HEAL2100: Human Effective Argumentation and Logic for the 21st Century. The Next Step in the Evolution of Logic

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Abstract

This editorial is about weaponising the Fallacies, and offering them as active additional components to modern formal logic, thus forming the new evolutionary logic for the 21st Century. Logicians since Aristotle considered the fallacies as wrong arguments which look correct but are not. They classified them into groups, discussed them and left them by the sidelines of logic as failures.

Modern society, with the rise of the internet, Twitter, Facebook and You Tube showed the fallacies as most used and most effective in argumentation and debate. If this is the way humans reason and think then we need to develop the logical theory of the the use of the fallacies and legitimise them as a significant component of modern reasoning.

This manifesto outlines our approach to the new logic of the 21st century which allows for the systematic use of the fallacies in argumentation and debate as practiced by people in the mass media.

1 Logic (up to the year 2016)

Logic began with Aristotle.[1] He realised that in order to write his books he needed logic as a tool (organon) and he wrote his five books on syllogistic logic. Aristotle's logic was refined in later periods and the next significant step came with Peter

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[1]The Stoics invented propositional logic in antiquity, and Aristotle himself was the first to systematize dialectic in *Topics* and *On Sophistical Refutations*.

Abelard who worked in the early 12th century. His treatise the Dialectica [2] contained new ideas such as *de re* and *de dicto* modalities. It became possible to apply logic to language, theology and philosophy. New handbooks of logic appeared in later centuries, by Peter of Spain, Lambert of Auxerre and William of Sherwood. Later logicians were William of Ockham, Jean Buridan, Gregory of Rimini and Albert of Saxony. The best known textbook was by Antoine Arnold and Pierre Nicole The Port Royal Logic [3], J S Mill, *A System of Logic*, [61], 1843 in the 19th century.

Two points to be borne in mind about the development of logic up to the 19th century:

- It was mainly syllogism with extras.

- It dealt with human beings, their language reasoning, *their argumentation*, and their behaviour (as opposed to pure mathematics).

Modern mathematical logic was developed in the late 19th century carrying on until the middle of the 20th century [4, 5]. There were four pillars to mathematical logic: model theory, set theory, proof theory and recursion theory. Emphasis was diverted from the study and application of logic to the humanities, to the study and application of logic to mathematics and its foundations [5].

Dov Gabbay and John Woods [12], called this *The Hundred-Years' Detour*. This has changed with the rise of computer science, artificial intelligence, computational linguistics etc. There was a strong consumer demand for devices using this new technology. *In turn*, there was an urgent need to develop and evolve logic to serve these demands. Emphasis in logic reverted back to the analysis of day-to-day human activity. New logics were developed by diverse non-cooperating non-communicating communities, each driven by the needs of certain types of application or device. The landscape of logic became a *chaos of different methods*. New proposals for what Logic is have been pushed forward by Dov Gabbay and colleagues, such as *New logic with mechanisms* and *New logic with mechanisms and networks*, see Figure 2. For an evolutionary survey of modern logical systems see [23].

The above mentioned 20th century developments (problems and New Logic proposals) turned logic out of its 100 years detour, back to the modelling of the human approach, nevertheless, it still suffers from three limitations.

1. Logic remains a mathematical, formal system which cannot come completely to grips with human reasoning

2. It excludes the study and use of fallacies (see Section 2 below) and so ignores the most effective human use of (fallacious) logic

3. Worse yet, the new developments, though also sometimes applied in the humanities (logic and law, logic and analytic philosophy, logical analysis of language, logic and theology, logic and argumentation and debate), does not include a unified coherent logical theory nor is there a perception of differences in systems of thought arising from differing cultures such as Western vs. Islamic or Christian vs. Jewish. Frequent misunderstandings arising from such differences are not surprising and very damaging.

There is some realisation among a few of these diverse logical research communities that there needs to be more communication between them and unifying principles are indeed being sought.

The logic with which we are familiar reflects a Western cultural way of thinking and behaving. There are other major cultures which think and behave differently.

The following are strong communities developing the new and old areas of logic:

- The traditional mathematical logic community

- The fuzzy logic community

- The argumentation communities

- The informal logic community

- The researchers dealing with fallacies

- The non-classical logic community and research groups

- The logic and language community

- The probability and Bayesian network community

- The philosophical logic community

- The logic programming community

- The automated reasoning community

- The belief revision community

- The legal reasoning community.

Such communities of course share many common members.

There were several logicians and groups who since the late seventies tried in research, conferences and social administration to encourage unification and communication among the various communities, through publishing many research books,

a large number of handbooks and journals and many conferences, workshops and summer schools.

Bringing communities together is not easy. A major obstacle is that the majority of rank and file researchers work in their own restricted area and are concerned with quick publications leading to a promotion. Even when they become established famous and senior, some of them develop a territorial protectiveness and shy away from other communities.

There is another, more scientific difficulty. In most cases to show a connection requires further research and generalisation and this may take time and not be easy to do by a single individual and may not be easily understood.

In our case we want to bring the fallacies and the argumentation communities together by accepting the fallacies as legitimate reasoning schemas (see however Remark 1.1 below). This is both necessary and possible now because of several scientific and social developments:

1. Social media and internet made it clear that fallacious reasoning and patterns of thinking are most effective to the extent that such ways of thought can topple governments, influence elections and support and foster terrorism. The fallacies have been weaponised on a large scale. Counter measure arguments are urgently needed and patterns of reasoning (such as HEAL2100) are urgently required.

   This increased use of fallacies is a result of two trends. The traditional media lost ground to social media and their moderating influence was decreasing. Traditional media wanted to appeal/sell to maximal number of people so they followed a middle reasonable non extreme course. The news/opinion makers on social media was free and abundant, so to compete they adopted extreme views as well as used fallacies and fake news to push these views and improve their ratings.

2. Developments in big data and the internet of things give us the means to develop the new logic. When a fallacy is encountered by a user, then he can use a big data application to find many other examples of the same pattern and responses to it, and thus construct his own response. Currently this is not possible in real time.

3. Good work on argumentation and fallacies is mature enough and detailed enough to enable us to move to the next step.

4. The outstanding technical success and applicability of the developments of the Fuzzy community and Bayesian community is also an enabling factor towards

the next step in the evolution of logic.[2]

5. Developments in theories of universal distortions and the use of logic in the sex offenders therapist communities show the effectiveness of countermeasures to fallacies.

6. There is an important social trend that enforces the importance of developing HEAL2100. Traditional media (often known as "legacy media" such as printed newspapers and TV cable and broadcast channels are declining in popularity while their target audiences are ageing.

These are being replaced by digital media on platforms such as YouTube and Twitter (and their successors) created by individuals or small groups with limited budgets. Tight resources result in one person expounding to a static camera or a couple of people discussing an issue at much greater length than could have been allocated by a TV or radio station. Most viewers understand that the content creators will have partisan views or a low commitment to veracity but nevertheless an increasing proportion of the demographic below 40 years old is consuming this new media and is exposed to argumentation and logic, to differing degrees, in a way that was not previously available. There will be many times when consumers watch one discussion which seems reasonable enough until they then open up the next channel and find the arguments in the first debunked as either untruthful or specious.

