

**Proceedings of the
15th European Conference on
Research Methodology for
Business and Management Studies**
Kingston Business School, Kingston University
London, UK
9 - 10 June 2016



**Edited by
Vladlena Benson and Fragkiskos Filippaios**

A conference managed by ACPI, UK

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The 15th European
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ECRM2016

9 - 10th June 2016

Hosted by
Kingston Business School
Kingston University London
UK

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Print version ISSN: 2049-0968

Print version ISBN: 978-1-910810-94-1

E-Book ISSN: 2049-0976

E-Book ISBN: 978-1-910810-95-8

Published by Academic Conferences and Publishing International Limited
Reading, UK. 44-118-972-4148. www.academic-publishing.org

Linguistic Analysis of Manager Behaviour Aimed at Replacing Human Managers With Robots

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Abstract: Management, especially interaction between a manager and subordinates, is difficult to accurately capture due to cultural, linguistic, and structural aspects. Building knowledge and understanding of management in research in this field of study, depends on the consideration of several essential aspects. This paper presents theoretical foundations for creating knowledge about the activities of team managers using a system of organisational terms, and showcases how linguistic analysis can be applied to enhance findings in the area of management studies. The paper discusses the results of an experiment carried out with management students within the field of project planning. The students played the roles of team managers and were asked to plan a specific project using the following online management tools: a goaler (to set up goals) and a tasker (to describe tasks). All activities of experiment participants were recorded by these tools. The data gathered during the experiment enabled us to answer several research questions: (Q1) Which elements of the plan are changed and how often are they changed until the plan is accomplished? (Q2) Which cognitive processes take place when managers are given a complex project to plan? (Q3) Are there any dominant linguistic routes when planning the project? (Q4) Is it possible to develop a pattern of (human) manager linguistic behaviour in order to replace human managers with robots? (Q5) How can the linguistic findings be utilised in order to optimise and automate the formulation of tasks and goals in the future? The methodology of the paper consists of a literature review, an experiment with students, and the findings of linguistic analysis of manager behaviour.

Keywords: Linguistics, manager behaviour, mixed method, reasoning, text analysis, Wittgenstein

1. Introduction

Increasing areas of human life are developed with the help of machines and robots, or are replaced by them. After the first age of robotics in manufacturing, rapid developments in computer science have provided the opportunity of replacing team managers with robots (see McAfee et al, 2015). In recent years, the idea of replacing humans with robots has also emerged within the organisational environment, in particular in consultancy, stock exchange, and market analysis.

However, there is still a lack of research in this respect, within the field of team management. Despite the fact that it is common to track activities of Internet users or online applications (e.g. Google apps), there is hardly any research using online management tools in order to obtain data about managers' behaviour. At the beginning of the 20th century, Frank Gilbreth and Lilian Gilbreth took a step in this direction (Fogelholm, 2000: 195). They investigated human motions at work, which is viewed as the beginning of workforce automation in various types of industry. In the 21st century, it is worth investigating management activities in order that work can be further automated.

In general, this paper showcases the latest results from the observation of managers' behaviour, carried out with the help of the system of organisational terms and selected online management tools available on the transistorshead.com platform. It is worth adding that the online management tools utilised are regarded as research tools in this paper (see Section 2). The data gathered during the observation was further analysed from a linguistic perspective using the tenets of anthropocentric linguistics and the so-called CCC (correspondence, consistency, and correctness) model (see Section 5).

In particular, the paper aims to:

- describe the concept of the observation,
- present the theoretical background of quantitative and linguistic analyses,
- illustrate the mechanism of management tools on the transistorshead.com platform,
- present the results of linguistic analysis of manager behaviour aimed at replacing human managers with robots,
- present further research paths and possibilities of results implementation.

The paper provides a literature review, presents an experiment with management studies students, and discusses the results of the linguistic analysis of manager behaviour. The research questions are as follows:

- Q1: Which elements of the plan are changed and how often are they changed until the plan is accomplished?
- Q2: Which cognitive processes take place when managers are given a complex project to plan?
- Q3: Are there any dominant linguistic routes when planning a project?
- Q4: Is it possible to develop a pattern of (human) manager linguistic behaviour in order to replace human managers with robots?
- Q5: How can the linguistic findings be utilised in order to optimise and automate the formulation of tasks and goals in the future?

