The Authentication of Textual Assertions

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http://www.rogerclarke.com/ID/ATS-ISF {.html, .pdf}

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1

Motivation

- The origins of the IS profession and of the IS discipline are in structured data
- Other data forms have been less of a focus
- **Text has now become central to IS**
- There is a great deal of concern about the reliability of textual statements
- **IS needs a framework within which textual statements can be authenticated**
- We need to draw on relevant meta-theory in order to expand the IS discipline's horizons

2

Data Forms

- Structured data: files of records of data-items, each with defined formats

- Audio
- Images, Video
- Vector Graphics, Animations
- Software
- ...
- Text

3

Text in IS

- Tightly-defined data-items containing text-data since the early 1960s
- Free-form 'comments' data-items since the mid-1960s
- Text-string handling facilities since the late 1960s
- Free-text search since 1970 (Docu / Master, ICL Status, IBM STAIRS)
- Email and Bulletin Board Systems since the end of the 1970s
- Library systems, initially cataloguing metadata, by 1980 with content
- Internet text-handling capabilities in the 1980s
- Self-publication of text on the World Wide Web from the early 1990s
- Discovery of text-content from the early-to-mid 1990s
- Evidence management systems

4

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- Evidence management systems
- Text surveillance as a sub-field of data-/cyber-security, since 2000
- Synthetic textual statements by Generative AI since mid-2010s / 2022

The Objective

- Provide guidance to IS practice and practice-relevant IS research for **the authentication of textual statements**
- Draw on descriptive linguistics
- Apply a generic theory of authentication
- Account for relevant complexities
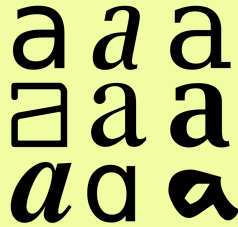
Some Examples of Textual Statements

- This investment will return you 16% p.a.
- My only borrowings are a mortgage loan on my house, and a credit card
- I've made no insurance claims in the last 5 years
- We can deliver that item within 48 hours from stock held in your nearest capital city
- I have a doctorate in IT from Somerset University
- I earned $160 in the last fortnight from casual work in my local cafe

Structure of the Presentation

1. **Text**, its Representation, its Interpretation
2. **Assertions**, Textual Assertions
3. **Reliability**, Misinformation, Disinformation

4. **Authentication** Theory, Evidence
5. Authentication of **Textual Assertions**
6. **Reliability Criteria** for Textual Assertions

7. **Tests of Efficacy** of the Reliability Criteria

The Nature of Text

- Natural Language, visibly expressed using characters, symbols or glyphs

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Fonts / Scripts

texting

texting

Text

text

text

نص

The Nature of Text

- Natural Language, visibly expressed using characters, symbols or glyphs

- Logographic Scripts
- Alphabets
- Syllabaries

Logographic Scripts

Logogram: A written character that represents a semantic component of a language

Many began as a picture, came to represent a word(-part)

- Cuneiform script   ◁⊟   (1,000 Sumerian chars)
- Egyptian hieroglyphics   ♀   (several sets)
- Chinese kaishu   中文   (c. 50,000 characters)
  Japanese Kanji   漢字   (c. 50,000 characters)
                                (c. 4,000 for literacy)
  Korean Hanja   한자   (c. 8,000 characters)
- Other ancient Asian scripts, and Mayan and Aztec

Alphabets

- **Alphabet**: A set of glyphs, each representing short sound(s): consonants (mouth closed), vowels (open)

  Sinai c.1700BC, via the Pheoenicians c.1000-500BC (via Ancient Greek and Latin, to Western Europe)
- **English Alphabet** (a successor to Latin / Roman): 26 letters, for 24 consonantal and 20 vowel sounds
- **Other Alphabets**: >370, some with diacritics (ç ü) Flexible, with many used for multiple languages Alphabet size 21-74 characters (74 in Khmer)

- **Abjads** – consonantal characters, mostly not vowels
- **Abugidas** – indicate vowels with diacritics

- ? Chinese pinyin (21 initials, 38 finals, 5 tones)

Syllabaries

- **Syllabary**: A set of glyphs, each representing an extended sound with consonants and vowels
- Mycenaean Greek, Linear B   (87 characters)
  Japanese Hiragana   (48 characters)
  Japanese Katakana   (48 characters)
  Cherokee   (85 characters)

- ? Chinese pinyin (initials x finals x tones = c.400)

The Diversity of Textual Forms

- **Written Natural Languages:**
  - >3,000,   c. 30 of them with >1m users

- **Alphabets, Syllabaries, Logographic Scripts:**
  - c.300,   >150 of them in contemporary use
  - >1500 languages use the Latin Alphabet

- **Unicode repesentations**
  - c. 150,000 characters

The Interpretation of Text

- **Data-Item Domain Definitions Controlled Vocabularies**
  Permitted Values of Colour = red, green, blue and/or rot, grün, blau and/or 赤 緑 青 , etc.)

