The Circumstantial Relational Process Clauses
in Scientific Texts in the Framework of SFL

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ABSTRACT

This paper will present the results of the study of circumstantial relational process clauses in scientific texts, especially in mechanical engineering ones. This study is aimed to identify the relational process occurring in Circumstantial relational process clauses and analyze the lexical verbs realizing the relational processes. To conduct the study, three mechanical engineering textbooks used as references by Mechanical Engineering Students of Politeknik Negeri Bandung (Polban) were used as the source for collecting the data. The method used in this study was qualitative one and Systemic Functional Linguistics (SFL) framework was applied to analyze the data. The results showed attributive relational process occur more frequently than identifying one. The attributive relational process was realized by various lexical verbs. The account of this will be presented in the rest of the his paper.

Key words: Systemic Functional Linguistics (SFL), circumstantial clauses, function, structure, identifying process, attributive process

INTRODUCTION

Relational process is one of the primary processes in Transitivity system. It is dominantly found in scientific texts (Martin, 1992) and it serves to characterize and to identify as stated by Halliday and Matthiessen (2004; 2014). This suggests that there are two types of relational process: attributive and identifying ones. The clauses below are the examples of both kinds of the relational process.

   1) Mary is smart.

   2) Mary is the leader of the class.

Both of the relational processes in the clauses above are realized by lexical verb *be*. However, they have different meanings. In clause 1), the relational process belongs to attributive one since one participant (smart) is attributed the other participant (Mary) in the clause. Whereas in clause 2), one participant (the leader of the class) serves to identify

another participant (Mary) in the clause. Thus, it could be seen that although the processes are realized by the same lexical verb, they give different meanings to the clauses they belong to.

Furthermore, both types of the relational processes occur in three categories of relational processes clauses. They are intensive, possessive, and circumstantial relational process clauses as listed by Halliday (1994). Since this paper concerns with the third category of the clauses, the other two types of the clauses will not be discussed here.

Circumstantial relational process clauses are different from the other two clauses. Unlike the firts two types of relational process clauses whose both of their participants are realized by nominal group, circumstantial relational process clause has one participant realized by a circumstantial element. But the circumstantial element may also be manifested by the process as stated by Halliday and Matthiessen ((M.A.K Halliday and Christian M.I.M Matthiessen, 2004) (Berg, 2017)2004; 2014). Supporting this, Eggins (2005) exemplified the clauses below.

3)   *The bomb was in her luggage*.

The bomb	*was*	*in her luggage*
Carrier	Process: attributive	Attribute

4)   *The operation lasted one hour.*

The operation	*lasted*	*one hour*
Carrier	Process: attributive	Attribute

Both of the clauses above belong to circumstantial relational process clauses operating on attributive mode. However, the circumstantial element in clause 3) is represented by Attribute while in clause 4), the circumstantial element is manifested by the process. Concerning with this type of relational process clause which found in scientific texts, this paper aims to answer the following questions.

- What type of relational process is dominated in circumstantial relational process clauses found in scientific in scientific texts?

- What lexical verbs do realize the relational process in circumstantial relational process clauses found in scientific in scientific texts?

- What types of circumstantial element realize the participant of the circumstantial relational process clauses occurring in scientific texts?

LITERATURE REVIEW

Scientific Texts

Scientific texts can be easily distinguished from other types of texts. They have special features. First, they are realized by scientific language which is free from bias as stated by Reeves (2005). Second, scientific language is realized by special lexicogrammar (Halliday, 1993). The lexicogrammar does not only become the characteristic of scientific texts but also the obstacle for learners to understand the texts. Third, Martin (1992) specified that texts with special register, such as science are dominated by identifying relational process which occurs in relational process clauses. One type of relational process clauses is called circumstantial relational process clause because it contains circumstantial elements.

Circumstantial elements

Circumstantial elements may be viewed from two points: structure and semantic. Structurally, circumstantial elements are realized by either adverbial group or prepositioanl phrase (Halliday and Matthiessen, 2014: 222). Whereas semantically, they have nine basic meanings (Table 1.).