Modern media has often been criticised as the death of civilisation but in many ways it offers an opportunity for the general public to learn about argumentation in a way that has been available only to the better educated in universities and elite schools but has not been open to the general population since the days of the Athenians meeting on the Pnyx, See Figures 1 and 2.

Remark 1.1. *We said above that we hope to bring together with us the fallacies and argumentation communities. We need to make a quick remark here, which will be developed fully in a later section. These communities regards fallacies in the context of deductive reasoning. The weaponised fallacies we have identified in the media are not only deductive fallacies but also what we now call "Action-Fallacies" (we need to coin this new concept now). This will be defined in a later section but meanwhile let us give a schematic explanation.*

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[2]Note, however, Gilbert Harman's [62], a Discussion of the Relevance of the Theory of Knowledge to the Theory of Induction (with a Digression to the Effect that neither Deductive Logic nor the Probability Calculus has Anything to Do with Inference). He points out that no human reasoner is capable of fulfilling the Bayesian constraints. See also, independently, Woods and Walton in chapter 1 of their *Fallacies: Selected Papers*, [31].

Assume a deductive encounter between a witness and a defense attorney in front of a Jury. Call the deductive encounter level 1 encounter. It is important for the defense attorney to discredit or falsify or argue against the testimony. If the defense attorney fails then his client may be jailed. The attorney may move to a level 2 encounter (meta-level) by arguing that the level 1 encounter should be canceled altogether. For example the attorney may argue (fallaciously or not) that the proceedings is an appeal proceedings and no new witnesses are allowed. There are , however, many action-fallacies which can be used, ranging from the extreme Mafia "fallacy" of assassinating the witness, or the lesser options; intimidate the witness, insult the witness, drug and confuse the witness and so on. These are level 2 non-deductive action - fallacies designed to abort the level 1 proceedings.

A real example of this is reported in Example 4.4 below.

So to summarise, when we talk about integrating the fallacies we mean action-fallacies, which may be deductive fallacies or real actions fallacies used in a higher level to abort a lower level..

Aristotle	Syllogism, 13 fallacies The concept of logic is based on human reasoning		
Middle ages	Studied aspects of various languages	Studied logical rules connected with religion	Classified and studied more fallacies
Mid 19th century	Boole/De Morgan	**Big detour from human based logic towards mathematical logic**	
Mid 20th century	Logic for computer science Deductive human reasoning (problems and New Logic proposals, see Figure 2)		
21st century	Deductive human reasoning + integrating fallacies		

Figure 1: Time-line for the evolution of logic, from Aristotle to the present

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2 Fallacies

This Section presents our views leading to the idea of integrating the fallacies into *New logic with mechanisms, networks and fallacies* which we also call HEAL2100. Defining HEAL2100 is research in progress. We do not know yet what form it will take.

We follow several Subsections. Subsection 2.1 presents a short objective survey of the state of affairs up to now. We found [10] very helpful and we are following its presentation. Subsection 2.2 discusses our view/interpretation of the survey in Subsection 2.1

2.1 Historical and current view of fallacies

Aristotle

Aristotle was the first to systematise logical errors into a list and to establish the convention that being able to refute an opponent's thesis is one way of winning an argument [7]. Aristotle's "Sophistical Refutations" (De Sophisticis Elenchis) identifies thirteen fallacies. He divided them up into two major types: linguistic fallacies and non-linguistic fallacies, some depending on language and others that do not. These fallacies are called verbal fallacies and material fallacies, respectively. A material fallacy is an error in what the arguer is talking about, while a verbal fallacy is an error in how the arguer is talking. Verbal fallacies are those in which a conclusion is obtained by improper or ambiguous use of words.[3]

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[3]Aristotle's 13 fallacies:

I. Fallacies dependent on Language (De Soph Elen 4, 165b24-166b28)

Ambiguity (equivocation or homonymy)
Amphiboly (or ambiguity)
Combination
Division
Accent
Form of expression

II. Fallacies outside of language (De Soph Elen 5, 166b28-168a18)

Accident
The use of words absolutely or in a certain respect
Misconception of refutation
Begging the question
Consequent
Non causa pro causa
Complex question.

1960	Traditional mathematical logics. Intuitionistic and classical logic. Let us refer to this as **TDL**, Traditional Deductive (modern formal, classical or intuitionistic or other axiomatic) Logic The traditional view of the Fallacies is called **SDF**, Standard Definition of Fallacies, See [18, p. 52]
1960–1990	Intensive development in computer science and AI The rise of many new logics
1980-2000	Systematizing and legtimizing many logics
Dov Gabbay and Many Colleagues Published Multi volume Handbooks of Logic	Handbook of Philosophical Logic, Handbook of Logic in Computer Science, Handbook of Logic in AI, and many more.
2000 Dov Gabbay–John Woods	*New logic with mechanisms* = whatever system is working in the head of a logical agent = traditional deductive logic (**TDL**) + various logical mechanisms (which arose in artificial intelligence, theoretical computer science and study of language during the period 1980-2000)
See paper [12] proposing the *New logic with mechanisms.*	
2009 Dov Gabbay	*New logic with mechanisms and networks = New logic with mechansims* + Networks + Argumentation + Axioms + Action sequences + A variety of Metal-level Postulates and Algorithms
Luxembourg Lecture of Dov Gabbay. See [23]	

Introduced in a 2009–2017	Incredible developments of Smartphones and Social Media: Facebook, YouTube, Twitter, Wikipedia as well as technical developments of the internet and the emergence of the new area known as Big Data
2017 Dov Gabbay–Lydia Rivlin	*New logic with mechansims, networks and fallacies* (which we call HEAL2100)= *New logic with mechanisms and networks* + Integrated fallacies

Figure 2: Time-line for Logic in the period 1960–2017

Modern times, first wave

Irving Copi in his influential textbook from the mid-twentieth century — defines a fallacy as "a form of argument that seems to be correct but which proves, upon examination, not to be so", see [18]. Copi lists (1961) 18 fallacies, (of which 11 are from Aristotle, also called by John Woods ([17] (1992), "The Gang of 18"[4]). His view is what is known as the traditional view, **SDF**. This view is supported by other distinguished researchers such as Woods [17] (1992), Walton [16, p. 179](2010)

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[4]The Gang of Eighteen fallacies:

ad baculum
ad hominem
ad misericordiam
ad populum
ad verecundiam
affirming the consequent
amphiboly
begging the question
biased statistics
complex question
composition and division
denying the antecedent
equivocation
faulty analogy
gamblerÕs
hasty generalization
ignoratio elenchi
secundum quid.

(Walton says that a fallacy is an argument that seems to be correct but is not), Salmon [20], and Powers [19].

It was Hamblin [9], who wrote the first book totally devoted to Fallacies, who first criticised **SDF**.[5] He was followed by others. Finocchiaro distinguishes six ways in which arguments can be fallacious. They all have deductive aspects. Finocchiaro [51] observes that it is adequate to classify all the kinds of errors Galileo found in the arguments of the defenders of the geocentric view of the solar system.