The Interpretation of Text

- **Data-Item Domain Definitions**
  Controlled Vocabularies
  Permitted Values of Colour = red, green, blue
  and/or rot, grün, blau and/or 赤 緑 青 , etc.)

- **Semiotics**: study of symbolic communication
  - **Syntactics**: Symbol-Symbol relations
  - **Semantics**: Symbol-Thing relations
  - **Pragmatics**: Symbol-Interpreter relations

Syntactics versus Semantics

> **Lightning strikes and bush-fires**
>
> **not permitted at this installation**

Semantics   versus   Pragmatics

> **Dept of Environment Property**
>
> **Trespassers will be prosecuted**

Semantics   versus   Pragmatics

> **Dept of Environment Property**
>
> **Trespassers will be prosecuted**

> **CROCODILE-INFESTED SWAMP**
>
> **Survivors will be prosecuted**

Pragmatics

I asked someone how glutenous is spelt

I was a bit bemused when they answered "very"

Pragmatics

Pragmatics

Challenges for Utterers

- Choice of Words and Expressions
- Style
- Context-Relativity
- Culture-Relativity
- Time-Relativity
- Nuance, Ambiguity, Playfulness
- Transcription from Verbal Speech

The Hermeneutic Proposition

- The Utterer's intention is not directly conveyed
- Rather, text is interpreted by the Reader
- Interpretation is based on the Reader's
  - state-of-mind (Heidegger 1962)
  - pre-understanding (Gadamer 1976)
  - background (Winograd & Flores 1986)

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xkcd on Hermeneutics

https://xkcd.com/1576/

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  - background (Winograd & Flores 1986)

- Interpolated sub-texts
- Re-reading using a different value-set
- Deconstruction (Derrida)

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7. **Tests of Efficacy** of the Reliability Criteria

RFI #1
Are any Key Aspects of Text Missing?

- **The Representation of Text**
  - Visual Expressions of Natural Language
  - Alphabets, ..., Syllabaries, Logographic Scripts
  - The Unicode standard's c.150,000 characters
  - ...
- **The Interpretation of Text**
  - Disciplined Use (controlled vocabulary / thesaurus)
  - Grammar and spelling diversity, richness, ambiguity, 'word-plays'
  - Semiotics: Syntactics, Semantics, Pragmatics
  - Formal text cf. Transcription of spoken words
  - Hermeneutics: Interpretation; pre-understanding / state-of-mind
  - Imputed sub-texts; Alternative value-sets; Deconstruction

29

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30

Relevant Occurrences of 'Assertion' in the >17,000 Corpus in AISeL

- **Specific to Assertions re Identity, Attributes**

  Security Assertion Markup Language (SAML), 'Claims'

- **Generic, <u>encompassing</u> Identity, Attributes**

  One directly relevant
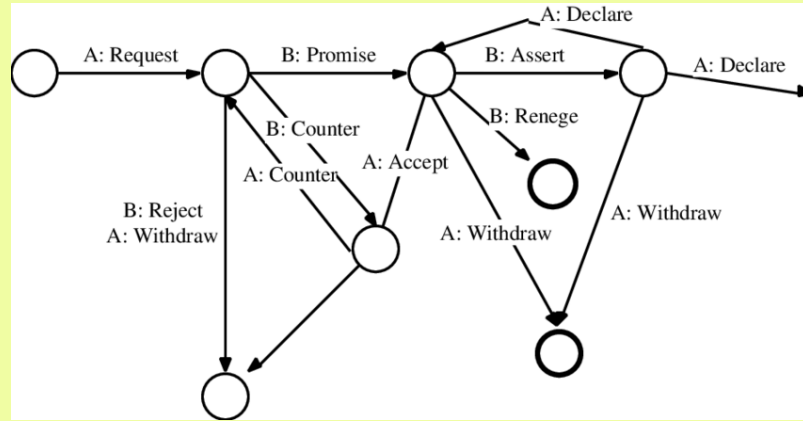
  (+ Predecessor papers of my own at ACIS and Bled)

