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## Understanding the inventor's mind through patent analysis: A CLIL team-teaching experience at the Technical University of Madrid

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### Abstract

We report on a CLIL-based team teaching initiative recently accomplished at the School of Agronomic Engineering of the Technical University of Madrid (UPM). Two teachers—an agronomic engineer and an applied linguist, together with around 20 master students, analyzed a patent document by contrasting it with a 'twin' research article written by the same authors on the same technology and examining their differing contexts and textual and social outcomes. The seminar, with a total duration of seven and a half hours and a hands-on approach, not only is intended to provide disciplinary (agronomical) and know-how contents (the inner workings of patent writing), but is also to raise audience sensitivity and foster transversal skills.

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*Keywords:* CLIL; team-teaching; contrastive genre analysis; patent writing; engineering education

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### 1. Motivation and objectives

The motivation behind this specific seminar on patent analysis has been twofold: its content not only fosters an ideal collaboration between instructors—one very close to a CLIL 'adjunct model' or team teaching (Brinton et al. 1989, Greere & Räsänen 2008)—but also provides a 'know-how' (twofold in turn, as it refers to both technological knowledge and patent writing strategies) useful to the agronomic engineers' community of practice (Wenger 1998).

Through systematic textual comparison focused on authorship, publication date, titles, visuals, promotional and vague language, contexts of use and informational structure of research articles and patents (hereafter RAs and Ps, respectively), community members may become more aware that knowledge construction comprises content and form alike, and that the different textual forms and writing conventions adopted by science and technology shape different perceptions of the same object or phenomenon. In a sense, this awareness of difference may paradoxically contribute to dilute the traditional dichotomy between art (patentable inventions) versus science (research), two approaches to problem-solving, the *raison d'être* of engineering, that nonetheless diverge in their use of shared repertoires and generate disparate discourses. Such divide was reinforced during the 1990s by the advent of the Internet, thanks to which the amount of scientific and technical information available has increased exponentially and been stored separately, nowadays with over 300,000 utility patents and 35,000 scientific papers online.

Another motivating advantage of Ps and RAs analysis has been that it brings to the fore three important components in engineering education: the scientific-technological, linguistic, and didactic factors. The participants may learn the history of a certain technology or scientific discovery by examining the evolution of the patent document over time, get familiarized with its field, tenor and mode (Halliday 1985), that is, with its technolect, legal jargon, rhetorical structure, and with the socially agreed conventions related to reader-friendliness (engagement) and medium-bound format, as well as with the repercussions all of these variables may bear on intellectual vindication. Simultaneously, seminar attendants have an opportunity for exercising their creativity and lateral thinking, reflecting on what information should be openly disclosed, expressed tacitly, or merely taken for granted. In this regard, science and technology communications differ considerably because of their opposed goals: dissemination for the former and marketization for the latter, even though research is becoming increasingly sponsored by private corporations. This two-faced reality has turned science and technology into 'twin dilemmas' with distinctive communicative needs but a common risk of misinterpretation and distortion.

Together with providing engineers with practical skills, the primary objective of the course is a mind adjustment at a social and an operational level, closely intertwined. From a social standpoint, the participants hone their audience sensitivity (having to write for lay and expert readers at a time), learn to discern the utility and investment feasibility of inventions, and enjoy the pleasure of modulating linguistic vagueness/accuracy, always within a minimum of descriptive precision. Operationally, they keep up with the current technological achievements in their field, understand the motivations and writing behaviour of patentees, and practice the verbalization of visual messages and the visualization of verbal ones. Obviously, verbalization and visualization depend on the type of audience and technological surveillance requires understanding the validity of inventions and the inventor's mind. And conversely, grasping these last two aspects helps to stay informed about recent patents and detect inventive gaps.

### **Nomenclature**

CLIL	Content and Language Integrated Learning
P(s)	Patent(s)
RA	Research article

## **2. Seminar features**

For this first seminar edition we selected a twin example (patent/research paper) related to agricultural machinery. In particular, one with a dedicated device that enables the segregation of grain and other materials (MOG) by means of a multispectral vision device, something rather new that has already been commercialized with great success and gained the recognition of technical awards.

Daily class dynamics consisted of three slots: a brief lecture (including a slide show) on all the technical and linguistic information necessary to accomplish the tasks of the corresponding worksheet of the day, workshop time, and a final discussion. Worksheets are completed during workshop time and subsequently discussed, and extra 'food for thought' and pending tasks, if any, are assigned as homework and commented on in the next session. The topical

chronogram implemented is indicated in Table 1.

