Sensory-Motor Concepts and Metaphor in Usage

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Abstract

This paper explores the relation between metaphor and Sensory Motor concepts in language use. Sensory Motor concepts in language use are defined as a number of semantic fields distinguished by WMatrix, comprising Sensory lexis and Motor lexis, including words under 'Sight' and 'Sound' as well as 'Moving, Coming, Going' and 'Pushing, Putting, Pulling'. The incidence of this lexis and its metaphorical use is examined in the VU Amsterdam Metaphor Corpus, a 190,000 word selection from BNC Baby annotated for metaphor. The relation between the selected semantic fields and metaphorical and non-metaphorical use reveals a substantial distinction between the metaphorical use of Sensory Motor lexis and all other lexis as well as between the metaphorical use of Sensory lexis and Motor lexis. Interactions with word class and with genre are also explored, indicating more specific behavior of each of the various groups of lexis expressing the distinct concept categories. The paper concludes by suggesting that Sensory-Motor concepts may indeed play a special role in metaphorical language use, and that additional distinctions are needed to capture the four-way interaction between metaphor, word class, register and semantic field.

Keywords: Sensory-Motor concepts, semantic fields, metaphor, language use

1 Introduction

How are Sensory-Motor concepts expressed in language? And when are Sensory-Motor concepts used metaphorically in language? I will explore these questions in order to offer some tentative views of the relation between Sensory-Motor concepts and metaphor in usage. The connection between Sensory-Motor concepts and metaphor is natural since Sensory-Motor concepts afford one of the most popular source domains for generating metaphorical language and thought: according to the influential cognitive-linguistic account of metaphor launched by Lakoff and Johnson (1980), we think of for instance understanding as a sensory experience (UNDERSTANDING IS SEEING) and of change as a motor experience (CHANGE IS MOTION). More recently, one basic group of metaphors, called 'primary metaphors', have been distinguished on the basis of their immediate grounding in embodied cognition by means of so-called 'image schemas', which are presumably derived from sensory-motor experience (e. g., Gibbs,

2006; Hampe, 2005). Since then, Sensory-Motor concepts have been taken as fundamental to figuration in thought and language (e. g., Lakoff and Johnson, 1999; Mandler, 2004).

In this paper I will utilize a substantial set of generally representative linguistic data to explore the relation between Sensory-Motor concepts and metaphor in usage. Previous work done in our lab led to the first attempt at an encompassing corpus-linguistic description of the relation between metaphor and its use in language (Dorst, 2011; Herrmann, 2013; Kaal, 2012; Krennmayr, 2011; Pasma, 2011; Steen et al., 2010a, b). This research on metaphor in usage has shown a highly varied distribution of metaphor across registers and word classes:

- Some registers are more metaphorical than others, ranging from academic and news through fiction to conversation.
- Some word classes are also more metaphorical than others, ranging from prepositions and determiners through nouns and verbs to adjectives and adverbs.
- And some word classes are more metaphorical in some registers than in others; for instance, adjectives have higher metaphorical usage in news, fiction and conversation than may be expected by chance, but not in academic texts, where they do behave according to chance (Steen et al, 2010a: 211).

Since, in addition, some word classes are more frequent in some registers than others (cf. Biber and Conrad, 2009), the underlying general interaction between register and word class needs to be taken into account when interpreting the relation between metaphor, register and word class.

These patterns were determined without paying explicit attention to their relation to distinct semantic fields. The data do naturally include the use of all semantic fields that can be distinguished, including those fields presumably relating to Sensory-Motor concepts. This means that, in theory, the relation between Sensory-Motor concepts and metaphor in usage could be analyzed as a four-way interaction, between (a) Sensory-Motor concepts, (b) metaphor, (c) register and (d) word-class. Taking our previous work as a provisional startingpoint, the simplest model of this four-way interaction would yield a 2*2*4*8 design for analysis, with Sensory-Motor concepts having two levels (Sensory-Motor concept or not), metaphor having two levels (metaphor or not), register having four levels (academic, news, fiction, and conversation), and word class having eight levels (adjective, adverb, conjunction, determiner, noun, preposition, verb, remainder). Such a design is clearly much too complex to remain meaningful without further context, certainly for an exploratory paper like the present one. I am therefore

going to dismantle the four-way interaction into a number of components that are theoretically meaningful in order to achieve a first understanding of the possible relation between Sensory-Motor concepts and metaphor in usage. The following findings are hence partial and tentative, in the awareness that future research on a grander scale will have to take into account more complex interactions as possibly influencing the general trends.

The overall aim of this exploration is to sketch a first picture of the employment of Sensory-Motor concepts for metaphorical purposes in language use. Data collection and analysis are based on a data set that has since been corrected, requiring another round of research in order to take these corrections into account. I have also selectively applied just a handful of small-scale statistical tests that ideally need inclusion in a more encompassing and sophisticated approach in the future. What I aim to do in this paper, therefore, is to present a relatively informal account of the most important tendencies in the data that are visible in spite of the error and noise I just acknowledged. Since these most important tendencies are starkly visible, future research is not expected to have drastic effects on the present conclusions and is hoped to profit from the first sketch and new questions I can offer at this moment.

2 Method

The data were collected from the VU Amsterdam Metaphor Corpus (Krennmayr and Steen, in press), a sample of just under 190,000 words from the BNC Baby, which itself is a four-million word sample from the British National Corpus. This is a 100 million word collection of samples of written and spoken language from a wide range of sources, representative of present-day British English. The VU Amsterdam Metaphor Corpus (from now on, 'VUAMC') was annotated for metaphor, yielding about 25,000 metaphor related words (13.6 %). These were then analyzed for relations with word class and register, revealing a three-way interaction between metaphor, word class, and register (Steen et al., 2010a, b). The version of the database used for the present paper still includes a number of mistakes, both in Part-of-Speech tagging as well as in metaphor annotation. These were since corrected for a second, revised edition but the figures presented here are adequate enough to be representative for a first exploration of the trends discovered.

