MEDIATING BETWEEN THE 'TWO CULTURES' IN ACADEMIA: THE ROLE OF CONCEPTUAL METAPHOR

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Abstract

This contribution focuses on metaphorical expressions in academic papers in science and in the humanities. It represents an approach to 'intercultural' communication in the sense of the so-called 'two cultures' after C. P. Snow who referred to the sciences and to the humanities as two different cultures. Unfortunately, within academic discourse today there are few attempts at interdisciplinary communication between sciences and humanities. Only a few fields are bridging this gulf (e.g. some of the cognitive sciences). Much of the mediation between the two cultures is carried predominantly by metaphorical expressions. In this contribution, metaphor is analysed as the figurative use of verbs of perception within the framework of cognitive linguistics. We will focus on the analysis of source and target domain which are given membership in semantic ontologies.

Key words

corpora, academic English, metaphor, cognitive linguistics, conceptualization, conceptual metaphor, cultural linguistics

1 Introduction

The denominator of cross-cultural communication can be extended beyond its common scope to different types of culture. In this contribution, communication between two specific cultures is investigated. These two cultures are the 'two cultures' as suggested by C. P. Snow in his Rede lecture in 1959 at Cambridge. Snow imagined academia separated into protagonists from the humanities and the natural sciences as carriers of different cultures. He attributed the gulf between sciences and humanities to a communication breakdown which he saw as a major obstacle to solving "the world's problems" (Snow 1959). Looking at products of modern science communication, however (as exemplified in peer-reviewed research articles or papers on preprint servers intended for speedy circulation), may even solidify Snow's claim as they are virtually impenetrable even for researchers of related disciplines. However, some linguistic bridges across the gulf can be built. For metaphor this means that it could be a possible mediator between the 'two cultures' in which different linguistic strategies show recurrent patterns of mediation. This rests upon linguistic observations about academic

discourse and it offers several interfaces at which metaphor can be a tool in cross-cultural communication. These interfaces are: sciences vs. humanities and academic content (of either sciences or humanities) vs. layperson interests in research. Several difficulties of talk between these different cultures are 'genetic' rather than constructed. In fact, there is not much merit to the "social constructionist" view of academic discourse in which scholars (usually with training from the humanities) claim that "writing is always a personal and socio-cultural act of identity whereby writers both signal their membership in a range of communities, as well as express their own creative presence" (Hyland 2006: 35).

2 The academic discourse situation

2.1 The pragmatic viewpoint

The academic discourse situation can be defined from a pragmatic point of view as a contract of diffusing knowledge which author/speaker and reader/listener enter into and in which both, A (the author or speaker) and B (the reader or listener), share the knowledge that: A knows that B does not know everything that A knows (about X).

A uses conventionalised strategies to express him/herself comprehensibly which means that semantic means such as metaphor and hedging are used to modify the propensity of a statement. Propensity is defined here as the degree of probability of a statement to hold true. As a consequence, A relies on the shared cognitive endowment with B: both possess instruments of bodily perception so that any phenomenon that can be hypothesized or measured in the natural sciences can be mediated and transferred into comprehensible processes. As most of these phenomena are completely removed from any bodily experience, these linguistic markers are important and can be made subject of systematisation. The systematisation can be studied in the figurative uses of verbs of perception. The separation of the perceivers from their objects thus demands semantic extensions (Hooper 2004: 1742).

2.2 Metaphors in physics and psychology

The use of and even the need for metaphor is apparent in the simplest and most basic physical dimensions like time. Whereas space can be experienced via a complicated construal from two-dimensional retina images or via proprioception, time cannot. Subjective time is an "intuitive generalization of

our bodily experience of rhythmic processes […] which lead to counting" (Euler 1997: 159). Decoupling subjective time from physical time is a starting point of modern physics (cf. ibid.) and in a way is made possible by the use of metaphor. This means that the systematic extension of meaning produces the figurative readings that empower scientists to grasp concepts that cannot be grasped directly (Geeraerts 2002: 436).

