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THE MOVE-STEP STRUCTURE OF THE INTRODUCTORY SECTIONS OF SPANISH PHD THESES

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ABSTRACT. *This paper presents an analysis of the introductory sections of 21 PhD theses in computing written in Spanish. The study is based on a modified version of Bunton's revised CARS model for English PhD thesis introductions (2002). Spanish PhD thesis introductions take special care in contextualising the research and explaining the organisation of the theses, which accounts for the high number of steps and sub-steps distinguished. Besides, most introductions present either alternating moves or recurrent sequences of moves which form different cyclical patterns. Our findings suggest that the construction of the Spanish thesis introductions is complex due to the nature of the research topic, the various objects under study and the need the graduate student feels to display an extensive knowledge of the field and to clearly announce his/her research.*

KEYWORDS: *Genre analysis, PhD theses, introductions, academic writing, computing.*

RESUMEN. *El presente artículo analiza las secciones introductorias de 21 tesis doctorales escritas en español en el ámbito de la informática. El estudio se basa en la propuesta de Bunton (2002) a partir del modelo estructural CARS, sobre introducciones de tesis escritas en inglés. Las tesis en español dedican especial atención a contextualizar la investigación y especificar el esquema organizativo del estudio, lo que explica la aparición de nuevos submovimientos. Además, la mayoría de las introducciones presentan alternancias de movimientos o secuencias recurrentes de movimientos que conforman diferentes patrones de ciclicidad. Los resultados muestran la complejidad de las introducciones de las tesis en español debido a la naturaleza de la investigación, a los diferentes elementos de estudio y a la necesidad del doctorando de exhibir su conocimiento de la disciplina y presentar con claridad el objeto del trabajo.*

PALABRAS CLAVE: *Análisis del género, tesis doctoral, introducciones, escritura académica, informática.*

1. INTRODUCTION

Since the 1990s written academic genres, especially the research article (RA), have received quite a lot of attention among discourse and rhetorical studies. There has also been a growing interest in the writing of graduate students with pedagogical purposes in the context of English for Academic Purposes (EAP) and genre-based approaches. As a result, a great amount of handbooks and guides have been published giving advice on how to prepare and conduct research and on the design, organisation and writing up of theses and dissertations, so that the graduate student can demonstrate both his/her knowledge related to the research undertaken and his/her knowledge to argue logically and meaningfully the research findings. Besides, a number of studies have analysed the discourse structure of actual texts and have focused on the description of various aspects of master's and PhD theses written in English, notably their overall organization (Dudley-Evans 1994, 1999; Paltridge 2002), particular sections or chapters (the introduction: Dudley-Evans 1986, Bunton 2002; the conclusion: Dudley-Evans 1986; Hewings 1993; Bunton 2005; the literature review: Ridley 2000; Kwan 2006), specific features (metatextual references: Bunton 1999; citation practices: Hyland 1999; Thompson 2005) and disciplinary variation (Prior 1998; Samraj 2000a, 2002b; Hyland 2001). However, this research is somewhat limited if we compare it to the studies that have examined the research article (RA), maybe because of the difficulty to obtain the theses and their overwhelming size (Paltridge 2002: 126). In addition, research on PhD thesis writing has been carried out mainly on both native and non-native English texts and we have not been able to find any studies based on theses written in Spanish. In order to fill this gap in research, this study seeks to describe the organisation of the introductory sections of 21 PhD theses in computing written in Spanish.

Studies on the context of situation and culture recognise that doctoral research work is subject to different rhetorical traditions, and notions of what constitutes an acceptable thesis vary from country to country (Thompson 2005: 308). Internationalisation of scholarship, however, tends to favour uniformity (Duszak 1997: 25). The Spanish academic community is strongly influenced by Anglo-American literature and research, particularly in the field of computing. As Spanish and English discourse communities make use of the conventions of their own language culture, one would expect to find some differences as well as some similarities with respect to the rhetorical patterns described for PhD thesis introductions written in English.

1.1. *Background*

Genre-based studies have had a profound influence on the teaching of English for Specific Purposes (ESP). Apart from implying new approaches to the teaching of academic writing, they have also been applied to the creation of teaching materials for graduate students who need both a rhetorical and a linguistic awareness of the academic texts and linguistic forms that they have to write and use. In order to establish the conventions of a genre, one important area of research has analysed the discourse structure and functions or communicative purposes of the various genres most commonly used in the academy (Flowerdew and Dudley-Evans 2002: 463).

According to Bhatia (1997: 183), introductions in academic work have "a single dominating fairly general function of introducing a written or spoken academic event". Manuals on research writing agree that introductions should be used to orient readers, providing them with the perspective they need to understand the detailed information coming in later sections. These sections introduce the thesis statement and give the purpose of the study. Manuals aimed at Spanish graduates state that introductions describe the preliminary aspects and operations on which the research is based (Sierra Bravo 1994: 413) and serve to present the contents. In them authors justify the choice of the topic, make the objectives, method and constraints of their work explicit and review previous literature (Rigo Arnavat and Genescà Dueñas 2002: 31). These communicative functions regulate the structure of the section.

Initial corpus-based research on introductory sections has focused on identifying the move structure of introductions written in English using Swales's *Create a Research Space* (CARS) model (Swales 1990, 2004) for RA introductions. According to Swales, (1990: 140) a *move* is a rhetorical movement, while Holmes (1997:325) refers to this phenomenon as a segment of text that is shaped and constrained by a particular communicative function. Although the CARS model has proved valid for a number of studies (e.g., Peng 1987; Bhatia 1993; Holmes 1997; Nwogu 1997; Posteguillo 1999; Ruiying and Allison 2004), several authors have suggested a variety of modifications to account for RAs, master's and PhD thesis introductions in greater detail.

Anthony (1999) finds out that RA introductions in software engineering present an extensive review of background literature, many definitions and examples, and an evaluation of the research in terms of application or novelty of the results. Samraj (2002b: 16), in an analysis of biology RA introductions, points out the necessity of (1) "a greater degree of embedding" in the CARS model to effectively describe the rhetorical organisation of the texts analysed and of (2) some flexibility in the rhetorical structure postulated for a genre (aiming to be valid for a range of disciplines), as some discoursal aspects of a genre may be found in different positions within the organisation framework. Árvay and Tankó (2004: 79-81) identify two new steps in linguistics RA introductions: *Examples*, in Move 1 (M1), and *Analytical details*, in Move 3 (M3). *Analytical details* gathers information of different sorts to delineate the details of the investigation presented: working definitions, clarification of terms, a concise description of the theoretical framework adopted, or conventions regarding codes and symbols used.

