

Knowledge Representation Support for Substantive Patent Law Precedents

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Abstract — The paper outlines a KR (Knowledge Representation) based IES (Innovation Expert System), for testing a claimed – classical as well as emerging – technology invention under the SPL (Substantive Patent Law) of any NPS (National Patent System), in particular under the 4 §§ 101/102/103/112 of 35 USC (United States Code), as interpreted by the Supreme Courts' *KSR/Bilski/Mayo* decisions. Already the IES prototype is capable of indicating the amazing power of the "Patent Technology" induced by this US Highest Courts' SPL precedents as to such tests for a claimed invention. It works semi-automated when testing in explorative mode and fully automated/real-time when testing in confirmative mode. Developing this powerful Patent Technology has been enabled by performing substantial Mathematical KR research about recent US Highest Courts' patent precedents – published by Mathematical KR research papers and Amicus Briefs submitted to the US Supreme Court and the US CAFC (Court of Appeals for the Federal Circuit) as to KR insights so obtained into the problems of SPL precedents, e.g., when dealing with claimed emerging technology inventions, in particular CIIs (Computer-Implemented Inventions).

Keywords — SPL (Substantive Patent Law); KR Based IES Prototype; Emerging Technologies; Supreme Court's *KSR/Bilski/Mayo* Decisions; Inventive Concept; Preemptivity; Abstract Idea; CAFC's Recent Precedents

I. INTRODUCTION

Internationally and nationally, inconsistencies in SPL precedents have increased with the advent of claimed inventions dealing with subject matter in emerging technologies areas. As compared to classical technologies SPL precedents and its allegedly clearly understood pragmatics, applying SPL on emerging technologies inventions encounters new kinds of pragmatics not yet understood. Inconsistencies arise, as these new pragmatics of emerging technology inventions come together with their being intangible and invisible just as their subject matters. This requires replacing both by a purely mental model, the invention and its base of notions, that is, functionality provider. They will be called "model-based" from here on.

Examples of such advanced alias model-based technologies underlying recent patenting are business technology, nano technology, pharmaceutics technology, genetics (DNA (DeoxyriboNucleic Acid) technology), software technology. All these model-based technologies raised fundamental questions of thinking about the creativity embodied by inventions, about SPL stimulating and protecting it, and about the

subject matter of inventions dealing with them, which required decisions by the respective national Highest Courts. For this paper, of particular importance is the US Supreme Court's famous, as direction pointing, line of *KSR/Bilski/Mayo/Myriad* landmark decisions [32]-[34]. They deal with creativity/business respectively software/pharmaceutical/DNA respectively life science technologies – whereby especially the *Mayo* decision [33] provides clear guidelines.

These fundamental questions of thinking are hardly analyzable without applying Mathematical Knowledge Representation, customized to dealing with it - e.g. by simplifying accordingly the notion of "concept". While this notion is well-known in "Advanced IT"¹⁾ (e.g., DL/KR/... [3][4]) it is in this form far too complex to enable meticulously mathematically modelling SPL and SPL precedents - and also for ever becoming broadly accepted by the several million patent lawyers/examiners/judges/inventors.

This means that classical SPL precedents is not really applicable to model-based claimed inventions, as its classical claim construction assumes a tangible/visible subject matter, hence allegedly always patent-eligible, i.e., there no need existed to separate patent-eligible from non-eligible inventive concepts – potentially existing with intangible/invisible emerging technologies' subject matters. For dependably achieving this separation and understanding its implications, a refined claim construction is indispensable, as shown by the inconsistencies evolved already (see below). Yet, defining this refined claim construction precisely and completely, as required and clearly outlined by the Supreme Court's *Mayo* decision though with a broad brush only, involves serious intricacies. Removing them dependably is possible by KR Technology, partly by only Mathematical KR, as shown in [5].

To put this quite unmistakably: KR Technology indeed managed to identify the reasons for the notional inconsistencies of recent SPL precedents. It achieved this by removing them by defining, for a claimed invention, be it of classical or of emerging technologies, the refined claim construction precisely and completely. This is probably hitherto the most important contribution of KR Technology to solving a problem otherwise seemingly unsolvable: Of catering innovations in emerging technologies, and hence of technology depending societies. Anyway, the amazingly powerful "Patent Technology" outlined by this paper could not have been developed without this Mathematical KR (Technology) or the US Highest Courts' SPL precedents inducing it.

II. ON SPL AND SPL PRECEDENTS

This paper belongs to a series of other papers – as shown by the reference list – of an R&D (Research and Development) project, namely the FSTP (Facts Screening and Transforming Processor) project, dealing with supporting precise SPL interpretation and SPL precedents by Advanced IT¹ [3][4], e.g., for making patents, in particular on emerging technologies subject matters - and the IES described by this paper - "Highest Court proof". While this paper is self-contained, its terms/ notions yet are hard to understand without their detailed discussions in these other papers. Hence, there are many cross-references to them – though this paper's basic ideas are independent of the precise knowledge of this "context".

The *Mayo* decision [33] showed that describing a model-based claimed invention by its "inventive concepts" facilitates isolating/recognizing its new pragmatics in spite of its new mental problems due to its and its service provider's intangibility/invisibility. The term/notion of "concept" is similarly used since ever in Advanced IT¹ [3][4]. I.e., the far reaching potentials of the term/notion of "concept" are commonly known and fundamental in probably all branches of Advanced IT since dozens of years. But there this term/notion has been developed to a degree of sophistication completely clouding its potential usefulness for SPL precedents. But, the *Mayo* decision shows that only the next to trivial kernel of this notion is used by the notion of "inventive concept", which makes it apt for SPL. This is confirmed, again, by the Supreme Court's recent invitation of Amicus Briefs as to the question of patent-eligibility of computer-implemented inventions [24][25].

