

# Announcement of the principal findings and value addition in Computer Science research papers

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## Abstract

This paper presents a rhetorical analysis of the Introductions of Computer Science (CS) research articles from a specialized corpus with reference to “Announcement of Principal Findings” and “Statement of Value” steps within the framework of the “Create A Research Space” (CARS) model (Swales, 2004), conducted through corpus-based techniques. The results show that discursual practices in CS are result-oriented and in various ways highlight the writers’ contribution. The results are explicitly described with embedded “value” statements in the elaborate explanations of the nature of the present research. The common linguistic indicators used for this purpose are “contribution”, “efficient” and “novel”. The discussion concludes with the suggestion to amend the CARS model for CS writers.

**Keywords:** corpus-based genre study, computer science, introduction, value addition, findings.

## Resumen

### *Anuncio de los hallazgos principales y declaración del valor de la aportación en los artículos de investigación en el área de informática*

En el presente trabajo se realiza un análisis retórico de los apartados de introducción que figuran en los artículos de investigación del área de informática, partiendo de un corpus especializado, y haciendo hincapié en los pasos “anuncio de los hallazgos principales” y “declaración del valor de una aportación” contenidos en el ya conocido modelo CARS (*Create a Research Space*) de Swales (2004). Los resultados demuestran que las prácticas discursivas en el área de informática están orientadas a los resultados, resaltándose de diversos modos la contribución que realizan los autores de los correspondientes artículos. Se describen de forma explícita los resultados entre los que destacan las

declaraciones de valor como parte de explicaciones elaboradas relativas a la naturaleza de la investigación en curso. Los indicadores lingüísticos que se emplean en la presente investigación son “contribución”, “eficaz” y “novedoso”. Las conclusiones alcanzadas sugieren la necesidad de modificar el modelo CARS de forma que se ajuste a la práctica habitual de los autores que publican en el área de la informática.

**Palabras clave:** estudio de género basado en corpus, informática, introducción, valor de la aportación, hallazgos.

## 1. Introduction

The element of “selling” (Bhatia, 1993), “marketisation” (Fairclough, 1993) and “boosting” (Lindeberg, 2004) has gained immense popularity despite the advice of Hyland (2001) and Myers (1989: 4) that a “researcher must always humble himself or herself before the community as a whole”. Using the analogy of operating businesses with universities to sell their products, Fairclough (1993 & 1995) uses the notion of “marketisation” of research. This is called “quasi-advertising discourse” (Lindeberg, 2004) because the authors “have to “sell” their research reports” (Bhatia, 1993: 98). Discussing the concept of “surprise value in scientific discourse” and “news value”, Berkenkotter and Huckin (1995) report an increase in the statements of the main findings in the journal articles which foregrounds the newsworthy information. However, the research work in the area of “rhetorical promotion of oneself and one’s paper” (Hyland, 2000: 175) in Computer Science (CS) research articles is scarce and is mostly limited to the usage of personal pronouns for self promotion (Kuo, 1999; Shehzad (2007b) although rhetorical moves in CS research articles have been discussed by Cooper (1985), Anthony (1999 & 2001), Posteguillo (1995 & 1999), and Shehzad (2006, 2007a, 2008).

The present paper argues that Move Three of the Introduction of a research paper serves as the promotion strategy, especially the step regarding the “announcements of principal findings” and “stating the value of the present research”, which are the optional steps of the CARS model (Swales, 2004; and Swales & Feak, 2004). Unlike the “unifying principal of skepticism for the scientific culture that determines the value of research” (Zobel, 2004: 4), Computer scientists report the findings of their research candidly and firmly as well as with added value. This demands obligatory inclusion of these steps in the rhetorical move model.

## 2. Literature review

Rhetorical moves in specialized communication have been widely studied (Hopkins and Dudley-Evans (1988), Swales (1990), Salager-Meyer (1990), Bhatia (1993), Hozayen (1994), Dudley-Evans (1995), Williams (1999), Lewin, Fine & Young (2001), Swales and Feak (2004). Each move in an Introduction has its own typical intention that contributes to the achievement of the overall purpose. A writer may use rhetorical strategies to fulfil the communicative intention at the move level. This cognitive structuring can be compared to the schematic structuring in schema theory. Both are similar except that the former is the conventionalized and standardized organization used by almost all the members of the professional community and the latter is often a reader's individual response to the text in question (Bhatia, 1993).