As regards studies on Spanish texts based on Swales's model, it is worth mentioning Burgess's (2002) contrastive analysis of the rhetorical preferences of four groups of writers of RAs: Spanish English language studies specialists publishing in both English and Spanish, writers publishing exclusively in Spanish, and English speaking background scholars publishing their work in international linguistic publications. Burgess finds that writers in none of the four groups consistently realise the CARS schema though the international linguistic publications texts show a lower instance of move deletion and so are closer to the CARS schema than the texts in the other three groups (p. 208). She suggests that language background alone does not play the major role in determining preferences for certain generic structures and that the differences are accentuated by the relationship between the writer and the discourse community.

In contrast, few studies have been carried out on other academic genres, such as master's and PhD theses. They have somewhat modified Swales's model in the light of their results. This is the case of Dudley-Evans's (1986) and Samraj's (2008) studies of master's thesis introductions and Bunton's (2002) proposal of a model for PhD thesis introductions, which we will consider as the starting point for our analysis. Bunton studies a multidisciplinary corpus of 45 PhD theses written in English and adds new steps to Swales's model that reflect the many aspects that graduate students include or have been advised to include in order to clearly express the research perspective taken in the study, the purpose of their work, their positioning and the organisation of their text. These newly identified steps are shown in italics in Table 1.

Move 1 (M1): Establishing a Territory	
STEPS	
S1: Claiming centrality (importance of topic)	
S2: Making topic generalisations and giving background information	
*S3: *Defining terms*	
S4: Reviewing previous research	[Parameters of research]

Move 2 (M2): Establishing a Niche	
STEPS	
S1A: Indicating a gap in research	
S1B: Indicating a problem or need	
S1C: Question-raising	
S1D: Continuing /Extending a tradition	[Counter-claiming]

Move 3 (M3): Occupying the Niche (Announcing the present research)	
STEPS	
S1: Purposes, aims or objectives	
S2: Work carried out /Announcing research	*[Chapter structure]*
S4: Method	*[Research questions /Hypotheses]*
S5: Materials or Subjects	*[Theoretical positioning]*
S6: Findings or Results (Announcing or predicting principal findings)	**Defining terms* *[*Parameters of research*]*
Product of research /Model proposed	*[Application of product]*
S7: Justification/ Significance	*[Evaluation of product]*
S8: Thesis structure	

Newly identified steps are in *italics*.
* Indicates a new step proposed by Bunton which can appear in first or third moves.
[ ] Indicates a step which is occasionally present, according to Bunton.

Table 1. *Bunton's model for PhD thesis introductions* (Bunton 2002: 67, 74).

In this paper we study the move-step organisation of the introductory chapters of a set of PhD theses written in Spanish. We base our analysis on a modified version of Bunton's revised CARS model for English PhD thesis introductions (Carbonell, Gil, Soler in press). In the model used here most of the steps in Bunton's model are present, but some new steps and sub-steps are also included. By studying the structure of Spanish texts, we contribute to the study of an academic genre that has not been the object of empirical analysis among Spanish studies. We also hope that the findings obtained from the examination of actual texts will show Spanish graduate students the wide range of options thesis writers make and will help them to apply adequate models to their individual writing.

2. METHOD

The data we examined consist of 21 PhD theses introductions in the discipline of computing produced in Spanish by graduate students and teaching staff from the Universidad Politécnica de Valencia, all native speakers of Spanish (see Appendix for a complete list of the theses). The PhD theses were published in an online library of theses and dissertations, *ProQuest Information and Learning*. Twenty-one chapters titled *Introducción* were collected. The analysis was carried out in several phases. Each text segment was examined individually through the identification of predominant lexico-grammatical features and coded according to its communicative function. We used the model developed by Bunton as a reference. Individual coding was then peer-reviewed in a second phase so as to reduce potential differences in the analyses. Many of the text segments suggested the presence of the moves and steps proposed by Bunton. However, a number of segments did not seem to correspond to any of the steps in that model, or to the steps included in particular moves. We then created our own model, shown in Table 2.

Steps (S) and sub-steps (SS) found in M1: Establishing a Territory.

STEPS
S1: Claiming centrality (importance of topic)
S2: Making topic generalisations and giving background information *SS2A: Indicating a problem or need* *SS2B: Indicating limitations* *SS2C: Giving examples* *SS2D: Defining terms/ classifying and commenting on terminology)* *SS2E: Giving or anticipating solutions (or ways to solve problems/to tackle needs)*
S3: Defining terms */classifying*
S4: Reviewing previous research
S5: Explaining the institutional/research group context

Steps (S) and sub-steps (SS) found in M2: Establishing a Niche

STEPS
S1A: Indicating a gap in research
S1B: Indicating a problem or need
/S1C: Question-raising/
/S1D: Continuing /Extending a tradition/

Steps (S) and sub-steps (SS) found in M3: Occupying the Niche (Announcing the present research)

STEPS
S1: Purposes, aims or objectives
S2: Work carried out /Announcing research *SS2A: Work done* *SS2B: Focus of research* /*SS2C: Work or aspects out of scope*/ /*SS2D: Previous requirements*/
S3: Field of research
*S4: Method /*Parameters of research*
/*S5: Materials or Subjects*/
S6: Findings or Results (*Announcing or predicting principal findings*): *Product of research /*Model proposed/*Contributions*/*Solutions*
S7: Justification/Significance
/S8: Research questions/Hypotheses/
S9: Application of product
S10: /Evaluation of product/
S11: Thesis structure *SS11A: Overall thesis structure* *SS11B: Chapter structure* *SS11C: Chapter contents* *SS11D: Chapter goal*

Our newly identified steps and sub-steps are in *italics*.

*These were independent steps in Bunton's model.

/…/ indicates a step or sub-step which is occasionally present in our corpus (in 4 or fewer PhD thesis introductions).

Table 2. *Moves, steps and sub-steps found in Spanish PhD thesis introductions* (adapted from Bunton, 2002).

3. Results and discussion

The first information we obtained from our corpus after a preliminary examination of formal aspects was that the introductions vary greatly in length, ranging from 3 to 19.5 pages (average: 9.5 pages). Length varies according to the inclusion or not of the literature review and an extensive background on aspects pertinent to the research. Another formal feature is that especially long introductions are divided into sections and subsections (19 out of 21 introductions have sections, 10 have subsections).

