Graphics Press LLC P. O. Box 430 Cheshire CT 06410
Non Sequitur By Wiley Miller

AH-HA! THERE IT IS!!

HOW TO TELL YOUR POWERPOINT PRESENTATION NEEDS WORK

WILEY@NON-SEQUITUR.COM DIST. BY UNIVERSAL PRESS SYNDICATE
Why PPT is Better Than Overheads

From “Robert Rules For Dummies” by C. A. Jennings, Wiley 2005, Pg. 297
Helpful Instruction
What is Research Like?

THE START

325 Goldstein AC PVL
&
416A WP GC
rfrank @ pace.edu
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOC</td>
<td>3</td>
</tr>
<tr>
<td>Prelude to Research</td>
<td>5</td>
</tr>
<tr>
<td>Types of Research</td>
<td>2</td>
</tr>
<tr>
<td>What Research Is &amp; IS NOT</td>
<td>3</td>
</tr>
<tr>
<td>Why We Do Research</td>
<td>2</td>
</tr>
<tr>
<td>5 Research Examples (1, 2, 3)</td>
<td>21</td>
</tr>
<tr>
<td>Current IS Dissertations (4, 5, 6)</td>
<td>7</td>
</tr>
<tr>
<td>Commentary &amp; Advice</td>
<td>11</td>
</tr>
<tr>
<td>Appendix 1 Process</td>
<td>12</td>
</tr>
</tbody>
</table>

Table of Contents 1/3
## Table of Contents 2/3

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Title</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Appendix 2 Psychology</td>
<td>[72-80]</td>
</tr>
<tr>
<td>3</td>
<td>Appendix 3 Proposal Outline</td>
<td>[81-82]</td>
</tr>
<tr>
<td>4</td>
<td>Appendix 4 Research Paper Outline</td>
<td>[83-87]</td>
</tr>
<tr>
<td>5</td>
<td>Appendix 5 Dissertation Outline</td>
<td>[88-94]</td>
</tr>
<tr>
<td>6</td>
<td>Appendix 6 Dissertation Production</td>
<td>[95-98]</td>
</tr>
<tr>
<td>7</td>
<td>Appendix 7 What IS &amp; IS NOT A Dissertation &amp; A Defense</td>
<td>[99-103]</td>
</tr>
<tr>
<td>8</td>
<td>Appendix 8 Dissertation Notebook</td>
<td>[104-115]</td>
</tr>
<tr>
<td>Appendix</td>
<td>Title</td>
<td>Pages</td>
</tr>
<tr>
<td>----------</td>
<td>--------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>9</td>
<td>12 Step Writing Process &amp; Coplien’s Responsa</td>
<td>116-123</td>
</tr>
<tr>
<td>10</td>
<td>William Safire’s ‘Rules’ of Writing [Modified]</td>
<td>124-131</td>
</tr>
<tr>
<td>11</td>
<td>The Rest of the de Broglie Paper</td>
<td>132-139</td>
</tr>
<tr>
<td>12</td>
<td>RIF CV</td>
<td>140-149</td>
</tr>
</tbody>
</table>
How Does Humanity Itself Learn?  RESEARCH

Ideas:

• Better to get your own that YOU are interested in
• Can come from you advisor as a last resort

Criticism: [Grownup mind set]

• Experts (advisor) provide only OPINION – theirs
• OPINION ≠ LAW OF NATURE
• You must teach your committee and your advisor
• You know the work better than they do
Notebooks:

- Wear clothes, shoes, and your notebook [cf. App. 7.]
- $25 pocket recorder in your pocket & at bedside

Experiment: Watch TV for 10 Minutes w/sound OFF

- Count scene changes / 1 minute+ in an old movie
- Count scene changes / ~ 1 sec. in a commercial

*Your attention span has been rotted by TV*
Conscious use of your unconscious

- Jacques Hadamard “The Psychology of Invention in the Mathematical Field” (~$9)
  Dover ISBN 0-486-20207-4
- Henri Poincare “Science and Method” (~$16)
  Dover ISBN 0-486-243269-6
- Arthur C. Clark “The Collected Stories” (~$18)
  “Technical Error” Pg. 68
Self Esteem – 1 [cf. App 2 Psychology]

Shopping Cart

- A middle aged woman conceived of a folded pocketbook w/frame & wheels that becomes a shopping cart (city type).
- Family and friends ridiculed idea.
- Did nothing.
- 20 Years later it became a $million seller.
Computer Modification of Sewing Patterns

- Same Middle aged woman conceived of using a standard sewing pattern and computing the changes for a specific person – a computer home application in era of large mainframes.
- Family and friends ridiculed idea.
- Did nothing.
- 50 Years later has it been done. Laser Patterns.
Types of Research - 1

- Theoretical
- Experimental

- Basic
- Applied

Early Product Development

1. Basic Theoretical
2. Applied Theoretical
3. Basic Applied
4. Applied Applied

AD-tech
Types of Research - 2

**Boxs I and II Example:**

Basic research in Quantum Communication
Experimental Research in Quantum Encryption

**Boxs I and III Example:**


**Box IV Example:**

Magiq Encryption product,
http://www.magiqtech.com/
### What Research IS & is NOT

#### Characteristics of Research.
- Intensely personal activity
- Discovery of new knowledge
- Societal benefits
- Publication of discovery
- Creative in nature
- Don’t know if it can be done
- Public activity & results

#### Characteristics of Projects.
- Teamwork allowed
- Use of known knowledge
- Benefits aimed at sponsor
- Publication not necessary
- Derivative in nature
- Know it can be done (P>.5)
- Proprietary activity & results
What Research IS

- **NOVEL:** Create a NEW Contribution
- **VALID:** Prove results correct
- **VERIFIABLE:** Repeatable
  - Reliable Robust Results
  You and others should be able to repeat your analysis/process or a different process and get your results.

[:: Your Data Must Be Publically Available]
What Research is NOT

<table>
<thead>
<tr>
<th>Characteristics of NOT Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loud Assertion w/o reference</td>
</tr>
<tr>
<td>Argument by Authority</td>
</tr>
<tr>
<td>Fact without reference</td>
</tr>
<tr>
<td>Literature Search</td>
</tr>
<tr>
<td>Work of others (incl. advisor)</td>
</tr>
<tr>
<td>Presentation of the Known</td>
</tr>
<tr>
<td>Opinion (even expert)</td>
</tr>
<tr>
<td>Reference without vetting</td>
</tr>
<tr>
<td>Library “Research”</td>
</tr>
</tbody>
</table>
Why We Do Research

1. Discover new knowledge
2. Solve meaningful problems
3. Find new relationships
4. Answer questions worth knowing the answers to
5. Fulfill a vision
6. May be useful
   - Lipman Bers’ quote
   - Eugene Wigner’s quote
   - Albert Einstein’s Razor
Lipman Bers’ quote
[Personal Communication]

“There is an infinite number of true theorems. Work only on important ones.”

[Work on what looks like it will be “useful” elsewhere.]

Eugene Wigner’s quote

“The unreasonable effectiveness of mathematics.”

[Any mathematics is probably eventually useful.]

