GESTURE BASED SOCIAL MEDIA AND NEWS INTERFACE

By

Steven T. King Jr.

A DISSERTATION

Submitted to

The University of Liverpool

in partial fulfillment of the requirements

for the degree of

MASTER OF SCIENCE

dd/mm/201x

{**Edited 2011-January, 9 --- Version 12.2:** Dissertation Template (nested numbering version) and Author Notes Look like this. This is a special style used to annotate the boilerplate and also used to leave instructions and notes. This style stands out as a reminder that comments must be replaced or removed before a polished document is submitted. It is also a way to exchange notes with an advisor or review without impacting the document directly. It is also possible to use Microsoft Word to find all paragraphs in this AuthorNote style.

We thank Denis Hamilton who provided the template from which this one was adopted}

ABSTRACT

GESTURE BASED SOCIAL MEDIA AND NEWS INTERFACE

By

Steven T. King Jr.

This document is designed to use Body Text styles for all content. This is a typical body text paragraph.

{Some things to notice right away: In Word, select File | Properties and change the information to reflect your thesis document. It is no fun to have the author of a template you used (or your-name-here) be credited as the author of your dissertation in the document properties metadata.

Also, notice that the title is written on the cover and on the abstract page. Your name is also written in both places, as well as in the next section (the declaration). You’ll need to change the date, too.

The template uses the following formatting standards:

The Page Setup is defined to use the A4 paper size [changing it to letter paper size is also acceptable. Do this by selecting the whole file (CTRL & A) and then click File, Page Setup, Paper and in the Paper Size window select “Letter” and OK it], and has top and bottom margins of 2.54cms (1”), and left and right margins of 3.05cms (1.2”).

The DS title is capitalized and uses the Arial 14 font. Name and other headings in the first page are Arial 14. The rest of the words on the first page use the Arial 12 font.

All the paragraphs are (right and left) justified and the Text Body style used for text is Arial 10 font, double spaced, but if you find that the size 12 font is better you can use it.

The chapter headings are capitalized centered, and the font to be used is Times Roman 14; the chapter subheadings are underlined and use Times Roman 12 bold font.

The Appendix headings are capitalized, left adjusted, and in Times Roman 14 font.

Please note the three different page numbering systems. The first pages are counted but not numbered. The first number appears on the Table of Contents page and uses a Roman numeral. Numbering with Roman numerals continues with all the different TOCs. A new page count starts with the first page of the dissertation body (Introduction), using Arabic numbers.

On this page you begin following the style guidelines of the Dissertation Guide that applies to your dissertation project.

Although it may be convenient to author in the Print Layout, you may want to check the Normal View to see the kinds of section breaks that are used to satisfy layout, contents, and page-numbering requirements. This front matter is in an initial section for which the page numbers are not shown (although the pages are counted, as is customary).

BE VERY CAREFUL deleting pages or even paragraphs at the ends of pages, because this may remove an important section control, leading to destruction of the format that you need to preserve. It is useful to backup your document often, try new things only after saving what you already have, and using Undo immediately when something goes haywire.

The abstract should be around 350 words and should not exceed more than two pages.

The document may be submitted as a Microsoft WORD, postscript or PDF document. The preferred format for submission is .DOC using the WORD editor and page dimensions should conform to the A4/Letter format. However, the dissertation will finally be produced in hard-copy form as a public document lodged at the University, so it is important that it be laid out with this in mind.

The example is made of general comments and abstract headings, as well as text that was drawn from a dissertation. Needless to say that all these elements should be overridden by your own work}

DECLARATION

I hereby certify that this dissertation constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

I declare that the dissertation describes original work that has not previously been presented for the award of any other degree of any institution.

Signed,

Steven T. King Jr.