3.1. *Move level*

The lack of constraints about the length of PhD thesis introductions accounts for a structure that shows a greater number of steps and sub-steps and a considerable amount of move patterns and move cycling.

As regards their move structure, M1 and M3 were found in all the PhD thesis introductions analysed. However, M2 does not appear in 4 thesis introductions. Few thesis introductions in our corpus consist of the prototypical sequence [M1-M2-M3] as the only sequence of moves (T4, T6, T8, T21). Instead, most introductions present either alternating moves or recurrent sequences of moves which form different cyclical patterns. As can be seen in Table 3, the move sequence of the introductions involves M1 and M3 in all the texts analysed. Alternations of just M1 and M3 are found in 6 introductions (T1, T2, T3, T7, T12, T20), while these moves alternate with M2 in 11 other cases (T5, T9, T10, T11, T13, T14, T15, T16, T17, T18, T19).

Thesis	**Move sequence**	**M1**	**M2**	**M3**	**Total**
T1	M1 [M2] – M3 – M1 [M2]– M3	2	0	2	4
T2	M1 – M3 – M1 – M3 – M1 – M3	3	0	3	6
T3	M1 [M2] – M3	1	0	1	2
T4	M1 – M2 – M3	1	1	1	3
T5	M1 – M3 – M1 – M3 – M1 - M2 – M3 – M2 – M3	3	2	4	9
T6	M1 – M2 – M3	1	1	1	3
T7	M1 [M3] [M3]– M3 – M1- M3	2	0	2	4
T8	M1 – M2 – M3	1	1	1	3
T9	M3 – M1 – M2 – M1 – M2 – M3	2	2	2	6
T10	M1 – M2 – M3 – M1 – M3	2	1	2	5
T11	M3 – M1 – M2 – M3 – M1 – M2 – M1 – M3	3	2	3	8
T12	M1 – M3	1	0	1	2
T13	M3 – M1 – M3 – M1 – M2 – M3 – M1 – M3 – M2 – M3 – M1 – M3 – M1 – M3 – M1 – M3	6	2	8	16

Thesis	Move sequence	M1	M2	M3	Total
T14	M1 – M2 – M3 – M1 – M2 – M3 – M1 – M3 – M1 – M2 – M3 – M1 – M2 – M3 – M1 – M2 – M3 – M1 – M3 [M1]	7	5	7	19
T15	M3 – M1 – M2 – M1 – M3 – M1 – M3 – M2 [M1] – M3	3	2	4	9
T16	M1 – M3 – M2 – M3 – M1 [M3]– M3	2	1	3	6
T17	M3 – M1 – M2 – M3 – M1 [M3] [M3] [M3]– M3	2	1	3	6
T18	M3 – M1 – M3 – M1 [M3] – M3 – M1 – M2 – M3[M1-M2] [M1-M2]	3	1	4	8
T19	M1 – M2 – M1 – M2 – M1 – M2 – M1 – M2 – M1 – M3	5	4	1	10
T20	M1 – M3 – M1 – M3	2	0	2	4
T21	M1 – M2 – M3	1	1	1	3

[ ] indicates that a move is embedded in another move.

Table 3. *Move structure of the PhD thesis introductions analysed.*

The sequence [M1-M2-M3] was found in half of the theses analysed (i.e. in 11 introductions), showing that the cognitively natural structure of moving from general [M1] to specific [M3] when presenting information is used as a common expository pattern in the introductory chapters. In fact, this is the only combination of moves found in 4 introductions. If we assume that this combination displays the prototypical order of appearance of the three moves, its presence in only 4 introductions may seem low. However, if the introductory section of the PhD thesis is conceived as a complex cognitive and rhetorical textual unit, we can better understand that other moves and patterns are also present in order to frame in more detail the information presented with the basic sequence [M1-M2-M3]. Thus, it seems that the longer the introduction, the more likely the sequence [M1-M2-M3] is to be found either preceded or followed by other moves and both preceded and followed by other moves, especially M1. The sequence [M1-M2-M3] is recorded initially only in 2 introductions (T10 and T14) and it is used to close the chapter in 2 other theses (T9 and T18). In other cases this pattern is used medially, preceded and followed by other moves, mainly M1 and M3, which accounts for the effort of writers to present their research in a framework that emphasises its relevance.

The sequence [M1-M3] is the only pattern of moves present in 4 theses (where no M2 has been identified), which reveals that such moves in this order can be enough to make up a thesis introduction. In these cases, the introduction consists of 1 to 3 cycles of this combination: T12 contains 1 cycle, while T7 and T20 consist of 2 cycles, and T2 contains 3 cycles. When combined with other patterns, the number of cycles of [M1-M3] varies from 1 to 5 cycles. This combination is found initially (in T5 and T16), medially (T13, T14, 15, T18, T20), but mostly in a closing position (in 7 cases: T10, T11, T13,

T14, T16, T17, T19, T20). [M1-M3] is often found in between other cycles containing M2. In these cases, the total number of moves of the introductions tends to be significantly higher than when just the combination [M1-M3] is present (e.g. T5, T13, T14, T15).

Other cyclical patterns identified in 9 PhD theses analysed are: [M3 – M1], [M1 – M2], [M2 – M1], [M2 – M3] and [M3 – M2]. In addition, we also found that 8 theses in our corpus present embedding of moves in other moves. By this we mean that authors include rhetorical aims typical of a move within another move. M1 is embedded in M2 (T15) and M3 (T14 and T18). M2 is embedded in M1 (twice in T1 and T18, and once in T3). However, the most frequent embedding is that of M3 in M1 (T7, T16, T17 and T18). This can be explained by the fact that giving background information in introductions of theses is complex, because of the various aspects taken into account to contextualise the research topic, and authors intend the reader not to lose sight of the connection between the framework of their study and the work they have undertaken and is going to be presented in the PhD thesis.

3.2. *Step and sub-step levels*

M1 and M3 are extensively developed moves in our corpus. These moves incorporate information which is necessary for the reader to understand the various objects of the research and the perspective from which they are dealt with and presented. This explains the number of steps and sub-steps in our model and the presence of embedding of steps and sub-steps in other steps or sub-steps within a move.