Albert Einstein’s Razor
Let beauty lead you.
6 Research Examples
6 Research Source Examples.

1. de Broglie’s Paragraph  [Notice it in Nature]

2. My “Why IS That?”  [Notice it in Form]

3. Malcolm Cohen (Navy/Civilian, A4 Crashes)  
   “Applied Research”,  [Notice it in Real Physical World]

4. & 5. Web Services &/or XML Languages,  
   “Applied Research”,  [Notice it in Current Technology]

6. QKD “Applied Research”,  QKD in GRIDS.  
   [Notice Application of OTHER Technologies to IT]

Or YOU Could Create A New Technology
6 Research Examples.

A. First three of these are NOT DPS-like
   1. They are Mathematical/Physical in nature
   2. DPS-like is often not mathematical but could involve some basic statistics or optimization

B. 4, 5, & 6 ARE DPS but not specific to it

C. The commonality is the difficulty defining the problem and finding the solution [50/50]

D. You will be getting more DPS-like examples in the future in this Research course
6 Research Examples

But First A Reminder About Critics

Das Ei Des Columbus - The Egg of Columbus

[I learned it in a Scientific German Course]

1. Columbus Returns & Reports
2. Committee of Great Men Reviews Results
3. “Trivial and Obvious”
   Go west and run into land – no big deal.
4. Columbus: “Make an egg stand on end.” <Crunch>

Notice below, the 18 years from 1905 to 1923 in the first example (de Broglie)
Let us consider a material moving object of rest mass \(m_0\) moving with respect to a fixed observer with a speed \(v = \beta c\) \((\beta < 1)\). According to the principle of the inertia of energy, it should possess an internal energy equal to \(m_0c^2\). On the other hand, the quantum principle suggests associating this internal energy with a simple periodic phenomenon of frequency \(\nu_0\) such that 
\[
h \nu_0 = m_0c^2
\]
\(c\) being, as usual, the limiting velocity of the theory of relativity and \(h\) Planck's constant.

This is the wave nature of matter (has a frequency!)

\[
E = h\nu_0 [\text{photoelectric effect}] \quad \text{and} \quad E = m_0c^2 [\text{relativity}]
\]

Einstein's Nobel Prize ↑. Both are by Einstein! in 1905.

Schrödinger’s Wave Equation came after, in 1925
Prince Louis de Broglie

1. He added some more analysis of what is the particle’s wave frequency

2. He analyzed a light particle (slightly incorrectly) using basic relativity

3. He analyzed an electron in a circular orbit and showed the same results as Bohr & Sommerfeld (the Old Quantum Theory) and said he had derived optics of particles elsewhere – which he did

4. All in 4 pages [basic idea in 1st paragraph]
RADIATION — Waves and Quanta

Note of Louis de Broglie, presented by Jean Perrin.

(Translated from Comptes rendus, Vol. 177, 1923, pp. 507-510)

Let us consider a material moving object of rest mass $m_0$, moving with respect to a fixed observer with a speed $v = \beta c$ ($\beta < 1$). According to the principle of the inertia of energy, it should possess an internal energy equal to $m_0 c^2$. On the other hand, the quantum principle suggests associating this internal energy with a simple periodic phenomenon of frequency $v_0$ such that

$$h v_0 = m_0 c^2,$$

$c$ being, as usual, the limiting velocity of the theory of relativity and $h$ Planck’s constant.
Prince Louis de Broglie

1. He was **prepared** in QM & Relativity

2. He was free to be “stupid – clever”

3. It took Einstein’s intervention to get him his degree (faculty of “Great Men” thought it was nonsense)

4. It took years until experiment proved him right (electron optics).

5. His article 1923; Schrödinger’s Wave Equation 1925; his Nobel Prize 1929
I noticed a strange relationship for the N-D cube array of length n. [I also have ABD in Math - NYU]

This relates arrays to the binomial theorem.

This is a new geometric truth about array decompositions.

\[ T_n^N \sim n^N = ([n-1] + 1)^N = \sum_{i=0}^{N} \binom{N}{i} (n-1)^i (1)^{N-i} \sim \sum_{i=0}^{N} \binom{N}{i} T_{n-1}^i \]
\[
(n)^N \approx T_{\{n,n,n,n,...,n\}}^N \approx T_n^N \text{ for short.}
\]

\{n, n, n, n, ..., n\} is the "Shape Vector"

\[
T_n^N \approx (n)^N = (n-1+1)^N = ((n-1)+1)^N = \sum_{k=0}^{N} \binom{N}{k} (n-1)^k (1)^{N-k}
\]

\[
T_n^N \approx \sum_{k=0}^{N} \binom{N}{k} (n-1)^k \approx \sum_{k=0}^{N} \binom{N}{k} T_{n-1}^k \text{ all smaller arrays.}
\]

\[
T_n^0 \approx (n)^0 = (n-1+1)^0 = ((n-1)+1)^0 = \sum_{k=0}^{0} \binom{N}{k} (n-1)^k (1)^{N-k}
\]

\[
T_n^0 \approx \sum_{k=0}^{0} \binom{N}{k} (n-1)^k = (1)(n-1)^0 = T_n^0 = 1
\]

Recurring

\[
T_1^0 \approx (1)(1-1)^0 = 1 = T_0^0 \approx (1)(0-1)^0 = 1 = T_{-1}^0 \approx (1)(-1-1)^0 = T_{-2}^0 = 1 \text{ etc.}
\]
Lemma 1

\[ T_k^0 \approx (1)(k-1)^0 = 1 \approx T_0^0 \quad [\forall \pm \text{integer } k]. \]

\[ T_n^1 \approx (n)^1 = (n-1+1)^1 = ((n-1)+1)^1 = \sum_{k=0}^{1} \binom{1}{k} (n-1)^k (1)^{1-k} \]

\[ T_n^1 \approx \begin{pmatrix} 1 \\ 0 \end{pmatrix} (n-1)^0 + \begin{pmatrix} 1 \\ 1 \end{pmatrix} (n-1)^1 \approx (1) T_{n-1}^0 + (1) T_{n-1}^1 = (1) T_0^0 + (1) T_{n-1}^1 \text{ by Lemma 1}. \]

Recurring again, we get

\[ T_n^1 = (1) T_0^0 + (1) T_{n-1}^1 = (2) T_0^0 + (1) T_{n-2}^1 \cdots \text{by Lemma 1. Yielding} \]

\[ T_n^1 = (n) T_0^0 + T_0^1 , \text{which is: Lemma 2.} \]
CREATING A \{2, 3\} ARRAY BY THE OUTER PRODUCT OF VECTORS

\[ T_{2,3}^2 = (2T_0^0 + T_0^1) \otimes (3T_0^0 + T_0^1) = 6T_0^0 + 5T_0^1 + T_0^2 \]

This means 6 Cells (0-D Scalars), 5 1-D Vectors, 1 (2-D) Thingie.

\[ T_0^i \approx (0)^i \]
\[ T_0^j \approx (0)^j \]
\[ T_0^i \otimes T_0^j \approx (0)^i (0)^j = (0)^{i+j} \approx T_0^{i+j} \]

[\forall \text{ integer } i, j \geq 0]

\[
\begin{array}{cccc}
T_0^0 & T_0^1 & T_0^2 & T_0^3 \\
\end{array}
\]

\[ T_0^2 \equiv T_{0,0}^2 \]
\[ T_0^3 \equiv T_{0,0,0}^3 \]
ERA / NERA Representations

RED is new is mine.