{Remember to put your name here. It is possible to scan in a signature image or, with a tablet PC, create a signature and then paste the image here. This will allow your signature to be included in the submission and it will also appear properly in any PDF you make from the Word document.}

{Students who need to keep their dissertation confidential should add the following sentence on the same page, in the template, that they make their declaration about plagiarism, as inserting this statement will also preclude the dissertation from being placed in the University Library. Students that submit works that are not confidential should erase the following sentence.}

“This dissertation contains material that is confidential and/or commercially sensitive. It is included here on the understanding that this will not be revealed to any person not involved in the assessment process.”  
**Student, Supervisors and Classes:**

|  |  |
| --- | --- |
| Student name: | Steven T. King Jr. |
| Student ID number: | 15480884 |
| GDI name: | Taly Sharon |
| RMT (GDI) class ID: | ComputingReserachMethodsTraining.2012.21.01.906 |
| DA name: | Taly Sharon |
| DST (DA) class ID: | ComputingAdvisorClass. 2012.05.03.203 |

*{Please use the above format where yyyy is the year, mm is the month, dd is the day and nn is the class number}*

ACKNOWLEDGEMENTS

Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx.

{CAUTION: There is a section change at the end of this page. Do not do anything that deletes it. The section change is responsible for switching to the use of Roman-numeral page numbers.

The first part of the acknowledgments, which must be included, should cite the person or the organization that supplied you with the information that was used for the dissertation. You should specify the domain of the project, in what context it was performed, the environment where it was conducted, and any help that you received. This is even more important when the project was done in the context of the company in which you work. This information which should be explained in the Proposal should be included here as well.

The second optional part might include any further acknowledgments that you want to make. Even the most minor assistance should be clearly acknowledged.  
The acknowledgments should be in good taste and should not be longer than one page

The tables of contents are included in the next section. Any changes to the ToC styles and levels of nesting, and so on, will require that the table of content be regenerated. Changes you make in the sections will be reflected in the table of contents only after you regenerate it. This is accomplished either by right clicking on the entries, choosing “Update Field” and “Update entire table”, and then confirming by a click on the OK, or by performing an Edit | Select All followed by pressing of the F9 key, which will lead you to the same forms. This will make a new table of contents and update all captions and cross references. If the process completes with a message that all updates could not be done, simply do it again. We also suggest specifying that all information should be updated every time. It is the safest though slightly slower approach.

This template uses nested decimal numbering of chapters, chapter sections, and subsections. It is easier to have more levels while working on the document and then reduce the number included in the ToC if you find this to be appropriate. Always save a copy of the document and start with a new copy before making changes in this area. There are also Microsoft Knowledge Base and Office Online Help articles about working with tables of contents, heading numbering, page numbering, and the changing of heading styles in Appendix sections.

Note that Chapter 1 begins a new section, with different page numbering (starting over from 1 as specified in the Dissertation Guide). There is content here that has been retained from a draft dissertation because it allows the creation of Table and Figure contents to be demonstrated. As you introduce your own tables and Figures, you should delete the sample ones.

You will notice that the TOC, the tables and figures, and the headings can be cross-referenced, and those cross-references are implemented by links that can be followed (by clicking on the reference while holding the CTRL key) when reading the document in either Word or PDF format (if you use a good PDF converter). However, the hyperlink style has been modified so that the usual change of color and underlining are not done. This way, a print copy has the quality and appearance of a scholarly document while still being a hyper-document when viewed electronically.

Also notice that all numbering of headings, tables, and figures is done automatically. These will also be updated automatically as you make changes, add, delete, and reorder material. Let this happen.

You do need to know about applying styles to use this document, mainly because the different kinds of headings and subtitles are specified by using styles. There are settings in your Word configuration that also determine whether this is easy or hard. Place your cursor on some of this text and notice what style it was created under.

Captions for figures are created by going to Insert | Reference | Caption… . The cross-references to tables, figures, and headings are by created using Insert | Reference | Cross-reference… . You can make more places to cross-reference by using Insert | Bookmark, as in the bibliography, and you can refer to those by Insert | Hyperlink… , as when making citations in the text. All of these cross-references will be implemented by unobtrusive hyperlinks in the resulting electronic document and the PDF.}

**TABLE OF CONTENTS**

Page

[LIST OF TABLES vi](#_Toc283114601)

[LIST OF FIGURES vi](#_Toc283114602)

[Chapter 1. Introduction 6](#_Toc283114603)

[1.1 Scope 6](#_Toc283114604)

[1.2 Problem Statement 6](#_Toc283114605)