Any metaphorical strategy in the natural sciences can be tested on empirical grounds whether the metaphor employed mediates between a phenomenon that cannot directly experienced and a phenomenon close to human perception or emotional faculty. The following example shows both:

Gamma Ray Bursts from the First Stars: Neutrino Signals
Raffaella Schneider, Dafne Guetta, Andrea Ferrara
If the first (PopIII) stars were very massive, their final *fate* is to collapse into very massive black holes. Once a proto-black hole has formed into the stellar core, accretion continues through a disk. It is widely accepted, although not confirmed, that magnetic fields *drive* an energetic jet which produces a burst of TeV neutrinos by photon-meson interaction, and eventually *breaks out* of the stellar *envelope* appearing as a Gamma Ray Burst (GRB). Based on recent numerical simulations and neutrino emission models, we *predict* the *expected* neutrino diffuse *flux* from these PopIII GRBs and compare it with the capabilities of present and planned detectors as AMANDA and IceCube. If *beamed* into 1% of the sky, we *find* that the rate of PopIII GRBs is = 4 × 106 yr-1. High energy neutrinos from PopIII GRBs could dominate the overall *flux* in two energy *bands* [104–105] GeV and [105–106] GeV of neutrino telescopes. The enhanced sensitivities of forthcoming detectors in the high-energy band (AMANDA-II, IceCube) will provide a fundamental *insight* on the characteristic explosion energies of PopIII […] (arXiv:astro-ph/0201342 v1 21 Jan 2002)

This is different in a social science text like the following from the field of psychology with mediators highlighted in italics (metaphor) or underlined (hedge expressions):

Whenever competing options are considered in sequence, their evaluations may be affected by order of appearance. Such serial position effects would *threaten* the *fairness* of competitions using jury evaluations. Randomization cannot reduce potential order effects, but it does *give* candidates *an equal chance* of being assigned to preferred serial positions. Whether, or what, serial position *effects emerge* may depend on the cognitive demands of the judgment task. In

end-of-sequence procedures, final scores are *not given* until all candidates have performed, possibly *burdening judges' memory*. If judges' evaluations are based on how well they remember performances, serial position effects may resemble those found with free recall. Candidates may also be evaluated *step-by-step*, immediately after each performance. This procedure should not *burden memory*, though it may produce different serial position effects. Yet, this paper reports similar serial position effects […] (de Bruin, W. (2005) Acta Psychologica 118, 3, 245-260)

The linguistic means highlighted in the previous texts give evidence that both text types use metaphors to make the argumentation transparent. As a marked difference, we can discern a salience of visual metaphors in the physics text and numerous hedge markings in psychology, which uses especially modal auxiliaries to blur the propensity of its statements.

3 Methodology and data

3.1 Experimental setup and corpus materials

All data obtained was retrieved from the Chemnitz-based *Corpus of Scientific and Popular Academic English* (SPACE). This corpus contains texts from the natural sciences (physics and biosciences) and from one social science: psychology. It has a binary structure in which a large amount of original academic texts are collected together with their popularized version published by popular-academic journals like the *New Scientist*. The academic texts were compiled from three preprint servers for academic publications:

a) physics	from	*arXiv.org*
b) biosciences	from	*Proceedings of the National Academy of Sciences* (PNAS) and
c) psychology	from	*Public Library of Science – Medicine* (PLoS)

All popular-academic texts were compiled from the *New Scientist*. The total size of the corpus at the moment of the study is 734,466 words.

3.2 Data discussion

3.2.1 Verbs of perception in the corpus

Syntactically, the verbs of perception appear (with variation) in the shape of +HUMAN V_{percep} DO, although the passive voice is common.

The verbs of perception in Table 1 were queried and stored in concordances for the quantitative survey. The total numbers are given below:

subcorpora	**physics 001AX-046AX**	**biosciences 047PN-106PN**	**popular physics 001NS-046NS**	**popular biosciences 047NS-106NS**	**psychology**
visual perception					
discover	20	17	7	15	12
focus	21	21	2	4	3
glance	0	0	3	0	2
inspect	0	1	0	0	7
look at	3	0	0	0	2
notice	13	4	10	3	16
observe	123	182	18	1	246
peer	0	1	1	2	2
perceive	2	25	1	1	101
recognize	4	23	0	3	8
see	305	264	74	28	219
spot	0	1	13	4	30
stare	0	0	1	0	11
watch	0	0	1	0	16
auditory perception					
hear	0	6	2	3	22
listen	0	0	1	0	51

Table 1: Total numbers of $V_{percept}$ from the POS-tagged Corpus

A first observation is that several verbs of visual perception have no significant occurrence in the corpora, cf. *glance*, *peer*, *look at* (5 occurrences) and even *inspect* (8). Several others have comparatively low frequencies. These are verbs that represent very specific manners of perception like *stare* or *watch* (12 and 17 occurrences respectively). Across the board, texts from psychology show the highest lexical diversity. They also include most of the occurrences of verbs of auditory perception. Both facts are not surprising, however. Aspects of perception are very often the research topic in cognitive psychology wherein these verbs are used literally, not metaphorically. However, due to the low overall counts for auditory perception these verbs will not be considered for the rest of the study.