Mingers J. & Standing C. (2020) 'A Framework for Validating Information Systems Research Based on a Pluralist Account of Truth and Correctness' JAIS 21,1

31

Assertions

- **An Assertion**: A statement on which some entity may place reliance, and hence may perceive value in having adequate grounds for treating the content of the utterance as being reliable

- **A Textual Assertion**: An Assertion expressed in a natural language in visual form

32

Expressions that Constitute Assertions

Conversation for Action (Winograd & Flores 1986)

Expressions that Constitute Assertions

Speech Act Theory (Searle 1975):

- 'performative' utterances <u>constitute</u> acts
- 'illocutionary' utterances <u>motivate</u> acts

Expressions that Constitute Textual Assertions

Table 1 of 3

Mode	Mood	Description
A Fact-Based **Assertive**	Indicative or Evidential	A statement as of fact
A Belief-Based Assertive	Indicative or Evidential	A statement of belief that is intended to be understood as being determinative
An Opinion-Based Assertive	Indicative or Evidential	A statement of opinion in a context in which the statement is imbued with authority, or made by a person claiming relevant expertise

After Speech Act Theory (Searle 1975) and Mode and Mood (Yu & Wu 2016)

Expressions that Constitute Textual Assertions

Table 2 of 3

Mode	Mood	Description
		relevant expertise
A Necessary **Implication**	Indicative or Evidential	A necessary implication of a statement
A Power-Based **Inference**	Indicative or Evidential	A sufficiently firm nudge by a first party with effective power over the second party
An Authoritative **Imputation**	Indicative or Evidential	An inference drawn by a party perceived to have formal authority
A Strong **Potential**	Potential	A strongly probabilistic (cf. merely possible or tentative) statement, particularly one that includes an indication of relevant factors likely to determine the outcome

After Speech Act Theory (Searle 1975) and Mode and Mood (Yu & Wu 2016)

Expressions that Constitute Textual Assertions

Table 3 of 3

Mode	Mood	Description
A **Directive**	Imperative	A command
A Directive	Deontic	A statement of obligation
A **Commissive**		A commitment to an action
An **Expressive**		An indicator of attitude
A **Declaration**		An authoritative pronouncement
A **Conditional**	Conditional	A statement that includes an express indication, or a sufficiently clear implication, of contexts in which the statement does and/or does not apply

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Expressions that Constitute Textual Assertions Combining Tense and Aspect

- **Assertions about Now**:
  - Present tense — does
  - Continuing or progressive present — is doing
- **Assertions about Back Then**:
  - Past or preterit tense — did
  - Imperfect tense — used to do
  - Perfect tense — has done
  - Pluperfect tense — had done
- **Assertions about Later**:
  - Future tense — will do

- **Assertions Not Time-Bound (generic, universal or existential)**:
  - 'Ys are generally superior to other races'
  - 'All Xs are white'
  - 'There is at least one Z'

Expressions that are <u>NOT</u> Textual Assertions

Mode	Mood	Description
Questioning	Interrogative	Asking a question, e.g. 'Is this customer entitled to a loyalty discount?'
Optative	Hope	Expression of a wish, e.g. 'I hope this driver is licensed'
Postulating	Presumptive / Hypothetical	Expression of a possibility for consideration, e.g. 'Just suppose that this job applicant had already finished the degree that they're enrolled in'
Tentative	Potential ('may', 'might')	Conveying uncertainty about an outcome and about factors that will affect the outcome, e.g. 'Customers might not be happy with delivery delays'
Conditional	Subjunctive ('would', could', 'should', 'ought')	Conveying conditionality, e.g. 'This job applicant would be attractive if they had a driver's licence'
Weak Assertive	Opinion or Belief	Assertives not intended to be seen as determinative and/or uttered without special expertise, e.g. 'I think it's important that applicants be able to drive', 'This candidate doesn't seem appointable'

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The Reliability of an Assertion

- Reliability has to do with **trustworthiness**
- It may be associated with performance against spec. (in engineering), or performance consistency (stats)