Table 1. The nine basic types of circumstantial elements adopted by Fontaine (2013: 80) from Halliday and Matthiessen (2004:262)

TYPE	Sub-type	Question answered	Examples
Extent	distance	How far?	He ran three miles
	duration	How long?	He ran for three days

	frequency	How frequently	He ran <u>every day</u>
Location	Place	Where?	He ran <u>in Toronto</u>
	Time	When?	He ran <u>last year</u>
Manner	Means	By what means?	He saved her <u>with a rope</u>
	Quality	How?	She saved him <u>quickly</u>
	Comparison	Like what?	She ran <u>like the wind</u>
	Degree	How much?	She loved him <u>more than anyone</u>
Cause	Reason	Why?	She ran <u>because she loved to</u>
	Purpose	For what purpose?	She ran <u>to raise money</u>
	Behalf	On whose behalf?	She ran <u>for her sister</u>
Contingency	Condition	Under what condition?	<u>In the event of fire</u> leave the building
	Default	Under what negative condition	<u>Without an agreement</u>, the plan will fall
	Concession	With what concession?	<u>Despite her help</u>, the plan failed
Accompaniment	Comitative	Who/what with?	John ran <u>with Jane</u>
	Additive	Who/what else?	John wears mitten <u>in addition to his gloves</u>

	Guise	What as?	She spoke as his mentor
Role	Product	What into?	He was transformed into a prince
Matter	Matter	What about?	He warned me about the film
Angle	Source	According to whom?	According to the lecturer, the class is cancelled
	Viewpoint	From whose viewpoint/ perspective?	To me, he's an idiot

(Martin J. , 1992)

Circumstantial relational process clauses: their characteristics

Like other types of relational process clauses, circumstantial relational process clause also operates on two types of relational processes: attributive and identifying. Each of them possesses its own characteristics as listed by Halliday and Matthiessen (2014).

Circumstantial relational process clause operating on attributive mode has characteristics as follows.

- The participants involved in the clause are Carrier and Attribute.
- Carrier is realized by nominal group but Attribute is realized by prepositional phrase or by nominal group.
- The circumstantial element may be construed in Attribute or in process.
- The clause is not reversible.

Here are the examples of circumstantial relational clauses operating on attributive mode.

5)   *My story is about a poor shepherd boy.*

My story	is	about a poor shepherd boy
Carrier	Process	Attribute: circumstance (Matter)
Nominal group	Verbal group	Prepositional phrase

6)   *My story concerns a poor shepherd boy.*

My story	concerns	a poor shepherd boy
Carrier	Process: circumstantial	Attribute: circumstance (Matter)
Nominal group	Verbal group	Nominal group

Clause 5) is circumstantial relational process clause working on attributive mode. The attributive relational process is realized by verb *be*. Having attributive relational process, the participants involved in the clause are Carrier and Attribute. Carrier is realized by nominal group *My story* while Attribute is realized by prepositional phrase *about a poor shepherd boy.* This prepositional phrase is a type of circumstantial element which functions as a Matter. This explains the matter of the entity found in Carrier. However, in clause 6), circumstantial element is manifested by the relational process which is realized by verb *concerns*. Whereas Attribute functioning as matter is realized by nominal group. Thus, circumstantial element is not only construed by Attribute but also by process.

Meanwhile, identifying circumstantial relational process clause own some properties.

- The inherent participants involved in this kind of clause are Token – Value.
- Token is commonly realized by nominal group as in attributive clause and Value may be realized by the same structure as Attribute serving one of the circumstantial elements listed in Table 1.

- The circumstantial element may be manifested either by Value or by process.
- The clause has reversible version.

7)   *Tomorrow is the tenth.*

Tomorrow	is	the tenth
Token	Process	Value
Nominal group	Verbal group	Nominal group

8)   *A bikeway also circles the Village.*

A bikeway	circles	The Village
Token	Process	Value
Nominal group	Verbal group	Nominal group

Clause   7) and 8) are circumstantial relational process clauses operating on identifying mode. The former clause has identifying process realized by lexical verb *be*. Consequently, the circumstantial element is realized by Value which is nominal group. This nominal group serves circumstantial meaning of Time. Whereas in clause 8), the circumstantial element is construed by the process realized by lexical verb *circles*. This verb informs about Manner, a type of circumstantial element. Working on identifying mode, both of these clauses can be reversed without changing the meaning. They become: *The tenth is tomorrow* and *The Village is circled by a bikeway*.