Among the several instructional aspects covered, and besides encouraging the ultimate acquisition of claim-writing abilities, special attention was paid to awareness-raising concerning where to disclose information explicitly or communicate it implicitly for experts to ‘read between the lines’, when to shift registers/styles according to the mindsets and level of expertise of the audience and, related to both, when to arrange the message verbally or visually—and with what degree of accuracy or vagueness. In this vein, and as a preliminary approach to the divergent epistemological status of Ps and RAs (Myers 1995), students were asked to devise a graphical abstract for each of the ‘twin’ documents provided (Fig. 1), a task which involves feature identification and textual production and demands just a basic level of technical detail. A ‘satellite-like’ layout was chosen in both cases, with the inclusion of a considerable amount of verbalization in phrasal form.

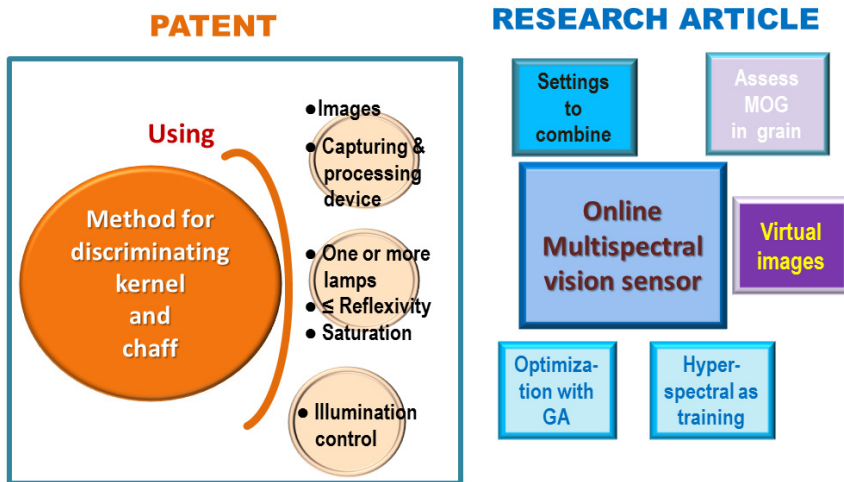


Figure 1. Construction of graphical abstracts

Table 1. Topical chronogram implemented in the seminar.

DAY-BY-DAY CHRONOGRAM				
DAY	TOPIC	ALLOTTED TIME	ASPECTS COVERED	TASKS
1	<i>'Twinness'</i>	1.5h	<p>Science and technology as 'twin dilemmas'.</p> <p>Epistemological convergence and discursive divergence of Ps and RAs.</p> <p>Circular causal relationship between Ps and RAs (A 'chicken-or-egg' story?)</p>	<p><b>Spotting differences</b> in purpose, target readership, title, abstract, publication dates, authorship, assignee, use of intertextuality and narrative.</p> <p><b>Construction of graphical abstracts</b> (Fig. 1)</p>
2	<i>Visuals</i>	1.5h	<p>Different aim, focus and viewpoint of visuals as complementary to the verbal text in Ps and RAs:</p> <p><i>Anticipatory function</i> = panoramic data anticipation (RAs) vs. design outline (Ps)</p> <p><i>Illustrative function</i> = argumentative support (RAs) vs. graphical guide to verbal description (Ps)</p>	<p>Discussion on visuals <b>location</b> in the document, <b>type</b> of visual (photo, diagram, graph, etc.), <b>legend length</b>, level of <b>detail</b>, verbal <b>references</b> (full, partial or no description, endophoric mention), existence of <b>data explanation or interpretation</b> and <b>tacit and explicit information</b></p>
3	<i>Promotional language</i>	1.5h	<p><b>Praise and criticism devices</b> in the patent document</p> <p><b>Location in the patent moves</b> (property scope, field &amp; application, prior/background art, physical &amp; functional description, cautionary statements)</p> <p><b>Marked and unmarked evaluation</b></p>	<p><b>Electronic concordance search:</b></p> <p>Community pointers, vague language (hedges), metadiscoursal guides, attitudinals, loaded evaluative terms, most frequent technical words in P and RA documents (Fig. 2)</p>

Table 1 (cont.). Topical chronogram implemented in the seminar.