3.2.1. Steps and sub-steps found in M1 - Establishing a Territory

According to the CARS model, the first move in an introduction is to establish a territory (M1). This is also the tendency of the introductions analysed, as 14 out of 21 introductions open with segments corresponding to M1. Table 4 shows the number of instances of steps and sub-steps identified in the Spanish corpus of PhD thesis introductions.

Steps	**Number of instances**	**PhD theses**
S1: Claiming centrality (importance of topic)	16	T1,T2,T3,T7,T[8],T9,T10,T13,T14,T15,T[18], T19,T20,T21
S2: Making topic generalisations and giving background information		T1,T2,T3,T4,T5,T6,T7,T8,T9,T10,T11,T12,T13, T14,T15,T16, T17,T18,T19,T20,T21
SS2A: Indicating a problem or need	55	T1,T2,T4,T5,T6,T7,T8,T10,T11,T12,T[14],T15, T16,T17,T18, T19,T20,T21
SS2B: Indicating limitations	10	T1,T[6],T10,T12,T14,T18,T21

Steps	Number of instances	PhD theses
SS2C: Giving examples	13	T13,T[14],T16,T18,T19
SS2D: Defining terms /Classifying and commenting on terminology	103	T1,T2,T3,T5,T[6],T7,T8,T10,T12,T[13],T14,T15, T16,T18,T19,T21
SS2E: Giving or anticipating solutions (or ways to solve problems/to tackle needs)	36	T2,T4,T5,T6,T7,T8,T11,T12,T[14],T15,T16,T18, T19,T20,T21
S3: Defining terms /classifying)	15	T2,T7,T11,T12,T15
S4: Reviewing previous research	20	T2,T5,T11,T12,T13,T14,T16,T18,T[19],T20,T21
S5: Explaining the institutional/research group context	10	T4,T5,T7,T10,T11,T13,T15,T20

[ ] indicates that in some theses, steps and sub-steps are embedded in other steps or sub-steps.

Table 4. *Steps (S) and sub-steps (SS) found in M1: Establishing a Territory.*

The high frequency of occurrence of S1 (*Claiming centrality*) and S2 (*Making topic generalisations and giving background information*) allowed us to consider that they are characteristic of this move. S1 was found in 14 PhD theses, which indicates the need writers have to justify their choice of the topic. S2 was found in all the PhD theses analysed and in some cases (T1, T3, T6, T8, T14, T19) occupies most of the space devoted to the introductory sections. This allowed us to infer that the writers of the PhD theses have been advised by their supervisors to include extensive information related to the topic under research in order to demonstrate their knowledge of the field and justify their claims to enter their discipline community. The length and complexity of the information included in this step led us to realise that the segments of text within this step performed different rhetorical functions that could be further specified. As their appearance was recurrent, they were considered to be sub-steps of S2.

Many topic generalisations and background information on the research topic contained descriptions of concepts, devices, techniques, etc. that constituted the object of the investigation, sometimes even from a historical perspective. But the description of the state of the art was accompanied in 18 PhD theses by the statement of problems and needs which had arisen while research related to the topic under study evolved. This justifies sub-step 2A (SS2A) of S2 in M1, illustrated in example (1):

(1) *Las tendencias que han aparecido posteriormente han cambiado significativamente la situación: el tráfico se ha equilibrado, el tamaño de celda se ha*

reducido, el número de terminales está en constante aumento, […]. Como consecuencia, estos procedimientos han adquirido relevancia, y es necesario cuidar la gestión de movilidad. (T1).

The statement of a problem is usually associated with information on how it had been or could be solved. Hence the SS2E (*Giving or anticipating solutions or ways to solve problems/to tackle needs*), as in example (2):

(2) *Aunque la aparición en la última década de máquinas cada vez más potentes, […] ha permitido aumentar el tamaño y el número de problemas resueltos de forma óptima, la resolución de estos problemas sigue demandando una mayor velocidad de proceso.* La computación en paralelo aparece como un posible camino para abordar estos problemas. *[…]* Esta técnica está siendo aplicada con éxito *en la resolución de algunos problemas difíciles, […].* (T2).

Instead of indicating a problem or need, 7 PhD theses mention the limitations of models, techniques, devices, etc. presented in the background descriptions and generalisations. This is considered to be another sub-step of S2 in M1 (SS2B: *Indicating limitations*, example 3):

(3) Esta característica impide que *los criterios de optimización tengan en cuenta la duración de las acciones y, por tanto, la duración real del plan.* (T13).

It is also characteristic of background descriptions to include some significant examples, in order to clarify or illustrate claims made, concepts used or, more broadly, the context of the research (SS2C: *Giving examples*, example 4):

(4) *Los CSPs son, en general, problemas intratables, es decir, no se conocen algoritmos polinómicos para resolver tales problemas*. Por ejemplo *un problema con 10 variables, y cada variable con 10 posibles valores, tendría un total de diez mil millones de posibilidades diferentes.* (T14).

We also identified 118 instances of *Defining terms*. This is in some cases an independent step (S3) in M1, which coincides with Bunton's finding for English PhD thesis introductions. But in many other cases the definition is provided at the background level. Besides, in order to clearly present the state of the art, writers include not only the definition of terms or concepts, but also classifications and explicit explanations of the terminology employed. Our corpus contains 103 cases of this sub-step, which we call SS2D: *Defining terms /Classifying and commenting on terminology* (examples 5 and 6):

(5) Se dice que un sistema es tolerante a fallos cuando *es capaz de continuar su trabajo aunque se manifiesten errores permanentes, transitorios o intermitentes*

(errores para los cuales se han previsto mecanismos de tolerancia en la etapa de diseño del sistema). (T7).

(6) Las primeras *arquitecturas paralelas eran fundamentalmente multiprocesadores con memoria compartida. […]* Otro grupo *de máquinas paralelas está constituido por los multicomputadores. […]* En este grupo *se pueden encontrar desde ordenadores que integren estos procesadores dentro de una misma plataforma hasta grupos o clusters de ordenadores personales conectados mediante una red de altas prestaciones*. (T18).

Step 4, *Reviewing previous research*, appears in 11 PhD thesis introductions. However low this figure may seem, it must not be surprising since PhD theses usually devote a separate section to the literature review. This, in fact, is the structure of T4, T9, T10, T15, T17, T18 and T20, which are organised in the ILrMRD (Introduction – Literature review – Method – Results – Discussion) format. Finally, a step in M1 that can be considered to be specific of Spanish PhD thesis introductions is 'Explaining the institutional/research group context' (S5, example 7):

(7) La presente tesis se ha desarrollado en el grupo de investigación de Informática Gráfica de Sistemas Informáticos y Computación. Este departamento pertenece a la Universidad Politécnica de Valencia. (T4 del departamento).