Gerald Massey [24], in 1987, has voiced a strong objection to fallacy theory and the teaching of fallacies. He argues that there is no theory of invalidity — no systematic way to show that an argument is invalid other than to show that it has true premises and a false conclusion [24, p. 164]. By the way this is now available (called refutation system, see [21], 2011). Note that Massey's view/objections to the fallacies is also deductively based, it requires a logical system generating the fallacious arguments as well as the valid arguments.

Johnson and Blair in their textbook *Logical Self-Defence*, first published in 1977, see [22] introduced new ideas for the time; the idea of an argument between two parties, in the presence of audience. Their emphasis is on arming students to defend themselves against fallacies in everyday discourse. In place of a sound deductively valid argument with true premises — Johnson and Blair posit an alternative ideal of a cogent argument, one whose premises are acceptable, relevant to and sufficient for its conclusion. Acceptability replaces truth as a premise requirement, and the validity condition is split in to two different conditions, premise relevance and premise sufficiency. Acceptability is defined relative to audiences — the oneÕs for whom arguments are intended — but the other basic concepts, relevance and sufficiency, although illustrated by examples, remain as intuitive.

We note the importance of the idea of self defence, which is compatible with our view of weaponising and defending against the use of fallacies. We also note that what they call cogent argument, which is not considered logical deductive in traditional logic (**TDL**), is considered logic in our *New logic with mechanisms*, (see Figure 2) because it is an instance of non-monotonic reasoning. The Johnson and Blair defence is just a *New logic with mechanisms* counter argument.

To conclude this subsection it would be useful to give an example,which will illustrate both an instance of a *New logic with mechanisms* system and an opportunity

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[5]The term **SDF** was coined by van Eemeren and Grootendorst. It was the name they gave to what Hamblin had said:

> **SDF**: A fallacy is an argument that seems to be valid but is not so.

Hamblin made the historical claim that everyone since Aristotle held this view about what made for a fallacy. Hansen [57] showed that Hamblin was wrong.

for self defence.

Example 2.1. *Consider the story below.*

The common practice in the 1970's in top North American philosophy departments is to find jobs for their students who just received a PhD. This is wonderful practice to be highly praised. Our story deals with the case of one student who got a PhD, let us call him H, ("the Hippy"), and the following is a departmental staff discussion of whether to spend resources and effort and take responsibility for placing H (finding him a position in another university).

Professor A (Reverend, Philosophy of Religion): We should abandon H. He is wild, looks like a savage, and although his thesis was strong, he will either fail his interview, or else shame us and be sacked within 6 months of being appointed.

Professor B (Social Choice Theory, H's advisor): We still have time until the interview. By the time of his interview, he will be presentable, shave his hair, wear a shirt and a tie and look like a normative candidate.

Any sane person would want a good job and prepare for it and I am confident H will do the same.

Professor A: H is too wild, it will not work. I appreciate your commitment to your student, but the department should not be involved.

Possible replies for Professor A.

1. *Argue and give evidence that H will behave.*
   This is compatible with the idea of Logical self defence. The defence would be in New logic with mechansims, *maybe present a detailed plan how to prepare H and evidence that H will comply.*

2. *Attack with a Fallacy.*
   Reverend, you seem to dislike H, ever since he said that Jesus was nothing but a political agitator! You should overcome that!

We now describe the system of New logic with mechanisms, *needed to model this argument.*

 i. *We need a language for facts and their negations.*

 ii. *We need a language for actions of clauses of the form:*
    Facts ⇒ Execute new fact and override existing fact.

iii. *We can have common sense mechanisms which can take a set of facts and expand it.*

iv. *We define a consequence relation between sets of facts S and a new fact x to be $S|-x$ iff there exists a sequence of actions and mechanisms leading from S to x.*

The argument between the professors is about the sequence of actions proposed.

Note that this logic is practical. If you have a business and go to the bank and ask for a loan, this is how you argue that you can easily pay it back. You present a business plan which is a sequence of actions which can generate and maintain income. We note here that an action fallacy can also be used, for example passing a note to the Reverend saying that unless he immediately concedes the point his adulterous relationship with a student will be immediately revealed.

This subsection is continued in Appendix A.

2.2   Our Initial Position on Fallacies

We first recall our our distinction between "Deductive-Fallacies" and "Action-Fallacies" as intuitively explained in Remark 1.1. The Deductive- Fallacies are what is commonly called Fallacies. We also recall recurring comment in Subsection 2.1, that if we consider the deductive logic against which we measure the fallacies as *New logic with mechanisms and networks*, see [23], then the statement below is still valid: A deductive-fallacy is the use of an invalid or otherwise faulty argument or dialogue move which *appears* valid. It is important to note that an action fallacy in say a weaker logic may become a deductive fallacy in a stronger logic, if the stronger logic incorporates as a legitimate move that kind of actions. We may also have a reverse change, a legitimate action in an earlier logic becomes illegitimate in a later logic. A striking example is the historic **Trial by Combat** rule. (Trial by combat was a method of Germanic law to settle accusations in the absence of witnesses or a confession in which two parties in dispute fought in single combat; the winner of the fight was proclaimed to be right. In essence, it was a judicially sanctioned duel. It remained in use throughout the European Middle Ages, gradually disappearing in the course of the 16th century. See `https://en.wikipedia.org/wiki/Trial_by_combat`, accessed on July 18, 1700 hours UK time)

A fallacious argument or move may be deceptive by appearing to be better than it really is. Some fallacies are committed intentionally to manipulate or persuade by deception, while others are committed unintentionally due to carelessness or ignorance. Lawyers acknowledge that the extent to which an argument is sound or unsound depends on the context in which the argument is made.

Fallacies are among the most effective arguments used by people and are among the most successful in affecting human actions and behaviour in social, political, legal and interpersonal interactions.[6] This being so we still have not been able to model and understand them. To this day, logicians have dismissed them simply as wrong reasoning and their use a sign of ignorance. See however, Woods' *Errors of Reasoning*, [56] and see the discussion in Subsection 2.1.

Fallacies are commonly divided into "formal" and "informal". A formal fallacy can be expressed neatly in a standard system of logic, such as propositional logic, while an informal fallacy originates in an error in reasoning other than an improper logical form, see [9, 16, 17] and Subsection 2.1. Arguments containing informal fallacies may be formally valid, but still fallacious.

Modern argumentation and informal logic identifies, discusses and classifies over a hundred fallacies, [11], listing over a 100 fallacies and [59], listing 137 fallacies, and there are hundreds (at least 500) articles about fallacies (see [60], Hansen and Fioret in Informal Logic, 2016). See also [16, 17].

