

# TEXTUAL REDUCTIONISM: FROM ENGINEERING RESEARCH ARTICLES (RAs) TO THEIR SUBSEQUENT POSTERS

**Tharwat M. El-Sakran**

*English Department, College of Arts and Sciences, American University of Sharjah, United Arab Emirates*

E-mail: telsakran@aus.edu

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**Abstract:** Converting a Research Article (RA) into a poster is a complex, recursive reading-writing activity that can impose an overwhelming cognitive load on designers. This study contributes to a growing body of research which emphasizes the importance of designing clear academic posters. It proposes practical guidelines for academic poster design and contents. A total of 20 published RAs with their subsequent posters from the engineering field were analyzed to see what elements of the RAs were modified, changed or totally removed. Several software packages were used for this investigation. A correlation was found between the length of the RA and the amount of RA contents retained in the poster. Analyses also show that function words, the literature review section and the list of references were the main victims of heavy reductionism. However, comparisons of RAs and their related posters revealed that visuals were the least sacrificed textual items in the reduction process. It is proposed that poster contents may reflect the original RA structure with more emphasis allotted to new information in the research. Such a practice will help reduce the limitations that the poster space may impose on the contents, allow the poster presenter more freedom to use a bigger font size, and most importantly; interact and engage actively with the interested audience. The research concludes with limitations and recommendations for further research.

**Keywords:** *academic poster presentation; academic research articles; poster contents; poster design; textual reduction strategies; visuals in posters.*

## INTRODUCTION

Although poster presentations are not confined to single academic disciplines, be they hard or soft sciences, they seem to be widely used in the hard sciences (D'Angelo, 2011). D'Angelo (2011, p. 15) ascertains that "posters play ... an important part in scientific conferences and constitute a valid and interesting alternative to paper presentations by facilitating informal discussions between presenters and their audience". Research on poster presentations (e.g., EL-Sakran & Prescott, 2015; Hand, 2010; Rezaeian, Rezaeian, & Rezaeian, 2017; Tomita, 2017) has focused mainly on aspects of design and communication

benefits. For example, El-Sakran and Prescott (2013) report on the use of poster presentations by engineering students in a professional communication course, where the focus is on improving students' written and oral communication skills. They conclude that poster presentations prepare students for relevant community membership by getting them engaged in interactive tasks that they may do in the future when they participate in academic discussions/conferences. In another related study, Cianflone (2011) discusses professional and formal poster presentations delivered in conferences and how they allow

interactivity between presenter(s) and audience.

Along the same lines, Brandt (2009) argues that academic speaking skills can be better developed through poster presentations. She points out that poster presentations develop these skills better than Powerpoint presentations as Powerpoint presentations can have a negative, reductive, effect on presentation content. Rowe and Ilic (2009, p.7) mention that “a poster ... needs to provide clear navigation in either vertical or horizontal planes in order to provide a sequential logic”. They further add that the information provided in posters needs to be supplemented by some form of oral presentation, or author presence, to further communicate the content. In a similar vein, Gordon, Darbyshire, Saifuddin, and Vimalasvaran (2013) note that poster presentations have limitations in terms of communicating full research information.

D’Angelo (2010) carried out a preliminary multimodal discourse analysis of the main textual and visual elements of a corpus of 60 posters belonging to the disciplines of psychology, law and physics to find out the authors’ preferred visuals and communicative strategies. She rightly argues that “... posters need to condense their content within a very limited amount of space” (p. 16). Similarly, Swales and Feak (2000) recommend the employment of compressed language in posters to avoid textual density. Although much has been written in the form of sound general advice on poster design and layout and contents, the level of generality surrounding such guidelines can, and indeed do, confuse academic poster designers.

Hence, this study presents a comparative discourse analysis approach on the RA and its subsequent poster with the purpose of delineating the linguistic and non-linguistic differences between the two. Specifically, it aims to answer the research questions: 1) What are the current practices in selecting academic poster contents? 2) What are the textual differences, if any, between the RAs and their subsequent

posters? and 3) What are the most appropriate layout(s) and academic contents for a poster? Seeking answers to the questions is expected to make available practical and user-friendly guidelines for prospective academic poster designers and presenters.