This step is often present in our corpus (found in 10 instances in 8 PhD theses out of 21 introductions). Although it is not mentioned in the literature on English thesis introductions, handbooks on thesis writing for Spanish graduates mention the adequacy of including in the PhD thesis introduction data on the graduate's curriculum and the institutions that have helped him/her to carry out the research (Sierra 1994: 413). This provides the graduate with an opportunity to show that s/he is a member of a community and has benefited from that membership. The incorporation of such information in Spanish PhD thesis introductions may reflect the increasing amount of research carried out by institutionalised research groups in the context of Spanish universities, and its high value for the academic community. The length of the segments of text belonging to this step varies form a few lines to over two pages, like in T7, where details of the research group, areas of research and projects are included.

3.2.2. Steps and sub-steps found in M2 – Establishing a Niche

Following Bunton, the second move in a PhD thesis introduction is to establish a niche (M2), either by indicating a gap, a problem or a need in research, trying to respond to unanswered questions or continuing a tradition. In our corpus, M2 is present in 17 PhD thesis introductions, which seems to indicate that M2 is not an obligatory move in the Spanish context. However, the statement of a problem, a need or a gap in research is realised explicitly in all the introductions, in an attempt to justify the need of further research and, consequently, the pertinence of the topic under study. Bunton's model (see

Table 1) situates the indication of a problem or need at the 'Establishing a niche' level and includes S1B in M2. But the complexity of the structure of the Spanish PhD thesis introductions causes both the identification of SS2A (*Indicating a problem/need*) at the background level (S2 in M1) and the embedding of M2 in M1 or M3 (examples 8 and 9):

(8) *1.1 El método del camino crítico y los problemas de asignación de recursos.*

El tercero de los problemas es *el de la programación de proyectos con recursos limitados, que consiste en minimizar la duración del proyecto, teniendo en cuenta que la disponibilidad de los recursos es limitada en cada uno de los períodos de ejecución*. A este problema es al que más tiempo y esfuerzo se ha dedicado*, y es el que se describe en el siguiente apartado y al que se dedica la presente Tesis Doctoral*. (T3).

(9) *1.3 Objetivos de la tesis.*

En general, los algoritmos paralelos encontrados que resuelven los problemas a los que se dedica esta tesis han sido desarrollados para arquitecturas concretas por requerimiento de las aplicaciones. Existe, por tanto, un vacío *de algoritmos paralelos que utilicen estas herramientas* que se pretende cubrir en esta tesis. (T18).

As can be deduced from Table 5, graduate students typically establish the niche by *Indicating a problem or need*, a step found in 12 PhD theses and 28 instances. Much less frequent is the rhetorical function of *Indicating a gap in research* (9 instances in 9 PhD theses). Other strategies that can be mentioned are those expressed in S1C and S1D. The characteristics of the discipline favour studies which extend the scope of previous research or look for new applications and implementations of already accepted models or processes. However, the number of instances found in the corpus show that they are not the usual ways of creating a space for the author to occupy.

Steps	**Number of instances**	**PhD theses**
S1A: Indicating a gap in research	9	T5,T6,T8,T10,T11,T14,T16,T[18],T19
S1B: Indicating a problem or need	28	T[1],T[3],T4,T9,T11,T13,T14,T15,T16,T17, T19,T21
/S1C: Question-raising/	4	T8,T14,T15,T19
/S1D: Continuing /Extending a tradition/	5	T[3],T5,T11

[ ] indicates that the steps are embedded in other steps within M1 or M3.
/…/ indicates a step or sub-step which is occasionally present in our corpus (in 4 or fewer PhD thesis introductions).

Table 5. *Steps and sub-steps found in M2: Establishing a Niche*

3.2.3. Steps and sub-steps found in M3 – Occupying the Niche (Announcing the present research)

The last move in Swales's model, occupying the niche (M3), announces the present research. As Table 6 shows, this move is present in all the introductions in our corpus.

Steps	**Number of instances**	**PhD theses**
S1: Purposes, aims or objectives	48	T1,T2,T4,T5,T6,T7,T8,T9,T10,T11,T12,T13, T14,T15,T16,T17,T[18],T20,T21
S2: Work carried out /Announcing research		T1,T2,T4,T5,T6,T7,T8,T10,T11,T12,T13,T14,T15, T16,T17,T18,T19,T20,T21
SS2A: Work done	38	T2,T4,T[5],T6,T7,T8,T11,T12,T13,T14,T[15],T16, T17,T18,T19,T20,T21
SS2B: Focus of research	15	T1,T5,T13,T14,T15,T16,T18,T19,T20
/SS2C: Work or aspects out of scope/	4	T1,T10,T18,T20
/SS2D: Previous requirements/	9	T8,T14,T17
S3: Field of research	5	T2,T5,T10,T13,T18
S4: Method/ Parameters of research	37	T2,T4,T5,T7,T10,T11,T12,T13,T14,T15,T16, T17,T[18],T19,T20
/S5: Materials or Subjects/	1	T4
S6: Findings or Results: Product of research /Model proposed/Contributions /Solutions	16	T4,T8,T10,T11,T13,T14,T15,T19,T20
S7: Justification /Significance	10	T4,T13,T15,T[18],T20
/S8: Research questions /Hypotheses/	2	T10
S9: Application of product	11	T3,T9,T10,T15,T18,T20
/S10: Evaluation of product/	3	T13,T18
S11: Thesis structure		T1,T2,T3,T4,T5,T6,T7,T8,T10,T11,T12,T13, T14,T15,T17,T18,T19,T20,T21
SS11A: Overall thesis structure	22	T1,T4,T5,T6,T11,T12,T13,T14,T15,T18,T19,T20
SS11B: Chapter structure	20	T1,T2,T3,T4,T5,T6,T7,T15,T18,T19,T[21]
SS11C: Chapter contents	122	T1,T2,T3,T4,T5,T6,T7,T8,T10,T11,T12,T13,T14, T[15],T17,T18,T19,T20,T[21]
SS11D: Chapter goal	13	T2,T6,T12,T15,T18,T19,T21

[ ] indicates that in some theses, steps and sub-steps are embedded in other steps or sub-steps.

/…/ indicates a step or sub-step which is occasionally present in our corpus (in 4 or fewer PhD thesis introductions).

