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Research Article

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Transitivity Analysis Annotation Scheme and Its Application to CQPweb: A Study on Stephen King's Carrie

Amanda Hanna Astriyanti^a, Prihantoro^b

^aEnglish Depatment, Faculty of Humanities, Diponegoro University, 50274, Indonesia ^bEnglish Depatment, Faculty of Humanities, Diponegoro University, 50274, Indonesia

> amandahanna232@gmail.com prihantoro@live.undip.ac.id

Abstract

In this study, I aim to create a Transitivity Analysis Annotation Scheme (TAAS) within which, process types and clause patterns are taken into account. Once created, TAAS is applied to corpus data, obtained from a novel entitled Carrie [1]. The scheme is manually implemented using XML format. The XML formatted corpus is converted to a format accepted in CQPweb [2], a corpus query tool. The corpus is tokenised using the Perl tokenizer, in TreeTagger [3]. Once tokenised, the corpus is tagged using English TreeTagger [3], which supplies two grammatical annotations (Part of Speech and Lemma). The annotated corpus is then indexed to CQP web. Once indexed, users are able to search the annotated corpus using transitivity analytic labels, POS tags and lemma, in CQP web.

Keywords: transitivity analysis; annotation; corpus linguistics; CQPweb.

1. Introduction

The general English clause describes a particular process (what kind of activity is involved or what is going on) and a particular participant (who is involved in the process) [4]. This is similar to Halliday's Systemic Functional Linguistics (SFL), whose analyses are centralised on clauses. SFL provides a reference for linguists to understand language as involving acts of meaning [5]. One of the SFL analytic systems is *transitivity*. The transitivity system constructs any participant roles depending on its process verb(s) in a clause. Process type is a verbal group in the transitivity system [6]. Subsequently, the participant is a nominal group in the transitivity system, also functionally labelled as an entity [6]. In the arrangement of experience patterns, participant elements also determine the process of happening and doing (material process), sensing (mental process), saying (verbal process), behaving (behavioural process), being (relational process), and existing (existential process), by analysing its clauses. As one of the widely used analytic systems

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in SFL, transitivity analysis may be used to examine how certain intrinsic elements (character, plot, theme, and setting) are presented in the literary works [7], [8] or to analyse the figure's speech using discourse analysis approach [9].

However, none of these studies focuses on the technical aspect of annotation (adding analytic labels to analytic linguistic units) i.e., how to make the annotated text becomes easily accessed. In this study, I will apply transitivity analysis using XML format [10] to be indexed in CQPweb [2] a user-friendly corpus tool. The aim of this study is to propose an annotation scheme of transitivity analysis (TAAS), which may be used as a reference for researchers to carry out SFL studies, using corpus annotation techniques. In line with the results of this study, it also aims to demonstrate how a corpus is annotated and indexed using XML format in CQPweb.

2. Research Methods

2.1 Create and Annotation Scheme

To classify the data using the transitivity features, I created an annotation scheme of transitivity analysis by encoding every feature in each process type to form clause patterns. The scheme is drawn using a chart editor from UAM Corpus Tool version 3.3 developed by O'Donnell (2008).

2.2 Collect Clauses to be Analysed using the Scheme

The unit of analysis in this study is a clause, which Wiranto [11] believes as the actualization of experience patterns by the participants of a particular process type. To understand the experiential meaning embedded in these clauses, I took sample texts from a novel entitled *Carrie* (1974) written by Stephen King.

2.3 Apply the Scheme to the Data Clauses using XML Format

The eXtensible Markup Language (XML) is a system of markup to corpus texts using <angle brackets> [2]. In this study, I will use XML annotation to encode SFL analyses. In the application of XML, there is a basic rule that tags must appear as boundaries to achieve a well-formed XML file. XML tags are composed of two angle brackets that surround a label, for instance, <sample>. XML can be used to indicate certain features of a text, such as paragraph boundaries, clause boundaries, sentence boundaries, etc. For instance, the <C> tag indicates clause boundaries from its actual text as follows:

<C>*The* student council committee held a football match at my school</C> <C>My friend, Sarah, competes against underclassmen.</C> </C> She accepted a defeat</C> that was only 1 point apart.

