, but the profoundly creative and human act of giving and receiving feedback in order to validate, challenge and inspire. So as to emphasise we are talking about this kind of feedback, we coin the term "creative feedback" to distinguish it from the pre-conceived rather dreary compliance-inflected notions of feedback and set out in this paper to characterise its qualities. In order to ground and motivate our definition and use of "creative feedback" we take a historical look at the two concepts of creativity/creative and feedback. Our intention is to use this rich history to motivate both the choice of these two words, and the reason to bring them together. In doing so we wish to emphasise the characteristics of an educational philosophy underpinned by social interaction. By describing those qualities necessary to characterise creative feedback this paper sets out an educational philosophy for how schools, communities and universities could develop their learning environments. What we present here serves not only as a manifesto for designing learning environments generally, but as a driver for designing technologies to support online social learning, as captured in the concept of social Moocs [70]. Technology not only provides us with new opportunities to support such learning but also to investigate and evidence the way in which we learn and the most effective learning environments.

Keywords. Feedback, creative, creativity, learning, technology

1. Introduction

When the word feedback is mentioned in universities — as happens now with increasing frequency — there are usually one or two winces around the room. The problem it is a word that has become associated with compliance, with checking competency, with measurement and judgement, with having to go through the motions of various government or funding body processes and, perhaps too, with feeling beholden to open up channels of communication so as to hear things that we would rather not have to hear. This is a pity, and especially so at universities, because feedback is central to learning. Not just to learn a discipline, but to learn about the way we are, to learn about the way we think, to learn about the way we interact and about the way in which we produce and value

our work. Whether that work is an analytical or interpretive essay, whether it is a poem or a composition, whether it is a new performance or a new artwork, it is only through actively seeking feedback both from others and from ourselves that we learn.

At one level it is clear that without the on-going feedback that we sense and perceive from our environment we could not operate or survive. Without basic perceptual acts such as seeing, hearing and touching we couldn't function for very long. However, feedback is also necessary to experience ourselves as social beings, and especially to understand and investigate the process of social interaction between individuals. Sometimes the communication from one human to another is like an experiment whose result is evidenced by the feedback perceived from the other [1]. For example, shouting "hello?" to check whether anyone is at home, the result might be the perception of a response like "I'm in the kitchen!" or complete silence. This is an example of a simple feedback loop at work providing evidence for a model of the world. At the other extreme feedback loops can be continuous and extremely complex, and often below conscious awareness such as when two jazz musicians are improvising together [2]. In all cases feedback is the way in which we understand the world we are in, and learn about our physical and social place within it.

Suppose you are learning to play music, for example. If you play a piece of music then the only way you can know how it was heard and experienced by others is to get their feedback on your performance. This feedback will be absolutely critical if you want to understand how you can improve yourself as a performer. Of course in any performance sustained self-feedback is critical too and musicians are skilled enough to give themselves this on-going and continuous feedback as they play. In addition to this, musicians have the option of recording performances and listening to them later in order to provide an entirely new perspective. The distance created in time and space, and moving from performer to listener, provides new opportunities for fresh insights on how to improve ones own performance. In addition, through an understanding of how we come across to others, we can often best advance the quality and precision of the feedback we give ourselves.

If we accept the need for building communities of feedback the issue then becomes how to build the right kinds of learning environments. If students can develop their own skills in giving and receiving feedback at school and university, then they will gain confidence in giving and receiving feedback from friends, colleagues, press and audiences too. Education environments should enable an exploration of how peers and tutors perceive essays, performances, software and artworks and in turn, how we all learn to be open to the feedback from others.

This philosophy is very strong in the Art department at Goldsmiths, where the emphasis is very much focused on developing communities of feedback. This department is especially interesting because of its reputation for producing world-class artists that have become important cultural and creative pioneers in the UK.[1]

In our observations, first, second and third year undergraduates come together weekly in order to give feedback on a small selection of undergraduates work. The students clearly worked as a group in balancing praise and criticism, combining the emo-

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[1](Damien Hirst, Malcolm McClaren, Mary Quant, Lucien Freud and Anthony Gormley are all alumni of the Art department. Other alumni include Laurie Provoust who currently holds the Turner prize and Steve McQueen who won a Bafta and Oscar for best film with "12 years a slave". The question to us is whether developing communities of creative feedback is the key to the Art department's success.)

tional and analytical, and moving from the sociological to the political. In all these open conversations students are learning about how to give and receive feedback to each other and understanding the ever present gap between any intention behind an artwork, and the perception by others. One of the most fascinating aspects observed in these sessions was the ability of students to take a sufficient emotional distance in order to be open to feedback, and to experience it freely without personalising anything. This ability is not only key in terms of learning how others experience their work but becomes an important skill for artists moving into a professional sphere with the free-for-all comment and criticism that social media now encourages.