DAY-BY-DAY CHRONOGRAM				
DAY	TOPIC	ALLOTTED TIME	ASPECTS COVERED	TASKS
4	<i>Patent claims</i>	1.5h	<p><b>Patents' validity criteria:</b> utility, novelty &amp; non-obviousness, maximum property</p> <p><b>Parts and features of claims</b></p>	<p><b>Associate technical descriptions with legal claims</b></p> <p><b>Discern patent embodiments through claims</b></p> <p><b>Write claims</b> for a fictitious invention</p>
5	<i>Patent contexts</i>	1.5h	<p><b>Evolution of the genre:</b></p> <p>Textual format Inventor's profile</p> <p><b>Knowledge asymmetries between audiences</b></p>	<p><b>Detection of language aimed at skilled-in-the-art readers those and non-skilled-in the-art</b></p>

This task was later on completed, on examining patents' visuals, with videos of the commercialized agricultural machinery under study. We found that the participants could barely imagine the final device and seemed to have difficulties in seeing beyond the obvious, that is, in discriminating critical details which indeed were not stressed in the patent. Through them they could have perceived straightaway what the interests and target audience of the video were, and what collectivities are favoured by the omission of those details in the patent: whether the 'validity people' (i.e. patent examiners and some legal courts) or the 'infringement people' (i.e. licensees and fellow inventors—competitors). This finding suggests that extra practice is necessary to help seminar attendants sort out visual information and foresee its effect on property claims.

Another suggestive task at this preliminary stage was the analysis of headings in the two twin documents (see Figure 2), which laid special emphasis on the interpretation of the different publication dates, framed by the RA (earliest reception and final confirmation of the revised version) so as not to lose the scientific priority (2007) and maintain the right to patent the invention or discovery thanks to a delay in the publication of the final revised version of the scientific paper (2009). That explains why the patent publication dates (2008 and 2009) are 'intermediate', that is, they appear framed by those of the RA.

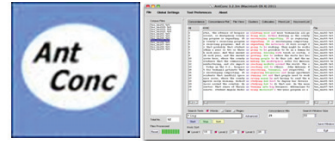
## Worksheet 1(a): Headers comparison

	RESEARCH ARTICLE	PATENT
Titles	Hyperspectral waveband selection for on-line measurement of grain cleanness	CROP PARTICLE DISCRIMINATION METHODS AND APPARATUS (US 2009/0297040 A1)
Publication dates	Received 18 December 2007 Received in revised form 11 May 2009 Accepted 20 May 2009 Published online 7 July 2009	Foreign Application Priority Data: (EP 08010081) June 2, 2008 Filed: Jun. 2, 2009 Prior Publication date: Dec. 3, 2009
Authorship	Carmen Wallays, Bart Missotten, Josse De Baerdemaeker, Wouter Saeyes	Bart M. A. Missotten, Winksele Carmen S. Wallays, IZegem
Assignee / institution	<ul style="list-style-type: none"> <li>Department of Biosystems, Katholieke Universiteit Leuven</li> <li>NH Belgium</li> </ul>	<ul style="list-style-type: none"> <li>CNH America LLC, New Holland</li> </ul>

Figure 2. Preliminary analysis of divergences between the two twin genres.

Another of the course highlights, promotional language, was tackled hands-on and from a double perspective. Firstly, participants were asked to computer-search ‘marked’ or ‘laden’ evaluative terms (e.g. advantage(ous), convenient, sufficient, better, reliable, problematic, improve(d), flaw(ed), etc.) and the community pointers (i.e. inclusive and exclusive personal pronouns and insiders’ boundary marker such as the inventor(s), those-skilled-in-the-art, obviously, clearly, as is known, etc.), hedges (instances of vague language aimed at experts, such as approximators, modal verbs and expressions of tentativeness) and the guiding metadiscourse (markers of inference and consequence and glosses aimed at lay readers) accompanying them. Subsequently, the most frequent technical words were equally computer-searched with the free software AntConc.3.2.1 (Anthony 2007) and graphically quantified (Fig. 3 & 4). This second task was intended to show the different semantic foci of Ps and RAs, which is a kind of promotion that does not use ‘promotional language’ at all, but merely gives some elements and concepts more technical saliency than others.

## Worksheet 3: Example of result



	Patent	Research A.
<b>Community pointer</b>		
o Skill in the art	1	0
o Known	4	1
o Shown	8	3
<b>Hedges (vague language)</b>		
o May	53	2
o Various	17	2
o One or more	26	0
o At least	15	0
o Common(ly)	7	1
o Frequent(ly)		
o Often		
o Nearly always		
<b>Boosters (emphasizers)</b>		
o Will	6	13
o Is/are	136	71
<b>Informative Guides</b>		
inferentials:	16	4
That is/since		
loaded terms:	10	0
easier/improved		

Figure 3. Quantification of the most frequent semantic foci of Ps and RAs words in both genres