Objectivity in the presentation of technical claims has been recommended by a number of style guides such as Barras (1978), Day (1979), Hamp-Lyons and Heasley (1987) and Zobel (2004) but more recently, scholars such as Pérez-Llantada (2003) emphasize the need for a redefinition of the “classical” objectivity sought in specialized discourses. An increased frequency in the statements of results in the Introductions of 66 articles from *Physical Review* was found by Swales and Najjar (1987) –from 36% in 1943 to 55% in 1983. Not so different are the results of Berkenkotter and Huckin (1995) in 350 journal articles of *Biological sciences* (56% in 1944 to 76% in 1989) which imply an increasing likelihood of the inclusion of statement of the authors' main findings. Swales and Feak (2004) based on Swales (1987) study, claim that physicists do this half the time whereas educational researchers hardly include such statements. For the rest they leave it open and suggest following the standard practice in their fields. One guideline, however they give, is not to duplicate findings if the research paper opens with an abstract. The present study seems to nullify this advice for Computer scientists as all the research articles under investigation opened with abstracts and yet had the explicit descriptions of their findings.

Presence of promotion in scholarly discourse has been discussed by many scholars such as Swales (1983), Bhatia (1993), Huckin (1993), Fredrickson and Swales (1994), Berkenkotter and Huckin (1995), Fairclough (1995), Hyland (1997, 1998 & 2000) or Lindeberg (2004); however, research work in this regard in the discipline of CS has been limited to few studies such as Anthony (1999) and Posteguillo (1999), which have contributed significantly

to the understanding of this discipline: Anthony (1999) was limited to Software Engineering papers and later worked on CS research articles' titles; on the other hand Posteguillo concentrated on the overall structure of CS research article. Similarly, in earlier works I presented a comprehensive analysis of the realization of Move 2 in CS and discussed the "outlining structure" step of Move 3 (Shehzad, 2007a & 2008), leaving a gap in our understanding of how the rest of Move 3 is realized for the promotion of one's research findings. Thus, this paper is a step forward in this direction as it draws on the corpus-based techniques to identify and analyze the strategies used by Computer scientists in the realization of rhetoric moves. Moreover, as compared to the earlier works, the present study presents the genre analysis of a larger corpus (56 articles from 5 different CS Journals) as compared to Anthony (1999) who used only 12 papers and Cooper (1985) who used 15 papers (from Electrical and Electronics Engineering – part of CS at that time) in their corpora.

### 3. Methodology

The present study involves both qualitative and quantitative methods of analysis. For the quantitative analysis WordSmith Tools (Scott, 1997 & 2001) including Wordlister and Concordance were used, and for the latter Swales (2004) CARS model and its pedagogical application by Swales and Feak's (2004) served as a means of entry into the rhetorical analysis. Shehzad's Computer Science (SCS) Corpus (Shehzad, 2006, 2007a & 2008) based on 56 Computer Science research articles from five different journals (11 articles from each journal, 12 from KDE) published by the Institute of Electrical and Electronics Engineers (IEEE) was used. The journals included: *IEEE Transactions on Computers (ToC)*, *IEEE Transactions on Pattern and Machine Intelligence (PAMI)*, *IEEE Transactions on Software Engineering (SE)*, *IEEE Transactions on Parallel and Distributed Systems (PADS)* and *IEEE Transactions on Knowledge and Data Engineering (KDE)*.

Three features of a well constructed representative corpus, including genre, topics and demographics as proposed by Reppen and Simpson (2002) were considered for the creation of this Corpus. It was representative as it included articles from five major journals in the target field and also because of high academic standing of the publisher reflecting the publications' soundness. It also covered a wide range of topics. The Corpus of 0.54

million words was created after the clean up of graphics, visuals, formulae, algorithms, captions, foot notes, running titles of the journals on each page, page numbers, bibliographical information, references, and the email contacts.