However, no one in the logic and argumentation community considers fallacies as an effective instrument of reasoning and no one has tried to model them from this point of view, systemise their use, offer counter-fallacies in debates and in general turn them into another pillar of logic and language. This is not a criticism. The tradition since Aristotle has been to regard a fallacy as a failure of reasoning which should be avoided. However, it has become increasingly obvious to those of us who have been studying the internet that logical fallacies have proved not only effective in argumentation but often more effective than pure logic. We have conducted a wide study of internet arguments, both in videos and in media such as Twitter and the evidence presented forced us to accept fallacies as a form of dialogue, which then prompted us to study how to integrate their use into formal theories of argumentation and logic. Furthermore our involvement with advances in the notion of logical systems, coming from human reasoning modelling in theoretical computer science and artificial intelligence made it possible for us to initiate the first integration of fallacies into such models.

There has been a lot of excellent research studying fallacies among the philosophical logic and informal logic communities, as we have seen in Subsection 2.1, which essentially forms the ground work for such integration. We have no doubt that the fallacies community at large would have reached the same conclusion as

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[6]We have not conducted a scientific study to back up this claim. However, the second author has been in politics for many years, (even running as a candidate for British Parliament) and has been following debates in the social media. The first author has been following Middle Eastern politics for years. This is the basis for our conclusion of the effectiveness and use of fallacies and that that it is time to integrate fallacies into Logic.

ourselves had they been exposed as a whole, as we have been, to internet debates and use of fallacies and to AI modelling of human reasoning. We are going to rely upon and use, as our starting point, the work on fallacies of prominent researchers who devoted their lives and many books to analysing these issues. Note however our comments on action-fallacies in Remark 1.1. We especially note the seminal work of John Woods [56], whose brilliant analysis of deductive fallacies is a good compatible starting point for us. See Woods' EAUI approach [56, p. 136]. Given this most valuable body of work, what we need now is to move to a NEW AREA of *Argumentation, Human Effective Argumentation and Logic (HEAL2100)* — THE NEXT EVOLUTIONARY STEP FOR LOGIC.

See Figures 3, 4 and Figure 5.

Fallacies	
Aristotle	13 fallacies classified into 2 types, rejections and mistakes
1970	The Gang of 18 Fallacies
2008	Over 100 fallacies classified many types. Still rejected as mistakes but analysed and refined by a very strong and vibrant informal logic and argumentation communities.
2008–2017	**Powerful use of fallacies as weapons of reasoning**
2017 Gabbay–Rivlin	Proposal to integrate the fallacies into deductive logic.

Figure 3: Evolution of the view of the logic community on fallacies

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Why integrate fallacies?

- The use of Fallacies in interactions between humans is more effective than traditional deductive arguments; it is extensively used.

- Modelling and integrating fallacies into the *New logic with mechanisms, networks and fallacies* can help develop logic on its evolutionary path and will include new models of formal logic, practical reasoning and practical Artificial Intelligence.

- Allows for better understanding of human reasoning and interactions, as it is now (2017 and onwards) extensively used and is here to stay in the social media. This we hope will result in better reasoning awareness among the public, better grasp of reality, normative laws, regulations, persuasion, political culture, etc.

Figure 4

Research activity Goals 2008

Our purpose was to propose how to integrate symbolic logic with network (neural and argumentation) reasoning.
Let us consider the human agent in his daily activity.
We ask: what 'logic' does he have in his head?
Current relevant buzz words circulating in the community are, among others: time, action, knowledge, belief, revision, deduction, learning, context, neural nets, probabilistic nets, argumentation nets, consistency, etc.
We want to understand what kind of integrated logic engine the human uses in his daily activity.

Research activity (work packages) goals 2017

Add and integrate the fallacies.

Figure 5: Change in research activity

3 Big Data

The means to model the use of the fallacies come from recent advances in computer science and AI in the area of Big Data (see [52]). The internet allows us access (in real-time of patterns of data, such as the use of fallacies), previously inaccessible and until recently non-existent data repositories, such as:

- Social Media (e.g. Facebook)

- Publicly Available Sources (government , databases, newspapers, online blogs, etc.)

- YouTube videos

- Streaming

- Advertising

- and so on.

The 2000 years of study and classification of the fallacies together with big data and our capabilities to search and mine the extensive use of fallacies in social media now give us the tools to embark on the next phase of our study in modelling a form of self-protection from fallacies as well as their use as a reasoning weapon. Such knowledge will also enable us to model cultural systems of thought — such as the Western European, rule-based system, the Jewish Talmudic system (which played an unacknowledged but fundamental role in the formation of Christian medieval commentaries), the Islamic Quranic and Sharia way of thought and Hindu darsanas, among the major ones.

The Use of Big Data. We have two main uses of big data:

1. To seek find and study the use of the fallacies in the social media.
   We need this to classify their use and integrate them into logic. So we need to use big data expert to work with us throughout the project

2. The new logic we are building will require a response to a fallacy by another fallacy, as our examples show. So part of the logic must be a big data mining application which given a context and a fallacy will offer candidate fallacies for response. For example, it could be a counter example using theorem prover if the fallacy is logical or a counter threat if the fallacy is a threat.

Also of great importance is the expected rise of the role logic and argumentation in everyday life, as discussed in item 6 of section 1.

4   Case Study: The Fallacy of Ad Hominem

Let us start by quoting from one of the most important of Big Data resources, Wikipedia:

"Ad hominem (Latin for 'to the man' or 'to the person'), short for 'argumentum ad hominem', is a logical fallacy in which an argument is rebutted by attacking the character, motive, or other attribute of the person making the argument, or persons associated with the argument, rather than attacking the substance of the argument itself.

Fallacious ad hominem reasoning is normally categorised as an informal fallacy, [3, 4, 5] more precisely as a genetic fallacy, a subcategory of fallacies of irrelevance. However, in some cases, ad hominem attacks can be non-fallacious; i.e., if the attack on the character of the person is directly tackling the argument itself. For example, if the truth of the argument relies on the truthfulness of the person making the argument—rather than known facts—then pointing out that the person has previously lied is not a fallacious argument."

This fallacy can be further refined into a different type of sub-fallacies, depending on the type of the attack. We chose this fallacy to illustrate how we are going to deal with it in the new area of logic HEAL2100.

According to the discussion in Subsection 2.1, when this fallacy is used in a debate or in argument discussion between two people, (such as in Example 4.3 and Example 5.6), it is a violation of correct procedure in the system. This will be agreed by the Pragma-dialectic approach, by the Walton Pragmatic approach and by the Johnson and Blair Self Defence approach,[7] as all three envisage a dialogue between two parties. In fact it will be agreed as a fallacious move by everybody.

We have to be careful here, as the next Remark 4.1 (by John Woods) shows.

Remark 4.1 (Smoking)**.** *When 15 year old Billy says to his Dad, "But why shouldn't I smoke, Dad, given that you suck down 20 cigarettes a day?", does anyone in his right mind really think that, in saying so Billy has committed an inapparent error of reasoning, or has broken an Amsterdam bylaw for "critical discussions"?*

It is generally agreed that ad hominem remarks can be very effective modes of persuasion. Even more so, they are entertainments designed to move the already-convinced and tick-off the otherwise-minded. The only reason that they got on the fallacies list is when used as premisses of arguments with generally unvoiced conclusions or other missing premisses. LetÕs come back to Billy. Suppose we reconstruct what he said along these lines.