Thus: Here the US SPL is taken exemplarily, i.e., the 4 §§ 101/102/103/112 of 35 USC, but the SPL of any other NPS could have been taken also, e.g., in the EU the §§ 52-57, 69 of the EPC (European Patent Convention). The inconsistencies in the US SPL precedents indispensably imply reconsidering in all NPSes their "claim construction alikes" for emerging technologies' inventions.

Proceeding as the US Supreme Court's *KSR/Bilski/Mayo* decisions [32][33] require is possible in all other national/regional SPLs, too. But this implies getting familiar with the "scientification" coming up in testing a claimed invention this way, especially with the *Mayo* decision's [33] new key terms/notions "inventive concepts" and "preemption"/"abstract idea" – as they facilitate separating in any SPL its concerns (= requirements) from each other [10][18]. Additionally, they fully compensate the impossibility of graphically supporting the presentation of the properties of a model-based claimed invention [19]. They thus enable showing/proving that these properties meet the separated SPL requirements/concerns.

The transition – from the classical claim construction to a refined claim construction by using these additional, new, and more purposeful terms/notions in i) interpreting an SPL, ii) describing the properties of the invention to be tested under this SPL, and iii) showing that these properties meet these requirements/concerns – is a "paradigm refinement", as explained in detail in [18].

Summarizing the message conveyed by this section: This paper is focused on showing i) that the groundbreaking insights coming together with the Supreme Court introduced terms "inventive concept" and "preemption"/"abstract idea" just leverage on Mathematical KR [5] but completely avoid confronting a user with any Mathematics ii) the huge advantages that the so by the US Highest Courts induced "Patent Technology" provides to every patent practitioner's professional life, by outlining the powerful functionalities of the IES.

III. ON PATENTS / INVENTIONS

"Patent/SPL Technology" and its refined claim construction – induced by the US Highest Courts' patent precedents – are intellectually only slightly more demanding than the hitherto allegedly sufficient classical claim construction [24][25]. Nevertheless, its "post-Mayo" refined claim construction dramatically reduces by its "purposefulness" [1][10][18] the time for testing a claimed invention under 35 USC §§ 112/102/103/101, i.e., under US SPL, while the classical claim construction is oversimplistic and so creates confusion and invites misuse in many practical cases, in particular if additionally applying the strange BRI (Broadest Reasonable Interpretation) [14][21][24][25].

Patent Technology is an administrative "cross-sectional technology" in that it impacts on decision making in all US institutions below the Supreme Court – but not on the top of this hierarchy, the AIA (America Invents Act) (as erroneously seen, due to its disaggregating the 4 compound legal requirement statements of its 4 §§ 101/102/103/112 into 10 SPL/FSTP tests) [10]. But this administrative view on Patent Technology ignores its impacts on everyday's patent business.

By performing this disaggregation of compound legal concerns/requirements – of the fictional but politically decisive "social contract" underlying SPL – Patent Technology implements the Supreme Court above interpretation of the §§ 101/102/103/112. It maps these §§'s 4 compound requirement statements onto (today) 10 "concerns separating" such statements, checked by 10 simple FSTP/SPL tests (for an invention to be patent-eligible and patentable).

This logically correct mapping – of 4 compound onto 10 elementary legal concern/requirement statements – implies that these 10 simple tests are to be passed by a claimed invention if and only if it is patent-eligible and patentable under the SPL of 35 USC. This mapping onto the 10 simple tests exposes that the Supreme Court's *KSR/Bilski/Mayo* [32][33] and CAFC decisions actually go far beyond their usual decisions impacting on subordinate institutions.

This mapping namely exposes key insights as to basic questions arising in developing a much further reaching "Mathematical Innovation Theory" needed as guide to finding/developing/financing/evaluating/marketing/using, with an efficiency unknown today, useful innovations in all areas of social life – of which the Patent Technology presented here is just a first step. These insights refer to the crucial question, in what way to systematically expand an appropriate KR of a subject matter by inventive concepts such that the resulting knowledge and its KR – both about

the new, so “invented” resulting subject matter – solve a given hitherto unsolvable problem, i.e., these Highest Courts’ hints pointed at and inspired starting developing what eventually may become and then would be called “Practical Innovation Technology”. Such fundamental technologies – earlier found ones are e.g., building an acre, or a state, or a wheel, or an academy, or an electric conductor, or a computer, … – once recognized are never forgotten.

IV. CONSISTENCY AND PREDICTABILITY OF SPL TESTS

In the international arena of national patent systems (NPSes), the US Highest Courts’ patent jurisdiction is just proving its leading role by adjusting the US SPL precedents to the needs of emerging technologies – by accordingly refining the interpretation of 35 USC §§ 112/101/102/103, i.e., the US SPL and hence its precedents’ paradigm. This adjustment is important, as the SPL together with its precedents are one of the sources of the wealth of any economically highly developed society, such as the US one.

