Creativity and IP in Arts and Sciences

– Some economic puzzles and paradoxes

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Abstract

The creative universe is constantly expanding and so is its dimensionality with new forms of arts and entertainment, new technologies and new scientific specialties. Legal and economic conditions easily get turbulent in the drag of this expansion process, creating all sorts of idiosyncracies, puzzles and paradoxes surrounding legal rights and economic values associated with creators and their creations. This paper is an early stage attempt to explore some of these apparent puzzles and paradoxes, based on a number of widely differing cases, sampled 'diagonally' in the creative space from a wide array of creative forms and also representing or being composed of in some sense basic elementary creations. These sampling criteria hopefully could be used for testing limits to conventional IPRs as well as challenges to conventional economic analysis, and – eventually – for searching and researching, creating and re-creating a more unified theoretical basis for various IPRs, as well as more effective vehicles for the creative process itself.

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1. Background

Let us start painting on a broad canvas. There are three main puzzles in contemporary science (as proposed by Francis Crick and others) – the creation (or origin) of universe, of life and of (human) consciousness. In religious belief systems about these puzzles, creative gods are IP-conscious, like in traditional Christianity (creationism apart) or ancient Greek mythology. Why this connection between creation and the notion of IP?[1] If it is an expression for need of control over a creation, at least Christianity runs into the paradox how an omniscient, omnipotent, omnipresent God cannot fully keep his creation under control (the Theodicy-paradox). If it is an expression for a natural (moral) rights notion, how can there be a form of "licensing agreement" between the original creator(s) (the god(s)), their follow-on creators (inventors) and licensees (humans) and their sub-licensees to other humans in turn?

If the connection between creation and IP notion is of a more fundamental biological nature than say cultural, rooted in features of human consciousness as embodied in the brain, enabling the keeping of trade secrets, what is then the survival value of the impossibility to fully control knowledge once it is out in the public domain, kinship altruism?

There are many more puzzling questions and perhaps paradoxical answers regarding the connection between creation and IP notion, but the above ones are sufficient to justify more detailed explorations, some of which will be very tentatively and much more modestly presented in this paper.

Now there are two views on the universe of creations. One is to view it as closed and limited, in which at least in principle everything can ultimately be discovered or invented (allowing for a residual according to Heisenberg's uncertainty relation), that is the creative (including technological) opportunities can be exhausted. This view has not been uncommon among technologists and economists, subscribing to notions of limited resources, diminishing returns and the like.[2]

The other view is looking at the creative universe as ever expanding, in which every new creation could be a new input into an open, never ending combinatorial process. This is the view adopted in this paper.

There are also differing views on the creative universe along a continuous/discontinuous (or discrete) scale, with continuity proponents like Usher and Polanyi and discontinuity proponents like Schumpeter. Continuity proponents typically protest against "atomization" in form of R&D projects and IPRs. However, protests against IPRs can also be based on a discrete view on creations with complex creative combinations being hampered by IPRs. Thus, it is difficult to simply adopt a view on this scale, also because we by and large lack a cardinal measure of technological changes.[3]

[1] That the emergence of the tendency to view private rights in creations as property rights is fairly recent in the history of legal ideas is not directly relevant here as 'IP notion' is a broader concept than 'IPR notion'.
[2] See e.g. Schumpeter 1942 for a critique of this view.
[3] See Ames and Rosenberg (1963). A cardinal measure of knowledge distance and technological distance in particular is proposed and illustrated empirically in Granstrand (1994).

2. Purpose

Thus, we view the creative universe as constantly expanding and so is its dimensionality with new forms of arts and entertainment, new technologies and new scientific specialties. Legal and economic conditions easily get turbulent in the drag of this expansion process, creating all sorts of idiosyncracies, puzzles and paradoxes surrounding legal rights and economic values associated with creators and their creations. This paper is an early stage attempt to explore some of these apparent puzzles and paradoxes, based on a number of widely differing cases, sampled 'diagonally' in the creative space from a wide array of creative forms and also representing or being composed of in some sense basic elementary creations. These sampling criteria hopefully could be used for testing limits to conventional IPRs as well as challenges to conventional economic analysis, and – eventually – for searching and researching, creating and re-creating a more unified theoretical basis for various IPRs, as well as more effective vehicles for the creative process itself.

3. Concepts and typologies

Key concepts like creation, invention, innovation, industry, technology etc. are used here in broad but fairly standard ways. Creation and innovation then almost by definition is the basis for cultural – including social and economic progress, which in turn provides very broad sampling frames. 'Creative industries' would then embrace almost all industries, so we use that term broader here than for industries being based typically only on artistic creations. In the distinction in the expression arts and (natural) science, we also include technology in science and 'creations' embrace both artistic and scientific/technological ones, like inventions, formulas and mathematical proofs. The distinction between discovery and invention is then legally important, but the two concepts are in fact conceptually and etymologically fairly close.[4]

As to a typology of arts, their relations to various human bodily senses – eyes, ears etc. – constitute a sufficiently good basis for classification. This means that food, drink, perfumes etc. – being related to taste and smell – could be (and are) subjected to artistic creations. This view is also in line with developments in IPR laws and practices, e.g. in the trademark area.[5]

A human sense based typology of arts is too limited, however, as intellectual and emotional experiences are also integral to arts, as well as fusions and combinations are. Categories like literary arts could then be added. However, the mere notion of art defies simple conceptualizing and typologies, and thus imprecise and incomplete ones have to suffice as approximations.

This type of typologizing is not primarily for providing pleasure to structuralists but to use as a way to probe or test the applicability of standard distinctions and typologies in economics and law. Since playing and listening, painting and viewing, cooking and smelling, moving and feeling etc. could be done simultaneously by individuals, the distinctions user/producer, buyer/seller, consumption/production, investment/consumption if not break down at least become fuzzy. A concept like an artistic or cultural production function becomes complex, if not infeasible, as does concepts like cost functions and exchange economies, due to joint consumption/production. Moreover, the nature of creative ideas lead to the Arrow's information paradox, and the nature of music performance lead to limitations of productivity analysis and the "Baumol disease".