METHODOLOGY

Method used in this study is a qualitative method in which quality is important. Quality is defined as the what, how, when, where, and why of a thing—its essence and ambience, thus, qualitative research is the meanings, concepts, definitions, characteristics, metaphors, symbols, and descriptions of things Lune and Berg (2017).

This suggests that the data may be in the form of texts or documents. The data for this study were collected from textbooks aimed for mechanical engineering students. *They are Mechanical Engineering Principles, An Introduction to Mechanical Engineering, Shigley's Mechanical Engineering Design*, and *Welding Principles and Application.*

The data taken from the textbooks were analysed descriptively based on the approach discussed above. First, all circumstantial relational process clauses were selected. Then, the selected clauses were classified according to the relational process they own. After that, the classified data were categorized in terms of the type of circumstantial elements. The clauses were analyzed based on circumstantial element realizing the participant. Finally, the conclusion was drawn. The stages of the data analysis are illustrated in the figure below.
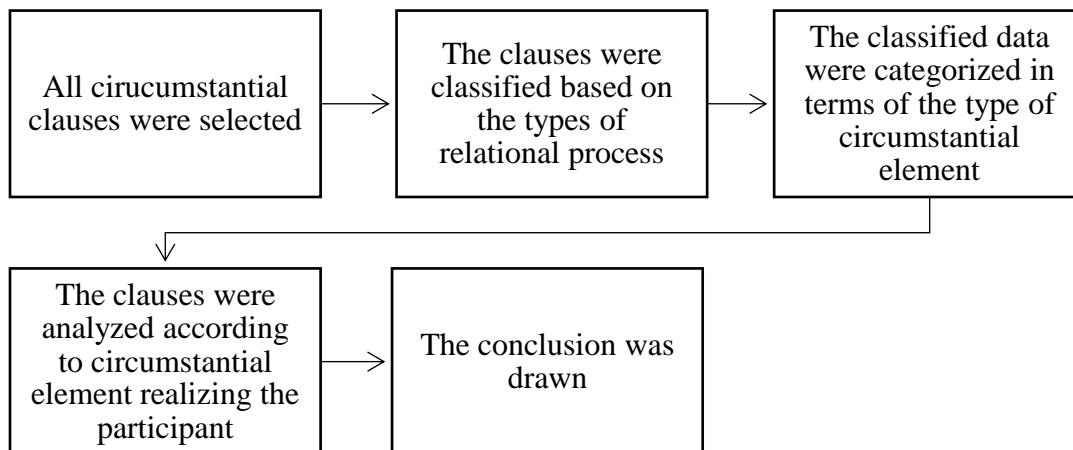

Figure 2.   The process of data analysis

RESULTS AND DISCUSSION

A total of 45 circumstantial relational process clauses were found. 44 clauses operate on attributive relational process and only one clause which operates on identifying mode. The attributive relational process is realized by seven lexical verbs while identifying one is realized only by single lexical verb (Figure 3.).
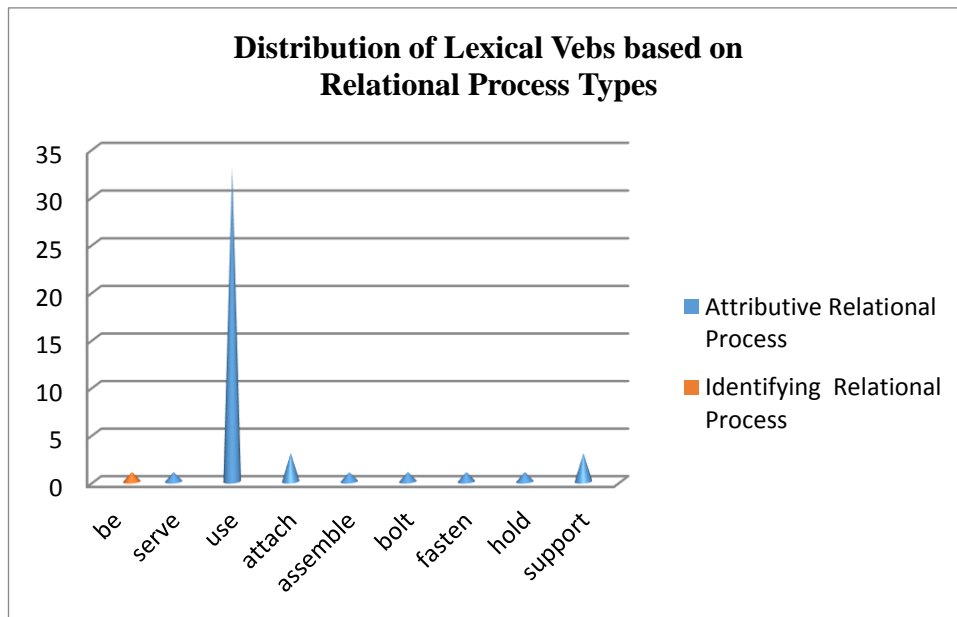
Figure 3. Distribution of lexical verbs based on relational process types