By KR, this adjustment phenomenon [1][5] is the following. It had started in 2007 with the Supreme Court’s interpretation of § 103 in the *KSR* case; but then this seemed to be, for many patent experts, the start of a US internal law administration dispute about the distribution of responsibilities in patent jurisdiction between the Supreme Court and the CAFC. Thereafter this adjustment went on refining the interpretation of 35 USC §§ 101 and 112, according to the Supreme Court’s *Bilski/Mayo* decisions [32][33] and the CAFC’s *Noah/CLS/Ultramercial/Accenture* decisions [35] [36][40]. By today, it is clear that this dispute between the Highest US Courts is much more than a question of distribution of responsibilities in US patent jurisdiction: Namely, that it is an internationally big step forward in getting under control the fundamental problems inevitably arising in classical patent precedents due to purely “model-based” inventions – being totally mental, i.e., of intangible and invisible subject matter, i.e., no longer of “MoT” (Machine-Or-Transformation) type – typical for all emerging technologies. Hence, these problems arise not only in the US but sooner or later in any high tech depending nation, putting the consistency and predictability of its patent precedents into jeopardy, as it happened in the US. With the above decisions the US Highest Courts reacted by starting taking the paradigm underlying US SPL to a higher level of development, which enables consistent and predictable patent precedents also for emerging technology inventions – as the first Highest Courts, worldwide.

This refined US SPL paradigm – underlying the refined SPL precedents and being just a refinement of the classical paradigm – embodies a significant increase of awareness of the intricacies in patenting e.g., business, human genome, pharmaceuticals, nano, and self-replication technology based inventions, and makes it notionally significantly more precise and complete than the classical one. This is recognized easiest by the *Mayo* decision’s [33] refinement. Its 3 additional key terms/notions are: “inventive concept”, “preemptive”, and “abstract idea”. But, as to their important meanings, this decision only briefly sketched them². Yet, the meaning of the term “concept” is known in all branches of

Advanced IT¹ [3][5], of which a simplified version is sufficient here; the precise meanings of the other two key terms follow from elaborating on the outlines provided by the *Mayo* decision [33] in terms of inventive concepts and KR².

In other words, the Supreme Courts’ directive to use “inventive concepts” for presenting a claimed invention in increased clarity – its patent-eligible inventive concepts separated from its patent-noneligible inventive concepts, for gaining an increased understanding of its legal aspects, which also enables testing it under 35 USC §§ 101 and 102/103 in a homogenous way – impacts, first of all, the classical interpretation of § 112 to become this section’s refined interpretation². This improved legal understanding of the claimed invention stimulates two important insights into it:

- Its hitherto 4 compound tests under the 4 Sections 101/112/102/103 of 35 USC may be broken down into a set of 10 elementary SPL tests, being logically and legally absolutely equivalent to these 4 intriguingly complex tests.
- Its claim (sloppily just “the claimed invention”) is preemptive if and only if it is an abstract idea only, whereby the latter statement is simply testable by the not-an-abstract-idea-only test¹⁰.

The structurally groundbreaking insights of the preceding paragraph are elaborated on by the 2 following subsections explaining the usability advantages of this term/notion²) “inventive concept” and of the new just quoted terms/notions’ “elementary SPL” tests, which comprise this “NAIO (Not-an-Abstract-Idea-Only)” test¹⁰, testing the claimed invention’s (non)preemptivity, as well as the “NANO (Novel-And-Non-Obvious)” test¹¹, testing its novelty/(non)obviousness.

A. Inventive Concepts: Basic Advantages

The “misunderstanding” of the Supreme Court’s term “inventive concept” among “patent practitioners” got to be removed, first [7, ftn 4.d]. Indeed, the term “concept” as such is ambiguous^{3,4}. I.e., there are

- over the millennia grown broad and sweeping meanings of the term concept, comprising different flavors, being “vagueness tolerating”, i.e., colloquially addressing big issues such as “soul, god, love, truth, drama, faith, belief, …, a general principle, a plot of a story, a pattern of events” and
- by IT defined specific meanings of this term concept, also comprising different flavors, but all of them being “details oriented” – as indispensably required for enabling precise statements by them, e.g., “formal specifications”, alias “mathematical models” of functional and non-functional properties of any complex system, its modules and their interactions, such as SPL prosecution or litigation cases.

The first systems, where this notion of the term concept was used for specifying/modelling/configuring them, were large data base systems in the early 70s – then also starting from the above broad notion, but stepwise learning the lesson that it had to

be refined to enable the needed kind of precise descriptions/models of properties of their processes and data structures – and then it migrated from there into other IT research areas, such as AI (Artificial Intelligence), Semantics, KR, DL (Description Logic) [3] [4].

While the use of the above IT notion of concept mostly comes along with the awareness of the pitfalls of human thinking/speaking about complex systems, such as controversial SPL cases – and how these concepts are aggregated therein from other concepts – those who have not undergone the tedious learning process how deficient natural language and thinking often is, e.g., many patent business practitioners, knee-jerkily leap to some historic/vague notions of concept, assuming erroneously it were well-definable and understood by them.

As to these two optional meanings of the term concept the following holds. The *Mayo* decision [33] quite clearly talks of a claimed invention's "details oriented" concepts to be identified as embodied by it, i.e., uses the IT interpretation of this term "inventive concept". By contrast those, worldwide, who disagree with the US Law Maker's and US Highest Courts' broad interpretation of 35 USC § 101 insist that the *Mayo* decision's notion of "inventive concept" uses the above historic/colloquial very vague meaning of this term, although their consequential argument that the Supreme Court had asked for the claimed invention's SINGLE inventive concept evidently contradicts the *Mayo* decision [33] – implying that this inconsistency strangely claims this were the proof that the US Supreme Court's whole line of *KSR/Bilski/Mayo* decisions [32][33] were untenable, i.e., its breadth of interpreting § 101.

But, if the above "details oriented" notion of the *Mayo* decision's [33] inventive concepts is accepted, a fundamental question remains. Namely, what then are such inventive concepts precisely – defined in terms of the person of pertinent ordinary skill/creativity, comprising some Advanced IT knowledge? This crucial question is answered by the following definition.