In the present context, however:

- Reliability of an Assertion means the extent to which an entity has <u>the perception</u> that the statement is <u>trustworthy, based on its correspondence with reality</u>

Related Notions
<u>To Be Investigated</u>

- Warranted Assertibility
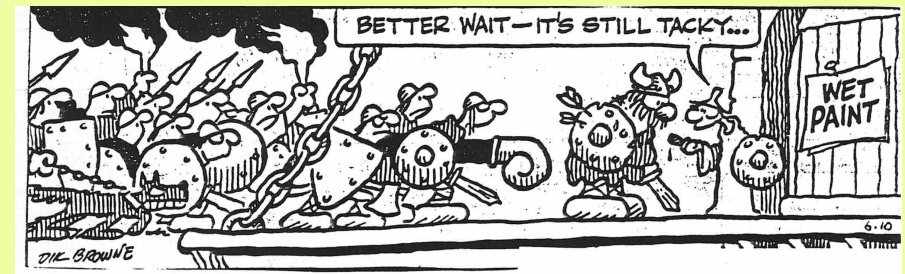- Rational Assertability
- Rational Acceptability

Dewey J. (1938) 'Logic: the Theory of Inquiry' Holt, 1938
Habermas J. (2003) 'Truth and Justification' Polity, 2003
quoted in
Mingers J. & Standing C. (2020) 'A Framework for Validating
Information Systems Research Based on a Pluralist Account of
Truth and Correctness' JAIS, 21,1

Mis- & Dis-Information Contexts

- The Law
- 'Natural Philosophy'
- The Sciences

- Politics
- Public Relations
- Advertising
- Media

- Social Media

The Spurious Authority
of the Written (or Painted) Word

The Mythology of Truth

- Yellow journalism
  The Tabloid Press
  Fake News
  Trumpian Post-Truth

- Air-Brushing
  Photoshop-ing
  Deep Fakes
  Generative AI

- A Metatheoretic Commitment:
  Assuming Human-Accessible Truth is Untenable

- The True/False Dichotomy is impractical,
  whether proposed by Floridi or by the EU
  ('Veridicality', 'Alethic modalities'; 'False Information')

Mis- & Dis-information

- **Disinformation** means one or more
  <u>unreliable</u> <u>Assertions</u> that were
  <u>demonstrably intended</u> by the utterer
  <u>to mislead</u> the reader or hearer

- **Misinformation** means one or more
  <u>unreliable</u> Assertions that were
  <u>not</u> <u>demonstrably intended</u> by the utterer
  <u>to mislead</u> the reader or hearer

RFI #2
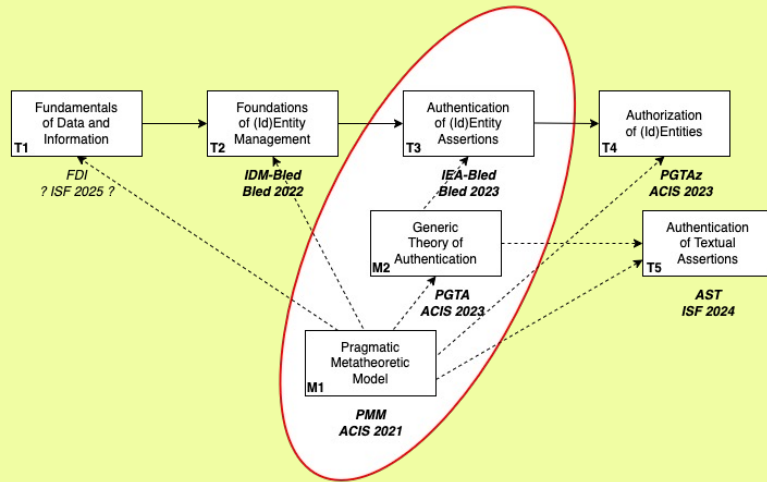## Textual Assertions and Their Reliability

How do I find relevant prior works
in IS and closely-associated literatures:

- Authors?

- Keywords?