[1.3 Approach 6](#_Toc283114606)

[1.4 Outcome 6](#_Toc283114607)

[Chapter 2. Background and review of literature 6](#_Toc283114608)

[2.1 Related Work 6](#_Toc283114609)

[2.2 Literature 6](#_Toc283114610)

[2.3 Industry Sources 6](#_Toc283114611)

[Chapter 3. Theory 6](#_Toc283114612)

[3.1 A 6](#_Toc283114613)

[3.2 B 6](#_Toc283114614)

[Chapter 4. Analysis and Design 6](#_Toc283114615)

[4.1 A 6](#_Toc283114616)

[4.2 B 6](#_Toc283114617)

[4.3 C 6](#_Toc283114618)

[Chapter 5. Methods and Realization 6](#_Toc283114619)

[5.1 A 6](#_Toc283114620)

[5.2 B 6](#_Toc283114621)

[5.3 C 6](#_Toc283114622)

[Chapter 6. Results and Evaluation 6](#_Toc283114623)

[6.1 A 6](#_Toc283114624)

[6.2 B 6](#_Toc283114625)

[6.3 C 6](#_Toc283114626)

[Chapter 7. Conclusions 6](#_Toc283114627)

[7.1 Lessons Learned 6](#_Toc283114628)

[7.2 Future Activity 6](#_Toc283114629)

[7.3 Prospects for Further Work 6](#_Toc283114630)

[REFRENCES CITED 6](#_Toc283114631)

LIST OF TABLES

Page

[Table 1 Principle Topics in Pattlets 6](#_Toc120440496)

[Table 2 Full Pattern-Description Organization 6](#_Toc120440497)

{To update the LIST OF TABLES, right click on the entries, chose “Update Field”, choose “Update entire table” and click on OK}

LIST OF FIGURES

Page

[Figure 1. Navigational Data-Entity Hierarchy (typical) 6](#_Toc120440498)

[Figure 2. Converse Matching of Association Types in Data-Entity Relationships 6](#_Toc120440499)

{To update the LIST OF FIGURESS, right click on the entries, chose “Update Field”, choose “Update entire table” and click on OK

}

# Introduction

New technologies for interacting with computers are changing the way we consume social information and news media. While touch devices such as the iPad and Kindle have changed media habits and website interaction by using gesture controls and touch interfaces, gaming systems such as the Xbox 360 have integrated motion and depth detection.

At the same time, HDTV flat screens are becoming more prevalent throughout homes and business and better way to interact with those devices is needed. Motion and depth sensing technology is rapidly developing and with the mass release of the Xbox Kinect in MONTH of 2011 by Microsoft, this technology can be found in millions of homes and businesses.

While the hardware is developing and price falls there are efforts to bring this technology to the personal computer and not have it limited to tablets or priority gaming systems. Microsoft enabled the ability to develop motion-based interfaces by releasing the Kinect Application Programing Interface (Kinect API). Open source projects such as DepthJS worked to integrate the Kinect API and the universal web browsers but have seen little adoption.

All of these developing technologies, both hardware and software are now converging into gesture controlled, large screen experience. Users in public places no longer have to use a touch screen kiosk but can not begin interacting with an application simply by stepping forward or swiping a hand. In homes, users a no longer limited to a remote control or a keyboard and mouse but can control the cursor with the wave and push of their hand.

This project will integrate the most common hardware configuration to test some current news and social websites as well as develop a custom-designed interface for gesture control and interaction with news and information.

{This is a potential introductory section. It has been included in this skeletal form just to demonstrate heading numbers, styles, and creation of the Table of Content.}

Scope

This dissertation will explore the necessary design and user experience concerns publishers and developers should consider when developing for the emerging technology. It implements the most common hardware configuration and integrates gesture enabling software design for the browser. This project will provide qualitative analysis of existing desktop and mobile interfaces as well as custom designed experiences.

The research is limited to the use of Xbox Kinect and DepthJS though other hardware and software solution are emerging in the market.

*{Say what the scope of the dissertation is. This may say what is covered and what is not covered, and the extent/level of each.}*

Problem Statement

Approach

**{An example of communicating with the DA:**

Although the determination of closed-source dependability and trustworthiness is also subject to this kind of treatment, there are some useful differences to contrast.