All separate VUAMC text files were concatenated into four long files organized by register: academic texts, news texts, fiction, and conversation. Each of these files was

uploaded into WMatrix, a web interface including a tool for semantic field identification (Rayson, 2009). The semantic fields distinguished in WMatrix are applied in its lexicon which describes the various senses of the distinct words in the English language that have been included. Words in a text that is uploaded can thus be automatically analyzed for the semantic domains that WMatrix attaches to the lexical units. WMatrix makes a distinction between 21 broadly defined semantic fields, including M, 'movement, location, travel and transport', and X, 'psychological actions, states, and processes', with additional subcategories. Six Sensory-Motor domains were deemed of highest interest to the exploratory purposes of this study: M1, 'Moving, Coming, and Going', M2, 'Pushing, Putting, and Pulling', and M6, 'Location and Direction', as well as X3, 'General Sensory', X3.2, 'Sound', and X3.4, 'Sight'. Lexical items representing these domains include *leave, turn, walk* (M1), *take,place, hold* (M2), *to, in, there, where* (M6), *feel, feeling, experience, sense* (X3), *hear, sound, noise* (X3.2), and *see, look, eye* (X3.4). It should be noted that all of these classifications are based on independent work done for WMatrix by Paul Rayson and his associates (Rayson, 2009). I hence take on board any decisions they have made in assigning particular lexemes to particular semantic fields and conceptual categories. For instance, it is self-eveident that these decisions have to do with the value of lexical units in the present-day system of the English language and ignore their historical provenance, even though this may be relevant for other research purposes. It is only by exploiting the tool as it is available now in empirical work in specific areas like the one reported here that constructive criticism can be formulated and the tool can be improvement for future work.

An example of the output of WMatrix for one sentence is given below:

```
0000025 010 AT     The              Z5
0000026 010 MC2    1990s            T1.3 N1 T3
0000027 010 VH0    have             Z5 A9+ A2.2 S4
0000028 010 VVN    witnessed        X3.4 G2.1 A10+@ S9
0000029 010 AT1    a                Z5
0000030 010 NN1@   shift            A2.1+ S5+c T1.3/I3.1
0000031 010 II     in               Z5
0000032 010 AT     the              Z5
0000033 010 NN1    art              C1 X9.1+
0000034 010 NN1    establishment    T2+ H1c G1.1c I3.1c
0000035 010 GE     's               Z5
0000036 010 NN2    attitudes        X2.1/E1
0000037 010 II     towards          Z5
0000038 010 NN1    art              C1 X9.1+
0000039 010 VVN    produced         A2.2 A1.1.1 A10+ K4 K3 Q4.3 F4
0000040 010 II21   outside          M6[i2.2.1 A1.8-[i2.2.1 Z5
```