Holds for NERAs too.

\[ T_{1,2,3}^3 = (1 \times 2 \times 3) = 6 \]

\[(1 \times 2 \times 3) \approx 6T_0^0 + 11T_0^1 + 6T_0^2 + T_0^3 = \]
\[
(1T_0^0 + T_0^1) \otimes (2T_0^0 + T_0^1) \otimes (3T_0^0 + T_0^1)
\]
The Array Characteristic Polynomial
Research “Tree” and Open Questions
© Ronald I. Frank 2008
VisioDocument
**THE MASTER EQUATION**
(Example cf. Appendix 11)

2x3x4 Full Decompostion to Null Arrays

There are 24 scalar cells. [0-D]

There are 26 vectors: [1-D]
- 6 vectors front to back
- 12 vectors top to bottom
- 8 vectors right to left

There are 9 matrices (planes): [2-D]
- 2 horizontal planes top to bottom
- 3 vertical planes left to right
- 4 vertical planes front to back

There is one 3-D Entity. [3-D]

There are no higher D Entities. [4...-D]

\[
T_{(2, 3, 4)}^3 = T_0^0 (24) + T_0^1 (26) + T_0^2 (9) + T_0^3 (1)
\]
RIF: A Good Topic Should Be Rich in Further Questions

1. What if $N$ (dimension) is negative or complex?

2. What if $n$ (length) is negative or complex?

3. Master equation allows subtraction of arrays - what’s this mean? Annihilation!

4. Generalization to ragged arrays?

5. What about arrays of arrays [= set theory]?

6. What about $n$-continuous arrays and quantum computing? [Master equation does hold!]
RIF: Work on what you know & like

0. I worked in APL development on and off for over 8 years.

1. I worked on this problem on and off for 10 other years.

2. I generalized cubes to N-D Bricks.

3. I found a master equation in null arrays (by recursion).

4. I developed an explicit algorithm for all sub arrays’ cells.

5. I developed code in APL, C++, and Java to confirm it.

6. I found potential applications in Hyper cube machine architectures and data mining OLAP.
Some A4s crash (randomly) for no apparent cause
Catapult off carrier & go **immediately** into water

**“Data”**

“Artificial Horizon” gauge problem was fixed

[Therefore not the gauge]

**Survey Data**

Artificial Horizon gauge not trusted
Crashes only on **moonless** nights

[Therefore no visual cues – so what?]
Malcolm Cohen’s – Theory*

[Personal Communication]

• Douglas Skyhawk – (A4) has noted reliability
• Pilots can’t see outside and don’t trust gauge
• Some perception causes stick forward into water
• *It has to be a positional perception miscue*

* Cohen, M. M., Crosbie, R. J. & Blackburn, L. H.
Malcolm Cohen's Theoretical Model Based on Pilot's (Psychological) Perception

**Catapult Force**

**Resultant Vector** *(Perceived Gravity)*

**Pilot**

**Resultant Vector** *(Perceived Gravity)*

**Actual Motion**

**Perceived Motion**

**Toward Earth**

 Correct by stick down to level out. Actual effect is to dive into water.

Correct by stick down to level out.

Climb TOO STEEPLY: causes stall

Real World

Perceived World. What Pilot Thinks.

Ronald I. Frank 2003
Malcolm Cohen’s - Solution

• Train pilots to understand incorrect perception
• Train pilots to trust artificial horizon gauge

Result

• No more crashes due to this cause
3 Current IS Dissertations
(#4 & #5 WS) #6 QKD
#4 & #5 Web Services &/or XML Languages

(NO LONGER Conjectural) [Applied Information Systems]

1. XML based.

2. Standards based.

3. “Applications” require defining general languages for new uses [language architecture == vocabulary].

4. Requires understanding of an application domain. Often used for app integration.

5. Limited window of opportunity for dissertation level work [2-3 years]. NOW SOA.
WEB SERVICES 'STACK' 
(Based on Deitel, Deitel, Duwaldt, Trees Pg. 103)

Using XML Languages

Vertical Language

SIF (School Interoperability Framework)

Vertical Language

Vertical Language

Vertical Language

e-Health

Web Services Technologies [All 3 are XML Languages]
WSDL, SOAP, UDDI

"Horizontal" XML Languages [ebXML]
(Cross Industry Business Processes)

Core XML Processing [First 3 are XML Languages]
(XML, XML Schema, XSL, DTD)

Web Framework {Not Necessary but Sufficient}
Internet Protocols, [ HTTP on TCP on IP ]

© Ronald I. Frank 2003
XML LOGICAL FLOW
(All Written in XML Except PARSER)

WHATS
Language Definition (Vocabulary)

XML SCHEMA
(Local & Remote)

XML DOCUMENT

WHICH
Document in an XML Language

STYLES
XSL-[XSLT & XSL-FO]
(Local & Remote)

HOWS
Style of Look of Document

An XML Language

An XML Language

XML PARSER

Canonical
Form of Document

DOCUMENT DISPLAY
or TRANSLATION

DOCUMENT OBJECT
MODEL (DOM) (TREE)
1. WS / XML based – Industry Integration.
2. Standards based – some not yet in place
3. Needs many specific languages – some exist
4. Small restaurants as a real example
5. Dozens of DFDs and Use Case Diagrams
6. Very intricate NEW/USEFUL architecture
7. Literature search was global (UN a player)
1. WS / XML based – Enterprise Integration.
2. Standards based – one new one
3. Needs one or two specific languages
4. Accounting Standards as a real driver
5. ~4/Ea. DFDs and Use Case Diagrams
6. Straight forward architecture
7. Literature search was US only
8. Virtual close is a side effect
#6 Apply QKD to GRIDS

1. QKD Secure Message Transfer (1 Hop).

2. Grid uses X509 Certificates (PKI)

3. Problem with PKI is secure transfer of passwords

4. Idea: Use QKD to transfer PKI passwords

5. Hierarchical Certificate Authority (CA)

6. Single hop to users in CA domain or between CAs
Commentary & Advice
IT’S BEST TO WORK IN AN AREA YOU ALREADY KNOW AND LIKE OR WILL HAVE FUN LEARNING
Plan for reading / learning equivalent to 9 graduate credits (in one year)

Literature search is NOT Research!

Research is CREATIVE!
HAVE FUN

OR

You May Not Finish
Have a Vision

• It does not exist (show this)
• It can exist (argue this)
• It should exist (argue this)
• Make it exist (do this)
  • Feasibility is enough
Prepare for Failures and False Starts Along the Way

• Cape Canaveral, was Cape Kennedy
• Is again Cape Canaveral
• Which was called “Cape Carnival”

Because of all of the early spectacular failures.
A GOOD TOPIC SHOULD BE RICH IN FURTHER QUESTIONS

SO

YOU CAN CONTINUE PUBLISHING

IF YOU WANT TO
You don’t “get an idea” and just write it up.