[4] The term 'cultural industry' is also overly broad and terms like 'copyright industry' suggest a typology of industries based on IPR types, for which the typology concordance is insufficient.

[5] A further logical step is to relate certain types of art to tactical senses as well as to drugs for sensory enhancement, legitimizing e.g. sex, drugs and rock'n roll as a sampling frame for artistic creations. The classical distinctions between body and soul, senses and intellect etc. should be used with caution, however.

4. Methodology

This paper presents some material from selected case studies. As described above, the sampling frame for these case studies is broad by design. This is to allow for exploring "distant corners" of the creative space by choosing widely differing cases, being extreme or in some sense diagonal in the creative space, spanned by the various dimensions of a typology of arts. This "diagonalized sampling" not only means choosing widely different art types but also within each type choosing extreme cases. For example comedy is part of literary arts and jokes could be seen as an extreme form of comedy. Mathematics is part of science but it is an extreme case in the sense that it is the only non-empirical one and the most cumulative one. Jazz is part of music and a unique form of music in its emphasis on improvisation and avant-garde jazz in turn a unique form of jazz and jazz improvisation by definition.[6] Recipes and formulas for food and drink are by many hardly considered to represent an art form but rather handicraft. Piano keyboards represent a kind of cultural technology, and the Jankó keyboard described below represents still another odd or extreme case.

The purpose of this diagonalized sampling is twofold. One is to find common denominators that by design then could be considered basic. The other purpose is to find puzzles and perhaps even paradoxes, which in turn are useful for further exploratory analysis.[7]

[6] Improvisation has played a role in other forms of music as well, classical music included, but hardly as much and developed as in jazz.

[7] A complementary method for sampling with these purposes, which is not imminent in this paper, is to identify basic elements in the various art and science types and e.g. see how these are combined and the impact from intellectual propertization upon the creative combination process. This in turn hopefully could be useful for finding ways towards more unified as well as useful theories of both IPRs and creative processes. An example of this approach is the scheme for inventive work developed on the basis of patent information analysis by the Russian patent engineer G. Altschuller (see Granstrand 1999).

5. Cases

5.1 Introduction

The connection between arts, creative industries and various intellectual property notions emerged early on, as illustrated in Table 1. It is also noteworthy that patents as a specific type of IP-notion did not develop much or play much of a role in the emergence of this connection.

Table 1 Chronological overview of early major events in IPR development

Year(s)	Event
3,200 BC	Potter marks found on fired clay pots, including jars buried in tombs of the First Dynasty Egyptian kings, providing a precursor to trademark protection. Stone seals or cylinder seals bearing such marks were used from about this time onward in both the Near East and Greece.
700-500 BC	Chefs in Sybaris, a Greek colony in southern Italy known for luxurious living, were granted one-year monopolies on the preparation of an unusual or outstanding dish. This right applied to no other art or science.
Ca 350 BC	One of the first recorded unauthorized copying events occurred when Hermodorus copied Plato´s speeches and without passing them off as his own, he took them abroad to sell for his own profit. An early “bootleg” incident.
330 BC	A law is introduced by the Athenian statesman Lycurgus, requiring that a transcript of the works of the great poets should be deposited and read to the actors by the city secretary in order to have them keep to the original text. Thus there was concern over not only plagiarism but also distortion, i.e. the creation and the creator were jointly recognized and protected as a basic IPR bundle.
100 BC	Trademarks used in Rome on an everyday basis to mark products such as cloth, lamps, glass vessels, cheese, and medicine.
40 – 100	AD the roman poet Marcus Valerius Martialis were so upset when others used his poems without reciting his name that he equalled it to kidnapping for which in latin is the word “plagium” (plagiarism).
Ca 100 AD	An acknowledgement of intellectual work and effort in the Roman empire is visible in the legal institute of specificatio. Specificatio was a method of acquiring ownership by the creation of a new thing out of someone else’s materials. If someone created a marble statue out of someone else´s marble the statue could be considered a “nova species” (a new thing) whereby the statue came to belong to the creator.
337 AD	Roman emperor Constantine decrees that artisans of certain critical trades are exempt from all civil duties. Chariot makers, engineers, and locksmiths are especially favoured.

5.2 Jokes – A case of creations void of any IPRs

There are three sorts of people in the world – those who can count and those who cannot count.

Once discovered, this joke was novel to the world. Being a joke it is also non-obvious, since otherwise it provides no humour. To the extent that a good laugh enriches life, the joke is also useful. It could then be seen as a creation or an invention, even a medical invention to the extent that it prolongs life. The invention becomes an innovation when successfully received by consumers of humour. This innovation then diffuses in society, becomes perhaps widely adopted, retold, modified, improved etc. During this process no real commercial transactions take place. What is more: there is not a single trace of any intellectual property (IP) notions – no copyright, no trade secret, no trademark, no business method patent etc. Still, a good joke could be claimed to fulfil requirements of being novel, non-obvious in relation to prior art, and useful. This teaches us that intellectual property rights (IPRs) are not (yet) everywhere, despite their pervasiveness, ancient historic tradition and current popularity. This is not to say that the whole area of jokes and humour is an example of an area of human needs free from any IP notions, commercial considerations and a "joke industry". Jokes could be considered part of comedy arts, which is part of entertainment, which is only partly industrialized. For example, the comedian Bob Hope allegedly ran almost factory-like operations for joke production and built a large inventory (database) of them, and the comedian W.C. Fields became involved in a lawsuit with a submitter of joke ideas.

Thus, there are exchanges in the economy that are driven by special remunerations without involving trade and property rights. In fact, much exchange of information in general takes place in this way. In fact, telling jokes has an element of joint production (reproduction) and consumption. Moreover, to the extent that laughters are contagious and "shared joy is double joy" joke telling is subjected to instant increasing returns, even to the point that the joke teller could be considered to create a debt to the joke listener, depending on their respective preferences and utility curves (i.e. their differences in sense of humour). Joke telling also clearly contributes to welfare but not to economic growth as conventionally accounted for.