## **METHOD**

A total of 20 engineering RAs, already published and publically available online, and their corresponding academic posters were used for this exploratory study. The corpus was personally culled from colleagues who applied for conferences to deliver oral presentations, but were instead asked by the conference organizers to give a poster presentation. All RAs and their corresponding posters had a minimum of three authors’ names on them. The authors’ nationalities ranged from Arabs, Indians, Canadians, Americans and British. The data, each individual RA and its related poster, were fed into the analysis tools, saw below for details, for an examination of their similarities and differences.

Several software packages were employed to help find answers to the research questions. These were: 1) Safe Assign; 2) Coh-Metrix; and 3) Lexical Density.

First, Safe Assign was to determine the similarities/differences between the poster and its related RA, the poster was submitted to the Safe Assign software at the academic institution the researcher works for. Safe Assign was one of Blackboard Products. It was utilized in this research to verify the extent of any textual matching between the RAs and their related posters. A matching percentage of 30% and above was taken as an indication of a copy and paste process.

Second, Coh-Metrix was a publically accessible computational instrument for natural language processing developed at the University of Memphis (Wang & Cho, 2010, p. 509). It provided 54 indices that measure the cohesion, coherence, readability, and language of text and discourse. It was applied to the collected RAs and their subsequent

posters for the identification of textual differences/similarities between each individual RA and its related poster. It was also used for measuring the level of narrativity in the data. This measure was used to explain differences, if found, between the level(s) of narrativity in the RA and its related poster, which may help account for textual reduction strategies and their effect(s) on texts. Narrativity as used here means that the RA or poster was more or less-story like in the sense that the more reductions the text was subjected to, the less narrativity it demonstrated and the more difficult it became to comprehend it and vice versa. As for syntactic simplicity, this meant that the texts examined had simple sentence structures, which enhance the creation of cohesion. By contrast, the syntactic complexity measure indicated the presence of cohesion gaps that require the reader to make inferences, which could be challenging and unsuccessful without sufficient prior knowledge.

Moreover, several other Lexical Density (LD) measures were used to distinguish between the RAs and their related posters. If those measures showed same or close LD between a RA and its related poster, this meant that the poster was a mere copy and paste process. On the contrary, if they showed a richer LD in the poster, compared to its related RA, then this was an indication that the poster had been subjected to heavy text reduction. LD as used here “provides a measure of the proportion of lexical items (i.e. nouns, verbs, adjectives and some adverbs) in the text (Johansson, 2008, p. 61). LD was calculated by counting the number of lexical words (or content words) divided by the total number of words. Lexical words give a text its meaning and provide information regarding what the text was about. Other kinds of words such as articles (a, the), prepositions (on, at, in), conjunctions (and, or, but), and so forth were more grammatical in nature and, by themselves, give little or no information on what a text was about.

There were two of the Lexical Density measures were: 1) *Textalyser* was an online text analysis tool for the analysis of LD and readability. It was applied to the data with the hope that the yielded results would help corroborate results obtained from other analysis tools; and 2) *AntConc Software* was a freeware corpus analysis toolkit for concordances, word frequency and text analysis. It was used to compare between frequencies of words in the RAs and their relevant posters.

Since all of the aforementioned tools were insensitive to the visuals used in the RA and its related poster, the examination was conducted manually by calculating the percentage (i.e., number) of visuals used in the RA and how much of that percentage was used in the poster.

Other external features (i.e., the layout of both the RA and the poster) were manually compared.

## RESULTS AND DISCUSSION

Examinations of the RAs and their related posters point to the existence of more similarities rather than differences, which proved resorting to the copy and paste process when transforming the RA contents into a poster format. Uploading the academic posters on the Safe Assign software yielded the matching percentages ranging from 100%, the highest, to 29%, the lowest. What follows was an illustration of exact copy and paste from RA 1 to Poster 1:

### *Extract from RA 1*

*The use of as-built building models and 3D mapping technology is widely acknowledged and researched in the architecture, engineering and construction (AEC) community. Although, in the past, novel methods of acquiring building model data has been identified to be labour-intensive, strenuous and time-consuming[1]. Traditionally, methods of acquiring data have been done through the use of terrestrial laser scanners and photogrammetric methods. Facilitating a more efficient method of creating as-built models has led*

researchers to automating the process, which has been proven effective. Photogrammetric methods, such as modelling from images and video, are more portable and convenient when compared to laser scanners. Pollefeys et al. (2011) developed a processing pipeline that constructed a 3D model from hand-held cameras.