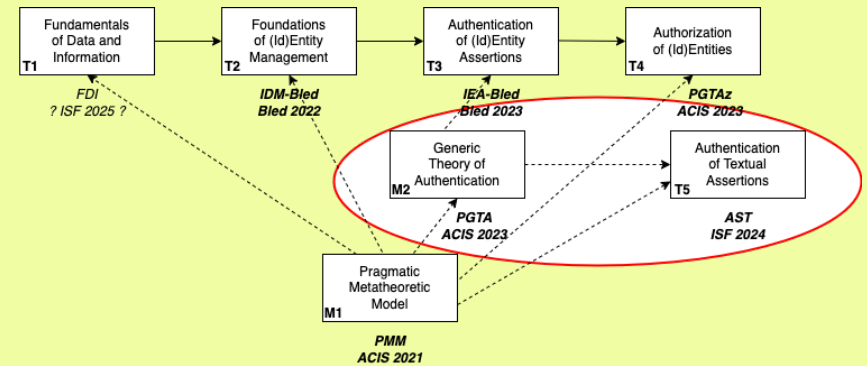- Conferences?   Special Issues?

- Other?

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Slide 49

A Generic Theory of Authentication

https://rogerclarke.com/ID/IDM-O.html
49

Slide 50

A Generic Theory of Authentication

https://rogerclarke.com/ID/IDM-O.html
50

Slide 51

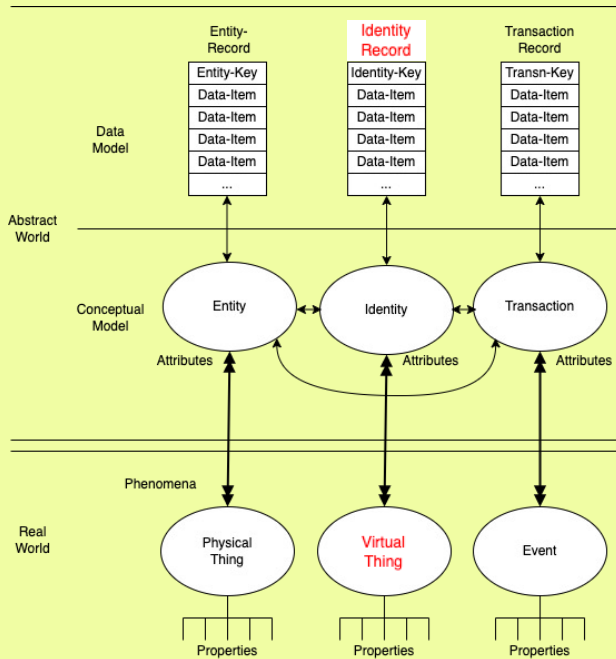# A Generic Theory of Authentication

- **Authentication** is a process that establishes a degree of confidence in the Reliability of an Assertion

- **Syntactic Level**
  Compliance with definitions, content-specifications and/or the rules of logic and grammar, to ensure that there is no invalid expression or inference
- **Semantic and Pragmatic Levels**
  Consistency with reality and perception

https://rogerclarke.com/ID/PGTA.html (ACIS'23)
51

Slide 52

A Generic Theory of Authentication

- **Evidence**, in relation to the Authentication of an Assertion, is data that tends to support or deny that Assertion

- Evidence may be <u>existing data already held, or acquired from, or accessed at, some other source</u> that is adequately reliable and is sufficiently independent of any party that stands to gain from masquerade or misinformation
- Evidence may be <u>newly acquired from a person or active artefact</u>, e.g. by means of challenge-response
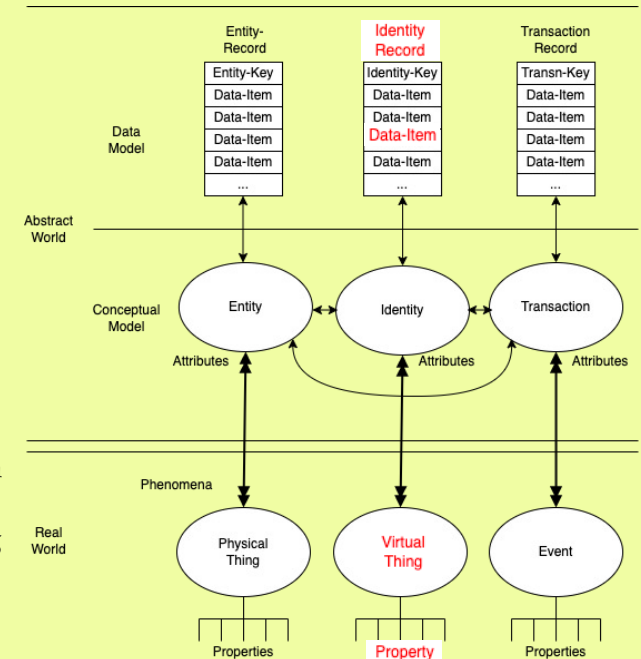
https://rogerclarke.com/ID/PGTA.html (ACIS'23)
52