Another finding is there are four types of circumstantial element found in the data (Figure 4.). They are means, Place, Purpose, and Guise. Among the them, Purpose is the dominant circumstantial element that occur in the data.
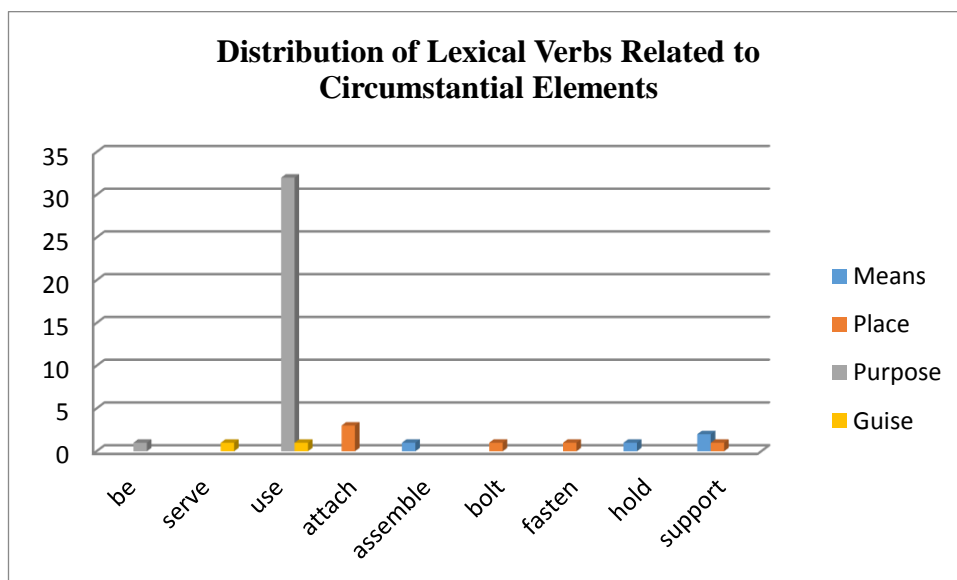

Figure 4. Distribution of lexical verbs related to circumstantial element

Based on the data above, it is implied that circumstantial relational process clauses occurring in scientific texts tend to work on attributive mode realized by various lexical

verbs. Further discussion to answer the research questions previously formulated is presented below. .

Circumstantial relational process clause: circumstantial element of Purpose

As previously presented, attributive relational process is the kind of process occuring the most frequently. The process is dominantly realized by lexical verb *use*. There are 33 clauses containing this verb. The clauses containing this verb tend to have Attribute realized by circumstantial element of Purpose and Guise (Figure 4.). The circumstantial element of Purpose may be realized either by prepositional phrase containing preposition *to* as in clause 1. – 3. or preposition *for* as in clauses 4. – 5. When the prepositional phrase is initiated by preposition *to*, it is followed by invinitive verb. When it begins with preposition *for*, the verb that follows should be in gerund or in ing-form. This can be seen clearly in the following table of analysis.