Definition: An "inventive concept" of a claimed invention is a notion²⁾ disclosed by the claimed invention's specification, the meaning of which meets also the usefulness requirement stated by 35 USC § 101^{5),6)}.

An inventive concept hence comprises the qualification of its meaning alias its pragmatics to be patent-eligible or not. While it is an indeed trivial mental/fictional construct – after one has understood it – it nevertheless is extremely helpful for clearly presenting and understanding the SPL construct of ideas. This becomes evident after having the following 3 bullet points clarified some basic features of inventive concepts.

- An inventive concept of a claimed invention is not only one of its "technical facts", as disclosed by its patent (application)'s specification, but also the "legal fact" logically underlying it therein. Thus, an inventive concept is a claimed invention's legal fact establishing its respective technical fact, i.e., represents a notional tuple. Inventive concepts hence are

artificial notions representing the mental – jointly legal and technical – building blocks of any patent. Every patent business practitioner actually does practically use them every day, when thinking about a patent, also if hitherto not having been aware of them – he/she simply has no alternative but to use these inventive concepts – though normally he would think, at a point in time, about just one of these components of an inventive concept.

- Another evident question seems to pose the relation between terms and inventive concepts in patent precedents, as terms are actually explicitly used in patent specifications' wordings, but inventive concepts hitherto usually not. But the *Mayo* decision's [33] requirement statement for them implies that inventive concepts need not show up explicitly in patent specifications' wordings. *Mayo* [33] implies even stronger: The names of inventive concepts may be freely chosen by the person analyzing the patent at issue to be self-descriptive in natural language (of the person of ordinary skill/creativity). Though, in the future, it would greatly facilitate interpreting a claim claiming an invention, if its specification would explicitly describe the inventive concepts it is made-up of, e.g., in a short section therein of its own.
- Inventive concepts may be compound or elementary. Using a claimed invention's compound inventive concepts when testing it under the SPL is often misleading; then disaggregating them into conjunctions of elementary inventive concepts is indispensable [5]. But, there are several reasons, why for many claimed inventions – especially model-based ones – also not all their technical elementary facts are suitable for its inventive concepts and/or why the sequence of discussing their disclosures matters [5].

Going beyond these clarifications – in testing a claimed invention under SPL – inventive concepts have primarily two advantages over terms, which make this next to trivial refocusing (of the use of the two mental instruments at issue) on "inventive concepts" instead of on "terms" extremely rewarding: This refocusing comes along with intuitively getting/understanding the "SPL construct of ideas" and hence testing a claimed invention therein. Firstly, to an inventive concept usually may be given a self-descriptive name (just as to an atomic concept in DL) unless this is superfluous because the inventive concept's meaning is known under its term's name²⁾ to the person of pertinent ordinary skill/creativity. And secondly, an inventive concept's meaning is stated as a useful property of an element – while a term's often identifies a meaning²⁾ specified by a negation of a useful property. The first advantage is evident, the second one explained by the next paragraph.

For showing that a claimed invention meets all §§ 101/112 requirements, the

- classical claim construction assumes that the inventivity⁷⁾ of this claimed invention becomes apparent to patent lawyers/examiners/judges by its limitations – ignoring that in their brains, limitations

- alone have difficulties to build up respective animate subcortically controlled recognition processes alias “intuition” as to this claimed invention, because limitations totally unnaturally are negations of the properties of this focal object – whereas
- the refined claim construction automatically engages, by its inventive concepts, these patent practitioners’ such intuitions while drafting/analyzing/defending a patent’s claimed invention – as these inventive concepts expose their contributions to the claimed invention’s total usefulness⁸⁾ in a natural way, which makes it for the patent practitioners’ brains significantly simpler to build up respective animate subcortically controlled recognition processes of properties of the focal object. This process is stimulated by the brain, as it automatically recognizes that these positive properties are those meanings, with the negations of which it was struggling before.

Such psychological phenomena – psychological preferences, when seeking understanding and/or working with some information, of assuming alleged congruities over concluding analytically, i.e., jumping at a whole over building up this whole – are well known.

This invocation of the patent professional’s intuition when testing a claimed invention under SPL does not only counteract any pretence of illegally broadening of terms’ meanings by the meanwhile really sophisticated misuse of the BRI guideline [14] and the *Markman/Phillips* decisions [38][39] it is based on [5], but it also animates the sharpness of a patent business professional’s ability as to criticism and creativity, thus increasing the comfort and efficiency of his/her work. This makes the refined claim construction based on the claimed invention’s inventive concepts by far superior to the classical claim construction based on solely the terms used by the claim’s wording.

Thus, in total, there are strong reasons for this superiority of the *Mayo* decision’s view of basing the granting of patents, in particular those for emerging technology inventions, on these claimed inventions’ inventive concepts – more precisely: for focusing the patent-eligibility and patentability tests of a model-based claimed invention on its inventive concepts, instead on solely its terms. Although inventive concepts as well as terms are subject to interpretations by the person of pertinent ordinary skill/creativity, there is the just outlined and undeniable better appreciation by a human brain of the meanings of inventive concepts than of the meanings of terms⁹⁾.

Evaluating the before said in this subsection: If the notion of inventive concepts at its beginning seemed sophisticated, this only shows how complex the thinking underlying testing a claimed invention under SPL actually is – often not at all recognized by those contemporary discussions clinging to using solely terms to this end, which bars their insights into this complexity. Such consistency and predictability creating insights, as described by the final part of this subsection, are clearly enforced by the Supreme Court by requiring using inventive concepts to this end, i.e., to use them in construing a claimed invention’s claim construction as described above.