However, as soon as costs of creating new ideas, information, data or knowledge become substantial or the benefits there from become substantial, adequate provision of new information and innovations in general is endangered. IPRs then constitute one out of several available approaches of private or public provision of costly or valuable innovations. The IPR approach is not perfectly tailored and by far does not fit all situations, however. It does not come free of charge, distortions and side-effects. Neither do other available approaches. Innovations are simple to welcome but difficult to invite. Attempts to do so involve a large portion of muddling through and scholars of innovation must count on uncountable difficulties. *Innovation non-jocus est*.

Appendix 1 gives a further illustration of some pro and con arguments for intellectual propertizing of jokes and promotion of entertainment industry.

5.3 Mathematical proofs – A case of cumulative and sequential innovation

A recent theme in discussing an IPR approach, with patent rights in particular, is its impact upon cumulative and sequential creation (invention) and innovation. In order to probe this issue it is natural to look at a most cumulative area such as mathematics and see if patent-like rights in mathematical knowledge production is fostering or hampering it.

Mathematics is highly cumulative in the sense that each new advance, i.e. invention, builds on some previous ones. Each theorem (or rather each proven proposition) is linked to original axioms through a chain of implications. The rules of proof are designed to avoid contradictions, although it is in general impossible to prove the absence of contradictions (according to K. Gödel). Thus, mathematics is built to last. However, the rate of cumulation may be slow (as with Fermat's conjecture) although it is not slowed down by empirical tests or observations (as e.g. in astrophysics). More importantly, cumulation is in general not proceeding through single chains of cumulative implications but the same proposition may be reached through various implication chains. Thus, there are invent around possibilities in mathematics just as in technologies in general and these possibilities are not fully known at any point in time and typically grow as more proven propositions are produced. Once complex proofs will later be simplified, once specific results will later be generalized, more necessary and sufficient conditions will be found (discovered) etc. In certain areas the implication network will at times grow fast and thick (as in computational mathematics and graph theory); in other areas it is rather the opposite (as in classical geometry or number theory). Some theorems become central and some are clearly non-obvious and may require many man-years to produce.

The point here is that whatever the relative merits of a patent system are in comparison with its alternatives (prizes, patronage etc.) mere cumulativeness of knowledge advances would not make it inoperable. It is conceivable that progress in certain areas would proceed only through one or very few long implication chains along which a number of blocking patents on "strategic theorems" could substantially delay progress and make invent around and research for substitutes a waste of time. However, that is an empirical question on which history of mathematics has little to say.

Finally, what has been said so far is not to be taken as a plea for a patent system in mathematics, far from it (due to common genericness of mathematical knowledge). The point here has been to take mathematics as an example of a highly cumulative knowledge field and to check whether cumulativeness in itself is a property of knowledge making IPRs in it improper. It then ought to become clear from the above thought experiment that cumulativeness of knowledge advances is not the primary property to consider but rather the connectivity or network structure of advances. This property in turn unfolds in a dynamic process as a result of research, which in turn may or may not be stimulated by patents, e.g. in form of invent around activities. In mathematics such activities would correspond to investing in search for alternative and possibly simpler (i.e. easier to teach and learn) or more elegant proofs, which could be considered more valuable. This unfolding process also brings in the issue of discovery versus invention, where a blocking patent can be viewed as spurring the discovery of valuable invent around possibilities.

Appendix 2 gives some examples of mathematical formulas, appreciated for their elegance or beauty.

5.4 Sound and music. The Jankó case

The fact that sound in general and music in particular have some kind of a direct connection to (individual and collective) emotions is well recognized but poorly understood, despite recent advances in a wide range of relevant disciplines. The mere concept of sound design for exploiting this connection, e.g. for entertainment, therapeutic or marketing purposes, is also a fairly recent concept.

As this concept evolves, various IPRs are being attempted and stretched for propertizing new sounds, including new types of music and musical products (e.g. jingles and caller-tones). Thus, trademarks as well as patents have been used, besides standard copyright protection in music. The trend towards *multi-protection*, using various different IPRs for protecting the same object as well as using portfolios with multiple rights of the same type, as well as the trend towards *evergreening* or market life extension through use of IPRs are strengthened by the use of various IPR-protectable instruments or sound machines and equipment in the development, production and distribution of sounds.

A particular type of instrument is the keyboard. A keyboard in general is a human/machine interface, more specifically an interface between human fingers and machines for processing in form of text, voice, sounds, images and data. As such it has to adapt to size, shape, function, etc. of bodily parts as well as to machine parts, an adaption which may become biased one way or another. A keyboard is then an example of what some have labelled “body technologies”, and as such subjected to ergonomic concerns. A keyboard also requires operating skills and thus subjected to concerns about learning, which may become substantial investments for operators, who may also vary a great deal in their skills.

Keyboards became famous in economic analysis through the works by David (1985) and Arthur (1988), analyzing the classic typewriter keyboard with the QWERTY-layout of letters. This layout represented a choice of technology once motivated by the poor level of a complementary technology (level of mechanical precision of typewriter arms) to avoid failure (jamming of arms) and thereby increase MTBF (mean time between failure) in order to increase technical performance in terms of average typing speed. When mechanical precision increased better letter layout could be chosen with frequent letter closeness in texts correspond to letter closeness on the keyboard, thereby enabling higher typing speed in the absence of jamming. However, the old QWERTY-design survived, i.e. it was not subjected to creative destruction, and thus was an illustration of technological lock-in and at the same time lock-out of ultimately superior technologies, a phenomenon which could be explained by the presence of increasing returns to adoption, in turn a special case of positive feedback, i.e. the more you have of something, the more you get of the same thing (also referred to us the Mathew effect in David (1994). Later work on the QWERTY-case, especially by Liebowitz and Margolis (1990) has questioned whether any superior technology (the so called Dvorak-layout was claimed to be one) was actually locked out. The importance of the increasing returns phenomena, which could lead to a number of market failures, a.o. inefficient

outcomes of technological competition, e.g. in the presence of overcrossing learning curves with different steepness, has not been questioned, however.