{We choose open-source software for several reasons - it is available, and it is amenable to inspection of the development process from end to end.}

{TROST itself developed as an open-source development}

{Although there is room for creativity, the point of a reference implementation is lucidity and narration of the options that are available and all of the places the reference implementation incorporates choices that would be re-assessed in any adaptation of it.}

{I think reference material on ODMA should be in an appendix, with regard to what it takes to incorporate a DMS integration in ODMA.}

Outcome

# Background and review of literature

Related Work

{Here is some example text just to illustrate citations of material in the bibliography. This is not offered as a correct way to provide background. It is more to show cross-references working. The cross-references on this page are made by first of all typing the reference in the REFERENCES CITED, then selecting it and through Insert | Bookmark | Add giving him a name (don’t use spaces in that name). Then return to the text and select the text (e.g., “(2004)”) and click the Hyperlink button on the Windows toolbar. Choose the “Place in this Document”, find the name in the list and click OK. The advantage of a hyperlink is that the text of the link can be anything, no matter what bookmark is the target. Cross-references, on the other hand, use target material to make text that is part of the link. That is inconvenient for bibliographic citations.}

Susan addresses trust from the point of view of e-commerce sites providing reassurances of trustworthiness in their presentation and operation ([2004](#Fallow2004)). Although the focus is on user interface, the principles applied and the care shown in having the site be trustworthy is instructive for the software-development and deployment focus here.

Simson Garfinkel examines the connection between usability and security in his Ph.D dissertation ([2005](#Garfinkel2005)). A number of elements of security assurance can be extended to trustworthiness, such as those given by ([Stoneburner 2005](#Stoneburner2005)). Several of the patterns that Garfinkel identifies are also appropriate for giving users confidence in the trustworthiness of software systems as well. There are also cautionary findings that raise concerns about intrusion on the user and in expecting that adopters will actually perform the confirmation and assurance actions that we propose to make available ([Garfinkel 2005](#Garfinkel2005)).

The employment of patterns and pattern language by Garfinkel is in the style of software design patterns ([Gamma et.al. 1995](#Gamma1995)). Garfinkel’s chosen patterns are more in-the-world in the spirit of *A Pattern Language* ([Alexander *et.al*., 1977](#Alexander1977)). This ability to shift attention from the formal workings of machines and software systems to the world of the software’s adopters and users is seen as critical to the achieving of trustworthiness in software, allowing us to address the “domains of action in which the customers of software systems live and work” ([Denning & Dargan, 1996](#Denning1996)).

Consideration of patterns and their levels leads to questions about the difference between artifacts and the situations in which they serve as instruments of human purposes. Hal Pierson speaks of the difference between the problem space and the solution space, noting that most of what is done in software development and engineering is focused on the solution space ([2004](#Pierson2004)). Although the thesis pilot project is deep within the solution space, the distinction is already critical.

Literature

Industry Sources

# Theory

{A description of the assumptions and theories employed to acquire the necessary information and skills to carry out the project.}

A

B

# Analysis and Design

{Documentation of the analysis and design containing full details of the design. The design documentation should also be supplied (possibly as an appendix).}

A

B

C

# Methods and Realization

{How the design was implemented? Changes made to the design in the course of the implementation. How was the data collected? How was the implementation tested? Typically code listings, screen shots and test runs will appear as appendices}

A

B

C

# Results and Evaluation

{Description of the results followed by their review. These may include, where appropriate, feedback from test groups, users and the project sponsor.}

A

B

C

# Conclusions

{A summary of the project as a whole. Lesson learned. Possible applications and extensions of the work}

Lessons Learned

Future Activity

Prospects for Further Work

REFRENCES CITED

{This section will demonstrate the Harvard-style bibliography for the entire dissertation. It must use the required format described <http://www.liv.ac.uk/library/ohecampus/ref.htm>. We have included some samples so that the use of cross-references from citations to the bibliography entries is illustrated.}

Alexander, C., Ishikawa, S., Silverstein, M., Jacobson, M., Fiksdahl-King, I., Angel, S. (1977) *A Pattern Language: Towns, Buildings, Construction*. Oxford University Press, New York. 1171 pp. ISBN 0-19-501919-9.