B. Elementary SPL Tests: Basic Advantages

The *Mayo* decisions [33] inventive concepts also invite breaking down a claimed invention’s 4 compound tests under the 4 §§ of 35 USC 101/102/103/112 into 10 elementary “SPL tests” [5][11]. These are scientifically developed, hence their principles are freely available – potentially not their particular applications as “FSTP tests”, as they are subject to patent applications.

Advantages these elementary 10 SPL tests offer to patent professionals are outlined below, after first identifying, which “aspects” of a claimed invention’s refined claim construction they check – in IT language: what “requirements” alias “concerns” stated by the 4 §§ of 35 USC they may state as being met by the claimed invention – being patent-eligible and patentable iff it passes all 10 SPL tests, i.e., a claimed invention’s 4 tests under these 4 §§ is thus refined into 10 tests of

- § 112 for the well-definedness of this claimed invention’s inventive concepts, i.e., of their all 1) disaggregation into elementary inventive concepts, and of their 2) lawful disclosures, 3) definitiveness, and 4) enablement;
- §§ 102/103 for the novelty and nonobviousness of this claimed invention, i.e., of its 7) novelty and nonobviousness by its “NANO test”, based on its 5) independent and 6) non-equivalent inventive concepts;
- § 101 for the patent-eligibility of this claimed invention, i.e., of its being 8) not a law of nature or natural phenomenon only, 9) not idempotent, and 10) not an abstract idea only by its “NAIO test”, i.e., of its claim being nonpreemptive.

The dramatic support of a patent professional working on a patent and its claimed invention – provided by an IES [7] leveraging on these 10 SPL tests – comprises,

- automatically prompting him/her through all steps of exploratively checking, whether they meet these 10 SPL as well as 4 §§ 35 USC respective requirements/concerns by having him/her interactively input or by automatically computing these statements and confirming them (= facts screening), and
- their automatic real-time affirmative execution (= facts transforming) on the user’s request. This execution provides to him/her controls for i) access to all information existing in any SPL test of the claimed invention, and ii) crossover from any one item in its patent to its peer in any one document and to any one of their relations, tests respectively their single steps, multiple presentations thereof, (and back), and iii) all these services anytime in “dialog real-time”.

In so far, the US Highest Courts have taken, by their patent precedents, SPL precedents to a level of development, on which the today notorious problems with emerging technology are overcome, i.e., with model-based inventions. The evolution of classical claim construction to this higher level of evolution – represented by the refined claim construction implied by the Supreme Court’s above line of

groundbreaking decisions, which in turn induced the above 10 semi-automatic SPL test – will dramatically increase the productivity of all patent practitioners, be they inventors, research managers, examiners, lawyers, licensors/-sees, investors, or judges [9].

Out of the 10 SPL tests, the NAIO¹⁰⁾ and the NANO¹¹⁾ test are of particular interest, the latter as to the *KSR* (§102/103) case, the former as to the *Bilski/Mayo/CLS/Myriad/Accenture* [32]-[35][40] (mostly erroneously understood as being plain § 101) cases. As claim construction up to § 112 is just becoming an issue for the Highest Courts again, the role of the remaining 8 tests will shortly encounter more interest, too, as removing the above loopholes of the *Markman/Phillips* decisions[38][39].

V. THE IES USER INTERFACE

The only prerequisite for applying these 10 FSTP/SPL tests, either exploratively or reconstructively, is appropriately having marked-up all documents involved in a PTR's (Problem of TT.0 (Technical Teaching) and RS (Reference Set)) analysis [6]-[9][11]. While this would only rarely happen with the doc.CTs (ConText DOCum ents of a PTR), the needs of additional mark-ups in doc.i's are frequently encountered during an explorative FSTP test's iterative executions, in particular if the tested PTR's RS is expanded by a further doc.i or the definition of a cr-C (CRreative Concept) is changed [8][10][11]. Such mark-ups will be based on some of the XML (Extensible Markup Language) derivatives currently discussed to this end. Independently thereof, the IES'es UI (User Interface) concisely models the requirements of the NPS'es SPL, of its precedents^{10,11)}, and potentially also of some application area specificities (such as of communications, software system, lifecycle, DNA, nano, selfreplication, ... technologies, including their above quoted pragmatics decisive for their social success).

Figure 1 shows 4 separate windows of the IES'es UI, simultaneously mapped onto one or several screens, in total called "survey window". These 4 windows are identified by their names "o-doc.i", "facts.i", "plcs.i", and "tests" in their top left corners. They serve for the knowledge representations of/about primarily i) the original document.i's in o.doc.i, ii) their "inventive concepts" on their o/BAD/BID-KR-levels (o=Original, BAD=Binary, Aggregated and Disclosed, BID=Binary, Independent and Disclosed) in facts.i, iii) their "patent logic carrying semantics" items on these levels in plcs.i, and iv) the 10 FSTP/SPL tests. They may be arbitrarily zoomed, positioned, and overlapped within the survey window. The graphical items within these 4 windows basically represent inventive concepts and/or their components in these KR's. The lines between these items represent their peering in any KR and indicate interrelations between them. Their arrowheads are exemplary for browsing between them – i.e., all lines may have two arrowheads.

This UI presents in its survey window – functionality top-down in telegram style – the following:

- The middle "tests" window provides access to the use of the claimed invention's inventive concepts by any FSTP test – skipped here but shown to the user on its request by the ANC (anticipates/not-anti-

cipates-and-not-contradicts/contradicts) matrix columns, represented by test specific matrix lines describing in short hand this use.