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XML tags consist of start-tag and end-tag, which serves as boundaries in the region of text [2]. Inside the start-tag, we can include information about the *region features* after the tag label, for instance, the transitivity analysis. To incorporate the feature, we use attribute-value pairs. Hardie [2] stated that "each attribute has one single value (enclosed in straight quotation), attribute and value are delineated using an equal sign." In this study, I have done manual annotations on the data using a transitivity analysis scheme. Next, I encoded the analysis in an XML document format. A sample of XML annotated clauses as follows

Table	1.	XML	annotated	claus	se

My friend	competes against	underclassmen		
Actor	Material Process	Goal		
<pre><sflc analysis="TS" pattern="APG" processtype="MA">my team competes against underclassmen</sflc></pre>				

2.4 Convert the Texts to CQPweb Readable Format

Using the Perl tokenizer, in Tree Tagger [3], a corpus text can be indexed to CQPweb if the format complies with the CQPweb-readable format. It is very similar to the XML format in terms of the tags. The main difference is that each token must be presented vertically, as shown in *Table 2* below.

XML format	CQPweb format
<text id="A1">Sarah is the best football player.</text>	<text id="A1"> Sarah is the best football player </text>

Table 2. XML and CQPweb format comparison

Once tokenised, the corpus is tagged using English TreeTagger [3], which supplies two grammatical annotations (Part of Speech and Lemma). Annotations for each token can

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be added in the subsequent column. For instance, in the italicised section as shown by *Text 1* below, the first column is the word form (e.g., 'player'), the second column consists of the POS tag (e.g., NN), and the third column consists of the lemma (e.g., 'play').

word level/ token	POS tags	lemma
<text id="A1"></text>	·	•
Sarah	NP1	unknown
is	VBZ	be
the	AT	the
best	RGT	best
Player	NN	play

Text 1. Sample text in verticalized format

2.5 Index the Texts as Corpus in CQPweb

The Corpus Query Processor (CQP), a web-based tool for indexing corpora, was created by a lecturer at Lancaster University [2]. In this study, I apply CQPweb to index a text, into which SFL analyses are encoded in XML format. Once a corpus is indexed, CQPweb allows users to analyse it using a variety of analytical tools, such *as collocation, distribution, categorising, sorting, frequency breakdown, thinning, etc* (see *Figure 1*).

	÷с.	O B Insultanet landacuk tertitiktere	ndaniashp?sic=009015n==Pu	inter a stand			8
Ye	our query '	(cool great awesome good fantastic)* retu 1,128.065 instances	rned 1,294 matches in per million words), or			00 texts]; frequenc	y:
1<	**	>> >] Show Page: 1 0	Line view		Show in corpus order	Choose action	1
0	Text		Solution 1 to 50	Pag	je 1 / 26	Observe action	1
1	K22	I do n't think	he 's her father - there 's no	recat	affection between them . Their conversations sound p		Л
	EBS	active with some outdoor games .	We all know that exercise in	reed	for us , and we should be getting 30 minutes of m	Frequency breakdown	q
	1926	is well advanced * . Trials	have found seaweed to be a	read	source of biogas , and Dr Kelly argues that further re-	Orabilitation Orabertation	
	C92	back with the pins . Sartre	and de Beauvoir , those two	is and	standard-bearers for the truth , were , in fact , noteply		
	R26	though she 'd slapped him .	Strangely that did n't feel as 👖	entertic	as she 'd thought it would , but she continued relevele	Colocations	
	059	X1 and Y, and X2	and Y. Moreover , three are	tees	reasons for believing that voters will follow other de-	Categorise	
	8.02	to do it ?	'I'll angress on him what a	Ettal	songwriter you are . "How ? ' I 'm not sure	Download	
	<u>N97</u>	and a half down at the	Spleen and Marrow It was	FULAI	I was a't even sick. Then . So the next	Tabulate Expand or narrow	
0	N2T	of freedom . * * Fe	redom ? But there 's a dama	steat	stone through there ! " " Yes , there is that ,	Save this query result	
0	E02	Am-tep and his people lived survived the terr	ible earthquake , though the	Great	Palace was itself almost totally destroyed . Much	Alberta State)
1	1922	local Jobcentre Plus office or Jobcentre . Apprenticeships	Apprenticeships are often a	EXER	way to earn a salary or receive an allowance while le	aming new	
2	E22	(continued) Take practical st	eps to manage your debt . A	real	way of approaching this is to look at the whole pictur	e,	
3	677	the new ethics. The analysis of flight p	resented here underlines the	scent	differences which separate modern ethical responses	to epidemics from those o	fth
4	827	from peg 5 on the Co	anal Pool . That was just too	read	for former Fish O' Mania champion Neil Machin who	weighed in 791b	
5	D09	a good discipline to help hun	structure his life and lead a	teet	one . Perhaps it does ; but that , of course ,		
6	G36	as a toddler. For poster	nty . (They 've always been	real	on posterity , Mum and Dad - school exercise books	lettera	