Denning, P., Dargan, P. (1996) Action-centered design. pp. 105-127, Chapter 6 in ([Winograd, 1996](#Winograd1996))

Fallow, S. (2004) Maximizing Consumer Trust in e-Commerce by means of Usability Concepts in Web Design. M.Sc dissertation, University of Liverpool, August. 94 pp. Available by request to the author, [webmaster@cardsatyourfingertips.co.uk](mailto:webmaster@cardsatyourfingertips.co.uk?subject=M.Sc%20thesis%20-%20maximizing%20consumer%20trust)

Gamma, E., Helm, R., Johnson, R., Vlissides, J. (1995) *Design Patterns: Elements of Reusable Object-Oriented Software*. Addison-Wesley, Boston. ISBN 0-201-63361-2.

Garfinkel, S. (2005) Design Principles and Patterns for Computer Systems That Are Simultaneously Secure and Usable. Ph.D. dissertation, Massachusetts Institute of Technology, May. 473 pp. Available on the Internet at: <http://www.simpson.net/thesis/> (accessed on: 2005 July 21).

Pierson, H. (2004) Models. *Hal 9000* web log entry, May 17. Available at <http://halpierson.blogspot.com/2004/05/models.html> (accessed on: 2004-06-06).

Stoneburner, G. (2005) Developer-Focused Assurance Requirements. IEEE *Computer* ***38***, 7 (July 2005), 91-93

Winograd, T. (ed.) (1996) *Bringing Design to Software*. ACM Press, Addison-Wesley, Boston. ISBN 0-201-85491-0

APPENDICES

###### Pattern-Description Template

*{This section shows how to start an appendix and how to illustrate tables and figures. These are extracts from actual material. In this particular project dissertation, a large part of the project was carried out on the web. Some of these particular appendices were abridged accounts that supported the thesis without requiring on-line access for the material and that allowed a print version to be self-contained.}*

**Latest version:** <[**http://TROSTing.org/info/2005/08/i050803b.htm**](http://trosting.org/info/2005/08/i050803b.htm)> provides the latest material on the TROST Pattern Description Approach.

**Version:**  **0.30** <[**http://TROSTing.org/info/2005/08/i050803e.htm**](http://trosting.org/info/2005/08/i050803e.htm)> is the version of the approach that this appendix is based on.

Pattern-Description Approach

Pattern descriptions are based on a detailed template that aligns with a variety of pattern descriptions in common usage.

The minimal pattern description consists of a pattlet providing a compact summary of a pattern’s essential characteristics.  The principles of the overall template are honored but the content is abbreviated.

For pattern descriptions with extensive content, a pattlet summary is used as a cover, with detailed description and supporting materials on supplemental pages.  In these cases, the pattern description will provide detailed coverage of topics and subtopics.  Variations will often be introduced at the detail level to accommodate different situations and methodologies.

There is provision for patterns being specialized variations of more general patterns.  It is also possible for patterns that are focused on realization in concrete implementations to be based on more-abstract patterns.  The different forms will be cross-referenced. The differences are in placement of emphasis and detail more than differences in the overall format.  The same pattern description structure is drawn upon.

Pattlet Summary Structure

Pattlets are summaries of pattern descriptions.  The ten key topics of the full pattern template are addressed briefly and selectively (Table 1).

Table 1 Principle Topics in Pattlets

|  |
| --- |
| 1. [**Identification**](#_Identification) - how the pattern is known 2. [**Situation**](#_Situation) - the setting in which the pattern can occur or be desired 3. [**Intention**](#_Intention) - what is to be accomplished 4. [**Concerns**](#_Concerns) – issues to be balanced and addressed 5. [**Approach**](#_Approach) – how to satisfy the intention – what to do 6. [**Realization**](#_Realization) – strategy for specific implementations of the approach 7. [**Considerations**](#_Considerations) – additional matters to be aware of 8. [**Consequences**](#_Consequences) – the result of achieving the pattern: benefits and limitations 9. [**Usage**](#_Usage) – actual cases, related patterns involved in completing the approach of this pattern 10. [**Sources**](#_Sources) – acknowledgment of source materials and contributions |

The pattlet format is convenient for determining whether it is promising to examine the complete pattern description.