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0000040 020 II22  of              M6[i2.2.2 A1.8-[i2.2.2
0000041 010 APPGE its             Z8
0000042 010 JJ    traditional     S1.1.1 A6.2+ T3++
0000043 010 NN2   parameters      A1.7+ N3.1 N2
0000044 001 . .
```

Case numbers are followed by clause identifiers and Part-Of-Speech tags for the relevant lexical unit located in the fourth column. Each lexical unit is then followed by the list of semantic field tags assigned to it by WMatrix. If a word is tagged as M1, M2, or M3 or X3, X3.2 or X3.4, as is the case for units 028, *witnessed*, and 040, *outside/of*, it is included in our study as expressing a Sensory-Motor concept.

A special feature called 'domain push' was activated for the selected domains. The domain push function enables identification of all lexical units that have these semantic domains, even when these semantic domains are not the relevant sense in context. The latter is clearly important for the identification of those words that are used in abstract senses in the current context but in concrete Sensory-Motor senses in other contexts.

All WMatrix output was visually inspected and a small set of overt errors were adjusted or removed. The data were then included in an SPSS database containing the general VUAMC information, including register and text identification, word class information, and metaphor information. This database was subjected to a small number of non-parametric statistical analyses by means of the chi-square test in order to examine first associations between a number of selected variables for portions of the data. A more sophisticated and encompassing quantitative analysis is envisaged for future research.

3 Results

3.1 Sensory Concepts, Motor Concepts, and Metaphor

Sensory concepts and Motor concepts in this study each comprise three subcategories, which may or may not display their own specific behavior in relation to metaphor. That is what we will examine in this section. We now first turn to the group of Sensory concepts, divided into three categories: General Sensory concepts, Sound concepts and Sight concepts. Their relation to metaphorical use is displayed in table 1.

There are 2,162 words in the VUAMC (N = 186,688) that are connected to the three selected Sensory domains, which is just over one percent. There is substantial variation between the three Sensory concepts as a whole: Sight concepts (n = 1,193) comprise

	Non-metaphor	Metaphor	Total
General sensory	322 (62.8)	191 (37.2)	513 (100.0)
Sound	348 (76.3)	108 (23.7)	456 (100.0)
Sight	843 (70.7)	350 (29.3)	1193 (100.0)
Total	1513 (70.0)	649 (30.0)	2162 (100.0)

Tab. 1: Frequencies (and row percentages) of three types of Sensory words, divided by non-metaphorical and metaphorical use

more than half of all Sensory concepts, while General Sensory concepts (n = 513) and Sound concepts (n = 456) account for the other other half in roughly equal measure. The relation between the three concept types and metaphor is significant ($X2_{(2)}$ = 21.68, p = < 0.001), Phi and Cramer's V indicating a modest effect size (0.10, p < .001). General Sensory concepts display a greater proportion of metaphorical usage than average (37.2 %), while Sound concepts display a smaller proportion of metaphorical usage (23.7 %) than average; Sight concepts are roughly average in their metaphorical use (29.3 %). The significant chi-square test indicates that this association between concept type and metaphor is statistically reliable. Since we do not have comparable figures for other languages and since the data as well as method of analysis are relatively specific, I do not want to speculate about their general significance. In the following sections we will take a closer look at the nature of all three sets of Sensory concepts. There we will make the link with their distribution across word classes and registers and attempt to understand how Sensory concepts relate to these essential dimensions of metaphorical language use.

Irrespective of this variation it is highly evident that Sensory concepts are much more metaphorical than all other concepts in the VUAMC: as mentioned above, the complete corpus has an average of 13.6 % of metaphorical use (Steen et al., 2010a, b). The odds of Sensory concepts being metaphorical in language are about three times higher than the odds of all other concepts being metaphorical in language. The theoretical assumption that Sensory concepts may play a special and relatively frequent role in the grounding of metaphor in usage is hence supported by these corpus-linguistic data. It lends further credence to the cognitive-linguistic proposals in Hampe (2005), a collection of chapters on the relation between image schemas as the mental repository of Sensory-Motor experience on the one hand and abstract cognition, including metaphor-

ical cognition and language use, on the other. For instance, here is Mark Johnson, who writes:

> The principal philosophical reason why image schemas are important is that they make it possible for us to use the structure of sensory and motor operations to understand abstract concepts and draw inferences from them. The central idea is that image schemas, which arise recurrently in our perception and bodily movement, have their own logic, which can be applied to abstract conceptual domains. (2005: 24)

At this point it may be useful to list the most frequent lexical units that are related to each of the three semantic domains of Sensory concepts and show their relation to metaphorical and non-metaphorical use (see table 2). It is striking that the ten most popular Sensory concepts for each of the three categories also account for the bulk of all sensory language use in the complete VUAMC: General Sensory 98 %, Sound 60 %, and Sight 86 %, respectively. It looks as if Sensory vocabulary is not highly varied but limited to a small number of frequently used basic terms. It is also striking that most of these lexical units are verbs, with nouns coming at some distance. Sensory language use apparently favours expression of sense experiences as actions, processes, events, or states. A third observation has to do with the differentiation between words that are preferably non-metaphorical (e. g., *tell, experience, hear, sound, ring, buzz, eye, watch*), words that are preferably metaphorical (e. g., *feel, catch, strike*), and words that are somewhat balanced between non-metaphorical and metaphorical use (e. g., *sense, pop, see, look*).

Thus, some Sensory language items typically appear in literal use, as may be illustrated with reference to *tell*:

(1) ... but how can you **tell**?
(2) ... and to **tell** you the naked truth ...
(3) **Tell** me what you want.
(4) ... you cannot **tell** one from the other ...
(5) Please, I've found something I must **tell** you.
(6) Doctor'll **tell** us.

Other Sensory language items typically appear in metaphorical uses, such as *catch* (only 9 is not metaphorical):

(7) be up to the US and Canada to decide whether they want to face towards the Atlantic or Pacific or be **caught** between two great trading oceans

		General Sensory (n = 513)			Sound (n = 456)			Sight (n = 1193)	
		Not-M	Met		Not-M	Met		Not-M	Met
1	tell	200	20	hear	74	6	see	270	159
2	feel	23	102	sound	51	2	look	226	64
3	experience	35	1	ring	24	4	eye	63	6
4	sense	13	23	buzz	22	0	watch	65	3
5	catch	9	22	strike	5	15	view	18	33
6	feeling	10	7	pop	11	8	miss	33	11
7	suffer	12	3	listen	15	0	notice	32	2
8	distinguish	5	5	noise	13	1	stare	13	3
9	greet	7	2	silence	12	0	glance	12	1
10	make+out	3	1	meow	11	0	observe	9	4
Total		317	186		238	36		741	286

Table 2: Lexical units and frequencies of top 10 Sensory concepts in non-metaphorical ('Not-M') and metaphorical ('Met') use

(8) he **caught** the stomach-turning odour of decay
(9) The people who get **caught** and imprisoned may not be a representative picture of all criminals
(10) Delaney's stillness **caught** the attention of the others
(11) She did and **caught** her breath