You start doing & WRITING and get ideas!

Your real problem is to find how you can create added value by solving a problem.

[RIF 2004,5]
Being able to state a topic or an idea does not mean that you know what you are talking about - or better – that you are talking about what you know.

[RIF 2003]
About Dissertation Questions / Problems

1. Finding them is $\frac{1}{2}$ the effort
   
   But more than $\frac{1}{2}$ the emotional pain because you are lost

2. The answer is $\frac{1}{2}$ the effort
   
   But more than $\frac{1}{2}$ the fun

3. Writing and production is $\frac{1}{2}$ the effort
   
   But most of the real pain
Previous Questions / Problems

1. Where do babies come from?
2. Why blood?
3. What are stars?
4. Why are stars?
   • *25 WHYs and you get to GOD*
5. Why is the sky blue?
6. How can legacy systems be integrated in Web Services?
Einstein: About Research

“If we knew what it was we are doing, it would not be called research.” *

* Quoted in Scientific American September 2002 Vol. 287 No. 3 (a special issue on Time) in the Antigravity column by Steve Mirsky: “Einstein’s Hot Time” pg. 152.
Appendix 1
Process
Doing a dissertation is itself a project: apply your project management skills.

- Lay out a Gantt chart (back of the envelope)
- Do a work breakdown structure
- Constantly monitor actual against baseline
- Do an earned value analysis
  - (value added vs. time spent vs plan)

- Don’t estimate your time to completion based on your writing schedule.
- Research time has to be factored in.

This should be a SMALL but ongoing effort!
Writing about your own contribution is not a matter of just describing an idea. It is a matter of proving it or showing how to do it.

Ideas are $\sim$ $0.10$/dozen.

Usefully articulated and proven ideas are not common.

Implemented ideas are rare.

Accepted ideas are extremely rare.
It is up to YOU to **find** a problem.

It is up to YOU to convince your advisor and committee that it is **worth** doing and worth THEIR time.

It is up to YOU to convince your advisor and committee that it is **done**.

It is up to YOU to convince your advisor and committee it is **worthy**.

Drs. don’t seek approval, they know & prove. Drs. don’t “piss & moan”, cry, yell, or try extortion.
We are here to help – not to do.

If you can’t find a problem, we will make suggestions, but you choose.

Learn from your advisors but don’t worship them.

It is up to YOU to do the work.
It is up to YOU to **schedule**.

It is up to YOU **control the process**: i.e., initiate meetings, set goals, set criteria.

It is up to YOU to **find help** if needed.

It is up to YOU to recognize hand-waving bull.... from insightful analysis.

If you spent a lifetime being sloppy, we can’t cure you. Repent oh ye sinners!

Drs. don’t suck up, they don’t have to. Drs. don’t try to fake it, they boldly take large slips in schedule.
“The Source Literature”
Computing is a different discipline:

2. Conference proceedings most important.
4. The “trades” show latest directions.
   [trade press newspapers and magazines]
5. Internet white papers (commercial).
6. Society & Internet scholarly sites.
Warning About “DATA”

Many uses mean SURVEY DATA

1. A few DPS dissertations use surveys
2. Most DPS dissertations do not
3. “DATA” might mean relevant examples
4. “DATA” might mean similar systems
5. “DATA” might mean previous work
6. “DATA” might mean environmental vars
1. A question is posed.
   In the mind of the researcher, a question arises that has no known resolution.

2. It's a matter of words.
   The researcher converts the question to a clearly stated research problem.

3. It's worth a guess!
   The researcher poses a temporary hypothesis or series of hypotheses.

4. The search is on!
   The literature is searched for a possible solution to the problem.

5. The search leads nowhere.
   Another avenue must be found to resolve the problem.

6. Data! Hard data! And nothing but the data!
   The researcher looks for data that may relate to the problem.

7. What do the data say?
   The data are analyzed to reveal their meaning.

8. The data speak!
   The researcher interprets the data and suggests a conclusion.

9. It's either... or...
   Either the data seemingly resolve the research problem, or they do not resolve it.

10. And, the hypotheses?
    Either the data support the hypotheses—or they do not.

[May not apply to your research]
1. Define the Question or Problem

2. Define Over-All Goal
   • Subdivide to N parts
     a. Posit solution part i
     b. Find solution part i
   • Repeat for all i in N

3. Evaluate Total Solution vs. Goal
   • Might find new problems facets
   • If Satisfied – Submit Thesis

4. Else Go to 1 using new insights

Loop

Within

Spiral.

Writing

All

The

Way.
The Scientific Method [State Diagram]

- Ignorance
- Observation
- Test
- Hypothesis
- Prediction
- Falsification
- Verification

- Hypothesis
- Observations
- Tests vs. Hypothesis
- "PROOF"
- Theoretical/Knowledge
- Ignorance
- Modify Hypothesis
- Inconsistent

© Ronald I. Frank 2005
VisioDocument
Appendix 2
Psychology
Notice that this is very like iterative refinement in software development.

Beware the *ANXIETY BLOCK* in getting started. Just write something to start and “Plan to Throw One Away” as Brooks says in Chapter 11, MMM.

**JUST DO IT.**

Do something, anything – it doesn’t matter. Don’t think, do. Once started, correct your mistakes.
Once Started:
Beware **AVOIDANCE BEHAVIOR**

Procrastination is well known. **BUT**
Substitution is more insidious:
There are always more important or more pressing activities to substitute for your dissertation work.

**JUST DO IT.**

A little bit of continuous progress doesn’t interfere with life. YOUR life includes your dissertation.
See step 1 in Appendix 8: Write for 15 minutes a day.
Once Started: Beware *Loss of Faith*.

Research is faith-based field-toil.

At some point you will despair of ever being able to add anything new.

**HAVE FAITH.**

**GO GET DOWN AND DIRTY.**

[Learn about the guts of the problem.]

**JUST DO IT** [and find a new problem]

This is another form of anxiety block.
Beware the Platonic Ideal.

You don’t just read and find a problem.

GO GET DOWN AND DIRTY and THEN you will see many problems.

It is the worst kind of Hubris to think you can just read and understand technology without doing it hands-on.
Once Problem is Found, Persevere

“It is common sense to take a method and try it. If it fails, admit it frankly and try another. But above all, try something.”

Attributed to [GUESS]
Franklin Delano Roosevelt

At the beginning of his experimental approach to solving the Great Depression, in an address to Oglethorpe University May 22, 1932

Quoted in Walter Savitch “JAVA” Pg. 343.
DO NOT EXPECT YOUR ADVISOR TO WORK ALONG SIDE OF YOU.

It is your dissertation and your work. Your advisor is your ADVISOR, Not your co-worker.