- On the left lower side, in the "o-doc.i" window, two stacks are shown: Of 3 peer doc.i's (their mark-ups comprising all potential cr-Cs' disclosures) and of doc.CTs (their mark-ups comprising all le-Cs (LEgal-Cs), e.g., law/precedents items to be applied where appropriate, respectively additional information potentially belonging to it, such as explanations/confirmations/warnings/..., all of them independent of the doc.i≠doc.CT, i.e., any pragmatics independent of the TT.i's).
- On the right lower side the "facts.i" window shows a stack of 3 doc.i's/TT.i's – for simplicity assuming doc.i comprised just a single claim, otherwise any claim would be one sub-plane. Per TT.i its elements' (= rectangles) properties (= ovals) are arranged on its plane in concentric "KR rings", delimited by dashed lines. The large/small ovals represent BAD/BED-in-Cs, o-in-Cs are parts of their elements' rectangles. A BED-in-C shows some of its relations to other in-Cs and what all their KR details are, e.g., where in a claim in "o-doc.i" or "test" it is involved in and where in the problem to be solved by TT.i in these windows. The encoding of all KR details and the tests is shown in "plcs.i".
- The "plcs.i" window on top is the IES "brain". It stores all in-Cs' peerings of all subject matter items (cr-Cs) with all legal items (le-C) and all their interrelations. It indeed shows everything the user's brain knows about the PTR: all its objects, as well as all potential and/or actual associations between them, and all the sophisticated structures potentially appended to them (not shown here for brevity).

The quick and total overview about all the documents and their mark-ups of all subject-matter items respectively legal/pragmatic items respectively all to these mark-ups related in-Cs (in o-/BAD-/BID-KR) in doc.i is provided to the user – be it an inventor or patent lawyer or examiner or judge – by the two bottom windows, whereby these stacks' items may be presented non-overlapping and then show the interrelations between their peer items.

The PTR independent counterparts to the cr-Cs, the le-Cs, potentially making cr-Cs to in-Cs are the items on the right of the top window. The respective doc.CT's, their mark-ups, and their items in the plcs.i-window are absolutely the same for all PTRs (in particular for their TT.0's claim constructions). For a given PTR, all such peerings and the explanations why they happened are the items on the left of the top window.

As usual, the user would access any item of interest in any window by clicking on it and zooming into one or several of its interrelations. Thereby simultaneously several of such interrelations as well as concatenations of them may stay displayed and zoomed as momentarily of interest for the user. What actually is – or ought to be – of interest to him may be determined by him or an additional application not elaborated on, here.

The “test” window, providing access to all FSTP tests (in all their various configurations), is highly configurable for the various needs of the user in particular in real-time confirmation mode for being able to appropriately guiding the user through a test.

In total: The survey window provides e.g.,

- immediate access to ALL information/knowledge existing in any one FSTP/SPL test of the claimed invention.
- immediate and instant crossovers between ALL KR_s of ANY ONE subject matter and/or legal item.
- immediate crossover from ANY ONE subject matter item to ANY ONE of its relation – and back.
- immediate crossover from ANY ONE relation to its peer in any TT.i – and back.
- immediate crossover from ANY ONE test using an item or relation to any test and its use thereof.
- immediate information about the impact of a change performed in one of the 4 windows on the other ones.

and all these services instantly, i.e., in “dialog real-time”, i.e., necessarily automatically.

An important other powerful feature of the UI of the IES had to be completely skipped in this paper [24][25], due to space limitation. It is its capability to translate all ASTs (Arguable SubTests) of a claimed invention into LACs (Legal Argument Chains) in a variety of multimedia presentations – including natural voice presentations, e.g., using the user's voice – and to enable the user to easily select and control any LAC's presentation in realtime as needed by the user, potentially as to the logics of testing even suggested by the IES.

VI. CONCLUSIONS

No system like the IES exists today – or could only have been thought of without the insights of Mathematical KR presented in [5] and the informal KR ex- or implicitly used in our publications addressing the community of patent law professionals. The kind of KR induced primarily by the US Highest Courts SPL precedents enabled transforming it into this Advanced IT system. While the current IES is only a prototype, even its final version would not yet be capable of acting as an autonomous innovations tracing system, but will be able only of supporting such tracing activities. It is designed as just as a versatile evaluation system of innovations completely identified and specified already – though an amazingly powerful one.

This is made evident in particular by its capability to semi-automatically generate in real-time all argument chains legally correct and technically as correct confirmed – in user controllable verbosity and user controllable multimedia presentations – that may be of actual interest in an invention's test whether it satisfies SPL[24][25].

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¹⁾ "Advanced IT" is a generic term for IT areas such as AI, Semantics, KR, DL, NL.

²⁾ A term together with its meaning is denoted as "notion", its term being the notion's name. A notion hence comprises a definition of the meaning and its name/term. This meaning may be a property of something, e.g., of an element quoted by a claim. Sometimes the meaning of a notion may also be taken as its name.

A notion is called an "inventive concept", if its meaning represents patent pragmatics, i.e., if its meaning also serves the purpose to define the "patent monopoly granting pragmatics, pmgp" determined by the Parliament or the Supreme Court, i.e. if it to this end puts one or several properties' limitations of the invention (of some broader set of such properties' limitations) such that it specifies an item of the invention's "§ 101(usefulness)" – additionally to its "§ 102(novelty)" and /or "§ 103(nonobviousness)", as explained in more detail later.

But already here is evident that an "inventive concept" as such – while being a mental/fictional construct, just as any notion – in no way may be understood as an "abstract idea", as suggested by some patent business practitioners. Also an "abstract inventive concept" cannot be thought as it is a clause contradictory in itself. A concept, just as an inventive concept, is always a concrete and named representative of something.