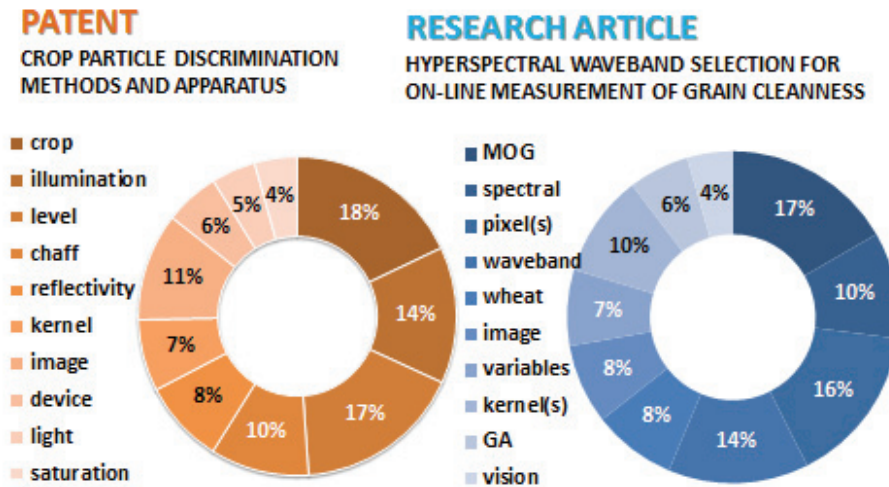


Figure 4. Quantification of the most frequent technical words in both genres

The last of the seminar nodes was claim-writing. As an initial step, students were facilitated the validity criteria for patent granting (i.e. novelty and non-obviousness, utility and maximum property) and taught the structure of claims (preamble + linking word + inventive body). Then they were given technical descriptions of the patent object of study to match with specific claims. This work enables learners to understand the nature of several rhetorical moves and realize the legal nature of the claim. After this task of guided identification, the participants

proceeded to write their own claims for a fictitious technological invention (Fig. 5, left), having previously defined its key features and organized them hierarchically (Fig.5, right). The various claim options were contrasted and discussed as to their legal meaning. Two samples written by students, (1) and (2), are displayed below.



Figure 5. Fictitious invention (left) and its key features (right)

- (1) An old-new fashionable device comprising an electromechanical typewriter to be used in combination with a touch screen interface, e.g. *i-pad* or tablet.
- (2) A key according to claim 3, wherein a typewriter key is mounted on, comprising an articulated key with at least 2-phase dumping and mass connection.

As expected, students' key features were less fine-grained than those proposed by the instructors. This fact was used to comment on its possible legal implications, as much property ground would be left unclaimed if features were not refined.

As a seminar round-off, students were informed about the sociolinguistic evolution of the patent genre, both at a sociological and textual level. Attention was paid to the transition from the figure of the solitary private inventor (e.g. the 'Edison model') to the hybrid corporate profile of university consortia. Likewise, the format changes over time were also noticed: the initial first-person epistolary tone of early patents up to the first quarter of the twentieth century, praising the inventor's achievement and claiming his/her rights within the line of argument, gave way to a more concise, depersonalized and header-organized format in which legal claims tend to be bulleted or numbered.

### 3. Seminar evaluation

On balance, this seminar has revealed that through a careful genre choice, team teaching is feasible and fruitful. The satisfaction survey administered to students, though, shows that they are not as aware of having acquired new skills as they are of having understood the workings of the course and learnt its descriptive and theoretical input (Fig. 6). The lukewarm welcome they gave the seminar at the beginning, caused by their generalized lack of contact with the patent genre, gave way to a most enthusiastic engagement once they understood the main objectives, the syllabus, and the class routines. However, their sense of achievement, as mentioned before, appears more centred on lexis and rhetorical structure at a receptive level than on being able to vindicate intellectual property by writing claims. We think that to enhance productive skills and help learners hone their perception of their know-how gains we should incorporate more writing practice in the future, one associated with peer evaluation to stimulate criticism and debate. Other interesting additions could be the inclusion of veteran in-house patent applicants' testimonies and a study of stylistic variation, if any, across the diverse patent objects (e.g. substances,



methods, devices, improvements, plants, genetic manipulations, etc.) and contexts, namely the consortiums formed by universities and companies, the academic university scenario, and the realm of the traditional inventor, isolated from institutions.



Figure 6. Results (in percentages) and sound bites from the final satisfaction survey

To conclude, we sense that the didactic potential of this seminar is enormous: it is exportable to other engineering fields and easily renewable with new twin sample choices RA-P. Language must inevitable be made prominent at all times because through it the content is adjusted to the targeted audience and intellectual property is finally claimed—language and engineering teachers therefore complement each other. Furthermore, linguistic expression and topical content go hand in hand with the transversal skills of creative and critical thinking, indispensable to modulate the explicitness and communicative accuracy of patent discourse.

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