2. Theoretical foundations

There are various knowledge management information systems focusing on selected areas of organisations (such as sales, distribution, production; see Yanchinda et al, 2011: 806, 817) offering numerous theoretical approaches to those issues. Knowledge management in organisations is defined as a process that enables their members to create, distribute, and use knowledge in practical ways in order to make organisations more efficient (Chalmeta and Grangel, 2008). White and Takeda (1996: 47–56) claim that knowledge in organisations is entirely based on human language. This statement was the inspiration of designing the system of organisational terms that constitutes the theoretical foundation for conducting experiments with managers, with the aim of replacing human managers with robots (Flak and Pyszka, 2013).

The approach by Matos and Lopes (2003) is one of the theoretical assumptions for replacing human managers with robots. Its authors present a model of creating tacit and explicit knowledge in organisations. Following this approach, certain issues must first be solved in order that human managers of teams can be replaced with robots. Firstly, it is necessary to find a method for capturing/recording the explicit and tacit knowledge developed by a team. Secondly, a means must be found to transform this knowledge into management processes. Moreover, important questions need to be answered, such as: Are existing knowledge systems built on a true representation of the reality (ontological issue)? Do these knowledge systems contain true information about the reality (epistemological issue)? (Kilduff et al, 2011). Chalmeta and Grangel (2008) claim that it is possible to obtain knowledge that represents the true reality of an organisation. For example, by transforming individual knowledge into collective organisational knowledge, and reincarnating organisations as knowledge organisations (Liebowitz, 2001: 4). We admit that this is a challenging and controversial task, and it might lead to images of science-fiction visions. However, the examples of pattern recognition of other human activities beg a serious question of ability of creating appropriate representation of managerial activities in algorithms (see Pentland and Liu, 1999; Kellokumpu et al, 2007; Turaga et al, 2008).

Despite the variety of theoretical knowledge systems in organisations and the large number of computer programs in companies (e.g. SAP, ERP, Google tools), there is a lack of complex management tools collecting data on the behaviour of human managers. In order to measure phenomena in organisations in a more systematic way, it is necessary to build a new ontological system by applying epistemic approaches. Without such a theoretical solution it is near impossible to compare data and verify scientific statements in an objective way in management science (Flak, 2007: 67).

Let us now turn to the system of organisational terms, which has been designed to build a knowledge system that could replace human managers with robots. The paradigm used for the system of organisational terms combines neo-positivism, functionalism, and a system-based approach to organisations (Holmwood, 2005). The system of organisational terms covers both qualitative and quantitative methods (Bryman, 2006). It is built on the philosophical foundation of Wittgenstein's 'states of entities' (Brink and Rewitzky, 2002: 544). Wittgenstein claimed that 'all the world consists of facts as the only beings' (ibid.). The development of this theory led to the conclusion that 'facts appear in the state of entities' (Precht, 2007: 122). There are several rules and arrangements that make the system of organisational terms coherent and ready for practical use (Flak, 2013a). The system of organisational terms covers both ontological and epistemological aspects and as such can be utilised to analyse manager behaviour and build the body of knowledge required when attempting to implement an artificial manager (Flak, 2013b).

The ontology of the system of organisational terms is based on a formal logic and Wittgenstein's theory of facts, according to which we can distinguish two types of facts: events and things. Things (physical or mental, such as a timetable, motivation, an idea, a decision, an organisational structure, a meeting agenda) are created by events (short or long processes: planning, motivating, creating, making, drawing, preparing). Facts can be divided further into four types, i.e. objective vs. subjective resources (things) and objective vs. subjective processes (events) (Ziembiński, 2006; see Figure 1).