And yet other Sensory language items appear to be equally eligible for non-metaphorical (12 and 15) and metaphorical (13 and 14) use:

(12) Because of this he had never **seen** the Oxford and Cambridge boat race until this year
(13) They **see** themselves not as author and illustrator with separate roles but as a partnership of book-makers
(14) so then I'm sure my colleagues will **see** the point of that
(15) Otherwise the best place to **see** working trams has been the tram museum at Crich

Taken as a whole, all Sensory language seems to be roughly equally useful for the designation of concrete, genuine Sensory experiences as for more abstract experiences that are metaphorically expressed by means of Sensory vocabulary. This is typically not the case for all metaphor since the average proportion of all metaphorical language is 13.6 %. At the same time, within this group, there is also some division of labour between non-metaphorical and metaphorical designation: some words seem to specialize into one direction whereas others prefer another direction, as was illustrated just now.

Worthy of note is the fact that the top 10 for Sound displays only 13.1 % metaphorical use; this suggests that the higher figure for metaphorical use for the complete Sound concept category is due to the remaining set of lexical units, which are used much less frequently than the ones in the top ten. These must be a different type of words, or so it seems, since they are used metaphorically more frequently. Further research will have to delve into this possible differentiation.

We now turn to the other main group of Sensory-Motor concepts, the Motor concepts. These also comprise three main categories for the purposes of this study: (a) Moving, Coming, and Going; (b) Pushing, Putting and Pulling; and (c) Location and Direction. Their association with metaphorical versus non-metaphorical use is displayed in table 3.

Motor concepts are much more frequent than Sensory concepts, exhibiting 24,353 in the data, which amounts to some 13 % of the entire VUAMC corpus. There is substantial variation between the incidence of the three distinct groups of Motor concepts: Location and Direction concepts comprise 72.9 % of all Motor concepts, while Moving, Coming and Going account for 17.1 % and Pushing, Putting and Pulling, for 10 %. The relation between these three distinct Motor concept categories and metaphor is significant ($X2_{(2)} = 51.43$, $p < 0.001$), Phi and Cramer's V revealing a small effect size (0.05). The Pushing, Putting and Pulling category has a greater proportion of metaphorical use (almost one in two) than the other two categories (just over one in three for Moving, Coming, and Going, and two in five for Location and Direction), which explains the statistically significant relation between concept category and metaphor.

	Non-metaphor	*Metaphor*	*Total*
Moving, Coming, Going	2,553 (61.5)	1,599 (38.5)	4,166 (100.0)
Pushing, Putting, Pulling	1,278 (53.0)	1,135 (47.0)	2,423 (100.0)
Location, Direction	10,737 (60.4)	7,051 (39,6)	17,788 (100.0)
Total	14,568 (59.8)	9,785 (40.2)	24,353 (100.0)

Table 3: Frequencies (and row percentages) of three types of Motor words, divided by metaphorical and non-metaphorical use

As a group, Motor concepts are much more frequently metaphorical than all other concepts, given the overall average of 13.6 % of all metaphorical use. The odds of Motor concepts being metaphorical in language use are no less than four times higher than the odds of all other concepts being metaphorical in usage. The theoretical assumption that Motor concepts may play a special role in the grounding of metaphor in usage is hence also supported by these corpus-linguistic data.

Below we will take a closer look at the nature of all three sets of Motor concepts in order to elucidate why Location and Direction is so much more frequent than the other groups. But a first indication of an answer may be provided by taking a look at the top 10 most frequent Motor concepts in metaphorical and non-metaphorical use (table 4).

	Moving, Coming, Going (*n* = 4,166)			*Pushing, Putting, Pulling* (*n* = 2,423)			*Location, Direction* (*n* = 17,788)	
	Not	Met		Not	Met		Not	Met
1 get	468	243	take	83	222	to	3475	1025
2 go	551	146	place	180	86	in	1026	1904
3 come	149	121	put	86	112	for	1417	–
4 leave	79	47	move	56	29	on	323	780
5 move	56	29	turn	50	35	there	808	37
6 turn	50	35	hold	29	43	this	98	703
7 walk	78	4	bring	32	31	by	716	67
8 run	20	45	lead	18	45	about	12	394
9 follow	8	47	pull	40	10	right	266	3
10 return	30	22	set	17	29	where	188	62
Total	1489	539		581	642		8329	4975

Table 4: Lexical units and frequencies of top 10 Sensory concept, divided by non-metaphorical and metaphorical uses

The ten most popular Motor words within each category account for the following percentages of all Motor language use in the complete VUAMC: Moving, Coming, Going 48.7 %, Pushing, Putting, Pulling 50.5 %, and Location and Direction 74.8 %, respectively. In comparison with Sensory vocabulary, the first two Motor vocabulary categories (Moving, Coming, Going, and Pushing, Putting, Pulling) turn out to be much more varied, the top ten lexical units accounting for about half of the number of cases in the corpus. Location and Direction is more limited to a smaller number of frequently used basic terms.

The latter may clearly be related to the strikingly high numbers of prepositions, adverbs, and demonstratives emerging in that category, which recur throughout the

data, with a total lack of verbs and nouns. Motor language involving Location and Direction most frequently concerns expression of sense relations between entities and processes, whereas Motor language involving movement and exerting force is more like the Sensory concepts and concerns actions, processes, events and states predominantly designated by verbs and their nominal derivations.

A third observation that can be made has to do with the different distribution than in Sensory words, which are preferably non-metaphorical, metaphorical or mixed. Most Motor language is roughly equally useful for the designation of concrete Motor experiences as for other experiences that are metaphorically derived and expressed by means of Motor vocabulary. Note that the lack of metaphorical use of 'for' is an artefact of the annotation method used in our corpus analysis, where both 'of' and 'for' were taken as too semantically bleached to display reliably recognizable contrasts between non-metaphorical and metaphorical uses (Steen et al., 2010a).

It should be noted that the top 10 for Moving, Coming, Going displays only 26.7 % metaphorical use; this suggests that the higher figure for metaphorical use for the complete Moving, Coming, Going concept category of 38.5 % is due to the remaining set of lexical units that are used much less frequently but, apparently, more often metaphorically. As with the Sound category above, this may be a different type of words meriting further exploration. Another interesting observation is the fact that the top 10 Pushing, Putting and Pulling words are used more frequently metaphorically than not metaphorically. This is a unique finding so far and also requires further inspection in the future. Both of these findings in this exploratory study suggest important avenues for further research.

There is a substantial difference between the frequencies of Sensory concepts and Motor concepts in all of the data, Motor concepts occurring about eleven times as frequently as Sensory concepts. Is it possible that this is an indication that motion is less abstract and even more basic, as it were, than sensory experience, which typically involves some associated form of cognitive response (cf. Grady, 2005)? We have also seen that both Sensory concepts and Motor concepts interact with metaphor in different ways than all other concepts: both Sensory and Motor concepts are much more frequently used metaphorically in language than all other concepts, while Motor concepts are even more frequently metaphorical than Sensory concepts. There also appears to be a substantial difference between the frequencies of the various subcategories of both the Sensory concepts and the Motor concepts, with additionally variable relationships with metaphorical usage: there is a rank order from General Sensory through Sight to Sound

