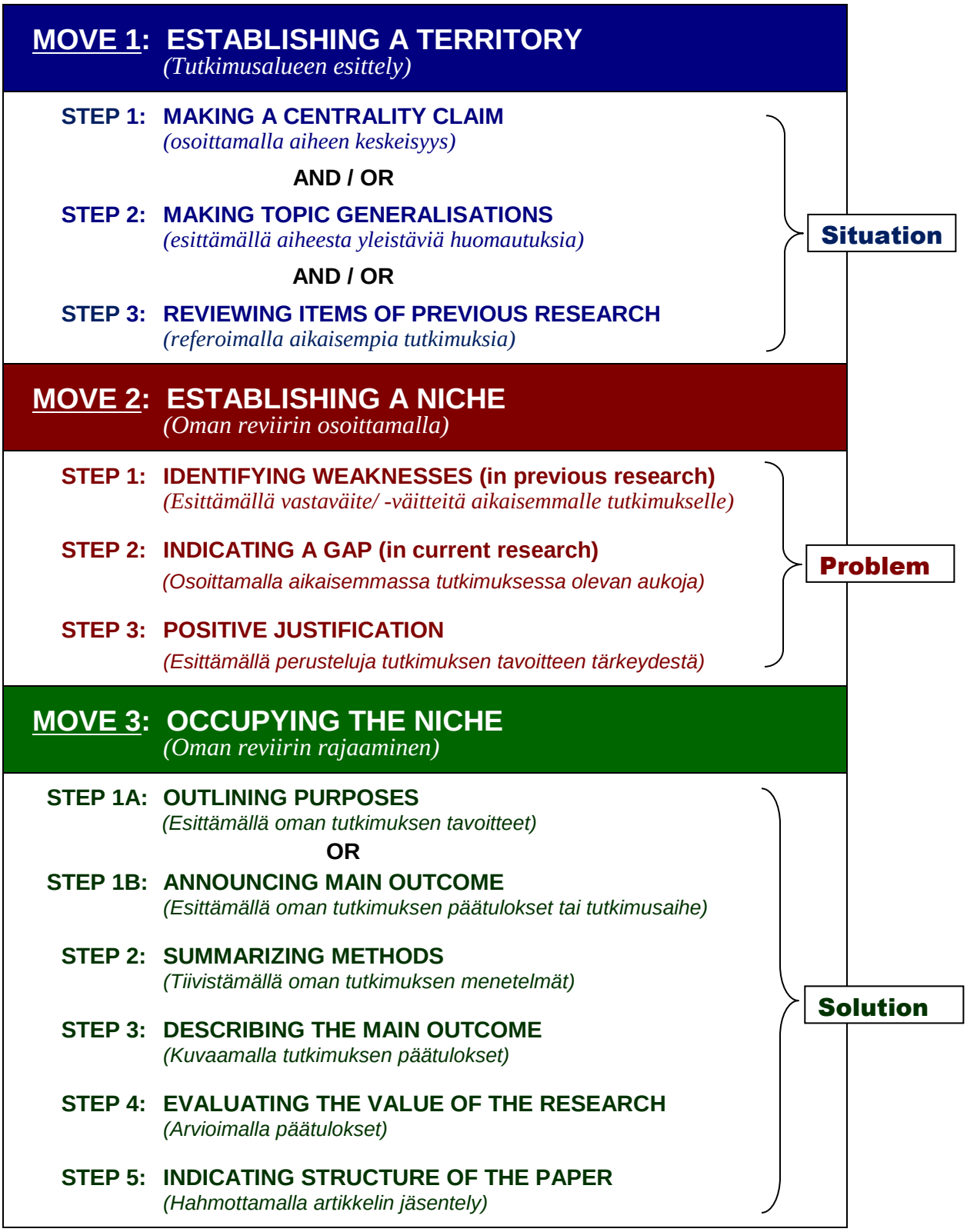
Appendix 3: The CaRS Model

Adapted from John Swales's **CaRS Model** *"**C**reating **a** **R**esearch **S**pace"*

In ecology, a **"niche"** is a particular microenvironment where a particular organism can thrive. In our case, a niche is a context where a particular piece of research makes particularly good sense. The CaRS Model uses the metaphor of the competition for resources in ecology to describe how academic writers justify their research. Just as plants compete for *light* and *space*, so do writers of RAs who compete for *acceptance* and *recognition*.



MOVE 1: ESTABLISHING A TERRITORY

In the introduction, writers generally start by describing a **"niche"** for their study using the following strategies.

STEP 1: CLAIMING CENTRALITY

The writer makes a claim that his/her topic of research is ***useful***, ***relevant***, ***important***, or ***worth*** investigating, since it forms part of a ***lively***, ***significant*** or ***well-established*** research area. This is frequently followed by evidence to support this statement. Note the use of the **present perfect tense** (*has/have -ed*) for showing the current relevance of past events.