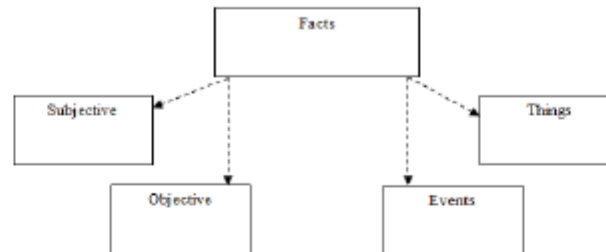


Figure 1: Division of facts

In order to capture the essence of the ontological background of the system of organisational terms, it is worth considering how facts happen in time. For this purpose a brief model can be created that showcases how facts take place one after another (see Figure 2). According to the model in Figure 2, in which for the sake of clarity there is no distinction between subjective and objective facts, event 1.1 causes thing 1.1, which in turn releases event 2.1 that creates thing 2.1. In the meantime, thing 1.1 starts event 3.1 which creates thing 3.1. Then, thing 3.1 generates a new version of the first event, i.e. event 1.2. In this way, a new version of the first thing (1.1) is created, which is called thing 1.2. And so on.

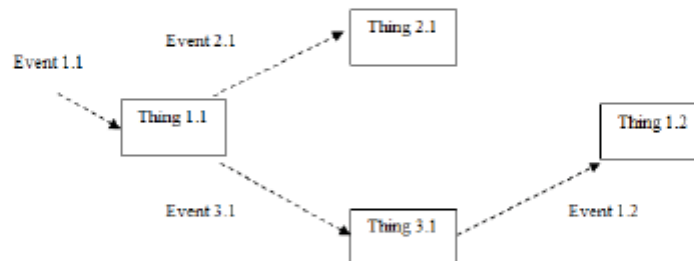


Figure 2: Pattern of facts

The features of facts in the system of organisational terms are grouped in dimensions called 'measured values'. It is not only colloquially measurable objects' characteristics that in management science constitute resources (Wernerfelt, 1984) or processes (Glykas, 2011). Features of facts cover the whole range of parameters, i.e. measured values, in both quantitative and qualitative ways.

The concept of the system of organisational terms includes two types of organisational terms: primary and derivative (secondary). The former reflects the facts of a 'thing'; in management science they are called resources. The latter reflects the facts of 'event'; in management science they are viewed as processes (Flak 2008: 13–22).

For the purposes of the experiment, the results of which are discussed in this paper, the system of organisational terms was coupled with the tenets of anthropocentric linguistics and the CCC model that allows for systematic texts analysis. These are discussed in more detail in Section 5.

3. Research Design

The research process consisted of translating facts within the organisational environment into binary language, via the online management tools, carrying out an experiment in the field of team management with management students, and drawing conclusions about cognitive processes and the linguistic routes for planning a project.

The experiment was carried out with the help of two original online management tools (here also research tools), which allowed the gathering of data relating to manager behaviour when planning projects. For the purposes of the experiment a mixed research method (Bentahar and Cameron, 2015) was used. It combined both neo-positivistic and systematic paradigms. Figure 3 depicts the research process.

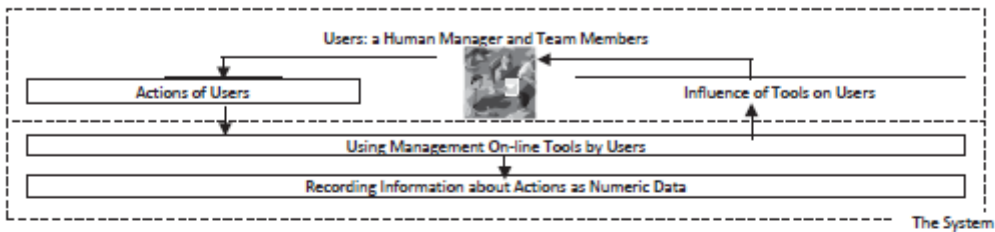


Figure 3: Research process

During the experiment, original online management tools were employed to record managers' activities. Each management tool covered only one aspect of project planning (i.e. setting goals and establishing tasks) so that the individual aspects of team management could be easily and accurately measured. The management tools utilised for the purposes of this paper are available on <http://transistorshead.com> and can be accessed through logging on with the username: john.smith, password: smith.