There are three moves in CARS (Swales, 1990 & 2004; and Swales & Feak, 2004) though the steps in each move are slightly different in the Swales and Feak's pedagogical model; and each move has been further divided into optional and obligatory steps. Swales (1990) using somewhat combative terms, explains the whole process of writing a research paper introduction as follows:

The need to reestablish in the eyes of the discourse community the significance of the research field itself; the need to 'situate' the actual research in terms of that significance; and the need to show how this niche in the wider ecosystem will be occupied and defended. (Swales, 1990: 142)

The last part of this process along with four other steps includes two rhetorical stages, "Announcing Principal Findings" (APF) (probable in some fields) and "Stating Value of the present research" (optional in nature). These two steps; statement of the major findings/ results and the contribution this research will make are investigated here to understand their rhetorical usage by Computer scientists to "defend" the "niche" established in the Introductions of the research articles (Shehzad, 2008) and to propagate it amongst the discourse community. Another difference with my earlier works is a detailed description of what goes on when Computer scientists realize this step.

## 4. Results and discussion

After a general comparison of the results of some earlier studies, I discuss the salient features of "Announcement of Principle Findings" followed by "Statement of Value". Both include identification and explanation of the strategies used by the writers in this field along with examples from the Corpus. A note on the linguistic sign posts applied in the attainment of the major goal of occupying the niche through the above steps is also given.

An increased trend in the documentation of Principal Findings in the Introductions of research articles was indicated by Swales and Najjar (1987) and Berkenkotter and Huckin (1995). As compared to Physics (Table 1),

there is definitely a marked increase in the reporting of CS findings. However, there has not been much change in this trend over the last decade which shows that Computer scientists still adhere to this trend.

Studies	Discipline	Percentages
Swales and Najjar (1987)	Physics	55%
Posteguillo (1999)	CS	70%
Anthony (1999)	CS	75%
Present Study	CS	73.21%

Table 1. Comparative studies of APF.

Table 2 shows this trend further.

Journal	Occurrence of APF	Percentages
KDE	10	24%
PADS	9	22%
ToC	8	20%
PAMI	7	17%
SE	7	17%

Table 2. Journal-wise occurrence of APF.

PAMI and SE had the same percentages but lower than ToC and PADS respectively. KDE with 24% showed the highest percentage regarding the inclusion of this step.

Berkenkotter and Huckin (1995), comparing RAs with newspapers, comment that people skim and scan to get the information quickly, skipping the later sections. Posteguillo (1999) uses this argument to explain the trend of incorporating main findings at the beginning of the articles. He found 70% application of the APF and reports that this tendency produces papers whose first section is named “Introduction and results”. Contrary to this view, none of the articles’ first section in the present study was found with this heading. One exceptional example was a subheading within the introduction that said; “1.2 Our Contribution”, but even this was the second subheading in the Introduction.

#### 4.1. Features of APF

The following features of APF can be instrumental in understanding the rhetorical and discursual intentions of CS writers.

#### 4.1.1. Explicit announcements

Rather than waiting for the reader to reach the results section of the article, Computer scientists make explicit announcements of their major findings most of the time in the Introduction itself. Consider examples (1) and (2) related to APF as extracted from the SCS Corpus.

- (1) *We have developed a method* to generate random adhoc network graphs for simulation purposes. *Our results show* that for small multicast group sizes, our core selection method can result in tree costs which are at most 20 percent more expensive than .... (INTR 37)
- (2) We performed an extensive series of experiments comparing (...) *The results uncover* an interesting trade-off between the cluster quality and the running time (...) However, our algorithm took more time to find its better answers. In our experiments with real data, *we found* that our stream technique has clustering quality comparable to the clustering quality of running the algorithm on all the data at once. We also compared (...) and *found* a similar trade off between cluster quality and running time. (INTR 54)

However, instead of using the words “results” and “findings” for their own work all the time, they prefer the use of phrases such as “We have developed a method”, “Our results show”, “We demonstrate” and “Our contribution”. Moreover, the use of pronoun “we” foregrounds the writers’ personality as discussed by Shehzad (2007b) which matches their style of “value addition” to their findings.