Arguably then, a learning institution's key objective is to provide the kind of supportive and trusting environments where students can develop their ability to give and receive feedback in a culturally-aware, sensitive, mindful, critical and challenging way. We certainly think so, and would like a label to describe the kind of feedback we have in mind, and for this we choose the term "creative feedback". In this paper we provide a historical account of the notions of creative and creativity in order to justify the use of this term in an educational context. Moreover, by using this term explicitly the hope is we can rescue the concept of feedback from its often rather dreary compliance-inflected interpretation.

In what follows we will call upon our experience as educators spanning mathematics, psychology, psychotherapy, music and computer science, to try to explain what we mean by creative feedback and to justify our use of this term. To do this we need to take a brief historical look at the concepts of "creative" (and the related "creativity") and "feedback" — particularly, though not exclusively, in an education context — in order to explain exactly what we mean by these terms and why we are bringing them together specifically. The aim of the historical analysis is to give currency to the use of the term and the underlying manifesto for learning. We clearly need to be mindful of using the word "creative" when it is used so loosely, and for so many different educational, marketing and political reasons. We not only have creative writing and creative learning but now we have creative musicianship, creative computing and creative financing, not to mention the growing importance given to "creative industries" and economic arguments about why they are such an important part of our future. The word is in danger of being no more than what is approved of, and we wish to recover an older and fuller meaning for our purposes.

1.1. Aims

In this paper we set out to characterise creative feedback as the basis of an educational philosophy that is inspired by the American psychologist, philosopher, and educationalist John Dewey. The idea that follows naturally from this is that we structure schools, learning groups and universities as "communities of discovery". There are a number of motivating factors for the work in this paper described next.

The first is the desire to build educational environments (which include online environments) that give more people access to developing "creative feedback" skills. Creative feedback belongs to what Dewey called "creative intelligence" which is a part of all human thinking and is available to everyone. A strong part of our individual learning journey is gaining an understanding how others see us. The way we think, the way we behave, what we produce. This understanding is such a crucial part of learning that

we want to build environments that encourage students to be aware of how others see them. As George Herbert Mead wrote, *"the individual mind can exist only in relation to other minds with shared meanings"* [3, p5]. If this is true, the relation to other people is grounded within a framework of feedback and the individual mind can only exist within such a framework.

Next, we want to emphasise that "creativity" depends on feedback from the world rather than being something that is an intrinsic quality that resides within individuals. It depends on feedback both in the act of creation itself, and also the social feedback that is received once it is made available to others (which may or may not amount to acclamation as great art).

As stated above feedback is not often seen as a creative endeavour but rather as being quite mechanical (tick boxes and scores) and about compliance (such as is often the case when making module feedback forms available to students). The impact of this notion of feedback on tutor/tutee relationships can often be dire. We explicitly introduce "creative feedback" to mitigate against this commonly held view of feedback and, in addition, to move away from another commonly held conception about feedback that it only exists in terms of praise and punishment. Furthermore, we want to emphasise how we are immersed in feedback as biological and social beings and we wish any definition to encompass this.

Most educationalists like us want to promote effective education as available to everyone rather than a middle-class luxury and technology clearly has an important role here. However, technology also provides opportunity to bring communities of learners together and, moreover, serve as a test-bed from which we can start to evidence the benefits of social learning over the individual, rote-learning and exam-based methodology that so dominates current political thinking. It also provides us with exciting new possibilities for understanding the way in which we learn. One of the drivers in our own research, for example, is to develop learning analytics and methodologies that can enable us to correlate creative feedback with learning.

The ability to use technology to understand and support social learning depends on whether we can construct systems that encourage humans to give and receive creative feedback. In order to achieve this we need participatory design methods working with a variety of user groups in order to design software that can support creative feedback across a whole range of disciplines (e.g. poetry, music, design, digital art). We believe a historical and educational underpinning is necessary to drive the principled design of such systems that not only support creative feedback but also allow mixed human and computational societies. One of the practical questions that we are addressing in the design of novel education systems that enable social learning is how to build autonomous artificial systems that can help exemplify creative feedback in a learning community.