Another type of keyboard is the piano keyboard. The standard one has a long history, spanning over many centuries and is a good example of a dominant design, even a technological lock-in and a technology monopoly, with an enormous installed base of operators, i.e. pianists, composers and piano teachers and tuners with their various interlocking skill sets and producer (i.e. piano makers) capabilities. The complementary technologies involve mechanical precision engineering, materials technology, acoustics, ergonomics and cognitive psychology. Closeness of tones in standard compositions also correspond to closeness of corresponding keys on the keyboard. However, standard piano keyboard has certain drawbacks and limitations. In the 1880s an alternative (substitute) keyboard was invented and patented by the Hungarian engineer, mathematician and musician Paul von Jankó, based on the idea of stacking three layers of double keyboards for the two whole tone scales on top of each other.[8] This layout then enabled:

1. A 25% larger span of a chord
2. Use of some fingering for any major and minor scale
3. Use of same cognitive pattern in transposing
4. A fuller "orchestra" sound

Some of the basic ideas went far back in history but Jankó's invention really meant an ingenious design and a performance breakthrough. The revolutionizing effects of the design was also heralded and (wrongfully) forecasted by well-known pianists and composers, including Liszt.

The Jankó design got a fairly decent initial reception, recognition and support for marketing and a few artists and composers as well as makers adopted it in Europe and US. However, it never took off and subsequently fell into oblivion, as did von Jankó himself, who died in 1919, having spent most of his resources on promoting his technology.[9] So far the Jankó case is a more clear cut case of technological lock-out of a superior technology than the QWERTY-case.

But the story does not end here. The Jankó-design survived (hibernated) in a side application, a special type of accordion.[10] Some related and follow-up inventions have also been patented in the 20th century. Then the Jankó-design has reappeared in recent years on a Japanese synthesizer and MIDI-controller. It thus appears as if the Jankó-layout could make a kind of technological come-back or what I would call in this context, a *technological un-lock*. However, if it leads to a true (large-scale) technological come-back and then to technological co-existence or substitution (creative destruction) is an open question.

[8] For a fuller account of the Jankó keyboard story, see Granstrand (2008).
[9] Today, there are only a handful of old Jankó-pianos left. One is in the Ringve-museum in Trondheim, Norway. I am grateful to the Ringve museum personnel and Astrid Tveter in particular for the access to and material about the Jankó piano.
[10] There is also a variant of the Jankó-design on an office machine.

5.5 Improvisation – The case of avant-garde jazz

Performance arts (music, theatre, dance, readings, happenings etc.) all have an element of joint concurrent development, production and marketing (on stage, real time), although many inputs may have been developed beforehand (e.g. compositions, scripts, choreography, text, ideas, formats etc.). That is, part of the art is created during the performance in form of interpretations, embellishments, improvisations and mere fill-ins and deviations from the pre-coded inputs. When substantial space is deliberately given for creation-on-the-spot ("spot creation"; cf. spot markets) in a pre-planned way we can talk about improvised art, although there might still be a pretty fixed set of rules or norms guiding the improvisation, e.g. an arrangement with chord changes.[11] This set of rules may also emerge as a result of a selective process during a series of improvisations and performances, say during a tour. The improvised parts themselves, say in music soloing, may moreover contain a number of already performed pieces, special phrases, signatures, runs, licks, riffs, ditties, chords, voicings, or more general citations, i.e. the improvising to some (limited) extent is based on sampling.

So, how do IPRs enter the improvisation scene? It is natural to expect that IPRs are related to the pre-coded inputs in a standard way, i.e. they are covered by copyrights and trademarks (incl. personal sounds as personal brands), occasionally by a design right but not (yet) patents and typically not significantly by trade secrets (since they are relatively easy to reverse engineer to a certain point by persons skilled in the art. The improvised parts on the other hand are:

1. Performed publicly when created, so any novelty requirement as for patents is violated (although the performer may enjoy a grace period).
2) Relatively easy to reverse engineer by persons skilled in the art (apart from special tricks). This, however, typically requires a recording of some sort, something the performers and other interested parties could control, so there is some room for trade secrecy protection, and market lead time until imitators and followers have learnt to replicate, and perhaps take some elements to another level as well. Some elements may be difficult if not impossible to replicate, however, like special sounds (e.g. the Coltrane sound) or difficult chord changes (e.g. in Giant Steps or in some Monk tunes) or the entire style of improvisation. Sound and style then becomes a *de facto* trademark.
3) Created, produced and marketed individually and sometimes as well collectively real time on stage (e.g. in a piano trio), giving rise to at least unregistered copyright as well as to at least implicit branding and reputation building based on a number of qualities (e.g. sound, style, swing, surprises).

[11] Improvising also plays (sic) an important, even integral role, in the creative process (development process) leading to compositions, but not necessarily in the presence of an audience. Renowned improvisers among classical music composers include Bach, Beethoven and Chopin, and perhaps foremost Liszt. Chopin in fact claimed the exclusive right to improvise over his own compositions and was irritated over Liszt's way of infringing on this right. (Cf. the parallel to opposition over actors variations of Greek dramas). For various reasons (e.g. influence from military music discipline) improvising in classical music became increasingly constrained in the 19th century.

4) Sometimes created interactively with the audience.

5) Sometimes resulting in a tangible artefact (e.g. an installation or a painting after a happening).

6) Jointly consumed and produced by performers (e.g. in jamming)

A special feature of improved arts in relation to IPRs is that any IPRs that would require in-licensing during the creative process would stifle it, since there is no room for negotiations and transaction times in general. Consequently the IP-regime for improvisations has become very open (with implicit open licensing and pooling) and basically based on branding and reputation building, making that a virtue out of necessity. In so doing, the creator/improviser (if not just a happy amateur) has to personalize his/her creations by developing unique features (e.g. a sound), marks (e.g. licks) and the like, and then focus on marketing him-/herself (and also the group and sometimes the venue as well, e.g. the Cologne-concert), although the outcome of the improvisation may be marketable as well if tangibilized in a fixed medium.