The following examples reveal the diversity of usage:

V_{visual}	Example
discover	**0104PN** discussion We PP we have VHP have ***discovered*** VVN discover unprecedented JJ unprecedented variation NN varia
focus	**0004AX** NNS mechanic . SENT . Here RB here we PP we ***focus*** VVP focus a DT a pilot-wave NN pilot-wave analogue
inspect	**0088PN** be evaluated VVN evaluate by IN by ***inspecting*** VVG inspect probability NN probability plots NNS plot display
notice	**0028AX** We PP we ***notice*** VVP notice that IN that , , , in IN in spite NN spite of IN
observe	**0017AX** Mmin . SENT . We PP we ***observed*** VVD observe 10 CD @card@ events NNS event in IN in the DT the
peer	**0032NS** allowing VVG allow us PP us to TO to ***peer*** VV peer inside RB inside , he PP he speculates
perceive	**0027AX** low-energy probes NNS probe ***perceive*** VVP perceive as IN Minkowski NP Minkowski ((flat JJ fla
recognize	**0004AX** evaporate if IN if one PP one ***recognises*** VVZ recognize that IN that our PP$ our universe NN universe is
see	**0047PN** density map NN map , , , we PP we ***see*** VVP see at IN at least JJS least four CD four to TO to fi
spot	**0008NS** should be VB be able JJ able to TO to ***spot*** VV spot the DT the terminuses NNS terminuses . SENT . A D
Stare	**0004NS** Right now RB now we PP we're VBP be ***staring*** VVG stare into IN into a DT a sort NN sort of IN of quantum

Table 2: Corpus examples

The verbs in this sample survey use modes of visual perception for three patterns (a-c) sorted after their complements:

a) different abstract objects
discover variation
focus a pilot wave
perceive as Minkowski (flat classical and continuous)
peer inside [*wormholes*]
see at least four to five connections between the Mn cluster and polypeptide backbones
spot the terminuses [of a *superfast transport network*]
into a sort of quantum fog
b) representations of abstract occurrences
inspect probability plots
observe 10 card events
c) *that*-clauses
notice that
recognize that

Semantically, verbs of visual perceptions allow a classification under semantic aspects, which considers two poles of meaning, the factive pole and the agentive pole. The verbs on the factive pole presuppose the truth-value of their clausal complements. The only non-factive verb in the study is *focus*. *Perceive* is factive but has zero occurrences. The agentive pole of the verbs is evidenced by their occurrence in active voice, thus making *focus* the only verb with only active occurrences on the agentive pole and *notice* the 'most factive' with more than half its occurrences complemented by *that*-clauses (see table below).

V_{visual}	**verbs per *that*-clause**	V_{visual}	**verbs per passive**
focus	**0**	*focus*	**0**
perceive	**0**	*see*	**0.009**
recognize	**0.033**	*notice*	**0.033**
see	**0.055**	*recognize*	**0.033**
observe	**0.071**	*perceive*	**0.034**
discover	**0.237**	*observe*	**0.074**
notice	**0.567**	*discover*	**0.085**

Table 3: Ratio of factive and non-agentive occurrences for selected V_{visual}

Discover is the least agentive verb and has a high indication of factivity. *See* and *observe* have the overall most occurrences and are considered as semantic cores. The semantic spectrum of verbs of visual perception in academic writing can therefore be plotted as follows:

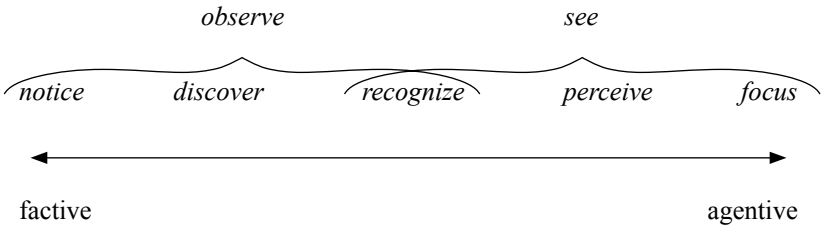

Figure 1: Semantic spectrum of usage

This spectrum represents the overall spread of core meanings in visual perception. The ontologically most generic term *see* accounts for more than half of all metaphorical uses. *See* is also the most general marker of visual perception with the more specified manners following in a large distance of frequency. Moreover, the distribution is more interesting and diversified when the academic domains are concerned.