Table 6. *Steps and sub-steps found in M3: Occupying the Niche* (Announcing the present research)

Several steps in M3 can clearly be considered to be obligatory, due to the high number of PhD theses that contain them. The purpose of the research (S1) and the presentation of the work carried out (S2), together with the thesis structure (S8) are aspects explicitly mentioned in all PhD theses or all of them but one. The way the work done (S2) is presented allows the distinction of several sub-steps within this step. Although the most usual strategy is to simply announce the work done in the research, that is, the object of the thesis, writers often focus their research and mention previous requirements that must be taken into account. Sub-steps SS2B and SS2D illustrate these communicative purposes (examples 10 and 11):

(10) En esta tesis se estudia concretamente *la gestión de localización*. (T1).

(11) *Las consideraciones apuntadas en el apartado anterior, y el estudio de la bibliografía existente, nos llevaron a la conclusión de que el sistema a desarrollar […]* debería cumplir una serie de condiciones, *que se enumeran a continuación*. (T8).

Occasionally, maybe in order to avoid criticism and show modesty, writers also recur to specifying the aspects out of the scope of their research (SS2C), as in example 12:

(12) […] Aquí no se ha trabajado sobre *la correspondencia entre elementos de Red Inteligente y bases de datos de red de comunicaciones*. (T1).

As for *Thesis structure* (S11), all the introductions contain Bunton's step, a space to indicate how the thesis contents are organised. However, our data show the convenience of proposing four new sub-steps in order to distinguish discourse functions: *Overall thesis structure* (SS11A), *Chapter structure* (SS11B: the structure of individual chapters), *Chapter contents* (SS11C) and *Chapter goal* (SS11D). The thesis global structure was found in 12 PhD theses (example 13). In 19 PhD theses the contents of each chapter are outlined in different degrees of detail (example 14). Less frequent but worth mentioning are the segments of text mentioning the chapter structure (11 PhD theses) and chapter goal (7 PhD theses), as in examples 15 and 16:

(13) El contenido de esta tesis se ha estructurado en 9 capítulos *que se detallan brevemente a continuación*. (T5).

(14) *Con el título de Resultados se enmarca* el capítulo en el que se mostrarán *los resultados obtenidos tras ser aplicados, en pacientes reales, los sistemas de telepsicología desarrollados e la presente tesis*. (T8).

(15) El capítulo se puede dividir en dos secciones: en la primera sección *se muestra […]*. En la segunda sección *se analiza […]*.

(16) El objetivo de este último capítulo es *también el de ofrecer a los futuros usuarios e investigadores la experiencia obtenida con este trabajo, realizando indicaciones concretas acerca de cómo y cuándo utilizar cada algoritmo*. (T18).

Optional steps in M3 are *Indicating the field of research* (S3*), Method*/*Parameters of research* (S4), *Materials or subjects* (S5), *Findings or results* (S6), *Justification* /*Significance* (S7), *Research questions*/*Hypotheses* (S8), *Application of product* (S9) and *Evaluation of product* (S10). Some of these steps coincide with Bunton's, but some comments need be made that derive from our findings.

A step included in M3 in our model and not present in Bunton's study is *Indicating the field of research* (S3), found in 5 instances. It provides a clear frame to understand the scope of the research topic, as illustrated in example 17:

(17) Todo el trabajo que se desarrolla dentro de esta tesis está enmarcado dentro del área de *la aplicación de la computación de altas prestaciones en la solución de problemas de la Teoría de Control moderna*. (T5)

Instead of announcing the research, the principal findings (S6) can be further specified as containing both the announcement and the prediction of results. We consider that this step may include Bunton's step *Product of research*/*Model proposed*, as well as other ways to express or present findings/results, namely *Contributions* and *Solutions*: the theses do not only propose novel systems, techniques or improved models but also solutions to a problem, contributions to a technique and definitions of frameworks for specific purposes (see examples 18 and 19). This step is often followed by *Justification*/*Significance* (S7), which makes the importance of the findings explicit, as in example 20:

(18) [Contribution] *El trabajo presentado en esta tesis es una aproximación metodológica al desarrollo de Flujos de Trabajo*. La principal contribución del trabajo *es la definición de un Ciclo de Vida que, integrando en un mismo marco técnicas aplicadas con éxito […], tiene como objetivo fundamental el desarrollo de Flujos de Trabajo de calidad*. (T11)

(19) [Solution] El conjunto de soluciones propuestas *conforma un marco metodológico en el cual los patrones (patrones conceptuales, lenguajes de patrones, patrones arquitectónicos y patrones de diseño) juegan un papel muy importante para resolver los problemas detectados*. (T15)

(20) *[…] De* ahí que esta tesis suponga la evolución de un trabajo *sobre la planificación, scheduling y planificación temporal cuyas ideas han madurado en paralelo con los requisitos de dichos proyectos y la propia investigación en planificación temporal*.(T13)

Another step which was frequently found (in 15 PhD theses) in our corpus is S4: *Method*/*Parameters of research*, which includes both specifications of the method and the parameters of research. This is illustrated in example 21:

(21) *Para la mejora del flujo de trabajo* se sigue una aproximación basada en técnicas de análisis de datos y extracción de conocimiento. (T11)

Research questions/Hypothesis (S8) and *Evaluation of product* (S10) are steps rarely found in our corpus, present in one and two PhD theses respectively. This coincides with Bunton's findings for PhD thesis introductions in English. However, *Application of product* (S9), a step Bunton considered to be occasionally present, was often found in our corpus (11 instances in 6 PhD theses). An example of this step is provided below:

(22) *La solución general aportada* debería aplicarse a *todos los patrones conceptuales que se utilicen como constructores de modelado*. (T15)