2. A History of Creativity and Feedback

2.1. The Education Wars

Ever since people started arguing about education, there has been an angry debate that is still not resolved, and is especially marked today in England. On the one hand, the Secretary of State for Education, Michael Gove, crusades for even more frequent and strin-

gent examinations and inspections in the State-based schools, creating what his critics call *"exam factories"* [4], designed to compete with the dauntingly efficient exam factories of the Far East. And on the other hand the popular educationalist Sir Ken Robinson speaks for many when he condemns such an approach for undermining creativity, which is, according to this view, the true goal of democratic education. It may be hard to define creativity, but everyone agrees that it is a good thing, and that it is not fostered by an exclusive focus on training students for success in exams. The emphasis on exam factories may even be self-defeating, since there are studies showing that the success of children in China and Japan depends more on the early nurturance of sociality, than on forced study and rigorous examinations [5]. That is, working more like what Coffield called *"communities of discovery"* than *"exam factories"*, so perhaps Gove is taking us *"ever faster down the wrong road"* [6].

2.2. Background to the Conflict

This quarrel occurs at every level of education, from toddlers to adults, and it reflects different views on the nature of children. At one extreme is the active child, full of wonder and curiosity at the world, who needs only skilled guidance from the teacher to flower into a civilized and creative adult. At the other is the resistant child, lazy and easily distracted, whose motivation and attentiveness require firm moulding and sometimes medication in order to learn lessons and become a good citizen. Around 1900 these extremes were given psychological and educational form by two prominent American thinkers [7], and this set the scene for many of the debates on education during the coming century. In the active, curious child camp sat the philosopher, educationalist and psychologist, John Dewey, the great champion of American pragmatism, which is a philosophy based on doing rather than thinking; in the other camp sat Edward Thorndike, famous throughout the 20th century for his puzzle box experiments with cats published in 1898 [8] in which he claimed to show that cats are incapable of reason and learn only through trial and error. During the second half of the 20th century both camps contributed to the new interest in creativity, which has now become a massive and well-funded research industry in Europe especially in relation to technology.

In this paper we aim to show how technology can contribute to the fostering of creativity in education in a way that can satisfy both the jeremiads of Professor Robinson and the ministerial anxieties of Michael Gove. But first we need to be clear about what kind of learner we have in mind, Dewey's or Thorndike's, since this determines what we mean by creative and creativity, and the deployment of these terms has provided a map of the hidden agendas of Psychology and Educational Theory during the 20th century.

2.3. E. L. Thorndike: Connectionism, Stimulus-Response and the Importance of Measurement

In 1911 Thorndike published his puzzle box experiments in *Animal Intelligence*, and developed the theory that learning is initially guided by random trial and error learning, rather than rational intelligence. For Thorndike and later many Behaviourists, the unit of behaviour was the stimulus response (S-R) connection, treated as a kind of reflex. Thorndike's view was that learning takes place by establishing connections in the brain and these connections are stamped in through a system of reward and punishment.

Applied to education it was argued that the randomness of the trials in initial learning showed that little is to be gained by relying on the prior capacities of the novice learner.

Connections were treated as "atoms of the mind", and Thorndike speculated that *"the vague gross feelings of the animal sort might turn into the well-defined particular ideas of the human sort, by the aid of a multitude of delicate associations"* [9, p289]. This is Thorndike's Connectionism, and it has been one of the main models guiding studies of learning throughout the 20th century, though it was quickly found that the S-R scheme needed to be extended to S-O-R [10]. In this extended scheme O refers to the state of the organism, which is made up of many variables or factors, including prior knowledge (the multitude of delicate associations), motivation, attentiveness, intelligence and many other variables.

During the second half of the 20th century computers became the new model of the mind, and the language for describing "a multitude of delicate associations" became increasingly sophisticated, eventually leading to a new brand of Connectionism as a model for perception and learning [11]. But even in its most sophisticated form, it is still about the selection of successful acts and the "stamping out" of "profitless" [9, p283] acts by reward and punishment. Nowadays we speak of input and output of information rather than S-R, but whatever the cognitive complexity of what goes on in between, a basic linear structure remains, with the environment operating on the organism, rather than the organism on the environment.

But Thorndike was not only one of the founders of S-R theory, he was also a pioneer of mental testing as a way of classifying individuals for social control, and therefore for assigning numbers to the "O" variables in the S-O-R scheme. Thorndike greatly admired the work of Darwin's cousin Francis Galton (1822-1911) who spent much of his life studying and measuring human variation and its genetic basis after reading *Origin of Species*. As part of this interest Galton became the first to use questionnaires and statistics for the measurement of human differences and Thorndike in turn became a champion of measurement in Psychology and Education. In 1904 he published *An Introduction to the Theory of Mental and Social Measurements* [12] which introduced students to the new statistical methods that were to dominate the scientific practice of Psychology.