**Extract from Poster 1**

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The second test applied was to measure the differences/similarities in syntactic complexity/simplicity and narrativity between each individual RA and its related poster. The indices, syntactic simplicity/complexity, showed that posters exhibited more similarities, or near similar percentages of syntactic simplicity/complexity, rather than differences with their related RAs. In support of this, the statistical analysis for syntactic simplicity/complexity indices showed a strong positive correlation (correlation coefficient = 0.665 with p-value  $\leq$  0.001) between the RAs and their related posters as a result of the copy and paste process. The same strong positive correlation (correlation coefficient = 0.537 with p-value = 0.015) existed between the posters and their related RAs when tested for narrativity.

As for the readability for the posters in comparison with their related RAs, there was

no significant correlation (correlation coefficient = -0.018 with p-value = 0.940) between the RAs and the posters in terms of readability, which might attest to the presence of the copy and paste process. Nevertheless, calculating all percentage averaged for RAs and posters for readability, used 2 sample t-test, results showed statistically significant differences between the averages (t = -3.36, df = 33, p-value = 0.002), which might account for the fact that some RAs, especially lengthy ones, were shortened to make them fit into the poster space. Such a practice had led to statistically significant differences (t = 4.62, df = 29, p-value < 0.001) in LD, making these specific poster contents richer than their related RAs. It was also noted that RAs subjected to heavy deletions made their related posters text less readable in comparison with the RAs they are derived from. In such cases, function words (i.e., the, of, and, at) were the main victims for this heavy reductionism strategy. For example, some occurrences of 'the' (358 times in RA 4) were drastically reduced to 22 cases in the poster. In support of the above, results generated from applying the AntConc Software showed that the more frequent items in the RAs were function words (i.e., the, of, and, for, etc.) whereas for posters, content words (specific technical keywords related to the research topic) were the most frequent as demonstrated in the example below:

**Extract from paper 9**

*Based on the results of this study it can be concluded that: 1) The results for both single shear pullout specimen and flexural prism were comparable when considering modeled data versus obtained experimental data; 2) Despite the slight difference in the results, the models' behavior, has shown to be matching the experimental bond behavior especially in the flexural prisms; 3) Slip phenomenon was observed in the single shear pullout specimen model, which further verifies the efficiency of simulating bond behavior in the developed FE model; 4) Flexural prism model and experimental*

*ultimate load and corresponding deflection data were close to each other at failure, and in both cases the prism behaved elastically; 5) Variation of ultimate deflection value when comparing modeled and experimental single shear pullout specimen, could be due to experimental setup error, machine errors, or normal stiffness factor that is defined in the model's contact region; and 6) The developed and validated FE models could be used as a platform to conduct parametric studies.*

#### **Extract from Poster 9**

*Single pullout shear model and experimental specimen achieved comparable results  
Slip phenomena deflection was observed  
Variation in load graph  
Experimental error  
Machine irregularities  
Normal stiffness factor  
Flexural prism model and experimental specimen achieved closely similar results at failure  
Both the flexure model and experimental specimen behaved elastically*

As for comparisons of word frequencies for the RAs and their related posters, it was noted that posters of same text lengths as the RAs they were based on had same word frequencies and concordances. An example of this was poster 1, which had the following lexical and function words as the most frequent ones- Zed, crack detection, measurement, surface, the, of the , from the, it is- as its related paper. Furthermore, frequencies of occurrences for some content words were reduced by limiting the occurrences of same word type(s). For instance, the word "Parkinson's" in paper 4 was used 17 times, whereas in the poster its use was reduced to 5 times. Also observed that the two sections of the RAs where this process took place, the most, were the literature review (LR) section and the list of sources. In the latter case, the numbers of references in the poster were drastically reduced to less than one third of the total supplied in the RA, or even more. But, the poster, being an academic product, still

retained some sources. The striking reduction was found in the LR section, which was totally removed from the poster as illustrated in the following example:

#### **Extract: LR section from RA 10**

*Several FE investigations were performed to investigate the flexural and shear behavior of RC members where researchers would study stiffness response and stress/strain contour plots [17–20]. [18] studied the effect of plate debonding and performance of RC beams externally strengthened with bonded Carbon FRA (CFRA) plates. Nonlinear FE models expressing six beams were simulated, where results like the load–midspan deflection were in close agreement those of the experiment. In addition, a parametric study was conducted to study the impact of bar diameter and arrangements of the CFRA U-wraps on the beams' flexural capacity. As a result, the increase in bar diameter lead to an increase in the load capacity of the beam and a reduction in the ductility, and wider CFRA wraps aimed to delay the debonding which induced a more ductile specimen without impacting the load capacity of the beam. Other researchers utilized FE modeling to account for temperature effects on FRA composites and developed FE models to simulate insulated CFRA-strengthened specimens using experimental data [21, 22]. This provided an alternative to exhausting resources and funds for expensive experimental investigations. Abu-Obeidah et al. [20] conducted a nonlinear FE analysis of strengthened simply supported RC beams with AA plates, obtained from [4], targeting shear response. The experimental program included four RC strengthened beams in shear subjected to a four point bending test until failure. A parametric study was conducted to study the strip spacing and orientation of the AA plates. The five FE models were validated by comparing the load-deflection response curve of the numerical results to the experimental results. The results show that the developed FE models generally tend to overestimate the load-carrying capacity and*

*underestimate the ultimate mid-span deflection.*

**Extract: LR section from Poster 10**

*None*

As regards visuals, it was noticed that all types of visuals (i.e. graphs, pie charts, diagrams, etc.) were heavily populated in the RAs and their related posters. They were copied from the RA and pasted into the poster in the case of short length RAs, although some were sacrificed when the RA was lengthy. In these specific cases, only visuals portraying a new design, model, results, or process(es) were included in the poster. However, it was observed that the verbal texts had undergone more reductionism than the visuals used in the research.

An example of this was poster 8 where the most highly frequent word was the item “figure”, used 15 times. In other words, verbal text was reduced by 84.2% whereas visuals were only reduced by 14.3%. In some cases, visuals in the poster were more than the mother RA. An example of this was RA 10, where only 9 visuals were used, compared to 15 visuals in its subsequent poster. Looking into reasons why, it was found out that some of the processes verbally presented in the mother RA were presented as visuals in the poster. This procedure had also reduced the poster’s narrativity index to 0%. A second example was poster 17, which was mainly composed of visual items copied from the mother RA. It seemed that this process had drastically reduced the LD and narrativity measures. A third illustration was from RA and poster number 10, where all the verbal text in the results section in the RA was sacrificed in the poster.

Another text reduction strategy adopted was the use of word initials. For instance, poster 7 made 8 uses of the initials NTU, standing for Nephelometric Turbidity Units, whereas full words were used in the RA. The same strategy was used in posters 5, 9 and 12. Comparisons between the RAs and their subsequent posters showed that the longer the original RA was the smaller the matching percentage. This was justified because the

authors had to remove parts or big text chunks from the mother RA to make its contents fit into the poster size. Although this text reduction strategy had reduced the matching percentage, yet; the percentage was still indicative of strong matching relationships. Along the same lines, it was also observed that the shorter the original RA was, the higher the matching percentages. It was obvious here that the small size of the original RA tempts authors to copy from the mother RA into poster.

In three such cases, the matching percentages were 100%, 97%, and 93%. This was further supported when texts’ narrativity and syntactic simplicity/complexity were checked. Individual poster texts with more deletions had exhibited higher syntactic complexity and less narrativity than the related RAs. Likewise, posters with more deletions demonstrated more LD and less readability than their mother RAs and posters with more LD, more syntactic complexity, less narrativity and less readability might have been impacted by heavy deletion of function words and the disappearance of the LR section.

This heavy LD of some posters might also be a result of the reductions that happened in content words. For instance, in RA 3 the noun “fractions” came first (19 times), whereas in the poster it occurred 5 times only. Thus, LD might be a byproduct of reductions in the word token and increases in word type(s), lexical diversity (Alami, Sabbah & Iranmanesh, 2013; Gregori-Signes & Clavel-Arroitia, 2015). In all cases of text reductions, function words were the most heavily affected since, according to Gee (2011):

“They carry less of the real content of the communication (their job being to signal the grammar of the sentence), we can say that they tend to be *informationally less salient* than content words. While they are certainly helpful, they are often dispensable, as anyone who has written a telegram knows. Thus,

function words are usually informationally less salient than content words” (p. 130).