Slide 53

(1) (Id)Entity Assertion

A particular Thing is appropriately associated with one or more (Id)Entity-Records

53

Slide 54

(3) Property Assertion

A particular Data-Item-Value in a particular (Id)Entity Record is appropriately associated with, and reliably represents, a particular Property of a particular Thing

54

Slide 55

Categories of Assertion Important in (e)Commerce

(1) (Id)Entity

(2) (Id)Entity Match

(3) Property (Simple)

(4) Property (Complex)

(5) Principal-Agent

(6) Monetary **Asset-Value**

(7) Non-Monetary Asset-Value

(8) **Content** Integrity

https://rogerclarke.com/ID/PGTA.html (ACIS'23)

55

Slide 56

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56

Assertions as of Fact

**A Textual Assertion that involves
at least one Real-World phenomenon**

- An Assertion as of Fact may or may not be:
  - Supported by Evidence
  - A reasonable inference from Evidence
  - The subject of Counter-Evidence
- Many Assertions as to Fact are merely unsupported statements that the utterer claims that it is so
- Reliance on an Assertion as to Fact is advisable only where Evidence exists, and supports it more strongly than the Counter-Evidence

Relevant Assertions as of Fact

- **Out-of-Scope**
  - Ineffable mysteries (of a spiritual nature)
  - Evocative art-forms (poetry, ballads)
  - Graphical elements dominant over text elements
- **Within-Scope**
  - Statements about real world phenomena
  - Statements about associations between real-world properties and abstract-world data-items
  - Polemic, hyperbole and satire (because they affect attitude and behaviour)
  - Structured text (bullets, numbered segments, tables)

Quality Factors in Authentication

- Authentication Approaches depend on context, e.g.
  - In Courts
  - In Law Enforcement Investigations
  - In Commercial Transactions

- Authentication Quality depends on Data Quality
- Data Quality reflects the data source's motivations
- False Positives and False Negatives arise
- Cost Trade-Offs and Risk Management are applied

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Assertions as of Fact
Authentication and Evidence

- Easy: Assertions that involve structured data (the number of people at a meeting, the date of an event)
- The Laws of (Court) Evidence
- The Norms of Criminal Investigation
- 'Critical Thinking'
- Fallacy Theory
- ...
- 'How to spot fake news'
- Automated Fact Checking (emergent techniques)

Fallacy Theory

Ad hominem	Attack on some aspect of the person making an argument rather than on the substance of the argument
Ad misericordiam	Appeal to pity, a 'sob story'
Ad populum	Invocation of the majority view rather than a logical analysis
Ad verecundiam	Invocation of authority, rather than logic

Complex [or trick] question	Confusion induced by complex expression ('Do you still beat your wife?')

Secundum quid	Assumption that a heuristic or rule of thumb (which often holds) is a universal rule (which always holds)
Gambler's fallacy	Faulty assumption that prior events influence the next event (as in successive coin tosses)
Ignoratio elenchi	Faulty assumption that a point made is relevant to the issue

Woods et al. (2004) – 18
Wikipedia List (2024) – 140

Digital Misinformation
Information Reliability Criteria

- **The Author**
  incl. publishing record, background, affiliations
- **The Venue**
  incl. its nature, standing, ownership and goals
- **The Content's Origin and Nature**
  incl. sources cited, style (e.g. narrative, analysis or opinion), expression quality, coherence and cohesion of the argument
- **The Context of the Work**
  incl. declared and apparent motives,
  declared and apparent perspective(s) on the subject
- **Replication of the Content**
  incl. republication, review, quotation, citation

Ripoll & Matos (2019)

RFI #3
What other Sources / Approaches to Reliability Assessment?

- Easy: Assertions that involve structured data (the number of people at a meeting, the date of an event)
- The Laws of (Court) Evidence
- The Norms of Criminal Investigation
- 'Critical Thinking'
- Fallacy Theory
- 'How to spot fake news'
- Automated Fact Checking (emergent techniques)
- ...