2.4. Deweyan Inquiry

The contrasting philosophy was that of John Dewey, who was one of the first to acknowledge the value of Galton's statistical discoveries [13] but had little faith in the value of measuring the worth of individual human beings [14]. He believed effective education is powered by the child's spontaneous curiosity about the world and is social, taking place in "a community held together by participation in common activities" [15,61]. This social setting generates "inquiry", a process as natural as breathing in all animals. Inquiry is an ongoing process that reveals "novelty", which in turn becomes the spur to further inquiry.

In 1896 Dewey had made the revolutionary step of taking the basic S-R reflex studied in the laboratory by physiologists, not as the simple arc of Thorndike, but as a circular structure with neither stimulus nor response being dominant over the other. He argued that the S-R reflex is not an isolable molecule of behaviour, but is inseparable from an

ongoing process involving what 50 years later would be called feedback.[2] Dewey was not a laboratory psychologist, and unlike Thorndike's S-R, his scheme did not lend itself to precise control, since it required freedom of action for optimal learning to take place.

The main concern for the teacher therefore is to guide this action toward educational goals, and to avoid stifling freedom through the indiscriminate "stamping out" of what Thorndike referred to as "profitless" acts. For Dewey these "profitless" acts are part of what he called inquiry and to stamp them out is to suppress inquiry and to stunt human development.

2.5. Who Has Won?

In Psychology and in Education, Thorndike has won hands down: *One cannot understand the history of education in the United States during the twentieth century unless one realises that Edward L. Thorndike won and John Dewey lost* [16, p185].

But as Lagemann goes on to point out, Dewey paradoxically remains a significant figure in education, dominating discussion in schools of education, and pointing to an ideal, even if it is Thorndike who prevails in practice. But occasionally an indirect Deweyan light shines through. A possible example of this was the dramatic reception in the West of Vygotsky's Zone of Proximal Development (ZPD). Dewey had a strong influence on Russian education in the 1920's when Vygotsky was developing his ideas [17]. Vygotsky had certainly read Dewey's work [18, p53], and there is a close affinity with Dewey's ideal of "a community held together by participation in common activities" [15, p55]. ZPD contrasted the child's developmental level when measured by conventional tests, with the level shown under adult or peer guidance [18, p86] where the ability to follow and imitate comes into play: *"using imitation, children are capable of doing much more in collective activity or under the guidance of adults"* [19, p88]. This presupposes *"a specific social nature and a process by which children grow into the intellectual life of those around them"* [18, p88], which comes close to the collective learning through inquiry described by Dewey. In 1966 Bruner [20] introduced the word "scaffolding" to describe what is going on in ZPD, but this has been often been limited to the capacity to benefit from adult help [21], rather than from the more general sociality of "collective activity", which leads to a form of "social constructivism" [22]. Like an education based on Deweyan inquiry, ZPD in our interpretation goes very deep, and its effects, unlike those of scaffolding (if we take the metaphor literally), cannot be removed once the construction is complete.

In Psychology too, Dewey has been lurking in the background, and his influence became more apparent once the notion of feedback spread after the publication of Norbert Wiener's *Cybernetics* [23]. Later, in 1960, *Plans and the Structure of Behavior* [24] appeared, and brought together feedback of information (rather than reward and punishment) with some of the early influences on Artificial Intelligence. These included Chomsky's generative grammar [25] and Newell, Shaw and Simon on problem solving in com-

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[2]Thorndike's S-R connectionism also involved a rudimentary form of feedback. Reward and punishment applied to isolated S-R connections are feedback. But Dewey seemed to have in mind what we now think of as a self-organising system, in which the parts, which we may for convenience label stimulus, response, feedback, etc., cannot usefully be isolated and studied as "laboratory preparations" outside the system. The knowledge gained by an inquiring child involves, not a changing array of S-R connections, but an evolving place within a system that includes its social and physical environment.

puters [66]. The result was the TOTE (test operate, test exit), introduced as a unit of behaviour to replace the S-R model, and the authors were quick to recognise that this was similar to what Dewey had proposed in his 1896 reflex arc paper [26,27, p30].

More generally, affinity with the Dewey scheme rather than Thorndike's shows itself when the organism, animal or human, is treated as essentially in the world, active and subject to continuous feedback as it acts, rather than a static processor of information. Examples of this Deweyan scheme are Gibson's sensori-motor systems as a model for perception [28]; the move in Robotology from cognitive representations to a focus on sensori-motor activity [29]; Jean Lave's Situated Learning [30]; and more recent work in Psychology and Philosophy on Situated Cognition [31].