This seemed logical as the main objective of the poster presentation was for presenters to interact with audience, supply the needed information, and create cohesion and coherence among the ideas recorded on the poster. The second and third most highly impacted text chunks affected by the deletion process were the LR section and the academic sources/references used, especially in the cases of heavily reduced texts. Since the LR section tends to be in the more narrative side, that was, reviewing relevant research on the topic, which might increase the sense of narrativity in the RA and reduced it in posters when subjected to deletion or reduction. The references section was another victim of reductionism as the posters only display full details of the sources cited on them.

As regards the use of visuals, in addition to purely textual elements, engineering disciplines exploit the visual dimension, which was "an intrinsic and inseparable part of engineering" (Ferguson, 1992, p. 47). As Markel (1994) observes "many technical people, especially scientists and engineers, think visually rather than verbally" (p. 87). Visual language reflects an instrumental orientation to technology reflected in images and text (Taha & EL-Sakran, 2014). In support of this, comparisons of RAs and their related posters revealed that visuals were the least sacrificed textual items in the reduction process. It was found out that visual items closely related to the focal point of the research were maintained in the posters and vice versa, an observation that might lend some validity to Hess, Tosney, and Liegel's (2009, p. 319) viewpoint that "posters comprise primarily visual displays of data with just enough supporting text to provide context, interpretation, and conclusions." From the above, it might be concluded that there was an inversely proportional relationship between the mother RA and its related poster. That was, the closer the poster

contents were to its mother RA, the more identical their characteristics would be, and the less similar they were, the more LD, syntactic complexity and less narrativity the poster exhibits in comparison with the mother RA.

As for the layout and academic contents of the RAs and their subsequent posters, it was noticed that more than 85% the RAs adopted Swales' (1990) IMRD pattern (Introduction, Method, Results, Discussion) and that the posters mirrored the same design with same RA information details. Worthy of note here was that poster designers should know that posters might reflect same rhetorical structure as the RAs with varying degrees of prominence, since this hinges on the research objective/focus. Take this example: if the whole RA dealt with a new method, then the methodology section on the poster should be given more prominence by providing bullet point descriptions of the tool(s) and procedures adopted. An advantage of such a practice was that it would allow the presenters more poster space so that they could use a bigger font size that could be clearly viewed and read by all audience, regardless of their eyesight abilities. Furthermore, listing only key bullet points could be a direct invitation to onlookers/audience to ask for details, which would bring about the desired interactivity between audience and presenters that, as Hess, Tosney, and Liegel (2009) noted that the main aim of the poster presentation. The same bullet point technique could be applied to the rest of the sections. If, in other cases, the focal point of the research was the results section, then, more coverage in the poster should be allotted to this section and other sections could be reduced to the minimum; said one bullet point item, for example.

## CONCLUSION

This research proposes that poster contents may reflect the original RA structure with more emphasis allotted to new information in the research. That is, the research's focal point, what is new? should be given more focus than the other sections in the research.

Such a practice will help reduce the restrictions that the poster space may impose on the contents, allow the poster presenter more freedom to use a bigger font size, and most importantly; interact and engage actively with the interested audience. Doing so, will, hopefully serve to encapsulate the research topic in the minimum number of words/bulleted points, attract the audience to the poster and, compel them to inquire by asking questions.

Although all the evidence obtain in this study corroborates the conclusions reach in earlier researches that the poster is a mere copy and paste of the whole research or parts of it, yet; the small sample uses for this research, being collected from one educational institution and one academic discipline, may not be reflective of all practices. Thus, future research may consider analyzing a bigger sample and seek the perceptions of the poster designers about the factor(s) that may, sometimes, compel them to reduce texts for the poster and what parts of texts are sacrificed. Furthermore, considering the small corpus of RAs and their related poster examined (40; 20 RAs and 20 posters), the results may not be generalizable to standalone posters, those that are meant for audience to read on their own. Future researcher may also consider analyzing a bigger corpus of RAs and their related posters from specific academic disciplines and examine variations within disciplines. As the data for this study are collected from several engineering disciplines, the small number of RAs and their subsequent posters do not enable the researcher to investigate any possible variations within the disciplines the data are culled from. Other ethical and academic integrity issues, such as publishing same research twice, may be explored.

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