The experiment participants were masters students in management who were asked to perform a task provided by their teacher. Projects were conducted by students in groups of three or four in class and at home. In general, the project consisted of moving a company from one city to another within three months. The students (here team managers) were instructed in writing which tasks were necessary and why they should be performed. The managers were obliged to plan the movement of the company by providing short descriptions of the tasks at hand and delegating them.

The descriptions to be provided by the managers were divided into 'Goaler' and 'Tasker'. Both 'Goaler' and 'Tasker' consisted of several rows, which the managers were expected to fill in with text (as opposed to choosing an option from a list). The 'Goaler' comprised the following rows: 'vision', 'short name', 'measurers' (from 1 to 9), 'goal based', whereas the 'Tasker' comprised the rows titled 'name', 'verb', 'how to', and 'where to'. Every row included a short description, clarifying what information was needed. The rows in tandem with the descriptions, are depicted in Tables 1 and 2:

Table 1: Goaler

Row	Description
vision	Start from a vision of the future
short name	Create a short name for the goal (this field is required)
m1	Define a measurer 1
m2	Define a measurer 2
goal based	Create a statement which shows the goal based on green box details

Table 2: Tasker

Row	Description
name	Create a short name of the task (this field is required)
verbs	Write, using a verb, what is to be done
how to	Add details how to do this
where to	Add details where the task is to be done

For the purposes of linguistic analysis, texts composed by two managers (groups) were chosen (see Sections 4 & 5). This choice was motivated by the amount of text generated, as it was expected that it would allow a more complex and reliable analysis of manager behaviour. Moreover, by analysing texts from two groups the researchers intended to compare data. It is worth adding that the collected texts were sorted in tables in an Excel[®] file and thus constituted a corpus for text analysis. Using tables was helpful in annotating texts, comparing data, producing explanations, and finally arriving at conclusions (see Gibbs, 2007: 86). As mentioned in Section 2, in order to provide systematic analysis of the texts, tenets of anthropocentric

linguistics (Grucza, 2013) and the CCC model by Renkema (2001, 2009) were employed that are presented in Section 5.

4. Quantitative findings concerning manager behaviour

To answer the first research question (Q1), the activities performed by the two managers may be summarised in numbers that, at the same time, give an overview of the aspects of work done by them. When carrying out the project, both managers set up a similar number of goals, yet the number of tasks planned to achieve these goals differed. Manager 1 created 7 goals and 21 tasks, whereas Manager 2 set 6 goals and 13 tasks. In both cases, the duration of project planning was almost the same, lasting around 10,000 minutes. However, the actual work with the tools took different periods of time. Manager 1 needed 642 minutes and Manager 2, 397 minutes to plan the project. Interestingly, the number of work intervals (from log in to log out) varied too. However, both managers conducted the edition of the goals and tasks quite similarly in terms of quantitative findings. Table 3 depicts the quantitative results of the experiment.

Table 3: Summary of managers' behaviour

Measures	Manager 1 (group 1)	Manager 2 (group 2)
number of goals	7	6
number of tasks	21	13
number of actions	303	285
total time from first login to final logout (minutes)	10195	10303
duration of actual teamwork – editing time (minutes)	642	397
number of work intervals (from log in to log out)	7	3
number of goals editions	18	19
number of tasks editions	24	13
number of editions by object (goal)	3.42	3.16
number of editions by object (task)	1.14	1

It is worth adding that both managers were instructed to plan the project in the form of short texts. Whereas the instruction was a continuous text comprising seven paragraphs of 656 words in total, the short texts composed by the managers can be viewed as short messages comprising from 1 to 44 words. This means that in some cases produced texts equalled just one word or phrase, in other cases texts comprised sentences. The longest text composed by the managers consisted of three sentences. In total, Manager 1 used 533 words to plan the project, whereas Manager 2 wrote down 448 words (only the final versions of the project plan were considered in this calculation).