4. Conclusions

This paper analyses the structure of a corpus of introductions drawn from 21 PhD theses written in Spanish on a variety of computing topics. The study was carried out under the move-step tradition initiated by Swales and his CARS model for RA introductions and revised by Bunton for PhD thesis introductions in English. It was found that the construction of Spanish thesis introductions is complex due to the nature of the research topic and the various objects under study, and to the need the graduate writer feels to contextualise the research and explain the organisation of the PhD thesis. This explains the number of steps and sub-steps that describe the rhetorical functions of text segments in Spanish PhD thesis introductory chapters when establishing the territory (M1) and announcing the research carried out (M3). In M1, S2, *Making topic generalisations and giving background information*, unfolds in several sub-steps, namely *Indicating a problem or need*, *Indicating limitations*, *Giving examples, Defining terms* (which may include some classification and comments on terminology), and *Giving or anticipating solutions*. In addition, a step in M1 not mentioned in previous research and that can be considered to be specific of Spanish PhD thesis introductions is *Explaining the institutional/research group context* in which the PhD study was undertaken. In M3, several sub-steps give details on how S2 *Work carried out/Announcing research* is presented, that is, indicate the work done, the focus of the research, the work or aspects that fall outside the scope of the thesis, and previous requirements. A step is postulated, by means of which graduate writers specify the *Field of research* to which their study pertains. Due to the nature and objects under study, S6 *Findings or Results (Announcing or predicting principal findings)* includes not merely a *Product of research* or a *Model proposed*, but also *Contributions* and *Solutions* to the problems or aspects investigated. Finally, S11 *Thesis structure* is realised by different procedures: indicating the overall thesis structure, a chapter's structure, its goal, or its contents. Unlike M1 and M3, M2 was not identified in all the introductions analysed. Instead, in some cases the niche was established at the territory level or embedded either in M1 or M3. No new steps or sub-steps were identified in this move.

Our analysis also revealed that moves frequently unfold in cycles and sequences of alternating moves, notably the canonical [M1-M2-M3] and [M1-M3] patterns, which allows writers to introduce details of the research carried out alternating with its theoretical underpinnings. Even in some instances, a move was found embedded within another move. Thus, cycling and embedding of moves appear to be two strategies that enable the writer to present the current research in a way that enhances the link of the present research (M3) with the context or background (M1) in which it is being undertaken.

We hope these findings will help Spanish graduate students raise awareness of the schematic structure of PhD thesis introductions. Research on actual texts provides realistic information that can be used for academic writing courses allowing graduate students to appreciate the complexity and variation that is involved in the process of writing PhD thesis introductions. When teaching their students a new genre, instructors can make them aware of features that are obligatory or optional in that genre, such as the moves and steps in the introductory chapters of Spanish PhD theses. Whether the conventions of the genre are typical of the Spanish academic community or of the discipline of computing is likely to be answered after a contrastive study using a comparable corpus of PhD theses written in English, which will be the subject of further research.

NOTE

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REFERENCES

Anthony, L. 1999. "Writing research article introductions in software engineering: How accurate is a standard model?" *IEEE Transactions on Professional Communication* 42 (1): 38-46.

Árvay, A. and G. Tankó. 2004. "A contrastive analysis of English and Hungarian theoretical research article introductions". *International Review of Applied Linguistics* 42: 71-100.

Bhatia, V. K. 1993. *Analysing Genre: Language Use in Professional Settings*. London: Longman.

Bhatia, V. K. 1997. "Genre-mixing in academic introductions". *English for Specific Purposes* 16 (3): 181-195.

Bunton, D. 1999. "The use of higher level metatext in PhD theses". *English for Specific Purposes* 18: S41-S56.

Bunton, D. 2002. "Generic moves in PhD thesis introductions". *Academic Discourse*. Ed. J. Flowerdew. London: Longman. 57-75.

Bunton, D. 2005. "The structure of PhD conclusion chapters". *Journal of English for Academic Purposes* 4: 207-224.

Burgess, S. 2002. "Packed houses and intimate gatherings: Audience and rhetorical structure". *Academic Discourse*. Ed. J. Flowerdew. London: Pearson Education. 196-215.

Carbonell, M., Gil, L. and C. Soler. In press. "The schematic structure of Spanish PhD thesis introductions". *Spanish in Context* 6(2).

Dudley-Evans, A. 1986. "Genre analysis: An investigation of the introduction and discussion sections of MSc dissertations". *Talking about Text*. Ed. M. Coulthard. Birmingham: English Language Research, University of Birmingham. 128-145.

Dudley-Evans, A. 1994. "Genre analysis: An approach to text analysis for ESP". *Advances in Written Text Analysis*. London: Routledge. 219-228.

Dudley-Evans, A. 1999. "The dissertation: a case of neglect?" *Issues in EAP Writing Research and Instruction.* Ed. P. Thompson. Reading Centre for Applied Language Studies, University of Reading. 28-36.

Duszak, A. 1997. "Cross-cultural academic communication: A discourse community view". *Culture and Styles of Academic Discourse*. Ed. A. Duszak. Berlin/New York: Mouton de Gruyter. 11-40.

Flowerdew, J. and A. Dudley-Evans. 2002. "Genre analysis of editorial letters to international journal contributors". *Applied Linguistics* 23 (4): 463-489.

Hewings, M. 1993. "The end: How to conclude a dissertation". *Language, Learning and Success: Studying through English.* Ed. G.M. Blue. London: Modern English Publications. 105-112.

Holmes, R. 1997. "Genre analysis, and the social sciences: an investigation of the structure of research article discussion sections in three disciplines". *English for Specific Purposes* 16 (4): 321-37.

Hyland, K. 1999. "Academic attribution: Citation and the construction of disciplinary knowledge". *Applied Linguistics* 20: 341-367.

Hyland, K. 2001. "Humble servants of the discipline? Self-mention in research articles". *English for Specific Purposes* 20: 207-226.

Kwan, B. 2006. "The schematic structure of literature reviews in doctoral theses of applied linguistics". *English for Specific Purposes* 25: 30-55.

Nwogu, K.N. 1997. "The medical research paper structure and function". *English for Specific Purposes* 16 (2): 119-138.

Paltridge, B. 2002. "Thesis and dissertation writing: An examination of published advice and actual practice". *English for Specific Purposes* 21: 125-143.

Peng, J. 1987. "Organisational features in chemical engineering research articles". *ELR Journal* 1: 79-116.

Posteguillo, S. 1999. "The scientific structure of computer science research articles". *English for Specific Purposes* 18 (2): 139-160.

Prior, P. 1998. *Writing Disciplinarity: A Socio-historic Account of Literate Activity in the Academy.* Mahway, NJ: Lawrence Erlbaum.

Ridley, D. 2000. "The different guises of a PhD thesis and the role of a literature review". *Patterns and Perspectives: Insights into EAP Writing Practice*. Ed. P. Thompson. Reading, UK: CALS. 61-75

Rigo Arnavat, A. and G. Genescà Dueñas. 2002. *Cómo Presentar una Tesis y Trabajos de Investigación*. Barcelona: Ediciones Octaedro, S.L. Eumo Editorial.