YOU DO YOUR OWN WORK
I. Bernard Cohen: About Your Dissertation

[He Had Many Many Dissertation Students]

[Science and Mathematics Historian]

[First American Doctorate in the History of Science]

“Don’t get it perfect; get it done.” *

* Quoted in a memorial article by one of his students: “I. Bernard Cohen (1914-2003)” By Judith V. Grabiner in the MAA Focus Vol. 23 # 6, August/September 2003 pg. 24.
Appendix 3 Proposal Outline
Proposal Outline [Not Unique][Short]

1. The **Problem** and its context [== Literature Search]
   1.1 Statement of the problem
   1.1.1 List of sub problems
   1.2 Problem context [Include USE CASES / DFDs]
   1.3 Limitations of scope
   1.4 Definition of terminology
   1.5 Importance of the work
   1.6 The relevant literature and background [see 4 below]

2 Proposed **Solution** (components and schedule)
   2.1 Solution description [== Your “value add”]
   2.2 Methodology and Work Breakdown Structure
      2.2.1 Repeat for each sub problem
   2.3 Initial schedule [Baseline for planning & monitoring]

3 The **Researcher** [YOU] (qualifications and background)
   3.1 What preparation does researcher already have
   3.2 What new knowledge or skills are required

4 **Bibliography** [Reference EVERY assertion you made]

5 **Appendixes** (supporting peripheral detail)
Appendix 4 Research Paper
Outline
Research Paper Outline 1/4

(For Reporting On Someone Else’s Paper OR For Your Own)

1. **Header**
   - Topic
   - Title
   - Author(s)/Institution

2. **Executive Introduction**
   - "Tell 'em what you're going to tell 'em"
   - What will be the central contribution
   - Where does this fit into the Universe (context)?:

3. **Problem Statement**
   - "Tell 'em"
   - Use Cases
4. **Current State of the Art/Science/Business**
   - "Tell 'em"

5. **Solution to Stated Problem**
   - "Tell 'em"
     - What is the central contribution
     - Use Case

6. **Methods Employed in Solution**
   - "Tell 'em"

7. **Results & Conclusion**
   - "Tell 'em"
8. Future Direction
   • "Tell 'em"

9. Summary
   • “Tell 'em what you told 'em“
     • What was the central contribution

10. References
    A. Every major statement or assertion needs proof or reference
       1. Peer reviewed journals
       2. Textbooks & Theses (especially recent versions)
       3. May use URLs but with land based source addresses
          [Indicate date YOU last accessed it]

    B. Your opinion must be clearly delineated as such and is weak
10. References (cont.)
   C. Your assertion without proof is useless and not accepted
      
      D. Commercial products and consultancies are weak to useless
         • Except for proof of current state of the Business

11. Appendices
Appendix 5
Typical Dissertation Outline
1. **Header**
   - Topic
   - Title
   - Author(s)/Institution
   - Your Copyright Notice
   - Committee Signature Sheet

2. **Abstract** (<350 Words)
   - "Tell 'em what you're going to tell 'em"
   - What will be the central contribution
   - Key Words for indexing

3. **Preface** (Background of your work)
   - Acknowledgements
Dissertation Outline 2 / 6

4. **Table of Contents**

5. **List of Figures** [One figure can be the list of trade marks used]

6. **List of Tables**

7. **List of Most Important Equations** (if needed)

8. **Introduction**
   - **Problem Statement**
     "Tell 'em"
     Use Cases
   - **Flow of Development**
     Where you are going
Dissertation Outline 3 / 6

- **Methodology Overview**
  How you will get there
- **Review of previous work** (outline only here)

9. **Background Material (if needed)**
   - To better understand the problem - previous work
   - More detail on the current state of the art (if needed)

10. **Solution to Stated Problem**
    - "Tell 'em"
      - What is YOUR central contribution
      - Use Cases
    - **Methods Employed in Solution**
11. Results & Conclusion
   • "Tell 'em"
   • So What (the importance of the results)

12. Future Direction
   • "Tell 'em"
   • Future research items

13. Summary
   • “Tell 'em what you told 'em“
   • Again: what was the central contribution and its value
   • Where to go from here
14. References

A. Every major statement or assertion needs proof or reference
   1. Peer reviewed journals
   2. Textbooks & Theses (especially recent versions)
   3. May use URLs but with land based source addresses
      [Indicate date YOU last accessed it]

B. Your opinion must be clearly delineated as such and is weak

C. Your assertion without proof is useless and not accepted

D. Commercial products and consultancies are weak to useless
   • Except for proof of current state of the Business
15. **Appendices**
   A. Supporting material only if it is hard to get
   B. Proofs or other mathematical work incidental to main flow
   C. Incidental historical information (for cultural literacy)
   D. Code or worked examples if too big for main text flow
   E. Releases if you are using other’s work
   F. List of the tools you used if they were unusual or if their output is central to your conclusions (it this latter case maybe it should be a Reference instead)
Appendix 6
Dissertation Production
1. **BUY Strunk & White, (& Chicago Manual of Style), a good NEW Dictionary, and a good NEW Thesaurus (CD version is OK or even better)**

2. **Get your tools early, learn, and use them all along.**

   - Word and PowerPoint (**the Pace Dissertation Format**)
   - Endnote (bibliography) (**the Pace Dissertation Format**)
   - Visio (DFDs, Use Cases, UML, ERDs)
   - PIM (for scheduling meetings and To Do’s)
   - Browser
   - Acrobat WRITER (for mandatory PDF final version)
   - H/S Data Connection (to committee & libraries)
   - .NET/C#/Java/XML/VB [if implementing] [MSDNAA/IBM]
Have a really good machine, OS, software, and printer set up BEFORE you start. Keep it stable.

• Video & pictures require HUGE Ram & HDD.

• YOU and only YOU own, control, and use it.

1. Backup often ALL files (set of 3 generation sets).
   • Keep at lest one set off-site, best is 2

2. Get a BIG Thumb drive for moving copies to Pace

3. Try out 24 lb. bond on your printer early
   • Many cheaper printers can’t hack it

4. Learn how to change ink & fix jams
Production of Final Artifact

1. Be prepared to print a lot
   • Electronic files don’t get read

2. The final hand-in can take weeks
   • AFTER you are done.

3. The mandatory PDF of a your large .doc with many diagrams, figures, and other imbeds can take an hour + to run – don’t cut it off. [It can crash.]
Appendix 7
What IS and IS NOT A Dissertation & A Defense
Well Planned Attack on A Problem
A dissertation is written for a mixed audience:
1. For like-minded experts (so provide details)
2. For interested lay folks (so provide basic intros)

A dissertation posits a question (problem) and answers (solves) it.

A dissertation states the central answer/solution as a thesis.
1. Which must be clearly proved beyond a doubt.
2. Assertions without proof are not accepted.
3. Your opinion is LESS than worthless.

A dissertation uses only the provable or well known.
1. Every assertion/statement must be clearly vetted.
2. Even minor assertions without vetting are not accepted.
3. Your vetting of a statement is LESS than worthless.
A dissertation is not a time-limited process.
   1. Writing has to cohere, so leave time to go over and over your writing.
   2. Producing the final hand-in is itself a lengthy process.