³⁾ These new terms' meanings are here defined only in natural language of the person of pertinent ordinary skill and creativity, i.e., their Mathematical KR definitions – as far as today possible – are here left away [5], though its thinking is occasionally used.

⁴⁾ In patent law language the meaning of a term¹⁾ is often called "limitation". One meaning of a term/name may be split into two parts and/or subject to different pragmatics. An inventive concept of a claimed invention is, by the *Mayo* decision, in the US patent precedents always a notion of this "meaning-tuple" kind, whereby any meaning-tuple component may be subject to different pragmatics alias meaning-qualifications. I.e., an inventive concept always comprises a legal concept and a creative concept [5].

⁵⁾ Notwithstanding that any inventive concept of a claimed invention represents an item of usefulness and creativity of this claimed invention up to § 101, by the Supreme Courts' interpretation of the Constitution it is additionally to determine, whether an inventive concept – as being of an exceptional kind/quality/pragmatics, namely of "law of nature", of "natural phenomenon", or of "abstract idea" – is by § 101 non-patent-eligible, to be described by this inventive concept's legal concept.

Put in Mathematical KR clarity [5]: An inventive concept's "patent monopoly granting pragmatics, pmgp" qualifies this inventive concept as contributing to the claimed invention's pmgp-height (Q^{pmgp}) over prior art and pertinent skill (i.e., as contributing by 1 not only to its Q^{ples} ($ples$ = patent law carrying semantics), determined by the claimed inventions NANO test, but also to its Q^{pmgp}). I.e., an inventive concept may contribute by 1 solely to the claimed invention's $ples$ -height alias semantic height Q^{ples} over prior art and pertinent skill, but not also to this claimed invention's pmgp-height [6]. In general hence holds $Q^{pmgp} \leq Q^{ples}$. It evidently is the determination of any inventive concept's pmgp that performs the separation of concerns discussed above [5].

If the claimed invention is not well defined, i.e., does not pass one of the other SPL (e.g., the NAIO) tests, running its NANO test, i.e., determining its Q^{ples} , is meaningless, anyway.

⁶⁾ For representing its pragmatics, an inventive concept identifies one or several properties' limitations (of the claimed invention's total set of such

properties' limitations) putting it/them such as to specify its "§ 101(usefulness)" – in addition to its "§ 101/102(novelty)" and "§ 103(nonobviousness)". I.e., a well defined claimed invention embodies no inventive concept that does not meet the usefulness requirement stated by § 101, otherwise this claimed invention were not well defined [5] and the question as to its inventivity⁶⁾ were obsolete.

⁷⁾ The legal meaning of the notion "inventivity" of a claimed invention – i.e., embodied by it – is represented by this claimed invention's total set of limitations of all its elements, i.e., of all elements of the claim claiming the invention described by its specification. The psychological meaning of the notion of inventivity as such, counted in the number of inventive creative ideas it embodies, is not elaborated on, here. It has been clarified in [7], based on a pertinent German Highest Court decision, by the BGH (Bundesgerichtshof).

⁸⁾ The legal meaning of the notion "usefulness" of a claimed invention – i.e., embodied by it – is, just as its inventivity⁶⁾, represented by this claimed invention's total set of limitations of all its elements. Consequently, from the definition of the inventive concepts making-up this claimed invention follows [5] that any one of them contributes – by its contribution to the total set of limitations of the claimed invention – equally to the claimed invention's usefulness, too, as required by § 101.

The *Mayo* decision invokes, by its inventive concepts, for its refined claim construction for a claimed invention this additional "contribution to its usefulness" minded view at its claimed invention's inventive concepts. This "contribution to the claimed invention's usefulness" minded view at inventive concepts changes nothing with these inventive concepts' and/or their terms' hitherto only "contribution to this claimed invention's total limitations" minded pragmatics – i.e., nothing is changed for the more basic classical claim construction for this claimed invention. It evidently is this additional "contribution to this claimed invention's usefulness" minded pragmatics of the inventive concepts, by which the Supreme Court achieves an increased purposefulness of its refined claim construction.

⁹⁾ Whether the earlier exclusively used set of "terms" and their error prone interpretations/limitations of a claimed invention ought to be, in its refined claim construction, eventually completely replaced by a set of inventive concepts legally equivalent to them – and their more explicit names and more target-oriented pragmatics, i.e., their better as context sensitive guided interpretations – and hence making the former set redundant, needs no discussion, yet. Such redundancy is often avoiding committing errors of any kind and then to be preserved.

¹⁰⁾ The "NAIO test" of a claimed invention was originally suggested incompletely, as ignoring its potentially being pathological, which is fixed here. It is not clear at all, whether a pathological TT.0 exists – which also applies to the NANO test. For a more complete and detailed explanation see [5].

The complete NAIO test – just as the NANO test – would start with disaggregating the compound inventive concepts of the claimed invention into the respective sets of BED-in-Cs, then reduced to maximal sets of BID-in-Cs thereof.