Pattlets are also convenient as summaries of patterns having detailed descriptions provided elsewhere.  In that case, the summary saves the reader from having to track down additional sources simply to see how the pattern is being applied in an immediate situation.  The pattlet is a summary-level stand-in and connection to further detail.

Full Pattern-Description Organization

The following table illustrates the complete set of subtopics currently identified in the Pattern-Description Template.

Table 2 Full Pattern-Description Organization

|  |  |  |  |
| --- | --- | --- | --- |
| **1.** [**Identification**](http://compagno/TROST/info/2005/08/i050803c.htm#Identification#Identification)      1.1 [Name](http://compagno/TROST/info/2005/08/i050803c.htm#Name#Name)      1.2 [Version](http://compagno/TROST/info/2005/08/i050803c.htm#Version#Version)      1.3 [Summary](http://compagno/TROST/info/2005/08/i050803c.htm#Summary#Summary)      1.4 [Also Known As](http://compagno/TROST/info/2005/08/i050803c.htm#Also_Known_As#Also_Known_As)      1.5 [Type](http://compagno/TROST/info/2005/08/i050803c.htm#Type#Type)      1.6 [Archetype](http://compagno/TROST/info/2005/08/i050803c.htm#Archetype#Archetype)      1.7 [Keywords](http://compagno/TROST/info/2005/08/i050803c.htm#Keywords#Keywords)        **2.** [**Situation**](http://compagno/TROST/info/2005/08/i050803c.htm#Situation#Situation)      2.1 [Perspectives](http://compagno/TROST/info/2005/08/i050803c.htm#Perspectives#Perspectives)      2.2 [Context](http://compagno/TROST/info/2005/08/i050803c.htm#Context#Context)      2.3 [Applicability](http://compagno/TROST/info/2005/08/i050803c.htm#Applicability#Applicability)      2.4 [Indications](http://compagno/TROST/info/2005/08/i050803c.htm#Indications#Indications) | **3.** [**Intention**](http://compagno/TROST/info/2005/08/i050803c.htm#Intention#Intention)      3.1 [Intent](http://compagno/TROST/info/2005/08/i050803c.htm#Intent#Intent)      3.2 [Background](http://compagno/TROST/info/2005/08/i050803c.htm#Background#Background)       **4.** [**Concerns**](http://compagno/TROST/info/2005/08/i050803c.htm#Concerns#Concerns)        **5.** [**Approach**](http://compagno/TROST/info/2005/08/i050803c.htm#Approach#Approach)      5.1 [Key Statement](http://compagno/TROST/info/2005/08/i050803c.htm#Key_Statement#Key_Statement)      5.2 [Rationale](http://compagno/TROST/info/2005/08/i050803c.htm#Rationale#Rationale)      5.3 [Prerequisites](http://compagno/TROST/info/2005/08/i050803c.htm#Prerequisites#Prerequisites)      5.4 [Sketches](http://compagno/TROST/info/2005/08/i050803c.htm#Sketches#Sketches)      5.5 [Detail](http://compagno/TROST/info/2005/08/i050803c.htm#Detail#Detail)      5.6 [Models](http://compagno/TROST/info/2005/08/i050803c.htm#Models#Models)      5.7 [Diagrams](http://compagno/TROST/info/2005/08/i050803c.htm#Diagrams#Diagrams) | **6.** [**Realization**](http://compagno/TROST/info/2005/08/i050803c.htm#Realization#Realization)        **7.** [**Considerations**](http://compagno/TROST/info/2005/08/i050803c.htm#Considerations#Considerations)      7.1 [Testing](http://compagno/TROST/info/2005/08/i050803c.htm#Testing#Testing)      7.2 [Safety/Failure](http://compagno/TROST/info/2005/08/i050803c.htm#Safety/Failure#Safety/Failure)      7.3 [Deployment](http://compagno/TROST/info/2005/08/i050803c.htm#Deployment#Deployment)      7.4 [Security](http://compagno/TROST/info/2005/08/i050803c.htm#Security#Security)      7.5 [Operations](http://compagno/TROST/info/2005/08/i050803c.htm#Operations#Operations)      7.6 [Usability](http://compagno/TROST/info/2005/08/i050803c.htm#Usability#Usability)      7.7 [Support/Repair](http://compagno/TROST/info/2005/08/i050803c.htm#Support/Repair#Support/Repair)      7.8 [Performance/Scale](http://compagno/TROST/info/2005/08/i050803c.htm#Performance/Scale#Performance/Scale)      7.9 [Trustworthiness](http://compagno/TROST/info/2005/08/i050803c.htm#Trustworthiness#Trustworthiness) | **8.** [**Consequences**](http://compagno/TROST/info/2005/08/i050803c.htm#Consequences#Consequences)      8.1 [Benefits](http://compagno/TROST/info/2005/08/i050803c.htm#Benefits#Benefits)      8.2 [Limitations](http://compagno/TROST/info/2005/08/i050803c.htm#Limitations#Limitations)      8.3 [Trade-Offs](http://compagno/TROST/info/2005/08/i050803c.htm#Trade-Offs#Trade-Offs)      8.4 [Risks](http://compagno/TROST/info/2005/08/i050803c.htm#Risks#Risks)      8.5 [Next Challenges](http://compagno/TROST/info/2005/08/i050803c.htm#Next_Challenges#Next_Challenges)        **9.** [**Usage**](http://compagno/TROST/info/2005/08/i050803c.htm#Usage#Usage)      9.1 [Known Examples](http://compagno/TROST/info/2005/08/i050803c.htm#Known_Examples#Known_Examples)      9.2 [Variants](http://compagno/TROST/info/2005/08/i050803c.htm#Variants#Variants)      9.3 [Related Patterns](http://compagno/TROST/info/2005/08/i050803c.htm#Related_Patterns#Related_Patterns)       **10.** [**Sources**](http://compagno/TROST/info/2005/08/i050803c.htm#Sources#Sources)      10.1 [References](http://compagno/TROST/info/2005/08/i050803c.htm#References#References)      10.2 [Contributors](http://compagno/TROST/info/2005/08/i050803c.htm#Contributors#Contributors)      10.3 [Attribution](http://compagno/TROST/info/2005/08/i050803c.htm#Attribution#Attribution) |