concepts which differ significantly from each other in their propensity for metaphorical use; and there is a three-way distinction between Pushing Putting and Pulling (highly metaphorical) versus the other two Motor categories (less highly metaphorical), one of which, however (Location and Direction) is different from the other (Moving, Coming and Going) on account of its extraordinarily high overall frequency as well as its different types of word classes in the top ten. In other words, almost every Sensory-Motor category behaves differently than the other ones, suggesting that each type of Sensory-Motor concept has properties of its own.

This warrants taking a closer look at the nature of each subcategory of Sensory-Motor concepts in order to try to understand why Motor concepts may be so much more frequent than Sensory concepts, why Motor concepts invite metaphorical use more often than Sensory concepts, and what may be the causes behind the different frequencies of each of the subcategories of Sensory-Motor concepts with further variable metaphorical use within Sensory concepts and Motor concepts as main groups. Tentative explanations of these observations will be sought now by examining the nature of word classes of the metaphorical and non-metaphorical uses of the various Sensory-Motor concept categories (section 3.2) and their relation to the four registers of academic texts, news text, fiction and conversations (section 3.3).

3.2 Sensory-Motor Concepts, Metaphor and Word Class

Can the high metaphorical usage of the Sensory concepts and even more of the Motor concepts in comparison with all other concepts be understood with reference to particular word classes? Since previous work has shown a relationship between metaphor and word class, word class variation between Sensory-Motor concepts and Other concepts may also play a role in the variable metaphorical use of the three groups of concepts. It is the aim of this section to explore this relationship impressionistically for the most obvious understandable patterns. We shall also examine whether these main effects of word class on metaphorical usage of Sensory-Motor concepts are compounded by further interactions with subcategories of each Sensory-Motor concept or not. If there are interactions, the overall picture needs further refined and a more differentiated interpretation. I will therefore now check the relation of word class and metaphor to each of the three separate subcategories of Motor concepts and of Sensory concepts.

For this purpose, only the metaphorical uses of the General Sensory concepts, Sound concepts, and Sight concepts in our data will be related to word class (Adjective, Adverb

Determiner, Noun, Preposition, Verb, and Remainder). Table 5 displays the findings. Frequencies and percentages only indicate the proportion of metaphorical use *within* a word class for a particular Sensory category, all non-metaphorical uses having been omitted from the table.

	Adj	*Adv*	*Noun*	*Verb*	*Remain*	*Total*
General Sensory	0	–	34	157	–	191
(n = 514)	(0)		(39.5)	(36.9)		(37.2)
Sound	13	0	33	62	0	108
(n = 456)	(40.6)	(0)	(23.4)	(26.4)	(0)	(23.7)
Sight	3	0	84	263	–	350
(n = 1,198)	(15.8)	(0)	(28.7)	(29.9)		(29.3)
Total	16	0	151	482	0	649
(N = 2,162)	(30.8)	(0)	(29.0)	(31.3)	(0)	(30.0)

Table 5: Frequencies (and percentages) of metaphor related words per word class for three groups of Sensory concepts

Systematic statistical analysis by means of a series of comparable chi-square tests was not feasible because of the number of cells with zero observations, and collapsing categories would have led to complications. But visual inspection confirms that Verbs and Nouns account for the bulk of the data (in total 482 Verbs plus 151 Nouns makes 633 out 649), with Verbs occurring about three times as often as Nouns. In itself this is a remarkable proportion, as in general verbs display 18.7 % metaphorical usage, as opposed to nouns 13.3 % (e. g. Herrmann, 2013). Apparently, metaphorical uses of Sensory, Sight and Sound words are mostly verbal, followed at great distance by nominal, which is completely atypical in comparison with overall tendencies of the relation between word class and metaphorical use.

Variation in metaphorical usage per Sensory category seems to be largely due to variation in metaphorical use of the Verb class: General Sensory concepts have the highest metaphorical use because Verbs account for 30.5 % of the data (157 out of 514). Sight concepts follow suit because metaphorically used Verbs explain 22 % of the data (263 out of 1,198). And Sound concepts have the lowest proportion of metaphorical use because metaphorical Verbs comprise a mere 13.6 % of the data (62 out of 456). Throughout these patterns, metaphorical nouns consistently account for some 7 % of the totals and do not affect the overall score for metaphorical use in the distinct three Sensory categories.

The distribution of metaphorically used words expressing Sensory concepts hence mostly depends on the varying popularity of distinct categories of Sensory verbs having to do with General Sensory experiences, Sound, and Sight. Since Verbs as well as Nouns generally tend to have a higher metaphorical use than average (Steen, 2010 a, b), part of the high metaphorical use of the Sensory concepts is also explained by the fact that this category is dominated by Verbs and Nouns. However, at the same time, average metaphorical use of all Verbs and Nouns is substantially lower than 30 %: if this can be shown to be a significant difference in more encompassing statistical testing, this would suggest that Sensory Noun and Verbs are a special category of lexis eliciting metaphorical use more often than all other Verbs and Nouns. Sensory experience expressed in language may then indeed be regarded as a popular basis for metaphorical meaning on the basis of its ability to conceptualize the abstract via concrete embodied experiences.

Let us now turn to Motor concepts and relate metaphorical use of (a) Moving, Coming and Going concepts, (b) Pushing, Putting and Pulling concepts, and (c) Location and Direction concepts to word class again (Adjective, Adverb, Determiner, Noun, Preposition, Verb, and Remainder). Table 6 displays the findings in the same way as table 5: frequencies and percentages only indicate the proportion of metaphorical use *within* a word class for a particular Motor category, all non-metaphorical uses having been omitted from the table.

	Adj	Adv	Det	Noun	Prep	Verb	Remain	Total
Moving, Coming, Going (*n = 4,166*)	9 (37.5)	0 (0.0)	–	323 (43.3)	–	1267 (37.6)	0 (0.0)	1599 (38.5)
Pushing, Putting, Pulling (*n = 2,423*)	2 (10.0)	–	–	229 (39.0)	–	904 (50.1)	0 (0.0)	1135 (47.0)
Location, Direction (*n = 17,779*)	92 (21.9)	682 (33.6)	701 (87.7)	626 (44.3)	4615 (52.1)	280 (51.6)	55 (1.5)	7051 (39.6)
Total (*N = 24,368*)	103 (22.2)	682 (33.5)	701 (87.7)	1178 (42.9)	4615 (52.1)	2451 (42.9)	55 (1.5)	9785 (40.2)

Table 6: Frequencies (and column percentages) of metaphor related words per word class for three groups of Motor concepts

Table 6 immediately throws into relief the special role of Prepositions for all Sensory-Motor concept research: they increase the total metaphorical use of all Location and Di-

rection concepts by 4615 cases, to the strikingly high figure of 9785. Since Prepositions do not play a role in the other two Motor concept categories, nor in all Sensory concepts, as we have seen, Location and Direction Prepositions might have to be treated as a separate category. They account for almost half of the inordinately high proportion of metaphorical use of Motor concepts in comparison with Sensory concepts as well as all other concepts. This now appears to be a specific manifestation of the natural connection between the concepts of Location and Direction on the one hand and Prepositions on the other. It does not appear to be characteristic of the behavior of Sensory-Motor concepts in general.