1. *Dad thinks that the anti-smoking thesis is true.*

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[7]Ralph Johnson accepts the dialogue approach but Tony Blair now does not (as of January 2017, as he stated in a CRRAR meeting, `http://www1.uwindsor.ca/crrar/crrar-in-the-news`).

2. *But Dad himself sucks down 20 cigarettes a day.*

3. *[So Dad's practice discomports with his policy.]*

4. *[Therefore, the anti-smoking thesis is false.]*

Of course, this is a bad argument, but nowhere close to a fallacious one. Its badness is not inapparent, and hardly any ad hominem retort is made with the intent of this argument.

Remark 4.1 above is a good one. There are many other cases like the smoking example, such as the cross examining of an expert witness , where a personal attack on the expert and his qualifications may even be expected. What we have in mind, however, are cases where the ad hominem attack is a weapon in the meta-level to completely destroy the opponent. It may not even be an argument. Consider the following real examples, namely Example 4.2, Example 4.3 and the incredibly illogical but deadly Example 4.4.

Our question is: How do we respond to such a fallacious move? Do we explain to our opponent (the user of the fallacy) the reasons why this is a fallacy in the context of our discussion and ask the opponent politely to make another move?

This is not what we see in Social media practice. The fallacy is legitimately used as a weapon and the only way not to lose the argument is to respond with another fallacy. Thus ad hominem is a good case study for us to illustrate our HEAL2100 point of view.

We start by illustrating how this fallacy can be used as a reasoning weapon.

Example 4.2 ("Milk-snatcher" Thatcher)**.** *We quote from:*
`http://www.telegraph.co.uk/news/politics/7932963/`
`How-Margaret-Thatcher-became-known-as-Milk-Snatcher.html` *(accessed on UK 1130 hours May 06, 2017)*

> *"The Conservative government had to find substantial cuts to meet election pledges on tax. Removing free school milk for the over-sevens became the most notorious saving introduced. Edward Short, then Labour education spokesman said scrapping milk was Ôthe meanest and most unworthy thingÕ he had seen in 20 years. It earned Mrs Thatcher the nickname, "Milk Snatcher" and haunted her throughout her career. In 1985 she was refused an honorary degree from Oxford University because of her education cuts."*
>
> **After the war under Clement Attlee the 1946 Free Milk Act was passed providing one third of a pint to all children under the age of 18.*

Edward Short's argument was emotional and fallacious. Under traditional, rule-based logic Mr. Short would have been expected to give good reasons why Thatcher's policy was wrong and Thatcher could then have responded giving her reasons for the cuts.

However, the emotional argument and personal attack on Mrs Thatcher as a "milk snatcher" was much more effective. The only defence which would have made any impact on public perceptions of the situation would have been for Mrs. Thatcher to attack the Labour Party—possibly for the devaluation of the pound in 1967 opening the Labour Party to the charge of being called "pick-pockets" for stealing money old people and innocent children whose pensions and pocket money was subsequently worth less.

See: Dynamics of a Non-Decision: the Failure' to Devalue the Pound, 1964–7 TIM BALE 20 Century Br Hist (1999) 10 (2): 192-217. DOI: https://doi.org/10.1093/tcbh/10.2.192 Published: 01 January 1999 (accessed UK 1130 hours May 06, 2017).

Instead, the Conservative government of the time stuck to explaining the economic situation, an argument which cut little ice with the parents at the school gates.

Had Mrs Thatcher been in possession of our intended HEAL2100 logic model, and a big data computer at her disposal at the time and the inclination to respond in kind she could have taken the following steps:

- *Edward Short attacks Mrs Thatcher personally, using a fallacy*

- *Mrs Thatcher identifies the structure of the weaponised fallacy-attack*

- *She uses big data to find similar emotive issues around Labour Party policies[8]*

- *She finds a most similar case, although this is not strictly necessary, it could be anything (see the example of the Starkey-Hassan argument below)*

- *She counterattacks by presenting a case found by a HEAL2100 Big Data search*

Compare the above to the traditional deductive rule base logic behaviour:

- *Edward Short presents logical arguments against the cuts*

- *Mrs Thatcher analyses these arguments using facts and logic*

- *She presents her logical counter arguments*

---

[8]We do not currently have an application which can do that in real time. The projects aims to develop one.

Example 4.3 (You got my name wrong)**.** *This example is from a televised debate (BBC Question Time) which is now available on YouTube and entitled: "Mehdi (Ahmed) Hasan debates David Starkey on Question Time",* `https://www.you tube.com/watch?v=CzYlkGbYG1M`*, (accessed on UK 1130 hours May 06, 2017).*

Starkey starts by mistakenly referring to Mehdi by the name Ahmed.

At minute 1.23 of the video Starkey implies that Mehdi is prevaricating by pointing out that what he is saying in the televised debate is not what he said on the same subject when speaking to a group of Moslems in a mosque. Mehdi replies at minute 1.40 that Starkey cannot even get his name right, having called him Ahmed and not Mehdi. When Mehdi makes this point, the audience bursts into loud and enthusiastic applause.

People from Moslem societies frequently use a style of argument which is also increasingly used by politicians and ideologues — of whatever cultural background which we will classify as based on an appeal to emotions. This method of argument has as its goal the winning of the argument but not the discovery of any truth or an arrival at consensus. It is a form far better suited to all expressions of modern mass media in which the object is to get a message across to an audience with a widely diverse level of educational attainment and in many cases an extremely limited level of concentration.

In the same vein, Starkey could have answered along the lines of: "Nice to know you care about your name rather than the starving children of your people (or any other emotive issue)." Again our big data HEAL2100 logic could have offered structural analysis and responses. Starkey would not have needed big data to make this response but maybe there was some other additional useful related information about Mehdi.

We are specifically studying the appeal of emotional argument to a more primitive part of the brain because this sort of argument has extremely important implications for how we relate to electronic media.[9]

Let us explain: Suppose you are of Indian descent but have had little contact with either your family or culture for a long time. Then you walk into a house where, as you come into the hall, you can smell curry through the open kitchen door. Immediately you are transported back to your childhood, and are filled with

---

[9]We are grateful to Doug Walton for pointing out that this relates to what the psychologists call heuristics, short-cuts that appeal to emotions.

The heuristics and biases research program of Tversky and Kahneman [54], (Judgment Under Uncertainty: Heuristics and Biases) [1974] was criticised by Gerd Gigerenzer (see [55] for a survey), and others for being too focused on how heuristics lead to errors. The critics argued that heuristics can be seen as rational in a certain sense (bounded rationality), arguing that they can be good enough for some purposes without being too taxing on the limited rationality of the human brain.

memories of your mother's cooking, family meals, rows with your sister, etc.

The sense of smell is well recognised as being wired into the most primitive parts of the brain and smells are also well recognised as emotional triggers at a far deeper level than any other sense.

Compare this with a scenario in which you see a recipe for curry, recognise it, analyse it and are then reminded of your mother's cooking. The chain of associations is much slower and not nearly so personal.