Now, what happens with the IP-regime when the improvisation element is taken to the extreme in the sense that as many as possible precedent forms (formats, formulas) are dismissed as guidance for the improvisation, as in free-form performance arts, and in particular avant-garde music and even more particularly avant-garde jazz (“free jazz”) from the 1960s on?

It is pre-mature and pretentious to claim that results from a full-fledged analysis of this complex phenomenon is presented here, but a few observations are hopefully useful for further analysis:

1) Whatever the motivations of the major artists (political, community building, creative, fun, fortune, fame etc.), commercial interests were far from absent, much because artists were black US citizens with limited opportunities to perform and earn a living. IP concerns, especially related to building reputation, status and eventually legacy, thus were strong, as could be expected in an otherwise fairly open IP regime as described above. This a.o. resulted in some IP-thefts of the personal-credit-theft type, although not necessarily on a large scale or a larger scale than in other areas.

2) The absence of forms (which of course was not 100%) opened for entry of artists who were unskilled in a traditional sense and thus could not rely on traditional skills for their performance and reputation, leading to idiosyncratic and often misleading or false marketing. At the same time the rule-breaking absence of forms opened for and attracted a following both among performers (producers) and listeners (users, consumers).

3) The pricing of gigs became even more idiosyncratic.

The latter observation will be returned to below.

5.6 Recipes

In some respects recipes of new dishes and drinks are similar to jokes, i.e. when provided on a small scale they are a.o. typically created under joint consumption and production, and exchanged on a barter basis under a fairly weak IP- regime with occasional personal branding.

In other respects recipes differ fundamentally from jokes. For example, they are sometimes kept under very tight secrecy.[12] As a special form of IP-protection secrecy is superior to patent protection when e.g. reverse engineering and/or catching up is very difficult (i.e. costly) and/or time consuming and/or invent around possibilities are plentiful. More generally, secrecy protection is superior, if building secrecy barriers pays off to the creator/innovator while overcoming them does not to the imitator/competitor compared to patent protection.[13] There are many ways (strategies) to build as well as to overcome secrecy barriers.[14] Often crucial knowledge and skills (e.g. "noses" in wine-making or perfume-making) are embodied in a few individuals, who have to be incentivized and controlled, even protected, as agents (employees) to a principal (employer, owner). One secrecy strategy is then to fragment secret information among employees, making unauthorized assembly of the secret costly.

This trade secrecy strategy is commonly employed in industrial firms as well as other organizations (e.g. some churches or sects) and then at some expense of R&D productivity and employee motivation. One could then typologize various schemes (or sub-strategies) for secrecy fragmentation (or in other words the information sets in a non-cooperative game), and ask which scheme(s) is (are) optimal in some sense.

A particular simple scheme that has some optimality features is what could be called here "the Benedictine scheme".[15] The full secret is fragmented into two parts I_1 and I_2 distributed

[12] This in itself does not mean that secrecy protection is superior to patent protection from society's point of view. In fact, as is well known, the patent protection option was created by society as a private incentive to reveal professional secrets in the public interest. Conventional food recipes are not protectable by patents, although early patent-like protection in Venice during the 15th-century Renaissance, as well as in Sybaris in ancient Greece, originally gave protection to recipes of famous chefs. This is not to say that e.g. the Coca-Cola recipe is not patentable (at least as a medicine in principle), or that Coca-Cola's preference for keeping it a trade secret is due to uncertainty about patentability.

[13] See Granstrand (1999) for an overview.

[14] The Coca-Cola recipe is a classic example. The bottle has received US trademark protection as well, which was the first example of a 3-dimensional trademark. According to Prof. F.M. Scherer the early development of the Coca-Cola image was quite accidental, and only after some time did the company realize what a valuable asset they had and took aggressive steps to protect it.

[15] Such a scheme was allegedly used by the Benedictine monks for protecting the recipe to their liqueur. Only the abbot knew the whole secret, while two monks knew different halves of it. When the abbot died, one of these two monks was promoted to abbot, thus being informed by the other monk, while informing a new monk replacing him in turn. It has not been possible (yet) to confirm the truthfulness of this story.

Also note that the home page of Benedictine Liqueur (as of May 2, 2008) lists various open and free recipes based on the liqueur in turn. That is useful information about various applications given away for free while a critical component (cf. platform technology) is kept proprietary. In this sense the IP strategy for marketing is a kind of reverse of a camera/film strategy (or reverse razor/blade strategy), the latter strategy meaning (in pure form) that cameras (durables) are given away for free while non-durables (subjected to rebuys and user switching costs) are high priced. The latter strategy could then be generalized to apply to a range of complementary application products, not just to a single, non-durable one.

across three agents – the principal (P) and two agents A_1 and A_2 – according to the following scheme (where 1 indicates possession and 0 non-possession)

Info set	Agent		
	P	A_1	A_2
I_1	1	1	0
I_2	1	0	1

Moreover, when the principal with the full secret dies (exits), one of the other agents, say wlog A_1, is promoted into that position and informed by A_2 and then a new agent is hired as a new agent A_1, thus entering the scheme (game) by some form of controlled entry. Thus, this secrecy scheme is an attempt to "evergreen" the trade secret, just as evergreening can be attempted based on other IPRs, specifically patents and trademarks. However, the above scheme is likely to be more effective (long-lived and reliable) than the patent protection for evergreening described in Granstrand (2003) or the scheme based on joint patent/secrecy-protection described in Granstrand (1999). The optimality features of the Benedictine scheme could be derived in various ways. Without going into technicalities here, one particular feature is that each secrecy fragment is only known to two players. This means that if it is observed that a fragment has leaked out, both players will know who is the leak (assuming they know that no third party has the fragment, i.e. the secret is in the sole possession of the players). Penalties could then be imposed to deter defection. The scheme may finally be extended to more than two agents with further fragmentation.