5. Results of linguistic analysis of manager behaviour

As mentioned in Section 4, both managers composed texts when planning their projects. Within the constraints of anthropocentric linguistics, managers' behaviour may be observed on the basis of texts collected in the form of a corpus. The term 'text' may be understood twofold: firstly, on the expression plane, and secondly on the content plane (Grucza, 2013: 62). More specifically, a text is first and foremost a particular utterance realised in a graphic, phonic/oral, or hybrid (graphic-phonic) form, produced by a human being in a given act of communication (expression plane). Furthermore, a text expresses/represents certain content/meaning (content plane). However, it is worth stressing that a text does not contain any content or meaning (or language, see anthropocentric linguistics by Grucza 2010). Following a similar differentiation, Renkema (2001, 2009) proposed a model for document (text) quality, called the CCC model, which allows for systematic text analysis (see Table 4) and observation of linguistic behaviour, that in turn help to answer the second research question (Q2).

According to this model, in order to investigate a given text, it is necessary to consider three criteria, i.e. correspondence, consistency, and correctness, applied at five levels: document (text) type, content, structure, wording, and presentation. Table 4 provides a list (from 1 to 15) of aspects to be investigated.

Table 4: The CCC model (Renkema 2001, 2009)

	Correspondence	Consistency	Correctness
A. Type	1. Appropriateness	2. Purity of genre	3. Application of genre rules
B. Content	4. Sufficient information	5. Agreement between facts	6. Correctness of facts
C. Structure	7. Sufficient coherence	8. Consistent structure	9. Correct linking words
D. Wording	10. Appropriate wording	11. Unity of style	12. Correct syntax and choice of words
E. Presentation	13. Appropriate layout	14. Layout adapted to text	15. Correct spelling and punctuation

In the case of the texts generated by the two managers, the analysis at the level of text type and presentation can be left out. The managers did not have any choice as regards (A) text type or (E) presentation (particularly text layout). They were supposed to fill in the given rows in the management tools with short descriptions. This did not give them any space to be creative with regard to the two levels mentioned. Nevertheless, the aspects of correct spelling and punctuation, which are classified under 'presentation' (see point 15), were considered in the analysis. They did not, however, influence its results, as it turned out that spelling and punctuation were correct in the texts investigated. In short, the analysis of the texts produced by the managers in question focused on the three criteria of (B) content, (C) structure, and (D) wording. Additionally, it was analysed whether and how the generated texts changed over time.

As regards content, whether the texts produced included all the elements mentioned in the instruction (content analysis) was investigated. It turned out that the managers did not cover all the information from the instruction in their descriptions. In other words, in reality they would not be able to execute all the tasks and thus achieve all the goals set by the company's board of directors (here the teacher). However, the facts included in the descriptions were correct, and corresponded to those mentioned in the instruction.

With regard to structure, limited observation could be made due to the restricting number of characters of which the texts consisted. As mentioned in Section 4, the longest text comprised 317 characters (with spaces), which translated into three sentences (44 words). Therefore, as regards structure, only those descriptions consisting of sentences were taken into consideration. It turned out that when composing longer texts, the managers sometimes did not use correct linking words. For example: "Relating to the will of extending the business activity with a need product being T-shirts to be sold with the help of an innovative application, **that's why** we open a new department." This made their descriptions rather complicated for the reader (other team members) and probably difficult to understand. However, such incorrect structure would not, we think, influence the project outcome as long as the information provided was correct.

A more important point with regard to structure relates to the order of the listed goals and tasks. The managers did not write down the goals and tasks following the points listed in the instruction. Whereas Manager 2 started planning the project with the first task mentioned in the first paragraph of the instruction and finished with the task listed at the end of the instruction, Manager 1 began with the task which appeared in the third paragraph of the instruction and finished the planning with the first task mentioned in the instruction. It was thus nearly impossible to identify a route of project planning, comparing the behaviour of the two groups (see research question Q3).