2.6. Formative Assessment and Feedback

In one respect - through the notion of formative assessment - the Deweyan influence penetrated deep into the heartlands of Thorndikean territory, measurement and educational testing.

The psychologist L.L.Thurstone studied at Chicago with a close colleague of Dewey's, George Henry Mead, and spent most of his career there. Early on in his career he proposed a Deweyan model of ongoing behaviour as an alternative to the S-R scheme [32]. But his main achievements were in test theory and a more careful analysis than was usual of what is typically meant by measurement in Psychology [33]. Lee Cronbach, whose PhD was also from Chicago, continued this critical tradition within psychological measurement. His work with Meehl on Construct Validity [34] showed the limitations of psychological testing, since it measures constructs rather than reality. And he recommended that assessment be part of the learning process, rather than a test given after the learning is over [35]. Later this was labelled "formative" by contrast with the conventional "summative" assessment [36], the one made by tests after the course has ended; whereas formative assessment is the one made during the course, designed as part of the learning process. It is closer therefore to a Deweyan rather than a Thorndikian philosophy of education, and the formative assessor joins "a community held together by participation in common activities" [15, p55]. Formative assessment involves what came to be called formative feedback. In formative feedback the student is given ongoing information about performance, and the term has replaced the concepts of reward, punishment and reinforcement. But the old S-R scheme dies hard, and many of the experiments reported on formative feedback seem quite similar to those by Thorndike and others of 80 years ago [37]. They are a long way from the feedback of a sensori-motor system that is the necessary vehicle for Deweyan inquiry. This same pattern — an apparent massive victory by the Thorndike camp, yet a persistent critical or subversive presence from the Deweyans — exists in the field of creativity, where the difference between the two viewpoints is especially marked and important given that the concept of creativity is so dominant in educational discourse.

2.7. Creative Intelligence

In literature on Creativity, which spans many disciplines and is now remarkably large and increasing every year, two distinct points of view about its nature have remained unchanged. The first is that it is a perfectly ordinary and basic property of all human

and perhaps even animal behaviour. The second is that it is a puzzling and wonderful property of the human mind that has given rise to all great human achievements.[3] The reason for this strange contradiction between the two meanings, which seems to have gone largely unnoticed, may be because the modern word "creativity" derives from two distinct ways of thinking about novelty and innovation in the world. The first of these, which sees creativity as the basic process of every mind, belongs to the Deweyan view. The second, which came later, sees creativity as a marvellous addition to the mechanical processes of ordinary thinking; this belongs to the Thorndikean view.
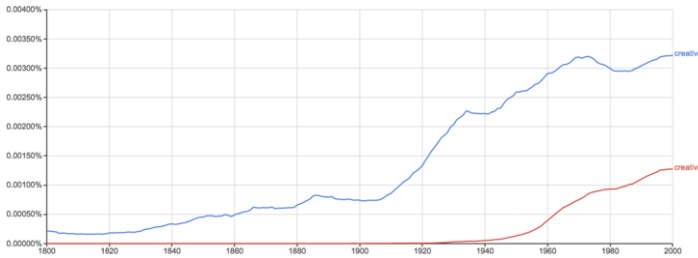

Figure 1. Creative and Creativity in Google's nGram

As the diagram above suggests, the popularity of words like "creative" and "creativity" is only quite recent. Originally both words were the prerogative of God, who was unique in being able to make something (the world) out of nothing. This is what creation meant, making something out of nothing. With this in mind, "Creative" (though not creativity) was occasionally extended to women giving birth and in the 19th century to refer to the divine and mysterious work of poets and artists.[4] This can be seen clearly in the diagram above.

But after the widespread acceptance of the Theory of Evolution by the end of the 19th century, the world itself could be seen as creative through variation and selection, with no help from God. This is how it is used in the title of Bergson's *Creative Evolution* [41] which was first published in French in 1907, and then translated into English four years later[5]. This was a book that was widely discussed, especially in the pragmatist circles around William James in Harvard and John Dewey in Chicago.

Dewey's *Creative Intelligence* was published later in 1917, and the word "creative" in the title was not being used to pick out one kind of intelligence amongst others, but to emphasise that human intelligence is inherently creative through a natural process of deliberate variation and invention. This could be the herald of a new beginning for education, since according to the traditional philosophies, *"If ever there was creation it all took place at a remote period. Since then the world has only recited lessons."* [42, p23]. Dewey thought that reciting lessons is a way of suppressing the variation that is necessary for creative intelligence to flourish. There was nothing divine about Dewey's view of creative thought, and he made little use of the popular concept of genius, instead

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[3]"Creativity is consensually viewed as one of the most remarkable characteristics of the human mind." [40, p147]. Creativity "is the humble human counterpart of God's creation" [38, p4].