The expected difference between the 'two cultures' is evident in the comparison of distributions at the interface between natural sciences and social sciences. As argued before, in the natural sciences metaphorical visualization is important due to the abstract nature of their topics. For the different sciences, we obtain the following signatures:

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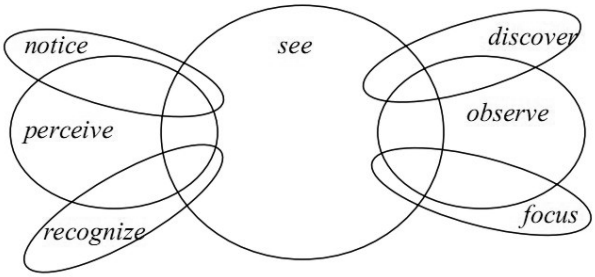

Figure 2: Semantic nuclei for 7 different verbs of perception

This is the overall picture that can be broken down into the following verbs:

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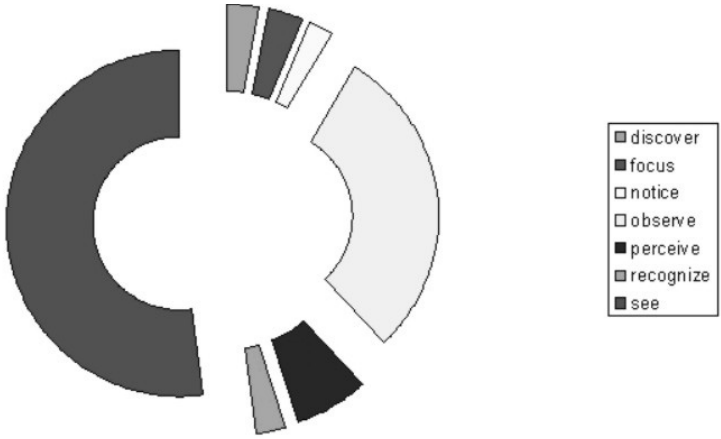

Figure 3: Distribution of verbs of perception – quantitative view

If this distribution is specified from the global to the local phenomenon of text types and scientific disciplines, the signatures change considerably.

In the following, the groupings of the verbs of perception are given in its signature and distribution gestalt. The size of the overlapping Venn-circles corresponds with the quantitative size of the findings.

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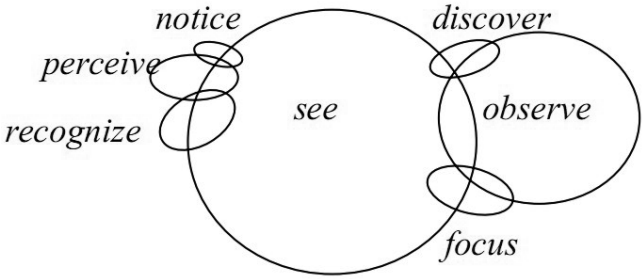

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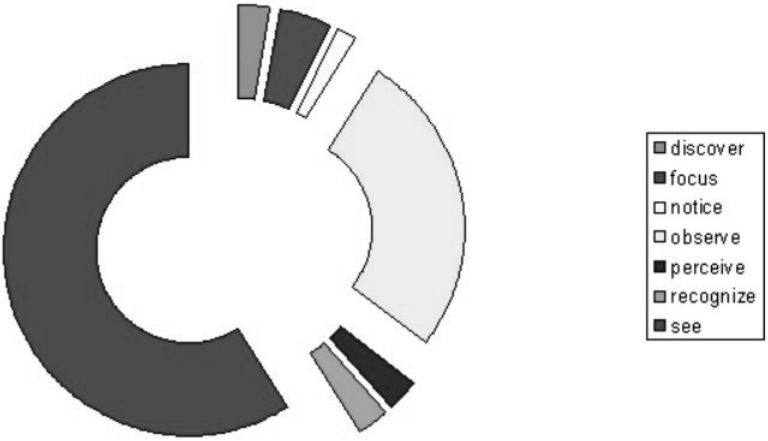

Figure 4: Verbs of perception in academic texts – physical sciences

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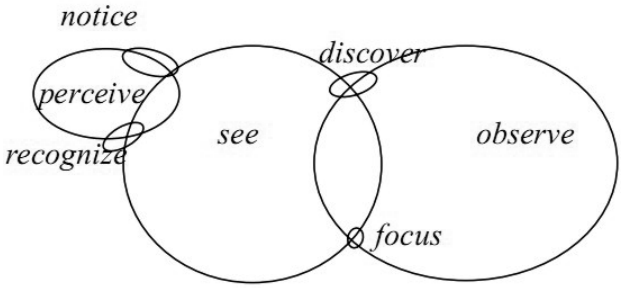