Statistical analysis was not feasible without raising complications again. Yet visual inspection shows that Location and Direction concepts display a different usage of Nouns and Verbs than the other two Motion concepts. Where Verbs and Nouns account for 99.2 % of all Moving, Coming, and Going concepts as well as of all Pushing, Putting and Pulling concepts (which is comparable to what happens in Sensory concepts), Verbs and Nouns comprise a meager 12 % in the Location and Direction concepts. Vice versa, Location and Direction is the only Sensory Motor concept category that makes substantial use of Adverbs and Determiners, too—as was already suggested by the top ten frequent words in table 4 above. Perhaps it is therefore not just Location and Direction Prepositions, but all Location and Direction lexis which ought to be treated as a separate category in the study of Sensory-Motor concepts.

Focusing on the two remaining categories of Motor concepts, that is, Pushing, Putting and Pulling as well as Moving, Coming and Going, these seem to exhibit rather comparable patterns of word class distribution. Both largely involve Verbs and Nouns, with Verbs dominating over Nouns in both categories. This is roughly comparable to the situation in Sensory concepts. It should not come as a surprise that both Pushing, Pulling and Putting concepts as well as Moving, Coming and Going concepts seem to be naturally related to the word class of Verbs, and this explains why a good deal of the metaphorical usage of these Motor concepts is related to the variable incidence of this one word class category. This again accounts for part of the higher metaphorical use of Motor concepts, given the generally high metaphorical use of verbs and nouns, but it also leaves another portion unexplained which apparently has to do with the specific nature of Motor Verbs and Nouns as apt source domains for frequent metaphorization of the abstract by the concrete.

Location and Direction concepts display behavior which is not shared by the other two Sensory-Motor categories examined in these data. Whereas initially it seemed nat-

ural to include Location and Direction under Motion and Motor concepts, this may now require further theoretical reflection. Moving, Coming and Going concepts resemble Pushing, Putting and Pulling concepts when it comes to their lexical expression in usage, Verbs and at some distance Nouns dominating the scene. Location and Direction display a completely different profile and are the only category that is heavily dependent on other word lcasses than Verbs and Nounds, with Prepositions, Adverbs and Determiners instead being most prevalent.

In sum, the relation between metaphor and Sensory-Motor concepts may be partly explained with reference to their interaction with word class. For the 2,168 Sensory concepts in the corpus, there are basically just two word classes involved, Verbs clearly dominating the picture, accounting for almost three quarters of all Sensory concepts. What is more, one third of these Sensory Verbs are used metaphorically, which is an inordinately high percentage: Sensory Verbs apparently lend themselves to metaphorical usage very easily. Likewise, Sensory Nouns account for the remaining quarter of all Sensory concepts, with a proportion of over 40 % being used metaphorically, which is also strikingly high.

For the 24,566 Motor concepts, we have a situation that is comparable to the Sensory category for two of the three Motor categories: Moving, Coming, and Going, and Pushing, Putting and Pulling. There is one category that is starkly different, Location and Direction: there Prepositions play a deviant and prominent role, accounting for more than one third of all Motor concepts in the complete corpus. Moreover, metaphorical use of Motor Prepositions is extraordinarily high, comprising over 50 % of all Motor Prepositions. Prepositions hence account for 4,615 cases out of all 9,785 Motor concepts that are metaphorical. With the additionally different behavior of Adverbs and Determiners as well as Verbs and Nouns in the Location and Direction category, a case can be made for separating this category from the other two Motor concepts.

We already saw that Sensory concepts appear to be rather different than Motor concepts, but we may now add that perhaps all Sensory-Motor concepts ought to be seen as comprising not two but three rather distinct groups of concepts: Sensory Concepts, Motor concepts (including Moving, Coming, Going, and Pushing, Putting, Pulling), and Location and Direction concepts. This is based on the radically different relation between the various categories and word classes. Partly as a result of this, their overall frequency in language use varies considerably too: 1.16 % for Sensory concepts, 3.55 % for Motor concepts, versus 9.55 % for Location and Direction, respectively. The interaction between Sensory-Motor concepts and metaphor is clearly affected by the inter-

action between metaphor and word class. Apart from this, in the other two Motor concept categories, Verbs and Nouns are more frequently metaphorical in comparison with Sensory Verbs and Nouns (roughly over 40 % in Motor concepts versus about 30 % in Sensory concepts)—why Motor concepts would elicit more metaphorical use than Sensory concepts is an intriguing question. With a reference to Grady (2005), I have raised the question whether they might be less abstract and involve less mental response.

3.3 Sensory-Motor Concepts, Metaphor and Register

Can the relatively high metaphorical usage of the Motor concepts and the Sensory concepts be related to the increased use of Sensory-Motor concepts in specific registers, in comparison with other concepts? Since previous work has shown a relationship between metaphor and register, register variation in Sensory-Motor concepts may also interact with the metaphorical use of various groups of concepts. We shall now see whether these main effects of register on metaphorical usage of Sensory-Motor concepts can be refined by checking each of the separate subcategories of Motor concepts and Sensory concepts. We shall begin with the Sensory concepts again.

The overall distribution of the Sensory concept lexis across the four registers turns out to be very uneven. In the complete VUAMC corpus, the four registers are about equally large, averaging about 47,000 words each, which would predict a 25 % division of the Sensory concepts across the registers by chance. This is not the case: Fiction has a high 40 % of all Sensory concepts, followed by Conversation, which is close to average with 28.1 %, while News (16 %) and Academic texts (15.9 %) are low. One interpretation of this finding is that Fiction has an emphasis on Sensory experience that is there for artistic reasons, making experience more palpable, as opposed to the more abstract concerns of News and Academic texts.

Table 7 displays the frequencies and percentages of only the metaphorical words per register for each of the three Sensory concept categories. The overall pattern of metaphorical usage in the complete VUAMC corpus manifested the following percentages for all lexis, Sensory-Motor and otherwise: Academic 18.5 %, News 16.4 %, Fiction 11.7 %, and Conversation 7.7 % (Steen et al., 2010a, b). From the previous sections we already know that there is a higher percentage of metaphorical use for Sensory concepts than average, but now we can observe two further conspicuous differences when we turn to the relation between metaphor and register for Sensory concepts. First of all, there seems to be a split between Academic and News texts on the one hand and