Example 4.4 (CNN Interview). *See this YouTube video:* `https://www.youtube.com/watch?v=CBZOC43O7OU` *(accessed on UK 1130 hours May 06, 2017).*

Katie Hopkins is being interviewed by CNN's Hala Gorani. Hopkins attempts to distract Gorani by referring to her first as "darling" and then, when that elicits no response, a little later, as "honey". At this point Gorani cannot ignore it any more and is forced to protest at the slight, thus diverting her fire from the argument. The question of legitimacy is important here. Hopkins' technique works well for a woman-to-woman argument (that is, contempt between equals) but it would not be legitimate if the interviewee were a man. Had a man called her "honey", Gorani would probably have terminated the conversation straight away and thereby would have "won".[10]
Worth watching.

Example 4.5 (Arguing with different logics). *John gives the proof:*

$$
\begin{array}{ll}
1. & \text{Assumption } (c \rightarrow a) \rightarrow c \\
2. & \text{Assumption } \ c \rightarrow a \\
\hline
3. & \text{Conclusion } a
\end{array}
$$

Proof: From 2 and 1 derive c and then from c and 2 derive a, all using modus ponens

Mary objects to the proof. She says: but you have used assumption 2 twice!

John uses say classical logic but Mary uses Resource logic.

This is a simple clear example but if the differences between John and Mary are subtle, how can Mary explain her different point of view to John. Big data can help.

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[10]As a side matter, it is also interesting to note the degrees of pressure Hopkins employs. The word "darling" can be used legitimately by men and women to talk to friends, especially among media people who wish to create an illusion of friendliness with an interculator whose name they cannot remember. Gorani would therefore find this term of address as slightly unsettling but not entirely outside the bounds of normal usage. However, the sobriquet "honey" is never used among friends, but only romantically or de haut en bas. Gorani could not ignore that. The first "darling", therefore, was a testing shot, preparing the ground for the next, and fatal assault.

Example 4.6 (The Taxi Driver-Analogy). *This is a real example, that happened in Israel. A passenger logician was returning by Taxi in a journey taking 50 minutes. The taxi driver was an immigrant from Uzbekistan, very right wing and a supporter of Prime Minister Benjamin Netanyahu. The prime Minister was investigated for accepting gifts (not too expensive but still considerable) from a very rich friend. Netanyahu did not report these gifts at the time and some investigative journalist discovered it and and the police were looking into the case. It was not a bribe, but just wrong behaviour. The taxi driver was arguing in favour of and supporting the prime minister.*

His argument was as follows

1. *What is wrong in accepting gifts from a friend?*

   Look at me, I wanted to meet my (male) friend from Uzbekistan, I sent him a ticket to come to Israel, I paid for his hotel, I did everything for his visit. What is wrong with accepting this, it is natural between friends.

The answer to that is that it is OK for your friend but not OK for the prime Minister of a country. He should have declared everything he was receiving.

The problem with this answer was that there was no chance in Hell that the taxi driver would understand it. He came from an ex-communist country which was still totalitarian and the fine aspects of democracy were beyond his conceptual world. The passenger clearly needed a better answer for him to grasp the concept, but he was in a taxi which was about to arrive in 15 minutes and he needed to produce an answer immediately. The passenger logician did not find the answer until the next day. It was really simple.

2. *Answer. Imagine (the passenger could have said to the taxi driver) that your friend is a woman who in the meantime got married. Had she, without telling her husband, come to Israel on a ticket you had bought, staying in a hotel you paid for, and then her husband had found out. What would he think?*

   She should have told her husband immediately and asked for his blessing.

   When in a democracy the prime minister receives gifts it is similar.

Now, had the passenger had a Big Data application, he would possibly have used his mobile phone to search for an analogous example using the right key words.

The taxi driver could have said that the women friend case is not the same as the prime minister case. Such a response is quite likely, but it would have offered the opportunity for further discussion. The taxi driver, at least, would have seen where the passenger's attempted counter-argument is coming from. Without such or a similar example, there would have been nothing to discuss.

Example 4.7 (Labelling)**.** *This is a simple technique of attack; label your opponent with a strongly emotional totally negative predicate, for example label as a racist. There are many such labels you could use, which carry such a strong emotional reaction that once an opponent is labelled by such a word people will reject anything he says. Here are some examples:*

- *Racism*

- *Apartheid*

- *Contrary to international law*

- *A crime against Humanity,*

etc.

The label need not be so powerful or even negative. It is enough to create a context which weakens the opponents arguments. If we use fuzzy logic where arguments have numerical strength, we can say something like "of course you would say so, it is to be expected, it is in your interests to say so". This is a generic weakening label, which is not negative, but which will weaken the strength of the opponent's argument. In general there is no good answer to such generic argument, but there are exceptions.

Recently there was (June 2017) on television an interview with a politician. He was a minister and resigned because of ideological disagreement with the prime minister (no scandal or mis-behaviour), see [15]. He started his own party. In the interview he was accused of trying to build himself a political career and possibly aim for a government position. This is a generic labelling attack on any politician. He replied to the television interviewer, "What are you talking about? I was a minister already"!

Example 4.8 (Prime example of labelling and counter-labelling)**.** *From an interview on the BBC radio programme "Midweek", broadcast on October 9th, 2005: `https: // www. youtube. com/ watch? v=Hy-Ap4LQB-4 `.*

Labelling is very often not direct but by implication, which is an especially deadly form of attack. When the accusation is delivered in an oblique way it is far more difficult to refute because before a rebuttal can be made the accused person has to put into words the full meaning of the implication only half-suggested by the accuser.

Darcus Howe is a master of this technique and, in the opinion of the authors, he made his living by wrong-footing the sort of people who are terrified of having even a hint that they might harbour politically incorrect opinions.

Howe starts the interview of a famous American comedienne, Joan Rivers, with his usual procedure of implying that Rivers has unholy attitudes — i.e. labelling her

as being at the very least a sort of passive racist — but he frames it in such a way that the meaning is ambiguous ("since black offends you"), this leaves him an escape route which he takes when Rivers flies into a fury. He then posits that the "use of the term 'black' offends you".

In other circumstances this would have been effective. The accused person would seize on the opportunity to have a conversation and would accept the lesser label of being uncomfortable with the word "black". Howe would retain the upper hand and anything the accused person would say thereafter would be slightly tainted. Rivers does not accept this. Instead she then starts labelling him, first by taking offence at his implication she is a racist (i.e. using the argument of offence) and then saying that he has a chip on his shoulder (that is, labelling him as unreliable because he has an unworthy agenda). Then again she repeats that he called her a racist ("don't you DARE call me a racist") driving home to the listener both that she is outraged by such a suggestion (self-labelling of innocence) at the same time as reminding the audience that Howe is not only being unfair but doing this with a dishonest agenda (labelling him as unscrupulous).

Howe then suggests that it is a "language problem" which is his attempt to redirect the discussion. This is the argument of redirection and at the very least, labelling Rivers as being uneducated or not that bright. If Rivers had been playing the game she would have agreed that perhaps it was a language problem. She would then have been labelled as someone who does not understand HoweÕs mode of expression. This would have got Howe out of trouble without an apology or explanation being necessary and Rivers would have been weakened by the implicit racism of not understanding Howe sufficiently well.