For brevity only considering the BID-cr-Cs of the BID-in-Cs, the NAIO test comprises 4 steps:

- 1) verifying the TT.0's specification of the patent (application) discloses a problem, P.0 (Problem), described to be solved by the claimed invention/TT.0, the latter described by its refined claim construction's inventive concepts, {BID-cr-C};
- 2) verifying, using these BID-cr-Cs of 1), that the so described TT.0 actually solves this problem of 1);
- 3) verifying for any one KR^A of TT.0 that this problem of 1), P^A , is in KR^A not solved by any TT^{A*} , derived from TT^A by ignoring therein one of these BID~in-Cs completely or relaxing its limitation by reducing its $TS(d(BID^{~in-C}))$ (TS =Truth Set, d =Domain, $in-C$ =INventive Concept), i.e., not solved by any $TT^{A*} <^{TT} TT^A$ (" $<^{TT}$ " being the "less in-C-limited than" relation between TTs resp. Ps in KR^A) – all these verifications to be confirmed by the person of posc (person of Pertinent Ordinary Skill and Creativity);
- 4) stating, if all steps in 1)-3) are executed successfully, that the so described claimed invention/TT.0 is "not an abstract idea only"

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- of this problem's solution, otherwise that it is only an "abstract idea" of this problem's solution.
- ii) The preamble of this NANO test and its respective first steps are the same as the ones described in the above NAIO test – for the given PTR, for its "anticipation combinations, ACs" and their "1 concept modifications, 1-cMs" for anticipating TT.0 each, as well as for an ind{BID-cr-C} (ind=INDependent) describing PTR's TT.0 (For a more complete and detailed explanation see [5]) – and thereafter comprises the steps:

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- 1) the user generating the ANC matrix for all $TT.i \in RS, i > 0$, its columns representing the BID-cr-Cs;
 - 2) the user generating, for any entry in the ANC matrix the technical and/or legal justification;
 - 3) automatically deriving from the predicates $\underline{X}.i.n, 1 \leq n \leq N, 1 \leq i \leq I$, and the ANC matrix an AC anticipating TT.0 with a minimal Q^{ples} of 1-cMs;
 - 4) automatically delivering Q^{ples} as TT.0's semantic height over RS and $\langle Q^{ples}, \{all\ justifications\ for\ AC's\ 1-cMs\} \rangle$.

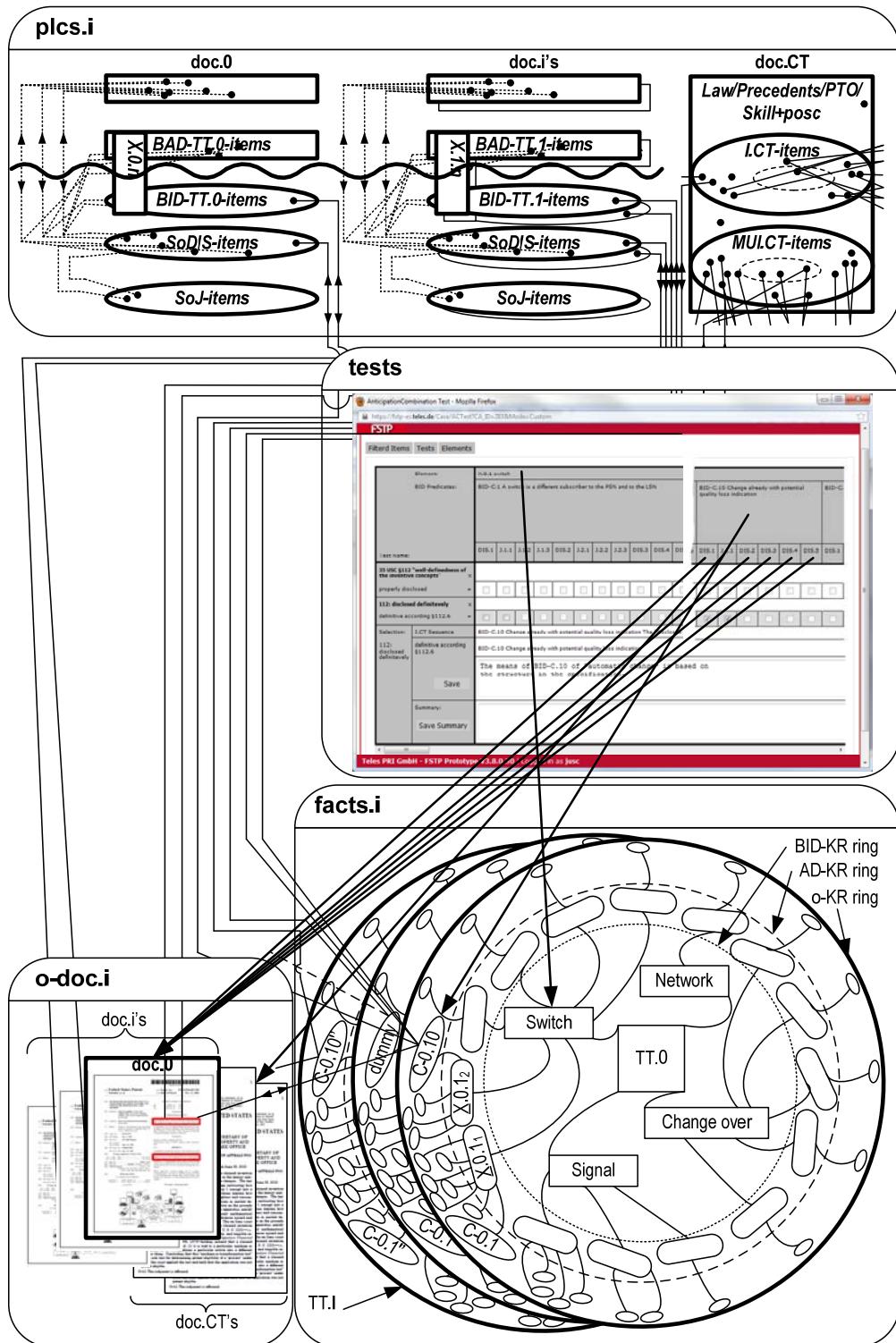


Figure 1: 4 separate UI windows of the IES