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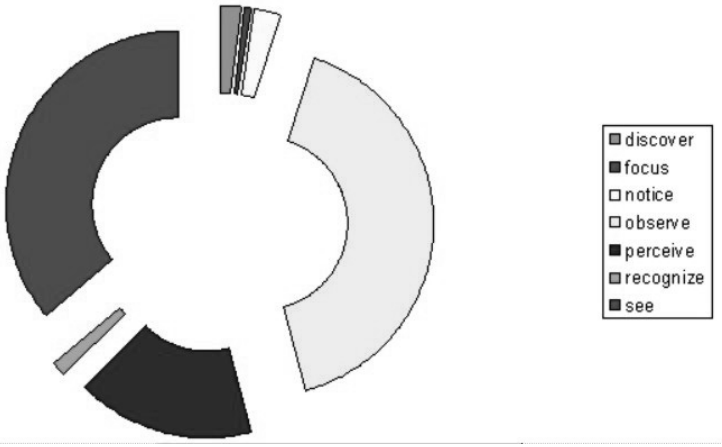

Figure 5: Verbs of perception in academic-scientific texts – social sciences

The graph for the sciences shows two prominent nuclei for *see* and *observe* which falls within the predictions of perceptual agency (cf. the spectrum in Figure 1). This is a stark contrast to the findings detailed above. Figure 5 shows the groupings and distribution for the findings in the social science considered, psychology.

We can see that explorative verbs are of negligible impact (*focus, discover, notice*) and that the global binome of *see-observe* is actually appended by *perceive* which can be expected in psychology (where the research topic is sometimes related to perception).

3.2.2 Academic cultures and their lexical profiles

An even more refine picture emerges when the lexical infrastructure of all subcorpora is concerned. This enables us to specify not only the interface between the natural and the social sciences but also between academia and popularized science. When we graph the lexical distributions of the verbs of visual perception, very different, culture-specific profiles emerge.

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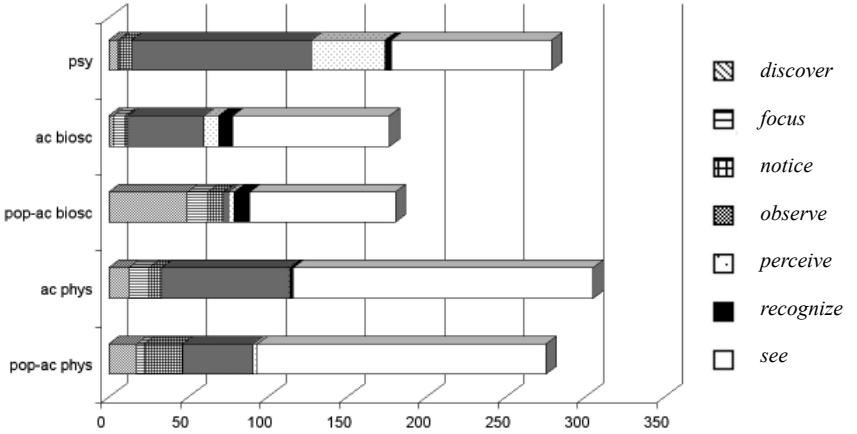

Figure 6: Lexical distribution profiles for all subcorpora

The bar length represents the total size of the subsets of verbs of visual perception. Even though the popular-science texts are much shorter than their academic counterparts (with a mean ratio of 1:5), they have substantial shares of verbs of visual perception. Verbs in texts in popular bioscience (pop-ac biosc) even outnumber verbs in the corresponding academic bioscience (ac biosc) texts by a small amount. Interestingly, both have quite different profiles with many instances of *observe* in the popular versions but rarely any in the academic versions. Overall, the lexical spread of the popular texts is larger. The diversity emerges mainly through the lack of codified descriptions of measurements in the popular texts which are written by science journalists but not by researchers (who are lexically less creative). The journalists use also more agentive forms and combine this with a richer use of the respective verbs. Another revealing fact is that the popular texts in physics (pop-ac phys) have a very similar profile in comparison with the academic texts in physics (ac phys) with no significant differences although there is slightly more 'observation' in the real science.

4 Conclusion

As a summary we can state that the natural sciences (popular and academic) show distinct signatures in comparison with psychology (psy) as a social science. The semantic poles in psychology are: *perceive – see – observe*

in the academic sciences the poles are: *see – observe*
and in the popular science the poles are: *see* – agentive V_{visual}

The popular science signatures reflect their origins in the academic sciences. Thus, is popular science discourse the 'true' mediator between the two 'cultures'? For further research this question needs rephrasing. We need to investigate the target domains, ontologically and quantitatively to achieve some reliable judgment about the initial question of the cultural differences between the two main fields of science – the natural sciences and the social sciences and humanities.

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