Again, she refuses to accept the offered compromise. She labels him "stupid", by defining his first statement as stupid. It is interesting that Howe does not react to that, most people would. But if he does react, he would then have to say something like "I am NOT stupid". This is exactly the sort of reaction he was trying to force out of Rivers at the outset and he knows the rules. He is also aware by this time that Rivers not only knows the rules, too, but is a superior exponent of them. He remains silent. Rivers then launches into an attack on his parenting responsibilities (Howe deserted his family in the West Indies). Again, Howe does not answer this for the same reasons that he has not reacted to the accusation of stupidity. He appeals to the interviewer to put the conversation back on to the original track. Rivers presses home her advantage and then accuses Howe of racism, turning the label 180 to his direction. By that time Howe has to concede that Rivers is not a racist in order to prevent any further attacks. Rivers finishes the exchange by stating that she would not choose to meet Howe in any other circumstances (an unpleasant person label).

It is obvious to the authors that Rivers had done some research on Howe before

the interview. She might have looked at his work online or spoken to someone about what he does and was therefore ready for any reference to racism he might make. She also knew about his deserted family. We are sure she was awaiting the opportunity to take towering offence at the smallest provocation, providing her with the excuse to return to him a whole list of labels. She accomplished her aim of defending herself against Howe without using any backing to support her arguments (e.g. I am not a racist because I have worked with black people, I have supported black artists, etc). In this sort of an exchange, proving innocence is a weak and ineffective defence.

5   Structure of possible future research

This section gives more details about the program of work of what do we need to do to get HEAL2100 to be accepted/adopted by the community of logicians.

5.1   Orientation: New logic mechansims and networks

Traditional logic **TDL** is based on rules. Even the various components of the *New logic with mechanisms and networks* (see [23]) such as nonmonotonic logic is based on rules with exceptions and priorities. Argumentation logic and dialogues logic are all based on all kinds of procedures, algorithms and conventions. The semantics for such logics is defined mathematically and is precise and clear

- Different choices of rules, algorithms and semantics gives different logics and these can be rejected or can be agreed to and adopted and applied to a variety of application areas.

- The connections between different logics and their properties can be studied mathematically and much of the activity of the logic community is devoted to such study.

What is happening in current modern logic (up to and including *New logic with mechanisms and networks*) is basically the same as what is happening in mathematics.

Some researchers define and invent new logics, other researchers investigate their properties, some logic communities adopt, apply and possibly even modify chosen logics which suit their needs, giving rise to new logics. And so the cycle continues.

In many ways this cycle is just like the development of major areas of applied mathematics: e.g. fluid dynamics. mathematical biology and other exact science modelling,

The operative consequences of this entire traditional modern logic activity up to the *New logic with mechanisms and networks* in contrast with our proposed New logic with mechanisms, networks and fallacies "HEAL2100" is that for any new candidate for a logic, or for any sequence of of arguments and counter-arguments, which can be put forward in the context of "*New logic with mechanisms and networks*" we can decide on the following questions:

1. Is this candidate a *New logic with mechanisms and networks* acceptable system at all?

2. What is its relationship to other known systems of *New logic with mechanisms and networks*?

3. What are its mathematical properties?

4. What application it is supposed to model?

5. What constitute a fallacy in the system?

   and so on.

There are many more traditional questions, (can the logic be axiomatised, what is its complexity, its semantics, proof theory, automated deduction, etc).

To give an example, imagine that we have a program on a computer implementing some known Artificial Intelligence *New logic with mechanisms and networks*. Assume the program is corrupted by a virus and starts behaving in a new way. We can then ask if the corrupt program is or is not a logic and we answer this question, using the mathematical tools of *New logic with mechanisms and networks* to test it and see what it does.

5.2   Our new logic HEAL2100

Let us now examine the challenges facing us in our *New logic with mechanisms, networks and fallacies* = HEAL2100.

We are trying to discover what legitimises a fallacy as a method of argumentation. This means we no longer say they are mistakes and put them aside but accept them as instruments of reasoning. Therefore we need to explain and define when, in HEAL2100, such uses of the fallacies are legitimate — as opposed to **TDL** where it is a given that the use of the fallacies is not legitimate, so there is nothing else to say.

We in HEAL2100 have a lot to say. Therefore let us use the term "2100-legitimate" for correct uses of the fallacies.[11]

The objectives are clear, namely to integrate the fallacies into the current state of logic, as described in the previous background section. The methodology of work is described by way of listing work packages groups, Group A, D, B, F and I

- Group A is a work package developing a big data application. Given a key word, say insult "you are a liar and a cheat", the application will find in real time some examples of that.

- Group D is a theoretical research and consultation work package with the mainly Canadian fallacies research community, trying to understand how fallacies work, in order to model them.

- Group B restructures/redesigns existing *New logic with mechanisms and networks* in a way that it can accept/integrate the fallacies.

- Group F classifies the fallacies, understands them and gets them ready for insertion into the restructured logic of Group B. This classification is motivated by the way the fallacies are being used in social media and is likely to be different from any traditional classification

- Group I integrates the fallacies into the restructured logic of group B to form the *New logic with mechanisms, networks and fallacies.*

Note that the above is an iterated process, which we can call the ADFBI process: We iteratively try to develop the groups: A, D, F, B, I, A, D, F, B, I,...

We now describe the work packages for the research Groups:

Work package for Group A. Task A1: Develop a real time search engine for certain search phrases arising from fallacious arguments.
Task A2: Develop guidelines of how to query the application of Task A1 for different fallacious arguments.
Task A3: Map the limitations of the use of Big Data. Preliminary searches (without Tasks A1 and A2) were not promising. It was not like searching the web for the meaning of a foreign word , which one can get and use instantly in a conversation.

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[11]We need to decide how far is a fallacyÕs legitimacy conferred by community acceptance? Wouldn't this make for very different fallacies in Berlin and Beirut? What about sub-communities — e.g. the South Side of Chicago compared to metropolitan Chicago? How extensively are we prepared to press the fallacies relativity line?

Work package for Group D. Tasks D1-D18: Discuss the nature of the Gang of 18 fallacies, respectively each fallacy a separate respective task. This requires careful study of the uses of each fallacy. To get an idea how it works , see our starting preliminary study of the ad hominem fallacy in this paper.

Work package for Group B: Background Work. This is the hard work of defining a generic New logic with mechanisms and networks system and showing how the traditional views of the fallacies, as described in Subsection 2.1 and as further put forward by other major researchers in the fallacy community (in work package D), can be embedded/integrated into our generic system. Doing this requires ingenuity, imagination and technical skill and it will take many man months to do. We can do it, using ideas and methods from [48, 49, 50].

Work package for Group F: Classification of the Fallacies. When is a Fallacy 2100 legitimate? To see the difficulty of classification let us look at some real examples.

We will start with the fallacy of attacking your opponent (*argumentum ad hominem*).