Ruiying, Y. and D. Allison. 2004. "Research articles in Applied Linguistics: Structures from a functional perspective". *English for Specific Purposes* 23 (3): 264-279.

Samraj, B. 2002a. "Texts and contextual layers: Academic writing in content courses". *Genre in the Classroom: Multiple Perspectives*. Ed. A.M. Johns. Mahway, NJ: Lawrence Erlbaum. 163-176.

Samraj, B. 2002b. "Introductions in research articles: variations across disciplines". *English for Specific Purposes* 21: 1-17.

Samraj, B. 2008. "A discourse analysis of master's thesis across disciplines with a focus on introductions". *Journal of English for Academic Purposes* doi: 10.1016/j.jeap. 200.02.005.

Sierra Bravo, R. 1994. *Tesis Doctorales y Trabajos de Investigación Científica*. Madrid: Editorial Paraninfo.

Swales, J.M. 1990. *Genre Analysis: English in Academic and Research Settings*. Cambridge: Cambridge University Press.

Swales, J.M. 2004. *Research Genres: Exploration and Applications*. Cambridge: Cambridge University Press.

Thompson, P. 2005. "Points of focus and position: Intertextual reference in PhD theses". *Journal of English for Academic Purposes* 4: 307-323.

Appendix 1. Corpus references

(T1) García Escalle, P. 2000. *Modelado y Evaluación de Estrategias de Seguimiento de Terminales Móviles. Análisis de la Carga de Señalización en la Red de Acceso y en la Red Inteligente*. Departamento de Comunicaciones. Universidad Politécnica de Valencia.

(T2) Crespo Abril, F. Sin fecha. *Programación de Proyectos con Recursos Limitados mediante Algoritmos Paralelos*. Departamento de Estadística e Investigación Operativa Aplicadas y Calidad. Universidad Politécnica de Valencia.

(T3) Alcaraz Soria, J. 2001. *Algoritmos Genéticos para Programación de Proyectos con Recursos Limitados*. Departamento de Estadística e Investigación Operativa. Universidad Politécnica de Valencia.

(T4) Mollá Vayá, R. 2001. *Aplicaciones de la Aritmética en Coma Fija a la Representación de Primitivas Gráficas de Bajo Nivel*. Departamento de Sistemas Informáticos y Computación. Universidad Politécnica de Valencia.

(T5) Mayo Gual, R. 2001. *Aportaciones para la Solución de la Ecuación Algebraica de Riccati Invariante y Periódica en Tiempo Discreto en Sistemas Multiprocesa-*

dor. Departamento de Sistemas Informáticos y Computación. Universidad Politécnica de Valencia.

(T6) Molero Prieto, X. 2001. *Factores de Diseño en Redes de Almacenamiento de Altas Prestaciones*. Departamento de Informática de Sistemas y Computadores. Universidad Politécnica de Valencia.

(T7) Rubio Moreno, A. 2002. *Propuesta de una Nueva Técnica de Puntos de Recuperación a Dos Niveles para Sistemas Distribuidos de Control Industrial*. Departamento de Informática de Sistemas y Computadores. Universidad Politécnica de Valencia.

(T8) Lozano Quilis, J.A. 2003. *Teleterapia Virtual: un Nuevo Paradigma de Telemedicina para el Tratamiento de Trastornos Psicológicos*. Universidad Politécnica de Valencia.

(T9) Gil Gómez, J.A. 2003. *Aportaciones para la Mejora de la Eficiencia en los Métodos de Radiosidad Jerárquica*. Universidad Politécnica de Valencia.

(T10) Molina Moreno, J. 2003. *Especificación de Interfaz de Usuario: de los Requisitos a la Generación Automática*. Departamento de Informática de Sistemas y Computadores. Universidad Politécnica de Valencia.

(T11) Penadés Gramaje, M.C. 2002. *Una Aproximación Metodológica al Desarrollo de Flujos de Trabajo*. Departamento de Informática de Sistemas y Computadores. Universidad Politécnica de Valencia.

(T12) García Granada, F. 2003. *Una Aproximación Estocástica para la Comprensión del Lenguaje*. Departamento de Informática de Sistemas y Computadores. Universidad Politécnica de Valencia.

(T13) Garrido Tejero, A. 2003. *Planificación Temporal Independiente del Dominio. Una Aproximación Basada en Grafos de Planificación*. Departamento de Informática de Sistemas y Computadores. Universidad Politécnica de Valencia.

(T14) Salido Gregorio, M.A. 2002. *Polyhedra, un Modelo para la Resolución de Problemas de Satisfacción de Restricciones N-Arias mediante Hiper-Poliedros*. Departamento de Informática de Sistemas y Computadores. Universidad Politécnica de Valencia.

(T15) Pelechano Ferragud, V. No date. *Tratamiento de Relaciones Taxonómicas en Entornos de Producción Automática de Software. Una aproximación basada en patrones*. Departamento de Sistemas Informáticos y Computación. Universidad Politécnica de Valencia.

(T16) Castro Bleda, M.J. 1998. *Modelado Acústico de Unidades Subléxicas mediante una Aproximación basada en Métodos Estructurales-Conexionistas*. Departamento de Sistemas Informáticos y Computación. Universidad Politécnica de Valencia.

(T17) Peinado Pinilla, J. 2003. *Resolución Paralela de Sistemas de Ecuaciones no Lineales*. Departamento de Sistemas Informáticos y Computación. Universidad Politécnica de Valencia.

(T18) Alonso Jordá, P. No date. *AlgoritmosPparalelos para la Resolución de Sistemas de Ecuaciones y del Problema Lineal de Mínimos Cuadrados con Matrices Toe-*

plitz. Departamento de Sistemas Informáticos y Computación. Universidad Politécnica de Valencia.

(T19) Correa Zabala, F.J. 2002. *Depuración Declarativa de Programas Lógico Funcionales*. Departamento de Sistemas Informáticos y Computación. Universidad Politécnica de Valencia.

(T20) Arias Antúnez, E. 2003. *Algoritmos de Altas Prestaciones para la Simulación, Estimación y Control de Sistemas no Lineales*. Departamento de Sistemas Informáticos y Computación. Universidad Politécnica de Valencia.

(T21) Julián Inglada, V.J. 2002. *RT-MESSAGE: Desarrollo de Sistemas Multiagente de Tiempo Real*. Departamento de Sistemas Informáticos y Computación. Universidad Politécnica de Valencia.