Reliability Criteria for Assertions as to Fact

Criterion	Guidance
The Work	
• The Author	Check their identity, affiliations, prior works
• The Venue	Check its nature, ownership, declared mission, reputation
• The Style	Check for expression, rigour, polemic and satire
• The Values	Identify the values embedded in the content
• The Author's Purpose	Identify the declared and/or implied or inferred motivations for creating the Work
The Author's Assertions	
• Their Clarity	Isolate the key assertions, and examine for ambiguities, emotional language
• Their Internal Consistency	Identify related passages within the Work, and check for inconsistencies among them
• The Sources	Identify declared, implied and inferred sources, including by Web-searches on key expressions and passages. Evaluate any key sources, using this Guidance
The Author's Argument	
• Its Clarity	Extract and critique the flow of the author's argument
• Its Premises and Assumptions	Identify the starting-points of the argument
• The Logic	Test for fallacious forms of argument. See #T5Table 5
Evidence	
• Other Sources	Perform searches independently of the Work, for sources on key aspects of the Premises and Assumptions
• Their Content	Assess the consistency of the Work with those Sources
Counter-Evidence	
• Other Sources	Perform searches independently of the Work, for sources on key aspects of the Premises and Assumptions
• Their Content	Identify inconsistencies between the Work and those Sources

65

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66

Test-Cases – 1

The Iraqi Weapons of Mass Destruction

During 2003, the US Administration of George W. Bush enlists the UK Prime Minister Tony Blair to create public belief that **Sadam Hussein's Iraq possessed 'weapons of mass destruction' (WMDs)** and is prepared to use them, and hence invasion is justified.

Trump and the Storming of the Capitol

In January 2021, Donald Trump addresses supporters at a rally 2.5 kilometers from the Capitol, where a joint session of Congress is conducting proceedings to certify the results of the election and thereby end Trump's Presidency. The Capitol is stormed. **Trump incited or at least encouraged the storming of Congress; or conspired to obstruct Congress**.

67

Test-Cases – 2

Textual Assertions underlying Robodebt

The Australian social welfare payment each fortnight depends on the amount of income the individual has declared for the previous fortnight. Most recipients are in, at best, sporadic employment. So some overpayments occur.

The social welfare agency intends to acquire the data declared annually to the taxation agency, divide it by 26 to impute fortnightly earnings, and demand repayment of amounts that appear from that data to have been wrongly paid.

The Assertions to be authenticated are that:

- **The 'income averaging' method is reliable**
- **The process is lawful**

Clarke R., Michael K. & Abbas R. (2024) 'Robodebt: A Socio-Technical Case Study of Public Sector Information Systems Failure'
Australasian J. Infor. Syst. 28 (Sep 2024),
at https://journal.acs.org.au/index.php/ajis/article/view/4681/1481

68

Test-Cases – 3

Textual Assertions that:
- A Payment has been made
- An Entity has a particular Property
- An Online User is a person not an active artefact

Textual Assertions underlying:
- Asset Valuations
- Claims about New Sources of Scarce Raw Materials
- IPOs
- Technological Inventions
- Business Cases

Textual Assertions in Job Applications

The Argument

- 'Authentication' is used in IS to refer only to a very narrow category of Assertions about Identity
- Many other categories of Assertions are important
- Most data has been digital for several decades now, whether structured, graphical, audio or textual
- **Quite suddenly, technology has emerged that automatically generates Textual Assertions**
- **Organisations expect IS to encompass Assertion Authentication, nomatter what form the data is in**
- **IS practitioners need practice-relevant research to underpin the Authentication of Textual Assertions**

The Contribution

- Outlines of the nature of text, of representations of text, and of the interpretation of text, which lay the **foundation for understanding Textual Assertions**
- The use of concepts from descriptive linguistics to enable **identification of the categories of Textual Assertion on which human activities rely**
- **Definitions** of Textual Statement Reliability, Misinformation and Disinformation
- The **application** to Textual Assertions **of a Generic Theory** of Authentication
- **Reliability Criteria** for Textual Assertions as to Fact

The Authentication of Textual Assertions

Roger Clarke
Xamax Consultancy Pty Ltd, Canberra
Visiting Professor, ANU Computing, UNSW Law

http://www.rogerclarke.com/ID/ATS-ISF {.html, .pdf}

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