###### Navigational Data odel

{This Appendix is included to show how section numbering is preserved in the Appendices, how figures are captioned and cross-referenced, and to verify that the table of contents is still being correctly produced.}

When expressing a pattern that involves organizations of data, especially documents, web pages, and software-deployment materials, navigational data models are employed. The following conventions apply to the reading and creation of the diagrams.

**Latest version:** <[**http://TROSTing.org/info/2005/08/i050809b.htm**](http://compagno/TROST/info/2005/08/i050809b.htm)> provides the latest material on the TROSTing Navigational Data Model.

**Version:**  **0.75** <**[http://TROSTing.org/info/2005/08/i050809c.htm](http://compagno/TROST/info/2005/08/i050809c.htm" \t "_top)**> is the version of the definition that this appendix is based on.

Hierarchical Organization



Figure 1. Navigational Data-Entity Hierarchy (typical)

The diagrams express organizations of data. Types of data entity are named and their composition in terms of constituent data-entity types is portrayed via a hierarchical connection of rectangles. The appearance is similar to that of organization charts.

Figure 1 illustrates a typical hierarchical composition for a data-entity type. Different cases are indicated by variations in the rectangles, in connectors among the boxes, and in special attachments in the diagrams.  Each rectangle signifies a data entity type, with the connecting lines establishing their hierarchical composition of constituent data-entity types.

**Example.** The modeling of parts explosion for manufactured assemblies in Figure 2 illustrates the use of converse associations in reflecting how parts may be assemblies that are used in specific places as subassemblies of further assemblies.  The symmetry of details in the converse associations is valuable in making the relationship unambiguous.  The notation also makes the converse-association pairs easy to locate, especially in extensive models where the mated associations appear on separate pages of the model's diagrams.



Figure 2. Converse Matching of Association Types in Data-Entity Relationships