Fiction and Conversation on the other, with Academic and News texts having double or more than double the number of metaphorical uses than Fiction and Conversation. And secondly, where Sensory concepts in Academic and News texts are in the same ordering from more to less metaphorical as may be observed for all concepts, Fiction and Conversation are in roughly the same position, Fiction having less metaphor and Conversation having more metaphor than expected when compared with the general pattern in the complete corpus. Upon close inspection this is solely due to what happens in the Sight category, which exerts a relatively great effect on the overall patterns because it accounts for half of all Sensory concept cases: in the General Sensory and Sound categories, the rank order between the registers regarding metaphorical use is in accordance with the overall pattern in the complete corpus. What we are dealing with, therefore, is a three-way interaction between metaphor, concept category and register, which moreover has to be seen against the background that Sensory concepts are proportionately much less frequent in Academic and News texts as opposed to Fiction where they are much more frequent. The relation between Sensory concepts and metaphor in usage is thus rather complicated when we examine it from the perspective of genre, which clearly affects their interaction.

	Academic	*News*	*Fiction*	*Conversation*	*Total*
General Sensory	44	46	66	35	191
(n = 514)	(46.8)	(52.3)	(33.5)	(26.1)	(37.2)
Sound	19	35	40	14	108
(n = 456)	(59.4)	(36.1)	(19.3)	(11.7)	(23.7)
Sight	131	68	70	81	350
(n = 1,198)	(60.1)	(42.0)	(15.2)	(22.9)	(29.3)
Total	194	149	176	130	649
(N = 2162)	(56.4)	(42.9)	(20.4)	(21.4)	(30.0)

Table 7: Frequencies (and percentages) of metaphor related words per register for three groups of Sensory concepts

For each of the three Sensory concepts, the relation between metaphor and genre was tested by means of a two-way chi-square test of significance. All tests returned significant results: for General Sensory concepts, $X2_{(3)} = 20.46$, $p < 0.001$, Phi and Cramer's V = 0.20; for Sound concepts, $X2_{(3)} = 42.57$, $p < 0.001$, Phi and Cramer's V = 0.31; and for Sight concepts, $X2_{(3)} = 163.14$, $p < 0.001$, Phi and Cramer's V = 0.37. Standardized residuals revealed significant effects of the categories furthest removed from the expected frequencies, such as high metaphoricity in News for general Sensory concepts, high metaphoricity in Academic texts and News texts for Sound, and high

metaphoricity for Academic texts but low metaphoricity for Fiction in Sight. The most prominent differences between registers manifested for metaphor in each of the three Sensory concept categories are statistically reliable.

For each of the four genres, the relation between metaphor and Sensory concept category was also tested by means of a two-way chi-square test of significance. Two tests returned significant results: for Fiction, $X2_{(2)} = 28.61$, $p < 0.001$, Phi and Cramer's V = 0.18; and for Conversation, $X2_{(2)} = 9.03$, $p = 0.01$, Phi and Cramer's V = 0.12. Standardized residuals revealed significant effects of the metaphorical use of Sound categories in Conversation, which is extremely low compared with the other two concept types in Conversation; of metaphorically used General Sensory concepts in Fiction, which is very high within Fiction, as well as of metaphorically used Sight concepts in Fiction, which is low within Fiction. For Academic texts and News texts, chi square was not significant, although revealing a tendency towards significance ($p < 0.1$): all Sensory concept categories are used in roughly comparable measure in both of these registers.

For Sensory concepts, we see a clear split between registers. The abstract registers of Academic and News texts have a comparatively low percentage of Sensory concepts that at the same time are used metaphorically relatively very often. In Academic texts, Sensory concepts are used metaphorically even more than half of the times, which is a unique finding. The more concrete registers of Conversation and Fiction have an understandably high proportion of Sensory concepts that at the same time are used metaphorically much less frequently than in Academic and News Texts, making Conversation and Fiction even more concrete. For instance, in our data the verb *to feel* is used non-metaphorically only in Conversation and Fiction (*feel the cold, feel warm*), not in Academic and News, where it is always used metaphorically. It is also true, however, that Sensory concepts in Fiction and Converation are still used metaphorically twice as often as all metaphorical lexis taken together in the entire VUAMC corpus: in the overall corpus, Conversation has 7.7 % metaphor, and Fiction 11.7 % metaphor, whereas for Sensory language use, these percentages climb to over 20 %. This may also be due to the relative frequency of such constructions as *feel anxious, guilty, uneasy,* and so on, which feature quite large in Conversation and Fiction. All of this is still a powerful indication that Sensory concepts do play a special role in affording metaphorical language and perhaps conceptualization.

We will now do the same analysis for Motion concepts. We will relate metaphorical use of (a) Moving, Coming and Going concepts, (b) Pushing, Putting and Pulling concepts, and (c) Location and Direction concepts to the four registers. Table 8 dis-

plays only the metaphorical frequencies and percentages of the Motion concepts (witl metaphorical and non-metaphorical totals listed under *n* in the first column).

	Academic	*News*	*Fiction*	*Conversation*	*Total*
Moving, Coming, Going (n = 4,166)	410 (70.3)	460 (55.1)	343 (30.4)	386 (24.1)	1599 (38.5
Pushing, Putting, Pulling (n = 2,423)	347 (65.7)	384 (61.6)	265 (34.6)	139 (28.1)	1135 (47.0
Location, Direction (n = 17,779)	2786 (54.0)	1933 (41.9)	1311 (31.4)	1021 (26.6)	7051 (39.6
Total (n = 160,167)	3543 (56.5)	2777 (45.8)	1919 (31.6)	1546 (26.1)	9785 (40.2

Table 8: Frequencies (and percentages) of metaphor related words per register for three groups of Motor concepts

In contrast with the Sensory concepts, the overall distribution of Motor concept lexi across the four registers is even. The percentages of Motor concepts across the fou registers of Academic texts, News texts, Fiction, and Conversation are 25.8, 24.9, 25.(and 24.4, respectively. This is in accordance with the size of the four sub corpora, an according to what might be expected according to chance. It throws into relief th special value of the previous finding of the uneven distribution of Sensory concept and suggests that there may be a difference between the roles of Sensory and Moto concepts that needs to be examined more closely.

The overall rank order of metaphorical usage across genres in the complete corpu is also reflected in the distribution of the Motor concepts across the four genres: Aca demic has the highest percentage (56.5), followed by News (45.8) and Fiction (31.6), wit Conversation at the low end of the scale (26.1). We already knew that there is a highe percentage of metaphorical use for Motor concepts than average, but we can now se that this holds for all registers, and that the mutual difference in metaphorical usag between the four genres may be somewhat greater than for all metaphor use. This wi have to be examined in future research with more encompassing statistical tests.

Next, when we examine the difference between Location/Direction concepts and th other two sets of Motor concepts, it looks as if there is an interaction between cor cept type and register: both Academic texts and News texts display a rather high fre quency of metaphorically used Moving, Coming and Going concepts as well as Pushing Putting, and Pulling concepts, while all other concepts seem to be distributed across th

four registers according to chance. Two series of two-way statistical tests by means of chi-square showed whether these first impressions were reliable.