#### 4.1.2. Embedment with Move 3, step a.

Although APF has clearly defined realizations as seen in the examples (1) and (2), many a times APF seems to be part of Move 3, step a, where the authors explain the nature of present research. Findings often look like part of the descriptions of the present research and it becomes difficult to differentiate between them. In the CSC corpus, 19.51% of the occurrences of APF in the Introductions are embedded with Move 3, step a. thus foregrounding the present contribution at an early point rather than introducing it towards the end of the Introductions. In example (3) , the phrases “We define”, “We demonstrate” and “Our synthesis algorithm ... translates...” can be taken both, as stating the nature of the present research (Move 3 step a) and as APF, followed by a statement of the value of this research, “This integration is important”:

- (3) *We define* an MSC language with sound abstract semantics in terms of labeled transition systems and parallel composition [32] (...). In particular, *we demonstrate* how this can be done for two different scenario synthesis algorithms. *Our synthesis algorithm*, which is integrated into LTSA [32], translates a scenario specification into (...) FSP specification [32]. (...) *This integration is important* in terms of our more general objective, which is to facilitate the development of behavior models in conjunction with scenarios. (INTR 26)

Similarly in example (4), description of the MVS system and an explanation of its characteristics is another reflection that step a, is conflated with step b.

- (4) This paper *introduces* the multiview storage system. MVSS *offers a single framework* for accommodating migration of different services to active storage devices based on existing file system and disk interfaces. *Multiple views of a file are provided* to users through the file system namespace. Different views of a file can be tailored to provide different types of service. Through these views, *MVSS provides a flexible and extensible way* for supporting various device-level enhancements. *MVSS has the following combination of characteristics. It uses* (...) widely used in today's systems. *This allows it to support* a wide range of heterogeneous platforms, and allows the simplest reuse of existing file system and operating system technology. *It provides a scheme* to separate the deployment of services from file system implementations and, *thus, allows* migration of application-specified processing to devices to realize active disks.. *It can be built* on existing systems (...) *It allows applications* to take advantage of new services transparently. (INTR 46)

### 4.1.3. Contribution

Along with the phrases mentioned above, authors of CS research articles also use the word “contribution(s)” to report their significant findings. This act encompasses 12.19% of the total occurrences (73.21%) of this step. It should be noted that when they mention their contribution(s), they are more organized and conscious of the metadiscourse as in example (5) with the sequence markers highlighting their contributions.

- (5) This paper makes *three important contributions* in the field of mobile-agent-based computing systems. *First*, it studies the interagent communication and synchronization requirements of Internet applications and proposes (...) *Second*, the paper proposes a new type of synchronization (...)

*Finally*, this paper provides an actual implementation of all of the models and analyzes them based on (...) performance. *In addition*, it describes different ways of constructing ... (INTR 39)

The authors' "boosting" of the model designed and a new type of synchronization mechanism is followed by the "boosting" of the implications of the contribution. "Boost", which I call "value addition", is the promotional term used by Lindeberg (1994) for the positive assessment of contribution and step 6 of Move 3 in the CARS model.

Another example of contribution (see example (6) below) shows sequence numbers and formatting used to feature the focal points of their disquisition.

- (6) This paper *contributes* to the aspect-oriented analysis and design of middleware architecture in the following ways:
1. *We show* that middleware architectures inherently suffer from (...)
  2. Our aspect analysis is based on (...) *We develop* (...) methodology and a software tool to exercise this methodology.
  3. Through (...) *we report several new aspects* that are specific to (...)
  4. *We are the first to perform* (...)
  5. *We quantify the benefits* of (...) by applying a set of software engineering metrics to the original and the refactored implementation. From this evaluation, *we show* that aspect oriented technology lowers (...) (INTR 47)

In this example of APF, the "boost" addresses the superiority of the "aspect-oriented analysis and design of middleware architecture". Here, the value of the contribution is explicitly expressed along with the contribution itself through phrases such as "We are the first to perform", "We quantify the benefits", "We report several new aspects" and "We develop (...) methodology and a software tool to exercise this methodology".

#### **4.1.4. Problem/solutions as principal findings**

Sometimes, the authors of CS discourse write about the problems (which could be Move 2) but then offer a solution to these problems turning them into announcements of their findings. For example:

(7) Our study of CPM reveals the following problems: (...)

*To address these problems, we propose a choice relation framework to support CPM. Our framework includes the following features: (...) a more rigorous approach for representing different types of constraints (...) consistency checks of specified constraints among choices (...) automatic deductions of new constraints among choices whenever possible, and (...) a more effective test frame construction process. (INTR 31)*

In this example, the “boosts” are explicitly anchored in the attribution of the shortcomings and problems in the previous research. Phrases such as “a more rigorous approach” or “a more effective test frame” are used for this purpose.

#### 4.1.5 Linguistic indicators used for APF

This widespread use of the announcements of principal findings was further studied through a Concordancer. The main indicators found are shown in Table 3 as well as hits quantified in the SCS corpus as having an APF usage. These are discussed in depth below.