6. Discussion

6.1 Introduction

The cases presented in the preceding section could be complemented with several others, left out in this paper. Still the cases presented here represent a variety of phenomena, of which some are puzzling and a few perhaps paradoxical. Standard paradoxes in economic analysis, like the Arrow information paradox, the Baumol disease (which could be seen as somewhat paradoxical), and the Giffen paradox are all represented. Puzzling phenomena like the queer QWERTY-type of technological lock-in and absence of creative destruction are as well. The question is whether there are any unique or idiosyncratic puzzles or paradoxes. The absence of any IP notions in connection with joke telling appears to be unique. However, this question must be left open for further exploration, and so must the question whether there are any new and generic puzzles, that could fertilize and further economic analysis. Table 2 summarizes the cases presented here. A few (out of many) themes will then be discussed in this section.

Table 2 in about here.

6.2 Creative cumulation vs. creative destruction in arts, technology and sciences

The Schumpeterian notion of creative destruction has gained widespread popularity and acceptance. But how common is it in various creative areas and industries? Is it time to challenge if not destroy it? A moment of reflection gives ample food for rethinking the notion of creative destruction. In music numerous works (e.g. Air, Appassionata, Aida, Autumn Leaves; cf. 'evergreens') seem to gain immortality and almost eternal market life times as if their qualities (in terms of utility, price/performance, aesthetic value, beauty, functionality) are unbeatable, despite a steady flow of new works, techniques, instruments, styles, fashions, etc. The same applies to visual arts, poetry and literature. Thus, the flow of artistic creations continually produces immortal innovations which cumulate at the same time as a number of artistic innovations get more or less short-lived. As to natural sciences, there is a steady flow of scientific theories in various areas, theories which become conjectured, confirmed and refuted, but a number of them survive indefinitely as useful approximations under certain conditions.[16] The same in mathematics, where new proofs and theories typically do not outcompete (i.e. destroy) old ones (although implicit contradictions can never be ruled out as shown by Gödel), but rather complement them or turn them into special cases (e.g. Pythagoras theorem and Euclid geometry as a special case of Lobachevski spaces).

In technology and also in medicine more or less complete substitutions of old products for new ones can frequently be observed (e.g. electronic calculators for mechanical ones and slide rules) at the same time as some technologies become very persistent or long-lived if not

[16] This is essentially a Popperian view, not a Carnap-type of logical positivist view, neither a logical empiricist view. The latter two views would not at all accept the Schumpeterian notion as part of their scientific (infeasible) ideals.

immortal (cf. the QWERTY-design of word processing keyboards). Two technologies can also co-exist for long times, during which their relations may also change from being complements to become substitutes or vice versa (e.g. wired and wireless telephony). A technology can also "hibernate" (e.g. in a special application) and then reappear and revive, e.g. in response to developments in complementary technologies. The same phenomena occur for firms in industry and for other (economic) institutions (e.g. universities), although the rate of substitution (e.g. of old firms for new firms) might be larger there (not apparently for universities, however).

Thus, creative destruction is not universal and unavoidable, but rather co-evolves with creative cumulation. The extent to which creative destruction occurs, or in other words the relative rates of creative cumulation and creative destruction, then becomes an empirical question with variations in answers across creative areas and industries. Unfortunately we know very little about this question and the determinants behind the variations. For example, creative cumulation seems to dominate over creative destruction in some technological areas and industries (Granstrand 1994, et al. 1997), but we still lack an explanatory factor model.

A special set of determinants is the various IPRs. All of them except trade secrets and trademarks are time-limited rights and thus could be expected to be limited in the ways they contribute to cumulation, technological lock-in or persistence and "evergreening", if at all. However, e.g. patents could build upon each other in a cumulative way in case of improvements and/or new product/process-generations, i.e. in sequential innovation.[17] Same holds true for database rights. When several IPRs are moreover used as part of a multi-protection strategy the market life time can be prolonged substantially, even eternally in principle. However, IP-strategies like these are neither sufficient nor necessary for evergreening, only contributory. They are not sufficient since complete substitution without IP-infringement may still occur, although it is rare as long as relevant IPRs are valid. At the same time strong IPRs may be instrumental in the provision of substitutes, so IPRs have mixed effects in general on creative cumulation and creative destruction. Moreover, strategic use of IPRs is not necessary for evergreening since evergreening may also occur due to increasing returns that derive from various sources, some of which are independent of IP-protection, e.g. increasing returns from reputation building without trademarks (see Arthur 1988). However, IPRs may be instrumental in early stages of diffusion of an innovation for establishing an increasing returns regime, e.g. through trademarks.

6.3 Increasing returns and technological lock-up

The general phenomenon of competition among technologies, leading to technological lock-in (which in fact could be seen as a case of evergreening) has been sufficiently recognized and explained in terms of increasing returns to adoption in the economic literature. That such a lock-in also could lead to lock-out of an ultimately superior technology, implying a puzzle at least for believers in the efficiency of competitive markets, could also be explained in

[17] See Granstrand (2003) for an analysis of patent strategies for "evergreening", enabled by a low level of inventive step or non-obviousness requirement.

terms of increasing returns to adoption.[18] Thus, the demise of the Jankó keyboard in spite of technical and artistic superiority, strong patent protection and strong promotion, including reputation and endorsement (e.g. by a superior "lead user" and virtuous improviser such as Franz Liszt), could be explained in this way. The Jankó case also parallels the classic case of competing technologies – the victory of JVC's VHS-system over Sony's Betamax system – the importance of complementary products, in this case in form of software.[19] Just as the adoption of Betamax suffered from the relative absence of prerecorded movies, the Jankó keyboard suffered from almost complete absence of musical compositions, demonstrating the superiority of the Jankó keyboard.

Besides being a clear case of technological lock-out of a superior technology, that was also patent protected, the Jankó keyboard possibly also can illustrate a "technological unlock" from being previously locked out. That such an unlock can occur can then be considered a puzzle, especially if it occurs in the presence of increasing returns. The simplest way to resolve this puzzle in principle and allow for technological unlock is to let the ultimate returns to the next adopter of the locked in technology (the dominant design) dip below the initial returns of the locked out technology for some reason, e.g. congestion or diseconomies of very large scale but not mere exhaustion of increasing returns. However, this implies some presence of decreasing returns, although they may be quite local, as long as they just trigger some next adopters to switch to the locked out technology.[20] If increasing returns are persistent there are other ways in principle to allow for technological unlock, e.g. through exogenous complementary developments changing the increasing returns profiles of the competing technologies. Probabilistic modelling and heterogeneity of adopter preferences as well as coordinated adoption could also be used for explanations.