For each of the three Motor concepts, the relation between metaphor and genre was tested by means of a two-way chi-square test of significance. All tests returned significant results: for Moving, Coming, and Going, $X2_{(2)} = 519.23$, $p < 0.001$, Phi and Cramer's V = 0.35; for Pushing, Putting and Pulling, $X2_{(2)} = 246.69$, $p < 0.001$, Phi and Cramer's V = 0.32; for Location and Direction, $X2_{(2)} = 843.75$, $p < 0.001$, Phi and Cramer's V = 0.22. Standardized residuals revealed significant effects of all categories in each of the two-way interactions, suggesting that no single category crossing two variables behaved according to expectation by chance.

For each of the four genres, the relation between metaphor and Sensory concept category was also tested by means of a two-way chi-square test of significance. Two tests returned significant results: for Academic, $X2_{(2)} = 77.24$, $p < 0.001$, Phi and Cramer's V = 0.11; and for News, $X2_{(2)} = 119.52$, $p = 0.01$, Phi and Cramer's V = 0.14. Standardized residuals revealed significant effects of all categories in each of these two two-way interactions. For Fiction and Conversations, chi square was not significant, although for Conversation a tendency towards significance was revealed ($p < 0.1$).

In sum, each of the registers differs from the others when it comes to their use of each of the distinct Motor concepts. Moreover, Academic and News texts display different usages of each of the three Motor concepts within their own register. In Academic texts, there is a stunning 70 % of metaphorical usage of Moving, Coming, and Going lexis, followed by 65.7 % of metaphorical usage for Pushing, Putting, and Pulling. In News texts, Pushing, Putting and Pulling leads the way, with 65.1 %, followed by Moving, Coming and Going, with 55.1 %. Examples would include metaphorical uses of *take* in academic writing such as *take issue with, take an example, take a more mature attitude, take note of, take the view*, and so on. This is to be contrasted with metaphorical usage of both concept categories in both Fiction and Conversation, where percentages range between 24.1 % and 34.6 %. The verb *take* is used in those registers relatively more often as a verb that involves the taking of a concrete object. Location and Direction have a much lower metaphorical percentage in Academic and News texts, while they are relatively comparable to the other concept categories in Fiction and Conversation.

These are clear quantitative indications that the metaphorical use of Motor concepts in language cannot be treated as one uniform phenomenon, but that more work needs to be done on the relation between Motor concepts, metaphor, and register. A close examination of the cases involved is the next step that needs to be taken.

The relation between Sensory-Motor concepts and metaphor in language is clearly affected by register. Sensory concepts have an uneven distribution across registers, with Fiction clearly favoring Sensory concepts (in order to create a fictional world) while Academic and News texts do not; Motor concepts, by contrast, are evenly distributed. The language of fiction therefore has a higher Sensory-Motor quality than than other registers, while the language of Academic and News texts is less 'Sensory-Motory.' At the same time, Academic and News texts throughout favor metaphorical use of both Sensory and Motor concepts, even in absolute terms. This accords with their abstract nature and contrasts with the predominance of non-metaphorical use of Sensory-Motor terms in Fiction and Conversation. In addition, since Academic and News texts tend to be more metaphorical than Fiction and Conversation overall, it can now be seen that Sensory-Motor terms make a substantial contribution to this two-way distinction between the four registers.

4 Discussion

The relation between Sensory-Motor concepts and metaphor in usage has been on the agenda of cognitive linguists, psychologists, and scientists in general for some time. Theoretical motivation for this interest is amply available, but the present study is the first corpus-linguistic exploration of this relationship. Even though the study is partial and tentative it has revealed some new tendencies which require further scrutiny on the basis of more encompassing research, which is currently undertaken in our lab.

The most important observation is that Sensory-Motor concepts on the one hand do display a higher degree of metaphorical use than all other concepts, but that on the other hand this relationship is not uniform but variable across all categories as well as groups of categories that can be distinguished between the Sensory-Motor concepts included in this study. Thus, Motor concepts are eleven times more frequent than Sensory concepts; Sight concepts are twice as frequent as Sound concepts and general Sensory concepts; and Location and Direction concepts are an entirely different group of Sensory-Motor concepts than all others, comprising three quarters of all Motor concepts and having a radically different word class profile than all other five concept categories. In particular, all other Sensory-Motor concepts are dominated by verbal and at some distance nominal expression, while Location and Direction are based on prepositions, adverbs and demonstratives. Further research including other Sensory-Motor concepts clearly

needs to throw more light on the diversity of this group of concepts in order to establish its internal coherence.

The second most important observation is that despite this internal variation, all Sensory-Motor concepts are much more often metaphorical than all other concepts. This is consistent with the idea that Sensory-Motor knowledge has a special role to play in the metaphorical conceptualization of our experience. The ground of this idea is the assumption that Sensory–Motor knowledge is the most specific and best-differentiated concrete knowledge we have which can then be used as a model for less specific, less differentiated more abstract knowledge, for instance about social relations and processes (Sight for Understanding) or temporal and abstract processes (Motion for Change). The details of these varying relationships can now be studied in context with reference to a substantial set of natural language materials.

A third point emerging from this study is the role of register. Sensory-Motor concepts are not just more frequently related to metaphor in usage, perhaps mediated via obvious distinctions between word classes; these relations are also exploited to a greater or lesser extent in distinct situations of language use. We saw a clear distinction between, on the one hand, the more abstract registers of Academic and News texts, and, on the other hand, the more concrete registers of Fiction and Conversation. Sensory concepts were dispreferred in the former two, but those Sensory concepts that were used there were massively metaphorical. Sensory concepts were preferred in Fiction and Conversation, but their use was much less often metaphorical than in Academic and News, even if it was still more metaphorical than the average metaphorical use of all other concepts in Fiction and Conversation.

Motor concepts displayed a different relationship with register. They were distributed evenly across all registers but their metaphorical use went down from Academic through News and Fiction to Conversation. Metaphorical use of Sensory-Motor concepts is clearly promoted in Academic and News texts and less so in Fiction and Conversation.

The relation between Sensory-Motor concepts and metaphor in usage is therefore no simple one. It involves a four-way interaction between Sensory-Motor concepts, metaphor, word class, and register. This paper has only begun to sketch the possible outlines of this complex picture. I hope that it will provide a useful inspiration for more encompassing as well as thorough and detailed work in the future.

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