[4]"But this I know; the writer who possesses the creative gift owns something of which he is not always master—'something that at times strangely wills and works for itself'." Charlotte Bront in editorial preface to 1850 edition of *Wuthering Heights* [39, p 1iii].

[5]Translation of Bergson's *L'Évolution créatrice* from 1907 as *Creative Evolution* in 1911 [4]

seeing art and creativity as present in the most mundane activities: *"The sources of art in human experience will be learned by him who sees how the tense grace of the ball-player infects the onlooking crowd; who notes the delight of the housewife in tending her plants, and the intent interest of her goodman in tending the patch of green in front of the house"* [43, p3].

In this philosophy, education involves social control, but not via rules dictated by authority. Instead Dewey took as a benign paradigm of social control that of children playing games, in which the control is not from on high, but is naturally social from "a community held together by participation in common activities" [44, p55]. This underlies his practical experiments in education in the experimental schools he set up first in Chicago, later at Columbia University.

2.8. Creativity

The modern word "Creativity" came into play a little later than "creative," in the mid 1920's [44]. In 1924, around seven years after Dewey's Creative Intelligence was published, the mathematician and philosopher Alfred North Whitehead was invited to Harvard, where he developed the process philosophy for which he is best known. At the centre of this philosophy was his concept of creativity, a term he coined from the Medieval Latin "creare". [18, p208]. This was his word for the evolution of forms or species. Darwin had shown how this could be a property of organic evolution, and Whitehead applied the same basic structure (variation, and a means of fixing change) to the universe as a whole. It was his metaphysical principle through which entities are created out of flow (*"all things flow"* [45, p208]) which is more basic than the things that we experience. New forms (the solar system, new species) emerge and creativity is the power that enables this to happen. Dewey read this as a universal generalisation of his own views of human invention, managed by creative intelligence out of variation, and wrote approvingly about Whitehead and his ideas of creativity in 1937 [46]. On this view, there is nothing special about creativity. It is a basic principle of the world, and human creativity is no more than a reflection of this.

2.9. From Creativity to Social Creativity

Dewey's friend and colleague the social psychologist G.H. Mead had contributed one of the chapters in Dewey's Creative Intelligence of 1917 writing, *"The individual in his experiences is continuously creating a world which becomes real through his discovery"*. [47, p210] After reading Whitehead, he used the word "creativity" in his lectures during the 1920's, [47, p325], and it appeared in his best known book *Mind, Self and Society* [48] which was widely read.

There Mead described how any individual self is constituted by the social and physical environment it inhabits, but at the same time affects the environment in which the it is situated. More generally, the organism is partly determined by its environment, but also *"is determinative of its environment"*, a more general version of the circular process described by Dewey [49]. Thus the word "creativity" is will have been familiar to the many readers of Mead and Dewey, and they would have had a common understanding

that there was nothing special about it, not linked to genius but essential for the thinking of every human being and animal.[6] [65, p10-11]

2.10. Creativity as Faculty

But when creativity re-emerged in 1950 [50] it had a different meaning, and came from a different tradition of Psychology, that of Psychological measurement, therefore closer to Thorndike than to Dewey. It was not about creativity as the generation of change and novelty in the world, but referred instead to a personality characteristic. Launched by J.P. Guilford in 1950 in a presidential address to the American Psychological Association, he started by expressing astonishment at the lack of work on Creativity. He made no mention of Whitehead, Dewey or Mead, and based his concept of creativity on Factor Analysis, discovered by Charles Spearman [51]. Spearman had actually written a book called Creative Mind in 1930 [52], in which the word "creativity" appears, but it is not referred to by Guilford though he is likely to have known it. Spearman was a colleague of Whitehead's at UCL for several years before Whitehead left for Harvard, and may have picked the word up from him.

By partitioning similar correlations in tables from a large number of tests, Spearman had shown how to extract distinct factors of the mind, like intelligence, perseverance, memory and so on, and now creativity, which can be used to form part of the O in the S-O-R scheme. By 1950 Factor Analysis had reached a high level of sophistication, and Guilford had isolated a factor he called Creativity, based on his test of Convergent and Divergent thinking. Convergent thinking is conventional problem solving, converging on the correct solution, divergent is open ended and was thought to allow the free play of imagination, with questions like "in what different ways can you make use of a brick" Later many other tests of creativity were devised including Torrance's Incomplete Figure Test [53] tests of insight, similar to Duncker's classic candle problem [54] and of "remote associations" by Mednick et al [55].