In the actual case of piano keyboards the adoption process is two-fold on the user side – adoption by piano teachers and the adoption by piano learners in a context of overlapping generations. This gives strong increasing returns of the traditional type, which have to be dominated by new sources of increasing returns for the Jankó keyboard, e.g. new types of complementarities in new applications like in accordions or synthesizers.[21] A further technological forecast has to be omitted here, however.

6.4 The repugnancy paradox in arts

Market design is sometimes limited by repugnancy as described by Roth (2007). In arts there is sometimes a certain repugnancy to monetary exchange (see e.g. Scherer 2004). At the same

[18] In this respect the QWERTY-case is a doubtful illustration, since the alleged superiority of the competing Dvorak keyboard has been challenged by Liebowitz and Margolis (1990).

[19] For accounts of the VHS vs Betamax case, see e.g. Granstrand (1984), Rosenbloom and Cusumano (1987), Grindley (1995) and also Arthur (1988). Although many authors claim that Betamax was superior to VHS, this is doubtful . What is also not widely known is that Sony and JVC (as part of Matsushita) were dependent on each other's patents in video recording and if Betamax had won, JVC would likely have earned substantial license income anyway.

[20] It is straightforward to construct numerical examples of this. Just let the returns r (n, LIT) to the n:th adopter of a locked in technology LIT be lower than the initial return to adoption of the locked out technology LOT, i.e. r(1,LOT) where r(k, LOT) then is larger than r(n, LIT) for all k for some n.

[21] There are many cases of new technologies developing in side applications for a final surpassing of an old technology as described in standard "S-curve analysis".

time artists and art not only has to sell but wants (mostly) to sell, there is certainly a willingness to take pay. The quotation and formation of a price is complicated, however. In the presence of large uncertainty about values, willingness to pay, costs, qualities, pricing norms etc. a price quote has strong signalling effects of various types. For example, showing a need to sell might signal low demand, which in turn might lower demand. A large asking price with a low taking price might signal badly for future deals. A low asking price, e.g. for a gig, might establish a future low price level and also establish a low price and low quality category for the performer. Reversely a high asking and taking price signals high demand and with a naturally limited (monopolistic) supply, a race may be triggered which increases demand. In addition art and artist markets often become star markets with a winner-takes-all mechanism at work. In this way the Giffen paradox, i.e. that there are goods ("Giffen goods") for which demand decreases with a price decrease, is not as rare in arts as commonly portrayed in general in economic textbooks.

A further way to explain (rationalize) these types of behaviors is to relate them to reputation building or "branding" (with or without trademarks). As in trademark strategies in ordinary industries the combined CI/BI-approach (corporate image/business image) is a way to exploit economies of scope (e.g. Sony Walkman). Similarly the artist and his/her art jointly offer economies of scope of a kind of PI/AI-type (i.e. personal image/art or creation image) where the PI-value depends on price signalling at the AI-level. The PI/AI connection is much stronger in creative industries than in e.g. engineering industries, however. (Inventors do not sign their inventions, for example).

6.5 Interactive creation

Creation and learning (i.e. knowledge creation) also has the property of being interactive or recombinant, giving rise to connectivity and complexity.[22] Particular types of interaction are cumulation (reaping complementarities) and substitution which – as described previously in section 6.2 above – may work in parallel during a learning process or in an embodiment process.[23] When cumulation dominates over substitution net growth of knowledge will result. Combination and cumulation create a need to pool or source knowledge from many sources, e.g. many individuals in many fields and/or in different generations. Inter-personal learning is then essential, which in turn involves imitation. Thus, creation and inter-generational learning, being the essence of culture, has an inherent IP-tension.[24]

Continued creation and learning prompts for exchange and trade of knowledge assets.[25] This involves recurrent interaction and collaboration. Interactivity then will increase

[22] This has been widely recognized and phrased in various terms. E.g. David (1993) assigns interactivity and cumulativeness to knowledge besides its basic public goods properties.

[23] E.g. the shift in the technology base from an old to a new product generation typically involves both substitution (i.e. scrapping of old knowledge) and cumulation (i.e. scrapping of old knowledge) and cumulation (i.e. adding new knowledge to the remainder of the technology base). (Cumulation may then dominate over substitution with some ordinal measure of knowledge amounts as described above.

[24] The tension seen as a puzzle may be resolved by referring to kinship altruism, accommodating if fact both Darwinian and Lamarchian versions of philogenetic learning in principle, but it could also be resolved in more standard terms of economic rationality.

[25] Note that a state of asymmetric information or knowledge across agents with opportunities to interact and exchange information can never be Pareto efficient, given that agents have a preference for more knowledge and

transaction costs and more so when codification is poor as in early stage learning with many new discoveries, creative learning with many new ideas or learning with many inputs from various sources in different fields with different codes with interdisciplinary and multi-technology development as special cases. These are all circumstances that disfavour an IPR approach unless transaction costs can be mitigated through clearance contracting of some sort e.g. an open source model, an open innovation or science model, a "creative commons" model, patent pooling or cross-licensing schemes or joining all players in an collaborative organization such as a consortium or integrated firm (i.e. internalization) in which property rights are assigned or licensed away to a centralized body or legal person. Still such a clearance arrangement or collaborative organization is an unstable institutional arrangement under interactive creation and learning since a new valuable finding will create new strategies with a new value function in the cooperative game. New possibilities to form coalitions and find upsetting or even blocking strategies will emerge, and the core of the game is thereby jeopardized. The instability is moreover increased if entry and exit conditions in the collaboration are weak i.e. less costly to players. A property right approach may then offer possibilities to create entry and exit conditions that could mitigate defection but also lead to lock-outs and lock-ins and especially asymmetric lock-outs and lock-ins (i.e. cheap entry and costly exit or vice versa). In addition the motivations and incentive structures of key players differs so the value function becomes multi-dimensional, and the game is no longer cooperative.[26]

Thus there are many virtues and vices of an IPR approach to incentivize and govern complex collaboration in interactive creation and learning.[27] In other words, the functionality of IPRs in open co-innovation is largely an open question. This calls for experimentation and empirical studies, both of which currently grow. History has provided many examples of the occurrence of temporary open pockets with weak IP regimes, giving rise to successful collaborations, and more current models of open innovation and IP pooling are promising.