Indicators	Hits in SCS Corpus	Usage as APF
(a) Contribution	7	6
(b) Results	64	5
(c) Findings	6	2
(d) We have found	1	1
(e) We found	1	1
(f) We have discovered	1	1

Table 3. Indicators used for Move 3, step c.

(a) “Contribution”

The dominant indicator here is “contribution” in contrast to “results”, which was expected to have higher number because of its common usage. Computer scientists enjoy writing about the contribution their work has made or is going to make in their field. The adjectives used with the word “contribution”, as found in the Corpus are shown in Table 4.

The last phrase “Our contribution” has also been used as a sub-heading in one Introduction indicating the writers’ fondness and preference for this word. The concordance hits page for the lexical indicator “contribution” is given as a sample in the appendix to this work.

Adjectives	Noun Phrase
The actual	contribution of this work
Another	contribution of our work
The first	contribution of our work
The fundamental	contribution of this paper
Our key	contribution is an ...
The main	contribution of the paper
Our	contribution

Table 4. Adjectives used with "contribution".

## (b) "Results"

Although the use of the word "results" to express main findings in CS research article Introductions is low (contrary to my expectations), it has been used for APF. Some examples are as follows.

- (8) Our experimental *results* are summarized as follows: When compared to the baseline version of (...) our heuristic approach (...) (INTR 1)
- (9) Our *results* show that for small multicast group sizes, our core selection method can result in tree costs (...) (INTR 37)
- (10) The *results* uncover an interesting trade-off between the cluster quality and the running time. (INTR 54)

It is interesting to know why an important lexical item like "results" has been used only five times for the reporting of principal findings despite having a great number of concordance hits (see Table 3). A detailed look at the concordances reveals that out of 64 entries, 34 have been used in the outlining structure, step e of Move 3. Eight entries of "result" refer to the earlier studies in the literature review step, five to the value statements and eleven are used in a more general sense or used as verbs.

## (c) "Findings"

Both the instances of the lexical item *findings* in the SCS Corpus occur in the same introduction.

- (11) The consequences of our *findings* cast doubts on the results of all studies that have relied on MMRE to compare the accuracy of predictive cost models. (INTR 35)
- (12) The *findings* suggest that MMRE is an unreliable selection criterion; in many cases, MMRE will select the worst candidate out of two competing models ... (INTR 35)

(d) “We have found”, and (e) “We found”

There was one example (see examples (13) and (14)) found for each of the phrases: “we have found” and “we found”.

- (13) By comparing centralized and distributed control schemes, *we have found* that, although in some cases (...) *it has three major advantages that make its use preferable: (...)* (INTR 40)
- (14) In our experiments with real data, *we found* that our stream technique has clustering quality comparable to the clustering quality of running the algorithm on all the data at once. (INTR 54)

(f) “We have discovered”

The only example of the phrase “we have discovered” found in the corpus is given in example (15).

- (15) *After a thorough and detailed study* of which only a small part can be reported here, *we have discovered* centralized and distributed schemes that not only achieve good results, but also guarantee stable performance. (INTR 40).

Here, the phrase “thorough and detailed study” is used to highlight the value of the work. The minimum usage of the lexical item “discover(ed)” suggests that they avoid using this word, most probably because a discovery has an element of chance whereas Computer scientists lay a great emphasis on projecting what they have made, designed and developed.

While “establishing the niche” takes the form of contrasting two or more conflicting research streams we can deduce from these examples that “occupying the niche” in CS takes place by offering a richer approach/solution/method (Locke & Golden-Biddle, 1997). The explicit announcements of the principle findings in the introduction of CS research paper reflect the greater need of the scientists to attract their audience towards crucial elements such as what they have designed, the development of a method, the working out of an algorithm, the achievement of the desired efficiency of a certain system and increased productivity, etc. This deliberated mention of their achievements and contribution acts as the sensational news headline which makes viewers sit in front of their TV sets for a long time to follow the detailed accounts of the story.