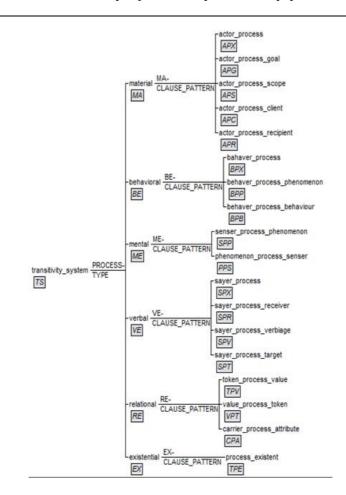
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Figure 1. Analytical tools of CQPweb

3. Results and Discussion

3.1 Transitivity Analysis Annotation Scheme (TAAS)

The annotation scheme that I propose is called Transitivity Analysis Annotation Scheme - SFL, abbreviated as TAAS (see *Figure 2*). It is visualised using the tree structure below and composed of categories and their corresponding category labels (grey segment). Users will later be able to search the annotated corpus using the labels. For instance, by supplying TS into the query box, users will be able to search all linguistics units, annotated using the transitivity analysis labels.



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Figure 3. Transitivity Analysis tagset

Transitivity System can further be subcategorized into 6 categories based on the process type at the clause level, namely material (MA), behavioural (BE), mental (ME), verbal (VE), relational (RE), and existential (EX). Further subcategorization of the patterns for each clause may vary according to the participant functions, present in each process type. The table below consists of process type categories (see Description) with their corresponding labels (see ProcessType) and example clauses.

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ProcessType	Description	Example Clauses
MA	Material Process	 Desjardin placed the napkin, cleaned the girl up with wet paper towels and got her back into her plain cotton underpants she slapped Carrie
BE	Behavioural Process	 Miss Desjardin made an irritated cranking gesture She frowned
ME	Mental Process	 Desjardin could only look at her helplessly She still believed that she thought all children were good.
VE	Verbal Process	 I'll talk to them tomorrow She tried twice to explain the commonplace reality of menstruation
RE	Relational Process	 her shorts were blinding white A terrible and black foreknowledge grew in Rita Desjardin's mind.
EX	Existential Process	 There was a bright flash overhead there was silence

Table 3. Description of process types

Each category can further be detailed using its corresponding Clause Pattern, encoded as pattern. For instance, I took one of ProcessType as a sample, i.e., MA (material process). The *Table 5* below shows examples of clause pattern from MA. Unique labels for each pattern are present, namely APX, APG, APS, APC, and APR.