Wording applied by the two managers was appropriate throughout, i.e. it corresponded with the wording applied in the instruction. At times, the syntax was incorrect, as mentioned previously in this section. The style was inconsistent throughout. Similarly to findings from another project conducted by the authors (Flak and Alnajjar, 2015), the managers in question used different forms in their descriptions, e.g. verbs or nouns. The verbs were also applied inconsistently. Either an infinitive or second person plural forms were applied.

With the help of analysis of the content, structure and wording of the texts under investigation, it was also possible to analyse and interpret changes made in these texts. Interestingly, the managers altered relatively few texts. Manager 2 made changes in the description of goal 2, which consisted of shortening the description to a great extent in the second version of the goal (altogether there were three versions, although versions 2 and 3 were identical). In this case, the characteristics of the company were correctly removed from the description. Nevertheless, the modified goal still included the fact, which probably should have been more

explicitly incorporated in the description of the goal (content analysis). The 'goal based' row concerning this goal was altered accordingly, though only in the third version, while the second version was left empty. Again, the corrected version was shorter and in accordance with the alterations in the main goal. The measurers with regard to this goal were altered too. Here, however, the number of measurers grew from 4 in the first version through 5 in the second version to 7 in the third and last version, whereas the measurers from version 1 were not copied to version 2. The measurers in version 2 were in accordance with the changes in the 'goal' and 'goal based' rows made previously. In addition, measurer 5 was specified in version 3, and the wording, in particular the style, of the measurers in versions 2 and 3 was unified with other measurers composed by Manager 2.

As regards the tasks, two changes were undertaken by Manager 1 and one by Manager 2. Let's start with the changes made by Manager 1. The first change related to task 4. It was modified from 'Implementing a new product' (version 1) to 'Developing an application' (versions 2 & 3). The second change referred to the manner in which one of the main tasks could be performed ('how to' row). The number of particular tasks increased from four in version 1 to six in version 2. However, only two (the last two) from the particular tasks included in version 1 were copied to version 2. The first two were deleted, while four new tasks were added to the list. Manager 2 specified one task from 'Planning meetings' to 'Planning meeting with suppliers'. This manager also corrected the spelling in some rows. In three cases the description of the tasks in the first version started with a small letter, which in the second version was corrected to a capital letter. As regards changes, it should also be mentioned that with respect to the specification of the tasks, both managers decided to add them only in the second version. The first version was left empty by Manager 1: in column 'verb' (one case) and in column 'how to' (three cases), and by Manager 2: in column 'verb' (two cases) and in column 'how to' (four cases). In addition, Manager 1 did not specify the manner of accomplishing the last five tasks that he/she listed.

6. Discussion and Conclusion

It can be observed that managers plan their projects in steps and modify their plans over time. The tentative results presented in this paper indicate, however, that managers who proceed more systematically during the planning phase (i.e. carefully follow instructions) plan fewer project steps. On the other hand, managers who plan more tasks do not closely follow instructions and list their tasks in random order. Furthermore, it can be noted that managers who plan more tasks provide shorter descriptions of them, opposed to managers providing fewer tasks who describe them in more detail. This conclusion provides the opportunity to develop a pattern of linguistic behaviour of managers in order to replace them with robots (see research question Q4). Yet, further experiments are necessary in order to analyse more data and provide validation of findings. In particular it is pivotal to select texts on the basis of which efficient automation process can be designed and implemented.

The results of the text analysis presented in this paper demonstrate that it is necessary to supplement pure linguistic considerations with content analysis. Content analysis, however, should not be limited to looking at the behaviour of various managers. Rather it is necessary to compare this behaviour with the instructions given to the managers (comparative content analysis, see Flak and Alnajjar, 2015). As regards linguistic analysis for the purposes of the automation of manager behaviour in the future (see research question Q5), we see the need to devise a more tailored model or at least procedures in order to analyse manager behaviour more efficiently and systematically. Existing models, such as the CCC model applied in this paper, can be helpful. Though, future models should allow not only for qualitative, but also quantitative analysis. All in all, in order to automate managers' work in the future, it is worth investigating their behaviour further, from both a managerial and linguistic perspective. Yet, the prospects of exchanging human managers with robots or machines—controversial as they are—remain remote.

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