Recently, there ***has been*** *growing interest in…*
The possibility of…. . ***has generated*** *wide interest in…*

... ***has become*** *an important* topic for analysis…
A critical issue in… is…

The…. . . ***has been*** *extensively* ***studied*** in recent years…
Many investigators ***have*** recently ***turned*** *to …*

The following three structures are common **"opening" strategies** for signaling relevance. See **Appendix 4** for typical language used in these "opening" sentences.

1. *…**has** attract**ed** much **attention** in recent years due to …*
2. *…**has** generat**ed** considerable **interest** in …*
3. *…**has** emerg**ed** as a **promising** candidate for…*

STEP 2: MAKING TOPIC GENERALISATIONS

These consist of statements concerning the current state of either ***knowledge, consensus***, ***practice*** or description of ***phenomena***. Move 1-2 is always expressed using the **present simple tense** (*is/are -ed*).

*The general features of... are **well known.***
*Practicing engineers today **typically** perform … using…*
*Industry **currently** employs an X approach to ensure the quality of software development…*
*… is an automated verification technique that **can** be used to determine…*
*It is **generally accepted** that**...***
*For complex systems, the **main** technique for … is…*

*A **standard procedure** for assessing**...**has been**...***
*Such**...** methods are **often** criticized for**...***
*… is **commonly** used to**...***
*Commercially available systems **have tended** to use…*
*Many of these... **have** **traditionally** **been implemented** using**...***
*IGBT gate drive circuits **have** **conventionally** **employed** fixed gate resistors.*

*Deviation analysis **is concerned with**…*
*The application of such methods **involves*** the use of…

STEP 3: REVIEWING ITEMS OF PREVIOUS RESEARCH

Here, the writer needs to relate ***what has been found*** *(or **claimed**)* with ***who has found*** *(or **claimed**)* ***it***. See **Appendix 5** for the four most typical topic sentences used to introduce previous research.

***Smith et al** **[13] developed** a self-calibration technique for…*
Observations by Smith (1989)** suggest that**...
*In **ref [4]**, a self-calibration technique is introduced for…*
*Data **have been presented in the literature** **[5-10]** which suggest that**...***
*In a recent work, **Smith et al. [5] have presented** a face detection technique which…*
*The performance of … has been extensively studied by **Smith and co-workers [1]–[3].***
*Another approach for intrusion detection **has been proposed by Smith and colleagues [4].***

MOVE 2: ESTABLISHING A NICHE

One way that academic writers find a ***"niche"*** for their research is by showing that the previous research history is not complete. In other words, that there are aspects of the research field still needing further investigation. The most common way of achieving this is to present a ***negative evaluation*** of some feature of **Move One**. This is often signaled by words expressing a ***contrast*** or ***negative evaluation***:

CONTRAST	QUANTITY	VERBS		ADJECTIVES	
however	few	fail	neglect	scarce	ineffective
but	less	ignore	overlook	elusive	inconclusive
yet	little	lack	question	limited	uncertain
nevertheless	no	prevent	challenge	restricted	unclear
unfortunately	none	hinder	deter	difficult	unreliable
although	not	obviate	limit	inefficient	unsatisfactory

STEP 1: IDENTIFYING WEAKNESSES (in previous research)

Frequently following ***Move 1-3 (Reviewing Items of Previous Research)***, this strategy finds faults or problems in earlier researchers' work (i.e., methods, proposed techniques and solutions).

However, this view is challenged by recent data showing...
However, these studies have failed to recognize the...
However, recent work suggests that...
…have been reported in [7]–[9]. However, they commonly suffer from...
However, these approaches become increasingly unreliable when...

STEP 2: INDICATING A GAP (in current research)

Another strategy commonly used when there is very little or no research available in the writer's research field is to first discuss those topic areas in the larger field that have received attention, and then go on to claim that **no** studies/research, **little** research, or **few** studies have examined the problem area that you the writer plan to solve in your own study. This strategy frequently follows ***Move 1-2 (Making Topic Generalisations).*** Note that the strategies and vocabulary described in **Appendix 2** are often used to establish a gap.

*Although **much** research has focused on... little **research** has...*
*…has been **extensively** studied. However, less **attention** has been paid to...*
*Although … has been applied in **many studies**, few of **these** have -ed...*
*Despite the importance of..., few **researchers** have studied...*

*While there have been **many efforts** to…, these **have been limited to**…*
*…have been demonstrated in recent years [2-6]; however, they **were restricted to**…*
*The only reported **study** to date of...covered a limited **range** of...*

*However, to the best of our knowledge, no **previous work** has addressed the problem of detecting…*
*As a result, no comprehensive **theory** appears to exist.*

STEP 3: POSITIVE JUSTIFICATION

Although rarely used in engineering, this step emphasizes the importance of finding in answer to an immediately preceding problem presented by either **Move 2-1 or 2-2**. Positive justification is typically introduced with the causative connector ***'therefore'*** to show that this a logical deduction and is closely followed by **Move 3-1A** or **3-1B**.