All clause patterns begin with actor (A) and process (P). Thus, each label begins with AP. They can be followed by other functions such as goal (G), scope (S), Client (C), and Recipient (R). If the additional participant is absent, then X is appended. See full descriptions of the labels from the pattern of other ProcessType in the appendix.

Table 4. Material clause patterns

pattern	Description	Example clauses			
APX	actor + process	The thought	trailed off	-	
APG	actor + process +goal	She	took	one of the sanitary napkins	
APS	actor + process + scope	Miss Desjardin	employed	the standard tactic	
APC	actor + process + client	Miss Desjardin	led	Carrie	
APR	Actor + process + recipient	She	handed	him	

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3.2 XML Annotation Format

Presently, the only tag for further XML analysis is SFLC (SFL analysis at clause level). For the attributes and values, the following labels are used (see *Table 5*). The headings are used as attributes, while the labels are used as values. As a reference for readers to understand TAAS easily, I compiled the tagset above into a table below.

Table 5. Tagset of Transitivity Analysis

Attributes	analysis	ProcessType		pa	atter	ns	
		MA (Material Process)	APX	APG	APS	APC	APR
		BE (Behavioural Process)	BPX	BPP	BPB		
Values	TS (Transitivity	ME (Mental Process)	SPP	PPS			
	System)	VE (Verbal Process)	SPX	SPV	SPT	SPR	
		RE (Relational Process)	TPV	VPT	CPA		
		EX	TPE				

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-					
		(Existential			
		Process)			

Based on the table of the transitivity tagset above, the main attribute of the SFLC tag is analysis, which is equipped with a value called TS. Consider an example clause: *Desjardin said*. From its verb, the clause can be categorised as a verbal process (VE). According to the type of clause, it can further be categorised into SPX as it is composed of a sayer and a process, without any additional participant. The labels in the XML annotation sample can be described as follows.

- First of all, we will carry out an SFL analysis at clause level. For instance, Desjardin said is a clause that will be analysed using the SFL analysis system. For this reason, we supply the following XML tag <SFLC>. We are required to make sure the proper XML tag is supplied with both the start and end tag.
- 2. Then, we need to incorporate the type of SFL analysis that we are going to apply to this clause, which is the transitivity system (TS). For this reason, we need to add the attribute analysis that informs the type of analysis as TS. It must be supplied as an attribute-value pair inside the start tag.

<SFLC analysis="TS">Desjardin said</SFLC>

3. Once, we decided that this clause is going to be analysed by the transitivity analysis system. We will need to determine the ProcessType of the clause, which in this example is a verbal process on the basis of its verb. Therefore, we need to supply the following attribute-value pair ProcessType="VE" to indicate that this clause belongs to the verbal clause.

<SFLC analysis="TS" **ProcessType="VE"**>Desjardin said</SFLC>

4. The final step is annotating the pattern of this clause. As you can see, the clause consists of only a sayer and its process without any additional participant. For this reason, the proper label for the clause pattern is SPX. It is a value of pattern, which refers to the category of verbal clause pattern. See full descriptions of the labels from the pattern of other ProcessType in the appendix.

<SFLC analysis="TS" ProcessType="VE"
 pattern="SPX">Desjardin said</SFLC>

5. Note that the relational clause patterns can be categorised into identifying and attributive, whose values are TPV, VPT, and CPA (see *Table 5*). Earlier TPV

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(token + process + value) and VPT (value + process + token) fall into identifying categories, while CPA (carrier + process + attribute) falls into attributive categories.

An example of the application of TAAS, can be observed in *Text 2* as a part of the selected data from the novel Carrie in Part I BLOOD SPORT. Overall, the sample text contains several clauses marked with clause-level analytic tags, as shown in <SFLC>...</SFLC>. *Pity and self-shame met in her* is a sample clause in *Text 2*. The clause contains attribute-value pairs inside the start tag showing that this clause has been analysed using different categories or processes. TS (transitivity system) refers to the type of analysis. It shows that this clause is analysed using transitivity analysis. Subsequently, according to the ProcessType, this clause belongs to ME (mental process). The category clause pattern of this mental process is PPS (phenomenon + process + senser): *Pity and self-shame* is the phenomenon, *met* is the process, and *her* is the senser.