## 4.2. Value in relation to APF

CARS (Swales, 2004) considers it to be helpful at this stage to mention something about the contribution that the research carried out by the scholars would make as the “decisions have to be made about the winsomeness of the appeal to the readership” (Swales, 1990: 137). Since the earlier model (Swales, 1990) excluded this step, it is missing from the studies of Posteguillo (1995 & 1999) who used the 1990 model as a reference. Anthony (1999) on the other hand created a new step “Evaluation”. In evaluation, the present research is almost always evaluated, positively and on the bases of the applicability of the research and the novelty of research. The reason behind it is that, “Engineers want to know, how did you build it, does it work, how long, how fast is it, because they want to use it (...) they want to see some proof of concept” (Anthony, 1999: 44). This scholar reported 100% presence of evaluation step –in comparison with a 55.35% presence of the statement of value in the present corpus.

As Pérez-Llantada (2003: 28) explains, “technical communication does not only involve transcribing data in a clear and objective way but also convincing the audience of the validity of certain claims and proposals”. To achieve this objective, 55.35% of the CS research articles showed presence of “statement of value” step in the Corpus whereas, 8.75% acts of this step have been embedded with APF. It makes this coalition 64.10% of the occurrences of this step. These introductions do not contain simple “statements” of value, but rather detailed descriptions of praise and use of the vamping phrases such as: “problem ... can be completely addressed”, “not only achieve good results but also guarantee stable performance”, “This result is very important”, “provides excellent control”, “minimizes the risks”, “The novelty of the work”, “we provide”, “we show”, “we have found”. This line shooting is further seen in the phrases, “rather than being limited to” (as if others’ works had limitations), “we explore a variety of models rather than just ...” and “We provide extensive theoretical and empirical characterization”. In this regards, consider example (16).

- (16) The *contributions of this research* are manifold. First, *our study presents the effect of CK metrics on defects after controlling for software size. Some of the prior research did not account for this size effect* as noted (...) [25]. Second, *we validate the association between a subset of CK metrics and defects in two current language environments... and, to our knowledge, none of the published papers have compared the results across these widely adopted languages.* Third, on the methodological front, we use weighted linear regression

to study the interaction effect of some of these measures on software defects. *Again, to our knowledge, the interaction effect of these measures has not been studied in the past.* (INTR 28)

Here, researchers outweigh the findings of their research in comparison to the similar studies carried out in the past and validate the unparallel contribution their work has made towards the discourse community.

Along with the extremely close association of value statements with the reporting of the important findings, a limited association with the explanations of nature of the present research was also noticed –see examples (17) and (18).

- (17) This paper extends our previous work [2], [3], [1] by (...) The framework *introduces several novel features* (...) *One of these novel features is a new method* for (...) By using this (...), the general deformable contour optimization process becomes *faster and more robust*. (...) *Another novel feature of this framework* is a technique that (...) Imposing these constraints in energy optimization is a challenging task due to (...) *We show our framework's efficiency and effectiveness* by performing energy optimization experiments (...) (INTR 14)
- (18) This paper presents *an improved, systematic method* to convert (...) (INTR10)

#### 4.2.1. Lexical indicators for value statements

To understand the tendency of the proclamatory rhetoric of Computer scientists, concordance results of the lexical items used for this purpose have been discussed here first, as it becomes pertinent at this stage to identify the lexical items that function as value addition of the research work presented in the academic journals.

Table 5 shows hundred percent usage of “our findings” and 40% usage of “increased” for value addition but their actual occurrences in the value statements were restricted to one and two only, respectively. On the other hand, even though “efficient” and “better” registered low percentages comparatively, their usage in the value statements was much higher. The lexical indicators are discussed below according to their usage for value statements.

Lexical indicators	Hits in SCS Corpus	Value statements	Percentage
(a) Efficient	30	9	30%
(b) Better	26	5	19.23%
(c) Achieve	11	4	36.36%
(d) Important	66	3	4.54%
(e) Improved	9	2	22.22%
(f) Effective	23	2	8.69%
(g) Increased	5	2	40%
(h) Rather than	14	2	14.28%

Table 5. Lexical indicators used for value statements.

## (a) “Efficient”

“Efficient” is mostly used to state the value of the work presented. It has various referents, such as those shown in Table 6.

Lexical Indicators	Referents
Efficient	algorithm
Efficient	duplication algorithm
Efficient	heuristic method
Efficient	tracking of nongrid objects
Efficient	content-aware control policies
Efficient	deadlock-free dynamic reconfiguration techniques
Efficient	and effective approach

Table 6. Referents of the lexical indicator “efficient”.