***Knowledge of** the network characteristics **could** greatly reduce computer requirements**, thus** enabling the development of an optimal 3-D solution.*

***It is therefore highly desirable to** attain low-voltage charge transfer for CMOS image sensors ….*

***Therefore, a pressing need exists for** an accurate, scalable approach for countering insider threats.*

MOVE 3: OCCUPYING THE NICHE

Here, writers reveal their solution to help ***fill the gap*** or ***address the specific problem*** / ***weakness*** that was presented in **Move 2**:

STEP 1A: OUTLINING PURPOSES (Why?)

The author indicates the main **purpose**, **aim**, **goal** or **objective** of the study. The actual purpose statement can be structured in four different ways, depending on the conventions of the writer's own field. See **Appendix 5** for the language and specific verbs that can be used to express aims.

The | **purpose** / **aim** / **goal** / **objective** | *of this paper* **is to** *develop...* (**Traditional:** *aim /purpose /objective /goal*)

STEP 1B: ANNOUNCING MAIN OUTCOME

Since research papers in engineering fields are most concerned with disseminating technical research that is **new** and **"novel"**, it is not surprising that they would have no other purpose than to "announce" that they have something to share with the engineering community. This is commonly accomplished with a small set of verbs: **present**, **introduce**, **describe**, and **propose**.

In this study, **we** *develop a model for...* (**Personal pronoun:** *We* or *I*)

In this study, a model **is developed** *for…* (**Passive verb:** *is presented*)

This paper *develops a model for...*
This work *aims to develop a model for...*
The present study *tested... and measured...*
(**Inanimate actor:** *paper, work* or *study*)

In this paper, we **present** *a novel method for...*
This study **introduces** *a design for...*
This article **proposes** *a new classification scheme for...*

STEP 2: SUMMARIZING METHODS

This step briefly outlines the main **procedures**, **methods, materials** and any **experimental set-up**, and is signaled by language typical of the **means-purpose** shift.

> *The effect on the amount and molar mass of isolated polysaccharides* ***was determined using*** *different extraction conditions of time and temperature. The extracted material* ***was*** *then* ***assessed for*** *lignocellulosic composition, molar mass distribution and acetyl content.*

STEP 3: DESCRIBING MAIN OUTCOME

Here the writer describes the main features of the outcome (e.g., *device*, *algorithm*, *model* or *method*) developed in the paper.

> *The proposed system* ***consists of*** *a laser source, an electrooptic phase modulator (EOPM), a fiber Bragg grating (FBG), and a photodetector (PD). The light source* ***is phase modulated by*** *an electrical Gaussian pulse train via the EOPM. The optical phase modulation to intensity modulation conversion* ***is achieved by*** *reflecting the phase modulated light at the slopes of the FBG that* ***serves as*** *a frequency discriminator.*

STEP 4: EVALUATING THE VALUE OF THE RESEARCH

This step is most often found in research that aims to develop new methods, such as chemistry and engineering. However, in most fields evaluation of the results is left until the Discussion Section. Typically, this step is the opposite of **Move 2** in that it requires **positive evaluation** of some aspect of the solution described in the research article.

> *Numerical results show that **the proposed algorithm** not only enjoys the **advantages** of **low complexity** and **ease of implementation** but is also able to achieve performance **very close to the optimum achievable bound**.*

STEP 5: INDICATING STRUCTURE OF THE PAPER

First, the writer introduces the structure with a **topic sentence**:

> *The **rest/ remainder** of this **paper/work** is organized as follows.*
> *This **paper** is structured as follows.*
> *The **remainder** of this paper is divided into five sections.*

Next, the writer has three alternative structures that can be used to describe each **Section** (in research articles and reports) or **Chapter** (in theses or dissertations):

> **Section 3** *describes* the framework used to... **(Text as actor)**
> **Section 4** *presents* the model used to...
>
> *In Section 3,* **we** *describe* the framework used to... **(Author as actor)**
> *In Section 4,* **I** *present* the model used to...
>
> *In Section 3*, **a framework** *is described* that... **(Content as subject)**
> *In Section 4*, **a model** *is presented* for …

A quick-n-dirty analysis revealed the following 21 verbs to be common in electrical engineering:

analyze	**discuss**	**introduce**	**report**
assess	**evaluate**	**outline**	**review**
define	**examine**	**present**	**summarize**
derive	**explain**	**propose**	**survey**
describe	**explore**	**provide**	**validate**
			verify

Thus, a typical Step 5 in a research article would look something like the following, with one sentence usually being allotted for each *section* (or *chapter* in a thesis).

> ***The structure of the paper is as follows. Section II describes** the proposed MIMO OFDM transmitter and receiver scheme. **Section III defines** the MIMO OFDM signal model. **In Section IV,** the implementation of the MIMO OFDM synchronization and detection algorithms **are presented**, and the performance **is shown in Section V**. Finally, conclusions **are drawn in Section VI**.*