In learning more about properties of creation and learning, we must especially learn more about the dynamics of evolution of knowledge bodies and areas and their interaction or co-evolution with industries incorporating them in their knowledge (incl. technology) base. In this process, various properties and features change, influencing e.g. RoI-considerations. For example, typically product life cycle features change, with compressed market life times and times between new product generations at the same time as technology gets more differentiated, complex and capital-intensive; scales of investment in R&D, production and marketing increases; market growth slows down, intermediate markets emerge and competitive pressures increase. Changes like these put pressure on creating speed to market and large operating profit margins in order to sustain acceptable RoI-levels. Thus, market failures and appropriation problems may increase as knowledge, ideas and creations and their associated industries evolve, absent adaptive correction methods, such as IPRs, procurement,

information and the time/cost-budget for learning is non-binding. Trade moreover requires some kind of propertization.

[26] Cf. Baumol (2002) who analyses several sources of stability in technology-sharing consortia, which all in all tend to make them fairly stable in many but not all circumstances, and generally more stable than price collusion arrangements, which in turn are mostly detrimental to the public interest.

[27] Take music sampling or improvisation as samples. See also Romer (200) and e.g. Bessen and Maskin (2004).

taxes and internalization. As a corollary, the mere observation that industries, like the software industry or some creative industries have emerged successfully under a regime with weak or void IPR protection, is weak evidence that IPRs will remain absent or redundant for future developments.

Appendix 1

Boredomia is a faraway poor country with a poorly developed industrial base. Its gloomy history and bleak prospects for future progress and welfare creation has prompted its government to promote the creation of creative industries, among which the entertainment industry is considered politically and economically important. The following is a summary of a part of a policy initiative and its response.

First, removal of some standard limitations of patentable subject matter has been proposed, as evident in the proposed new IP law:[28]

> "Lack of technical character should not be a valid ground for exempting inventions from patentable subject matter…
> New, non-obvious and useful therapeutic, surgical and diagnostic methods should also be regarded as inventions."
>
> Article 1, Chapter 1, Boredomia Proposed New Basic Law on Intellectual Property
> (In provisional translation as of 2007)

Second, with special reference to jokes the following has been proposed to promote joke production and the comedy industry:

Summary of the Boredomia Initiative

(Supported by Entertainment Industry Association, General Joke Co., Start-up Comedians of Boringgrad among others)

Some proposals:

- Jokes should be considered medical inventions prolonging expected life times and increasing quality of life, therefore contributing to welfare
- Not only jokes about engineers (thus having "technical character") but jokes in general should be patentable subject matter.
- Jokes in general should be patentable subject matter, subjected to the standard test of novelty, non-obviousness and usefulness.
- Training of BPTO (Boredomia Patent and Trademark Office)joke examiners should start a.s.a.p. in consultation with Dept. of Health.

Third, foreign, economic consultants have been hired for joke valuation in investment appraisal:

[28] Note that in current European practice patentable inventions have to have so called technical character (in contrast to the US), which is an interpretation of EPC (European Patent Convention), Article 52(1), that says that patent rights could be granted to "…inventions which are susceptible of industrial application". For this and other reasons e.g. therapeutic, surgical and diagnostic methods are not patentable, neither are e.g. scientific discoveries, mathematical algorithms, "pure" software and business method patents.

Economic Valuation of Jokes

$\Delta V\ (J) = \Sigma\Delta_i(J_i\Delta_i)+FL-JP_i\ i \in Pop_s[2007,2027]$

Where

$$\Delta V_i = \iint_{Li} \pi_i(t_2\ J)e^{-rit}\ dt\ dF_{Li}$$

FL foreign licensing net income (discounted)
JP loss (discounted) from IP piracy

However, the proposal has been met with considerable opposition, also from abroad:

Opposition Against the Boredomia Initiative

(Supported by the Open Joke Movement, The Anti-Bore NGO,
Humour Rights Association among others)

Some arguments against the proposal are:

- "Humour is a human moral right"
- Jokes are public goods
- High transaction costs outweigh welfare gains
- Little or no investment character with little entrepreneurial risktaking requires no extra private incentives
- Joint production and consumption provides sufficient reward structure
- Positive production and consumption externalities (cf. contagious laughter) are considerable and could be jeopardized.
- There are alternative and superior incentive and provision mechanisms than market mechanisms and IPRs.

Appendix 2 The mathematical beauty contest

The connection between aesthetic pleasure and mathematics is well recognized but poorly understood. The following is the results of a poll among PSAs (persons skilled in the art) as polled by Physics World Magazine for creating a top hit list of mathematical formulas in terms of mathematical beauty and elegance (mathematical artistry?).

The winner (in 2004) was Euler's formula:

$$e^{i\pi} + 1 = 0$$

This formula contains nine fundamental mathematical constructs or constraints and is a pure logical creation.

Other formulas on the list were empirical ones, such as Maxwell's equations describing all types of electro-magnetic wave motions, Newton's second law describing mechanical notions, Einstein's equation relating mass and energy ($E = mc^2$), Schrödinger's wave equation, Boltzmann's equation for the wave length of mass particles and Pythagoras' theorem.

Other pure logical creations (although with empirical origins and applications) on the list were the Fourier transform and the simple formula 1+1 = 2, expressing the principle behind addition.

As seen, almost all beautiful formulas were branded with names of individuals (all male and dead) which are their only associated IP-notion. They all are well codified and consisted of just a handful of symbols, much less than for a short poem or a musical phrase. However, in order to enjoy the beauty, a significant amount of training is required. Finally, they were almost all produced in the “university industry”, in turn paving the way for a variety of products and industries, creative ones included.