- (19) The main contribution of the paper is to introduce a new framework for *efficient* tracking of nongrid objects. (INTR 17)
- (20) Another contribution of our work is that we have developed an *efficient* algorithm for ... (INTR 49)

Out of the nine entries found, “efficient” has been used six times for Move 3, step a. For example:

- (21) In this paper we present a simple and *efficient* heuristic method to address the MRIS problem. (INTR 1)
- (22) This paper presents a very *efficient* and effective approach for dimensionality reduction based on (...) (INTR 60)

## (b) Better

“Better” is another lexical item which is used to emphasize the significance of the research presented by the authors in research articles. For example:

- (23) As a result, networks based on our approach provide *better* uninterrupted service, increased network availability and dependability, and improved overall performance and quality of service support as compare to traditional (...) (INTR 44)
- (24) Our heuristic approach performs *better* in terms of all the above parameters, although the percentage improvement is relatively low. (INTR1)

“Better” may be followed by various referents as shown in Table 7.

Lexical indicator	Referents
Better	solutions
Better	tolerance
Better	service
Better	lower bound
Better	approach

Table 7. Referents of the lexical indicator *better*.

(c) Achieve

The lexical indicator “achieve” is used in the context of good results and the “selling” technique is used through the phrase “guarantee stable performance” in the value statements.

- (25) After a thorough and a detailed study of which only a small part can be reported here, we have discovered (...) schemes that not only *achieve* good results, but also guarantee stable performance. (INTR 40)

One exceptional case of the negative use of “achieve” was also noticed in the corpus and is shown in example (26).

- (26) By comparing (...) we have found that, although in some cases a distributed redirection algorithm may also *achieve slightly worse* performance than some centralized alternatives (...) (INTR 40)

(d) Important

Two examples of this presumably important word “important”, but with little occurrence in the corpus, are given in (27) and (28).

- (27) This paper makes three *important* contributions in the field of mobile-agent-based computing systems. (INTR 39)

- (28) This result is very *important* because stability is one of the most difficult attribute for any dispatching and rerouting algorithm that (...) (INTR 40)

(e) Improved

Twenty two percent examples from the entries of “improved” can be interpreted as “value statements”. For example:

- (29) This paper presents an improved, systematic method to convert march tests for BOMs into march tests for WOMs (...) (INTR 10)

(f) Effective

Out of the only two instances of “effective” used for “value statements”, one example is given here.

- (30) These studies show that our testsuite reduction techniques can be *effective* in reducing test suits while providing acceptable performance. (INTR 27)

(g) Increased

The only example of “increased” used for value statements looks is as follows:

- (31) Imposing these constraints in energy optimization is a challenging task due to *increased* parameter space size. (INTR 14)

(h) Rather than

“Rather than” has predominantly been used for the establishment of knowledge gaps (Shehzad, 2008), nonetheless, it has two examples of its usage as value statements.

- (32) The proposed methods work on high-dimensional binary transaction data *rather than being limited to* (...) (INTR 59)

- (33) We explore a variety of probabilistic models *rather than just the* independence model or mixtures. (INTR 59)

#### 4.2.2. Enhancement through comparison

Although rarely, comparison is also used by the scholars of this discipline to enhance the value of their work.

- (34) Note that *our approach is similar to the one proposed by (...)* Yet, in this work, we raise the level of abstraction—our reduction works independently of the implementation of the multi-valued model checking machinery (...) and can benefit from both approaches to the implementation. (INTR 34)

However, Computer scientists go beyond mere discussion of similarities and differences, engage their audience towards superiority and enhance application and benefits of their own work.

#### 4.2.3. Value of their own previous work

Self promotion in the current work through added value in their reporting of the major findings also leads the authors to “advertise” their previous work. This is done in their efforts to provide a link between the previous and the present work of the authors themselves. In the following example the reference [21] is of the authors’ work already published and value addition in this reference is apparent from the diction as underlined.

- (35) *We have completed a fully functional system* that was installed on a real aircraft and tested in flight with a real target aircraft flying various maneuvers [21]. *We have also implemented the (...)* A (...) has been developed to generate parallel programs *automatically*. The execution profiles of the resulting parallel programs *demonstrate the benefits of the scheduler and show that a NOW is a competitive hardware platform* for real-time video processing applications. (INTR 38)

Thus, at times a certain pompousness of the authors about their work can be felt by the readers. Some writers occasionally tend to scaffold their text around the expressions that carry the weight of pomp and show. See, for instance, example (36), which shows a high level of proclamation in the rhetoric of Computer scientists.