The general outline of a dissertation is tripartite:
   1. Introduce the problem/question (short section)
   2. Discuss what is already known (a little longer)
   3. State and prove the solution/answer (the main section)
      a. Everything else is supporting frill
      b. The details of your hard work are irrelevant
      c. How you found the solution/answer is tangential
      d. Keep your eye and writing focused on the three parts
      e. Length is not a meaningful metric.
      f. Make a clear conclusion.
      g. You can indicate work left to be done in the future.
What A Dissertation Defense IS & IS NOT

- A defense is a process not an all or nothing meeting.
- A defense is an ask and answer session: faculty ask.
- A defense could be a set of committee meetings ever improving the dissertation.
- Take notes because you probably will have to change something.
- A defense is not a PowerPoint presentation.
- A defense is not a timed session that has to end by a set time.
- Working hard or writing a lot are irrelevant as a defense.
  - You do not earn a pass by hard work or by loud assertion, but by force of your logic and the clarity of your writing.
Appendix 8
Maintain a
Dissertation Notebook
(Writer’s Notebook & Process Log)
Date: Since Forever
From: Prof. Frank
To: DPS Research Seminar
Subject: Maintain a Dissertation Notebook
Reference: The Real World [Don’t do this = look foolish]

Buy A Bound (NO METAL SPIRALS) Computation [~$13.00] or Lab Notebook [~$23.00] that has a left margin set off, quadrille paper, and printed pagination. A signature line is also a nice feature.

This is THE ONLY PLACE ON EARTH THAT YOU WRITE, DIAGRAM, OR DOODLE ABOUT YOUR Dissertation.

This is not a class notebook. It is not a personal diary. It is not used for ANYTHING else. It is not your dissertation, only a place to put ideas, thoughts and data.
Every page is sequentially numbered. Each new topic or coding project starts with a line across the whole page and a date with a short descriptive name in the margin or at top. Never remove pages!!!

You can make margin notes to keep track of the structure of the notes. For example, use circles & dates for TO-DO items. Cross them out when they are completed. If you need to, you can generate an index of topics and dates on the last few pages as you go along. This helps if you are jumping topics a lot. See the Cornell method below.

Advisor and other meeting minutes go in here, as do phone notes & #s and IDs of colleagues. No page-width line is put in until the start of the next topic. Interpolated sections from other topics are marked by a vertical mark in the margin, a blank area, and the name of the topic.

*Paper is cheap.*
You can scotch tape in small listings, or other documents from outside sources. See G. M. Hopper’s notes below. There should be no other paper you use to write on - ever. Only IMPORTANT email (decision agreements) get pasted in. Write under your paste-ins what they are, just in case they fall out.

Put your name, advisor’s name, start date and leave a space for end date in the front.

[You may generate more than one notebook.]

Put your address, phone number and email ID on the inside front cover so that when you lose it, the finder can contact you for pickup. Near your info, put a polite request to the finder to return your notebook - it can help. Label the book “Personal and Confidential” just to emphasize how you view it. Offer a small reward for its return.
If you have a patentable idea, document it in great detail with tutorial comments and immediately get (or leave space for quickly getting) two colleagues to read and UNDERSTAND the idea.

Then have them write, sign, and date a statement that they have read the idea and have understood it.

This is why the book must be bound, every page numbered, and every item dated - so that there can be no question about the idea pages being inserted at a later date.

You too can win a patent law suit for billions of dollars [lasers] based solely on this kind of documentation of a good idea.

If you pocket-record daily notes, they get written in THAT NIGHT if not immediately.
5 Notebook Styles
[Dr. Ronald I. Frank]

[1] Journal
[3] Accounting
[5] Laboratory

All have permanently bound sewn signatures except for #8 IBM – which is here only for an example.
1. **[1] Simple Journal Style {~$18}**
   Lined with no numbering or preprinting.
   [Cambridge 33401 Large]
   [National 56-301 “Record” - very thin.]

2. **[2] Simple Technical Notebook Style {~$2}**
   Quadrille* with no numbering or preprinting.
   [Any stationery store Quadrille notebook]
   [Moleskine small is truly pocket-sized.] {~$15}
   [Moleskine medium] {~$18}
   [http://www.shiptheweb.com/Gifts/Catalog/Moleskine_Notebooks_1297.html]

3. **[2] Simple Technical Notebook Style {~$15}**
   Quadrille* with no numbering or preprinting.
   *For wet field-work. Water-proof paper & pens.*
   [374-MX] [http://www.RiteintheRain.com/]
4. **[3] Accounting Style**{~$19}
   Lined and paginated, no preprinting.
   [Avery 56-211]  [National® Black Texhide® Record @ Staples]

5. **[3] Accounting Style (Large)** {~$39}
   Lined and paginated, no preprinting.
   [Avery 56-231]  [National® Black Texhide® Record @ Staples]

6. **[4] Computation Style (COOP)** {~$18}
   Quadrille* and paginated, no preprinting.
   [Harvard-MIT COOP Computation Book]

7. **[4] Computation Style (AMPAD 22-156)** {~$13}
   Quadrille* and paginated, no preprinting.
8. [5] **Laboratory Style** (IBM –Not Sewn) \{~”$100”\} 
[IBM ZM08-4615-09] FOR AN EXAMPLE ONLY.

9. [5] **Laboratory Style** (Esselte) 
[Boorum & Pease L 21-150Q (or R)] \{~$47\} 
[Boorum & Pease L 21-300Q (or R)] \{~$66\} 
Q=Quadrille*, R=Lined, paginated, NOT preprinted for book serialization and signature. Thick. 
[http://store.officeworld.com/ Search ESS21300Q]

10. [5] **Laboratory Style** (SNCO) \{~$23 w/S&H\} 
Quadrille*, paginated, preprinted for book serialization and signature. Can be personalized, #ed, & w/colors. 
[http://www.SNCO.com Search Catalog - 2001]
* I STRONGLY recommend QUADRILLE [It helps charting and diagramming].


I recommend [4] (# 6. or # 7.), or best [5] (# 10.) even though they are larger & harder to carry around.

[2] (# 2 & # 3) are smaller and handier but not paginated, or preprinted like # 10.

# 3 is virtually the only choice for wet field work
Taking Notes – How To

http://www.sas.calpoly.edu/asc/ssl/notetaking.systems.html

Good method:

http://www.sas.calpoly.edu/asc/ssl/notetaking.systems.html#cornell

Sample document:

http://www.dartmouth.edu/~acskills/docs/cornell_note_taking.doc
Adm. Grace M. Hopper’s—“Bug”

Photo # NH 96566-KN  First Computer "Bug", 1945

http://www.history.navy.mil/photos/pers-us/uspers-h/g-hoppr.htm

Notice: Pre-numbered quadrille paper notebook. Dated & topic header by time.
Appendix 9

12 Step Writing Process + Coplien’s Thoughts
12 Step Writing Process

From the TOMORROW'S PROFESSOR(SM) MAILING LIST (desk-top faculty development one hundred times a year) Sponsored by THE STANFORD UNIVERSITY CENTER FOR TEACHING AND LEARNING (CTL) http://ctl.stanford.edu More directly: http://ctl.stanford.edu/Tomprof/index.shtml
NOTE: Anyone can SUBSCRIBE to the Tomorrows-Professor Mailing List by addressing an e-mail message to: <Majordomo@lists.stanford.edu>

- SUBJECT LINE: empty
- MESSAGE BODY: type subscribe tomorrows-professor

UNSUBSCRIBE: e-mail message to:
<Majordomo@lists.stanford.edu>

- SUBJECT LINE: empty
- MESSAGE BODY: type unsubscribe tomorrows-professor
PUBLISH AND FLOURISH;
BECOME A PROLIFIC SCHOLAR

\{\text{Cope == Prolific not good per se}\}
Steps 1 - 6

Step 1. **Write daily for 15 to 30 minutes.**

Step 2. **Record time spent writing daily, share records weekly.**
   Do what works for you.