<SFLC analysis="TS" ProcessType="ME"
pattern="PPS">Pity and self-shame met in her</SFLC> and
mixed uneasily. <SFLC analysis="TS"
ProcessType="EX" pattern="TPE">There was a bright
flash</SFLC> overhead,

Text 2. Part I BLOOD SPORT

This XML Annotation Scheme may not necessarily be accepted by all corpus tools. Commonly, an annotated text is modified following a format, acceptable in a tool used to index the corpus. In this project, I will show how to convert the document format from native XML into the CQPweb readable format, as shown in the subsequent section.

3.3 Adaptation to CQPweb

The CQPweb program requires that a text is presented vertically. This stands in contrast to the previous text format, in which the XML annotations are presented in a horizontal form (see *Text 3*). As shown below, we can see that each line consists of a token (word or punctuation or symbol) or a tag (start or end).

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```
<SFLC analysis="TS" ProcessType="ME" pattern="PPS">
Pity
and
self
shame
met
in
her
</SFLC>
and
mixed
uneasily
<SFLC analysis="TS" ProcessType="EX" pattern="TPE">
There
was
а
bright
flash
</SFLC>
overhead
```

Text 3. Verticalized text of BLOOD SPORT.vrt

The clause inside the XML tags is considered as a group of tokens, which must appear in the first column. In the columns separated by tab characters, each token can be supplemented by optional annotations [6]. They can be POS (part of speech) tags, lemmas, semantic tags, as well as additional SFL analysis annotations. Consider a sample clause, *There was a bright flash*, from the *Text 3*.

word level/ token	POS tags	lemma	
<text cr01"="" id="</td><td>"></text>			
<sFLC anal</s	lysis=♥TS"	Proces Type="EX"	pattern="TPE">
There	EX	there	
was	VBD	be	
а	DT	a	
bright	JJ	bright	
flash	NN	flash	
<i>Text 4.</i> .	Sample clause	with POS and Lemma and	notation

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Following the Part-of-Speech tags in the Penn Treebank Project [9], the token *was* is encoded as *VBD*, which refers to copula verbs (e.g. is, am, are, was,were). Under the lemma, there exists *be* as the lemma form of *was*.

3.4 POS Tags Based Search

After converting the document format from native XML into the CQPweb readable format, the text containing the transitivity analysis annotations is ready to index on CQPweb. The indexed corpus appears as Transitivity Corpus SFL: powered by CQPweb, available from https://cqpweb.lancs.ac.uk/transitivity/. In this section, I will show how to search the corpus data from the CQPweb query box.

To search the corpus using POS (Part of Speech) tags, users have to add an underscore before the POS tag, here Penn Treebank POS tags [9]. For instance, a user wants to search for a group of verbs, specifically past tense. Then, _*VBD* needs to be supplied into the query box.

		Transitivity Corpus SFL: powered by CQPweb
es		Standard Query
(_VBD	
lata	Query mode: Number of hits per page: Match strategy:	Simple query (ignore case) Simple query language syntax ⁽²⁾ 50 Standard
3	Restriction:	None (search whole corpus) Start query Reset query

Figure 3. POS tags based search

3.5 TAAS Tags Based Search

To search the annotated corpus using TAAS (Transitivity Analysis Annotation Scheme) tags, users have to supply a CQP syntax query into the query box. On the query mode options, users need to select *CQP Syntax*. To search using CQP Syntax, a user must understand three labels: tag, attribute, and value. For instance, if we want to find all clauses annotated using TS, we also need to understand its attribute on the tag (see *Table 5. Tagset of Transitivity Analysis*). The CQP syntax query is shown as follows.

Query mode:	CQP syntax 🗸
Number of hits per page:	50 ~
Match strategy:	Standard V