- (36) *To our knowledge, no better lower bound on the guaranteed throughput has been presented in the literature than a straightforward bound in which (...)* (INTR 11).

## 5. Conclusion

The present work extends the use of an organizational pattern, increasing the range of particular strategic patterns as discussed above. The

Introduction in a CS research article is a result-oriented genre and points out to the reader in various ways about the writer's contribution. Results are very often explicitly described in the elaborate explanations of the nature of the present research. Value statements are often part and parcel of the Announcements of the Principal Findings, the latter being elaborate and comprehensive, and tightly woven into the methods, procedures and techniques used for the development or enhancement of a design or a model.

To the bold and clear announcements of the principal findings, Computer scientists prefer to call "contributions" to the field. Moreover, they do not shy away from taking the credit of their work by writing how "novel", "effective" or "efficient" their work is. Value statements are found embedded both, in the description of the present research and in the announcement of the principal findings. Value of the present work is also enhanced through comparison with other related works.

The Introductions in CS research articles address the "boosters", the positive assessment of the contributions made by the authors, in several ways: elaboration of theoretical and/or practical implications and applications, the model designed and its application, the method/technique used and its novelty (the first of its type) and theoretical developments in combining different streams of research and interest for practitioners. These contributions are given a great significance in the writing of Introductions. It seems like inviting a person to the podium to make a speech, twice: first, to ask him about his performance and secondly, to ask him to tell how good that performance was. In my opinion, both purposes can be achieved in one appearance. Hence, I suggest combining the steps of "announcing principal findings" and "stating the value" of the present research (CARS model) and making these obligatory in the rhetorical move model for Computer Science as there is a strong relationship between their need to announce research achievement and their desire to proclaim its significance.

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## Appendix: Concordance hits page of the lexical indicator “contribution”

CONTRIBUTION: 7 entries (sort: 1L,1R)

N	Concordance	Set Tagrd No.	File	%
1	sidered as an industrial-strength warehouse system, which also requires a query and analysis component to support the information needs of specific end-users [37]. The <b>actual contribution</b> of this work is the integration of a logic language into the InterBase multidatabase [29] so that complex materialized views can be easily and efficiently defined and main	477	h:\intr\intr57~1.txt	59
2	n rules. Since intertransaction association breaks the boundaries of transactions, the number of potential itemsets and the number of rules will increase drastically. <b>Another contribution of our work</b> is that we have developed an efficient algorithm for mining intertransaction association rule from large databases. Using the property that "A frequent intert	845	h:\intr\intr49~1.txt	82
3	s a drought in region A, there will be a flood in region B two years later from a long term regional weather database. From the above brief description, we can identify that the <b>first contribution of our work</b> reported in this paper is the formulation of an association mining problem that is more general than what has been discussed in the literature. The new	752	h:\intr\intr49~1.txt	72
4	ication and synchronization requirements of Internet applications and proposes general, system-level models that satisfy these requirements. This is the <b>fundamental contribution of this paper</b> . This paper provides a taxonomy of the models it proposes and analyzes these models based on their utility, semantic power, and performance. Second, t	502	h:\intr\intr39~1.txt	76
5	n meet both security and performance requirements. Our design integrates two well-known techniques, namely, replication and secret sharing, to achieve this goal. <b>Our key contribution is</b> an architecture that provides desirable levels of security guarantees and performance by exploiting the natural trade offs possible between the two conflicti	345	h:\intr\intr45~1.txt	58
6	[1], [30], [73]. Explicit tracking approaches of people [69] are timeconsuming and often the simpler blob model [75] or adaptive mixture models [53] are also employed. <b>The main contribution of the paper</b> is to introduce a new framework for efficient tracking of nonrigid objects. We show that by spatially masking the target with an isotropic kernel, a spatial	1,205	h:\intr\intr17~1.txt	82
7	rder to compute the connected component to which it belongs. Unbounded signal numbers are used and changes in the group are discovered following a common signal. <b>1.2 Our Contribution</b> This paper presents the first randomized algorithm for implementing a self-stabilizing group membership service in asynchronous systems. We introduce and	908	h:\intr\intr43~1.txt	80