Step 3. **Write from the first day of your research project.**
   Always start with a discovery draft.

Step 4. **Post your thesis on the wall, then write to it.**

Step 5. **Organize around key sentences**
   (first sentence in the paragraph). **Agrees.**

Step 6. **Use key sentences as an after-the-fact outline.**
Steps 7 - 12

Step 8. Share later drafts with little-e experts and Capital-E Experts.

Step 9. Learn how to listen (the reader is always right).

Step 10. Respond to each criticism (changes in response to each of these reviewers).

Step 11. Read your prose out loud. Cope agrees.

Step 12. Kick it out the door and make 'em say "No." [perfectionism and fear of rejection]. Carefully chose your venues to drive down your acceptance rate to 10%.
1. **Write your name on your piece.**

2. **Quality before quantity.** [Prolific is not good per se.]

3. **Notebooks.**
   Take good research notes. They are just another research reference.

4. **Be a great reader.**

5. **Write a lot.**

6. **Know who your audience is.**

7. **Write with passion.**
8. Strive for publication in the archival literature (Journals).

9. Craft every work as a masterpiece. Use the review process for the long view of your publication goals.

10. Be attentive to good presentation.

11. Be brief.

12. Don't use a word processor.
Appendix 10

William Safire’s
‘Rules’ of Writing
[Highly Modified by others]
‘Rules’ of Writing 1/7
1. Remember to never split an infinitive.
2. The passive voice is to be ignored.
3. Do not put statements in the negative form.
4. Verbs has got to agree with their subjects.
5. Proofread carefully to see if you words out.
6. If you reread your work, you can find on rereading a great deal of repetition can be avoided by rereading and editing.
7. A writer must not shift your point of view.
8. And don't start a sentence with a conjunction.
‘Rules’ of Writing 2/7

9. [Never use a preposition to end a sentence with.]
10. If any word is improper at the end of sentence, a linking verb is.
11. Don't overuse exclamation marks!!
12. Place pronouns as close as possible, especially in long sentences, as of 10 or more words, to their antecedents.
13. Everyone should be careful to use a singular pronoun with singular nouns in their writing.
14. Writing carefully, dangling participles must be avoided.
‘Rules’ of Writing 3/7

15. Take the bull by the hand and avoid mixing metaphors. [Even if a mixed metaphor sings, it should be derailed.]

16. Avoid trendy locutions that sound flaky.

17. Always pick on the correct idiom.

18. The adverb always follows the verb.

19. Last but not least, avoid clichés like the plague; seek viable alternatives.

20. [Comparisons are as bad as clichés.]

21. [Avoid annoying alliteration.]
‘Rules’ of Writing 4/7

22. [Don't verb nouns.]
23. [Don't use no double negatives.]
24. [Don't use commas, which aren't necessary.]
25. [About those sentence fragments.]
26. [One-word sentences? Eliminate.]
27. [Never use a big word when a diminutive one would suffice.]
28. [Parenthetical remarks (however relevant) are (usually) unnecessary.]
29. [Be more or less specific.]
‘Rules’ of Writing 5/7

30. [Eschew ampersands & abbreviations, etc.]
31. [Analogies in writing are like feathers on a snake.]
32. [One should NEVER generalize.]
33. [Foreign words and phrases are not apropos.]
34. [Contractions aren't necessary and shouldn't be used.]
35. [Also too, never, ever use repetitive redundancies.]
36. [Its important to use apostrophe's correctly.]
37. [Correct spelling is essential.]
‘Rules’ of Writing 6/7

38. [Between you and I, case is important.]
39. [Use words correctly, irregardless of how others use them.]
40. [Understatement is always the absolute best way to put forth earth-shaking ideas.]
41. [Exaggeration is a billion times worse than understatement.]
42. [If you've heard it once, you've heard it a thousand times: resist hyperbole; not one writer in a million can use it correctly.]
‘Rules’ of Writing  7/7

43. [Eliminate quotations. As Ralph Waldo Emerson said, "I hate quotations. Tell me what you know."]
44. [Puns are for children, not groan readers.]
45. [Go around the barn at high noon to avoid colloquialisms.]
46. [Who needs rhetorical questions?]
Appendix 11
The Rest of the de Broglie Paper
For the fixed observer, the frequency $v = \frac{m_0 c^2}{h \sqrt{1 - \beta^2}}$ corresponds to the total energy of the moving object. But, if this fixed observer observes the internal periodic phenomenon of the moving object, he will see it slowed down and will attribute to it a frequency $v_\perp = v_0 \sqrt{1 - \beta^2}$; for him this phenomenon varies therefore like

$$\sin 2 \pi v_\perp t.$$

Now let us suppose that at the time $t = 0$ the moving object coincides in space with a wave of frequency $v$ defined above and propagating in the same direction as it does with the speed $\frac{c}{\beta}$. This wave, which has a speed greater than $c$, cannot correspond to

---

1 Concerning the present note, see Brillouin, *Comptes rendus*, Vol. 168, 1919, p. 1318.

- Page 1 of 4 -
transport of energy; we will only consider it as a fictitious wave associated with the motion of the object.

I maintain that, if at the time $t = 0$, there is phase agreement between the vectors of the wave and the internal phenomenon of the object, this phase agreement will be maintained. In effect, at time $t$ the object is at a distance from the origin equal to $vt = x$; its internal motion is then represented by $\sin 2\pi v_1 \frac{x}{v}$.

The wave, at this point, is represented by

$$\sin 2\pi v \left( t - \frac{xB}{c} \right) = \sin 2\pi v x \left( \frac{1}{v} - \frac{B}{c} \right).$$

The two sines are equal and the phase agreement is realized if one has

$$v_1 = v (1 - \beta^2),$$

a condition that is clearly satisfied by the definitions of $v$ and $v_1$.

The demonstration of this important result rests uniquely on the principle of special relativity and on the correctness of the quantum relationship as much for the fixed observer as for the moving observer.
Let us apply this to an atom of light. I showed elsewhere\(^2\) that the atom of light should be considered as a moving object of a very small mass \((<10^{-50}\text{ g})\) that moves with a speed very nearly equal to \(c\) (although slightly less). We come therefore to the following conclusion: *The atom of light, which is equivalent by reason of its total energy to a radiation of frequency \(\nu\), is the seat of an internal periodic phenomenon that, seen by the fixed observer, has at each point of space the same phase as a wave of frequency \(\nu\) propagating in the same direction with a speed very nearly equal (although very slightly greater) to the constant called the speed of light.*

\(^2\) See *Journal de Physique*, 6-th series, Vol. 3, 1922, p. 422.
Let us consider now the case of an electron describing a closed trajectory with uniform speed slightly less than $c$. At time $t = 0$, the object is at point $O$. The associated fictitious wave, launched from the point $O$ and describing the entire trajectory with the speed $\frac{c}{\beta}$, catches up with the electron at time $\tau$ at a point $O'$ such that $\overline{OO'} = \beta c \tau$.