Restriction:	None (search whole corpus) V
	Start query Reset query
P-attributes in this corp	us:
vord	Main word-token attribute
-010	main word-token attribute
pos	Part-of-speech tag(using PennTreebank)
lemma	Lemma
S-attributes in this corp	05:
(SFLC>	SFLC
<pre>cSFLC ProcessType></pre>	ProcessType
<pre><sflc_analysis></sflc_analysis></pre>	analysis
<pre>cSFLC_pattern></pre>	pattern
(text>	Text
<pre>ctext_id></pre>	Text ID
and a second of the second of the	
A-attributes in this corp	

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Figure 4. TAAS based search

<SFLC> a:[] []* </SFLC> :: a.SFLC analysis = "TS"

The above query can be used as a template. The users just need to change the attribute and value. The tag for SFL search is always SFLC. Thus, it does not require any modification. Below is the corpus data concordance of annotated corpus within TAAS.

1<	~~	>>	>1	Show Page:	1	2		Line view	Show in c	orpus order O	hoose action	- 5	
ło	Text	Solution 1 to 67 Page 1 / 1											
1	CR01	ears and continued to cry. "Carrie, "Desjardin supplied.						ed ,	Her.ever.flashed.a.simal			which Morton cau	
2	CR01	to their Period Two classes and the bell had been silenced ,						ed ,	Miss Desiardin employed the standard tactic for hysterics ;			She slapped Carrie	
3	CR01	could not interpret . "I'm sure she'll be all right , "						ц. ²	abe said .			"Carrie only has to	
4	CR01	been silenced , Miss Desjardin employed the standard tactic for hysterics :						C9 1	She alapped Carrie			ss th	
5	CR01			Are	ally sh	itty thing	. " None of them had ever h	ard	a teacher call anything	abitty before.	Chris Hargen	sen	
ş	CR01			A	Uthoug	th I can't	understand why her mother	1	The thought tra	uled off.	forgotten for	the	
1	CR01								Miss Desiardin cras	red her neck	around brief)	y.,	
1	CR01			Her silver w	hintle	dangled	between her small breasts , a	d if	her shorts were the ones she had	been wearing on Friday.	no trace of C	arri	
,	CR01			your pr	om tid	kets woul	ld have hit you where you lay	1	Desiardin con	tinged.	"Unfortunate	dy,	
0	CR01	Miss Desjardin craned her neck around briefly , and						and	(ahe.) alapped her. handa			e B	
I.	CR01	handly would have admitted the pleasure the act gave her , and						and 1	the certainly would have denied that she regarded Carrie as a fat.			flan	
2	CR01	admitted , she hardly had to ask . "That passes , "						i, "	Miss Deviardin said.			sha	
3	CR01	briefly , and (she) slapped her hands together once .						ce.	Her shorts were blinding white,			100 0	
4	CR01	slapped her hands together once . Her shorts were blinding white ,						ne ; her	her less not too curved but striking in their anobirmive muscularity			lin e	
5	CR01	in her face . "One more remark out of you , "						. ⁻	Desiardin said			TIL 1	
6	CR01			Desjardin	could	only look	at her helplessly . For a mor	ent	there was sil	ence.:	Morton and I	Desj	

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Figure 5. The concordance of annotated corpus within TAAS

4. Conclusion

This study aims to demonstrate the creation of the Transitivity Analysis Annotation Scheme (TAAS), how a corpus is annotated in XML format using TAAS and indexed into CQPweb. The results of this study show that users are able to search the annotated corpus using the TAAS tags in CQPweb. The quantity of this corpus is indeed small, as it is considered a new project in the Linguistics Department FIB UNDIP. Subsequent studies can be geared towards improving the quantity, by accumulating TAAS annotated corpus into CQPweb. In line with the aim of TAAS, this annotation scheme can also be combined with other analytical systems, such as Mood, appraisal, theme, etc. Thus, this research is sustainable for further research that discusses system analysis in SFL

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