2.11. The Creativity Bandwagon

The vastness of the bandwagon launched by Guilford has been extraordinary, and cannot be explained only by the happy Utopian vision offered by the definition that runs throughout the literature: "a creative response is novel, good, and relevant." [56, xiii]. From a comfortable seat on board in 1966, Liam Hudson wrote:

'Creativity' [...] applies to all those qualities of which psychologists approve. And like so many other virtues [...] it is as difficult to disapprove of as to say what it means. As a topic for research, "creativity" is a bandwagon; one which all of us sufficiently hale and healthy have leapt athletically abroad. [57, p100-101].

But why? What are the reasons for the astonishing success of the Creativity bandwagon, which continues to gain speed, and has left in its wake a whole set of often quite unrelated "creative industries" (media, advertising, TV, film, design, games)? Even

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[6]Vygotsky had a similar view: "just as electricity is equally present in a storm with deafening thunder and blinding lightning and in the operation of a pocket flashlight, in the same way, creativity is present, in actuality, not only when great historical works are born but also whenever a person imagines, combines, alters, and creates something new, no matter how small a drop in the bucket this new thing appears compared to the works of geniuses."

banking is given the epithet "creative" without a trace of irony, as well as the great entrepreneurs, led by Richard Branson. Here are just a few of the possible reasons for this remarkable juggernaut.

A. It is held together by the scientific armour of Factor Analysis, a way of constructing smooth curves from the uncertain data of questionnaires.

B. Protected by this show of rigour, it was able to break away from the aridities of Behaviourism, which had given Psychology its needed scientific respectability but had bored students for years.

C. The giants of Humanistic Psychology got on board, each with a mouth-watering trade mark to draw students to Creativity 101: Carl Rogers' self-actualization in 1954 [58], Csikszentmihalyi's flow in 1975 [59], and Maslow's peak experiences in 1968 [60]. Charles Tart was there with altered states of consciousness in 1969 [61], and Frank Barron, veteran of LSD experiments in 1963 . And even Buddhism, offering an endless stream of books with titles beginning "Zen and Art of . . . ." to say nothing of Kabat-Zinn's introduction mindfulness as an essential component of creativity in 1990 [63]. It all added much needed glamour to Psychology.

D. Artificial Intelligence hitched a lift. As early as 1958 Newell et al [64], had raised the problem of creativity for computers and described a programme on ILLIAC that composed music. Computational creativity has progressed independently (there are remarkably few cross references between the two disciplines) but in parallel with Psychology's version, and has probably added a further bit of hard-nosed scientific respectability to the whole endeavour.

E. Last but not least, there has been massive funding from military and industry. As Guilford wrote in 1959, soon after the launch of Sputnik by the USSR *"The preservation of our way of life and our future security depend upon our most important national resources: our intellectual abilities and, more particularly, our creative abilities. It is time, then, that we learn all we can about those resources"* [66, p469]. The economy and safety of the West is thought to depend on the practical benefits of making things that work, from nuclear weapons to the stylish artefacts of Steve Jobs, and the secret is creativity.

3. Creative Feedback

But in the midst of all this razzmatazz, there was a quiet Deweyan revolution. Some of it took place on the bandwagon itself, where there are researchers who stress that Creativity is an everyday matter, and that we all possess it in our capacity for flow and mindfulness. More recently there are those who have turned away from creativity with a capital C, and looked at how a more modest Deweyan creative intelligence can be encouraged throughout education [67,68,69]. Dewey believed that creative intelligence is necessary for democracy to prosper, and it is fostered by what we call creative feedback.

This is the goal of MusicCircle Software project at Goldsmiths; to design an online environment to support communities of creative feedback for learning to play music [71]. It includes the ability to upload performances, share them with others, and then seek and provide creative feedback. It is developed through a process of participatory design, working with students and other users to ensure we build what people want.

Through systems such as ours perhaps we can begin to reconcile the conflicting demands of Michael Gove and Ken Robinson through evidencing clearly how learning takes place through creative feedback.

In order to understand how to design learning environments, we now set out to characterise creative feedback in more detail. We do so by describing its qualities along a number of dimensions drawing both upon our historical analysis and our combined backgrounds: teaching, programme development and management in higher education; performance and composition in music; design and implementation in software; and mindfulness and psychotherapy in practice. These qualities of creative feedback are offered in hope of receiving creative feedback to inspire the next steps.