One has then that

$$\tau = \frac{\beta}{c} [\beta c (\tau + T_r)]$$

or

$$\tau = \frac{\beta^2}{1 - \beta^2} T_r,$$

where $T_r$ is the period of revolution of the electron in its orbit. The internal phase of the electron, when the electron goes from $O$ to $O'$, has a variation of

$$2\pi v_\perp \tau = 2\pi \frac{m_0 c^2}{\hbar} T_r \frac{\beta^2}{\sqrt{1 - \beta^2}}.$$
It is almost necessary to suppose that the trajectory of the electron will be stable only if the fictitious wave passing \( O' \) catches up with the electron in phase with it: the wave of frequency \( v \) and speed \( \frac{c}{\beta} \) has to be in resonance over the length of the trajectory. This leads to the condition

\[
\frac{m_0 \beta^2 c^2}{\sqrt{1 - \beta^2}} T_r = n \hbar, \quad n \text{ being integer.}
\]

Let us show that this stability condition happens to be that of the Bohr and Sommerfeld theories for a trajectory described by a constant speed. Let us call \( p_x, p_y, p_z \) the momenta of the electron along three rectangular axes. The general condition for stability formulated by Einstein is in effect
\[ T_z \int_0^T (p_x \, dx + p_y \, dy + p_z \, dz) = n \hbar \] 

\[
\int_0^T \frac{m_0}{\sqrt{1 - \beta^2}} \left( v_x^2 + v_y^2 + v_z^2 \right) dt = \frac{m_0 \beta^2 c^2}{\sqrt{1 - \beta^2}} T_r = n \hbar ,
\]

which, in the present case, can be written as above.

In the case of an electron turning in a circular orbit of radius \( R \) with an angular velocity \( \omega \), one finds again for sufficiently small speeds the original formula of Bohr:

\[ m_0 \omega R^2 = n \frac{\hbar}{2\pi} .\]

If the speed varies along the length of the trajectory, one finds again the Bohr-Einstein formula if \( \beta \) is small. If \( \beta \) assumes large values, the question becomes more complicated and necessitates a special examination.
Pursuing research along these lines we have reached important results, which will be communicated soon. We are as of today able to explain the phenomena of diffraction and of interference taking into account the quantization of light.

3 The case of quasi-periodic motion does not present any new difficulty. The necessity of satisfying the condition stated in the text for an infinity of pseudo-periods leads to the conditions of Sommerfeld.

Translated by Brigitte and Barton Lane and transcribed by Warren F. Davis, January, 1978.
Appendix 12
RIF CV
8 “Careers”

Assoc. Prof. Ronald Frank
Pace U. Information Systems Dept.

Degrees in Math, Physics & Computers
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOC</td>
<td>[142]</td>
</tr>
<tr>
<td>College to IBM &amp; Masters in Math</td>
<td>[143]</td>
</tr>
<tr>
<td>IBM (Sales &amp; Marketing)</td>
<td>[144]</td>
</tr>
<tr>
<td>IBM (Ad. Tech &amp; FT Graduate Fellowship)</td>
<td>[145]</td>
</tr>
<tr>
<td>IBM (Ad. Tech, Consultant, &amp; Research Management)</td>
<td>[146]</td>
</tr>
<tr>
<td>IBM, Immersive Systems Inc., Pace</td>
<td>[147]</td>
</tr>
<tr>
<td>Dissertation Advising</td>
<td>[148]</td>
</tr>
<tr>
<td>My Latest Research Interests</td>
<td>[149]</td>
</tr>
</tbody>
</table>

10/1/2008 What is Research Like? V.44. (C) Ronald I. Frank 2003, 4, 5, 6, 7, 8
RIF CV (1-4 College to IBM)

1. Freshman Grad course in Numerical Analysis
   • Included installing & using 1st computer

2. Johnson & Johnson [Raw Material Inventory]

3. Service Bureau Corp [Ad Agency Accounting]

4. IBM
   • Started by teaching IBMers & Customers
     What are computers, & programming
   • Marketing (Small Scientific Systems)

• Part-time: Masters in Applied Math
RIF CV (4. IBM cont, - Sales)

• **Sales – National S&E Overlay Territory**
  
  [>10% US R&D]
  [Division Award/100% Club]

• **Large S&E Customers E.g.,**
  
  General Dynamics
  Lockheed
  Esso (sic) Research
  Bell Labs

• **Large Govt. Labs (Division Award)**
  
  Los Alamos
  DOE (Opened DOE to IBM)
RIF CV

(4. IBM cont. Ad. Tech & Graduate Fellowship)

- Advanced Technology Development
  - APL language & applications
  - 1st Telecom Measurement & Management

• IBM Graduate Resident Fellow
  (Full-time study Applied Math, QM)

- Advanced Technology Development
  - Distributed Remote VM Operation (PROP)
    [Corporate Innovation Award]

10/1/2008

What is Research Like? V.44.
(C) Ronald I. Frank 2003, 4, 5, 6, 7, 8
145
RIF CV (4. IBM cont. Consult & Research Management.)

- **National Technical Consultant to customers** (Incl. *US Science & Eng. PC Spokesperson*) [HQ Award]

- **Research (RSM & Manager)**
  - Low-end (Workstation) APL R&D
  - Parallel Systems User Front End R&D
  - 1st Networked Virtual Reality Multi-venue Game Multi-user
RIF CV

(4. IBM cont. Board, 5. Immersive, 6. Pace)

- IBM Corp. Board Consultant Internet & Ed.

5. CEO (Software Development Co.) (‘93-’98)
   Immersive Systems Inc.
   Govt. Contracts - VR Simulations

6. Teaching at Pace  (Part time since 1985)
   (Full time since 1998)
RIF CV  (7. Dissertation Advising)

7. Dissertation Advising [w/DPS Professionals]

Web Services  [For industry integration] &
              [Sarbanes compliance]

HIPPA     [Data compliance/transformation] &
              [Using Semantic Web Technology]

Grid Security [Quantum key distribution]

Mobile IP6 [HLL Model / Analysis] &
            [Military & Civilian, Mobile Base &
             Mobile Client Handoff]
8. My Latest Research Interests

Array structure theory  [*Discovered new forms*]

Working on extensions & applications

  [*N-Cube & OLAP*]

QKD pedagogy  [*Teaching Simulator*]

QKD business implications

Personal Productivity  [*Personal File System*]
The Universality of PPT

Doonesbury By Garry Trudeau

8/4/07

I'VE WORKED UP A POWERPOINT PRESENTATION FOR YOU, EXCELLENCY...

YOU KNOW WHAT POWERPOINT IS, RIGHT?

MR. DUKE, I COME FROM A SMALL, ISOLATED MOUNTAIN VILLAGE. WE HAVE NO RUNNING WATER OR PAVED ROADS OR HEALTH CARE SERVICES...

VERY SAD. WELL, LET ME EXPLAIN.

OUR MAYOR USES POWERPOINT.
What is Research Like?

THE END