1	Percentages	are used	to give a common standard.
2	Vise and clamps	are used	to hold the workpiece securely
3	An electric motor	is used	to power an exercise treadmill
4	A milling machine (mill)	is used	for machining the rough surfaces of a workpiece
5	A milling machine (mill)	is used	for cutting slots, grooves, and hole
	Nominal group	Verbal group	Prepositional phrase
	Carrier	Process: attributive	Attribute

To probe that these prepositional phrases are classified as circumstantial element of Purpose, question like "What is the purpose of Percentages/ Vise and clamps/ An electric motor/ A milling machine (mill)/ A milling machine (mill)? can be applied. The answer is found in Attribute.

Also found in the data that circumstantial element of Purpose may also appear to realize not only Attribute but also Value. Consequently, circumstantial relational process clause operates on identifying mode. This can be seen in the table of analysis below.

6	The purpose of quenching	are	to harden the steel
	Nominal group	Verbal group	Prepositional phrase
	Token	Process: identifying	Value

Since the clause works on identifying mode, it has reversible version. Value realized by prepositional phrase comes first before identifying process. Then Token realized by nominal group comes after the process. The clause becomes:

To harden the steel is the purpose of quenching.

Circumstantial relational process clause: circumstantial element of Guise

Besides, circumstantial clause operating on attributive mode realized by lexical verb *use* may also have Attribute realized by circumstantial element of Guise as in clause 7. Unlike the previous data, the circumstantial element of Guise is realized by adverbial group. To probe the clause, the question "What are Ceramics used as" is applied. The answer is "thermal barrier coatings" which can be found in Attribute. This can be seen clearly in the table of analysis below.

7	Ceramics	are used	as thermal barrier coatings
	Nominal group	Verbal group	Adverbial group
	Carrier	Process: attributive	Attribute

Circumstantial relational process clause: circumstantial element of Means

The following clauses are circumstantial relational process clauses which have attributive relational process. The attributive relational process is realized by lexical verbs support (8-9) and assemble (10). Although the relational process is realized by different verbs, all the clauses own Attribute realized by circumstantial element of Means. It is indicated that the circumstantial elements are realized by prepositional phrases. This can be probed with the question "By what means (Carrier) is supported/are assembled?" The answer will be found in Attribute, the other participant. The table analysis below indicates it clearly.

8	The shaft	is supported	by ball bearings on each side of the belt
9	A two-tier system to repair bridge infrastructure	is supported	by two steel cables for each platform
10	The shells	are assembled	by clamping, bolting, or pasting
	Nominal group	Verbal group	Prepositional phrase
	Carrier	Process: attributive	Attribute

Circumstantial relational process clause: circumstantial element of Place

The data also show that circumstantial relational process clauses operate on attributive mode realized by lexical verbs support (11), attach (12-14), fasten (15), or bolt (16). These lexical verbs manifest the circumstantial elements which require circumstantial elements of Purpose. This type realized by prepositional phrases represent Attribute. To probe the circumstantial element of Purpose, the question " is/are (Carrier) supported/attached/fastened/bolted?" The answer will be represented by Attribute as indicated in the table of analysis below.

11	The workpiece	is supported	on a table
12	A spool	is attached	to the rear axle
13	The output gear	is directly attached	to the front drive axle
14	The spur gear	is attached	to the 1-in.-diameter shaft
15	The eyebolt	is fastened	to a thick base plate
16	Three tension rods	are bolted	to a gusset plate
	Nominal group	Verbal group	Nominal group
	Carrier	Process: attributive	Attribute

CONCLUSION

Having presented the discussion of circumstantial relational process clauses in scientific texts above, it can be drawn some conclusions. First, circumstantial relational process clauses dominantly operate on attributive mode. The attributive relational process is realized by lexical verbs *use, serve, support, hold, attach, fasten, bolt* and *assemble*. The majority of attributive relational process is realized by lexical verb *use*. Whereas identifying relational process is realized by single lexical verb, that is *be*. It is also found that there are four types of circumstantial element which represent Attribute. They are circumstantial element of Purpose, Means, Guise, and Place, among which Purpose has the most frequent occurance.

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