1. CF is social. It comes from one social agent who has perceived the feedback object in some way (whether that is an output or a process of an individual) to another (the originator of the feedback object). Note this definition does not preclude students giving creative feedback to their own work.

2. CF is mindful. This incorporates at least two aspects: a) that the person giving the CF is aware of the cultural and individual context of the receiver (such as an understanding of the individual's artistic or scientific goals/methods/audiences etc.); and b) that individuals are aware of any personal judgments that are being made and can articulate these if required.

3. CF contains a degree of community awareness that: a) CF embodies an awareness of what creative feedback has occurred previously but also that it features as part of a complex and developing system; and b) giving and receiving CF should be embraced equally for the community to sustain itself. It would be difficult for communities to thrive if everyone wanted to give more CF than they wanted to receive of course. CF creates a self-sustaining self-organising system where flexibility and robustness need to be balanced. Whilst each learner may have more or less knowledge about what is required to maintain such a system it is clear that it can only exist if individuals in the learning environment actively encourages engagement in CF.

4. CF is clear, the language used being unambiguous and terms used mutually understood.

5. CF is democratic. Being a tutor or student bestows no special right to giving or receiving CF (though of course one might hope that tutors have more experience and skills in giving it).

6. CF is challenging. Underpinning any creative partnership is the notion of the challenge that the each brings to the other. CF that provides the right level of challenge is arguably the most sought after feedback. To do so involves "skill in means", a Buddhist concept meaning that feedback is geared to the level and character of the student, and is always open to the student's needs.

7. CF incorporates generosity of spirit and compassion. It is an act of giving and enabling, itself an essential aspect of skill in means.

8. CF is always open to discussion and further explanation.

9. CF is comparative rather than absolute. No absolute judgment about a feedback object can be made. Comparisons (explicit or implicit) of the feedback object to other existing objects is a mindful tactic in many cases and involves skill in means. (For example, CF to a jazz piano student from a tutor could simply say how close

the student's playing is to another well-known jazz pianist and how they may want to take a listen.) We believe the key to successful education is about providing the right kinds of environments where skills in creative feedback can develop. The role of technology is both to build new kinds of learning environments but critically to start to evidence how the creative feedback ability is correlated with learning and artistic development more generally. This may have ramifications for the way in which we think about structuring learning in schools, universities and any other kind of learning community.

4. Concluding thoughts

We are designing a new technology at Goldsmiths called Music Circle as part of a European Project (Practice and Performance Analysis Inspiring Social Education) through the Technology-Enhanced Learning Programme. [71] It is designed to allow students to upload and share performances and compositions within learning communities and then by inviting feedback from others. In order to identify the kind of feedback we wish to encourage in our system (which currently operates in a blended learning context at Goldsmiths) we have identified the term "creative feedback" which embodies a range of characteristics including clarity, mindfulness, generosity, challenge and democracy.

At the heart of the motivation for designing this system is the idea that students can learn a huge amount from the creative feedback given by others. Not only that, but that the students can develop their own abilities as musicians through the ability to give creative feedback to others. And there is little doubt that the ability to receive feedback well, to depersonalise it as much as possible and respond to it appropriately, will stand students in good stead for the world of professional musicianship. Moreover, outside the professional music world, employers will be seeking students who have the skills to work in communities that have skills in giving and receiving creative feedback. Indeed one can easily imagine a world where an employer is much more interested in the way in which a student has contributed to and benefitted from being in a community. So our manifesto and agenda for change may result in students leaving universities not with a transcript of module marks but with a detailed account of their sustained engagement with creative feedback in a community of learners.

As part of the design of the system, we are designing "creative feedback agents" that are software systems that can start to provide some aspects of creative feedback on uploaded performances and compositions. With the development of techniques from audio analysis, gesture analysis, and style analysis combined with building models of learners we are looking to build systems that can start to embody some of the CF characteristics we have identified in this paper. What is important to us is that the design of our software is underpinned by a strong educational philosophy that comes from an understanding of the historical precedents and discoveries of many before us. We want to move away from the idea that technologies are designed and built by technologists and we embrace a multi-disciplinary approach where learners, educators, designers, sociologists, philosophers, historians, psychologists and computer scientists come together to build systems but with a clear understanding of the work that has come before. Perhaps more than anything this paper is a call to arms to revive and embed a Deweyian educational philosophy that can now be both supported and evidenced through technology.

5. Acknowledgements

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