Example 5.1. *A true case of two university professors arguing:*

> *A1 says to A2:* you are a habitual liar
> *A2 retorts to A1:* You are an adulterer and a drug addict

Example 5.2. *From an Al- Jazira debate.*

> *B1 says to B2:* I say you are a liar and a traitor
> *B2 to B1: B2* takes off his shoe and throws it at B1.

(This method of argument is all too common on Al Jazira, throughout the Middle East generally and in parts of the Eastern Mediterranean as well as in some African and Far Eastern countries.)

Example 5.3 (Two cars collide on the road)**.** *The drivers are rolling on the asphalt trying to strangle each other. This is an incident witnessed by one of the authors of this paper in Jerusalem 60 years ago. NO WORDS ARE SPOKEN.*

Question: which of the above uses the *ad hominem* fallacy, Examples 5.1, 5.2 and 5.3, we consider as 2100-legitimate?

More generally, when is a use of a fallacy legitimate and when can we consider it a step in some argument sequence? Let us be systematic in trying to answer

this question. First of all, we need to collect data. We already have list of fallacies grouped into types. Aristotle listed 13, nowadays we list over 100. Let us write some steps. We rely on our results from Research Group B, because we need several candidates for our good generic system from Group B, to inject and integrate fallacies into them.

Task F1:   Collect and classify known lists of fallacies and their fine tuning variations. Such lists exist in the literature but they are viewed and classified from the point of view of fallacies being illegitimate and to be discarded. HEAL2100 views them as weapons of reasoning being put to effective practical use. Let us call this our starting list.

Task F2:   We need to use the Internet to collect many instances where fallacies are used, assess their success and reclassify them accordingly. Our research will initially classify them as theoretically 2100-legitimate in principle, with a view to deciding what is 2100-legitimate, pending a closer examination of how the community reacts to such fallacies. We can access big data to collect examples and see if these can help define legitimate use.

Task F3:   try to identify what cases are considered illegitimate. We will seek key properties for 2100-illegitimate use.

Task F4:   reclassify and possibly identify more fallacies in view if our findings in Task F1–3. We will call the new list our modified start list.

Task F5 : We iterate the process of Task F1–4 several times, using the modified fallacies collected at the previous iteration (see Task F4).

Note that this is a completely new type of work package and may take 18 months to execute.

Work package Group I: Interaction with rule based logics of *New logic with mechanisms and networks.*

Many fallacies are deductive. They can be remedied within *New logic with mechanisms and networks* or they can be remedied within HEAL2100. How do the two possibilities reconcile with one another? In practice correct reasoning can be combined with fallacies. How do we view this and integrate it smoothly? How does the interaction go? For example do we structure the argument interaction network into a network of meta-levels (i.e. a network of networks) and the fallacies move us from one meta-level to another?

Task I-generic. Develop a generic integrated system with several higher levels of reasoning and actions.

TaskI1–I10. Develop ten typical major integrated systems (we do not believe we can have one comprehensive system, in the same way that there is no single one major logical system).
   This research can take up to 18 months

Let us give some examples:

Example 5.4 (The jump approach). *This approach to be examined is where we reason logically and then insert a step which is a fallacy and then continue to reason logically. The simplest example of this is what is now known as "alternative facts", in which there is an introduction of fabricated facts into an argument.*

For example Soviet history books contain many fabricated or semi-fabricated Russian innovations, such as the discovery of America, the steam engine, radio and the helicopter, amongst others. Most of these claims are hyperbolic at best but having been established as fact, whatever argument they supported started from this point.

Example 5.5 (YouTube alternative facts ; start at 2.44m). *Recently we found a YouTube video in which it was claimed that Arabic was "the first language", and that all the characters in the Bible (and in the surrounding non-Biblical civilisations) spoke Arabic. The very disturbing aspect of this particular piece is that the speaker is a University professor and obviously intelligent. We might find such concocted history amusing but it is precisely this admixture of fact and fantasy that is killing hundreds of thousands in the Middle East at this time of writing.*
`https://www.youtube.com/watch?v=i_1wZSXEofE` *"Palestinians: Where does the name 'Palestine' come from?'*
Corey Gil-Shuster
Published on 26 Oct 2016.
   See also wikipedia article about alternative facts.
`https://en.wikipedia.org/wiki/Alternative_facts`.
   There are many more examples and we need to study how this is done, whether or not it is 2100-legitimate and possibly more importantly — how to deal with it.

Example 5.6 (An example of integrating a fallacy). *We have a single mother who is a top executive in a successful international corporation. Although she is busy she is still deeply devoted to her teenage daughter. The following happens one morning:*

Mother goes into her teenage daughter's bedroom. Her instant observation is that it is a big mess. There is stuff scattered everywhere.

Mother's impression is that it is not characteristic of the girl to be like this.

What has happened?

Conjecture: *The girl has boyfriend problems.*

Further Analysis: *Mother notices a collapsed shelf. Did the girl smash it? Upon further inspection, mother notices that the pattern of chaos shows that a shelf has collapsed because of excessive weight and scattered everything around, giving the impression of a mess. But, actually, it is not a mess, it does make some (gravitational) sense.*

There are several modes of reasoning:

1. *Neural nets type of reasoning.*
   She recognises the mess instantly, like we recognise a face.

2. *Nonmonotonic deduction.*
   Mother reasons from context and her knowledge of her daughter is that the girl is not disorganised like this. She asks 'what happened?Õ.

3. *Abduction/conjecture.*
   She offers a reasonable explanation that the girl has boyfriend problems, since this is common to that age.

4. *She then applies a database AI deduction and recognises that the mess is due to gravity. This deduction is no longer a neural net impression. It is a careful calculation.*

5. *It could have been a neural net impression.*
   For example, a man who sees many shelf-collapsing cases may recognise the pattern as if it were a face.

Mother Story Continued

- *Mother to daughter: why do you leave your room in such a mess?! You should have fixed this before going to bed last night.*

  Daughter's possible logical replies.

  1. *I was too tired*

  2. *I had pressing homework yesterday*

  3. *I am in shock*

  etc.

  Instead the daughter responds with an emotional fallacy.

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- *Daughter to Mother: What do you care, you are always at work, you hardly talk to me, you don't care about me, all you care about is your corporate career, you have no right to criticise me!*

Given this emotional action-fallacy the mother cannot continue with any rational deductive argument. If we consider the previous mother-daughter reasoning interaction as level 1, the object level matter of fact reasoning explaining and discussing the mess in the room, the daughter's outburst argument is moving to level 2, a meta-level seeking to abort any such discussion. Nothing will be effective to move back to level 1 except a counter fallacy. Once the counter action-fallacy is successful in level 2 a rational discussion about the mess can continue in level 1.

The authors' recommendation to Mother:

1. *Look sad, tell the girl sorrowfully how hard you work to support her. Remind her of past emotional family scenes. Tell her how much she is hurting you, (you might even try a tear or two).*

Other Options:

2. *Act insulted clear up the mess yourself, then complain it has hurt your back and you can't go to work and blame it on her, hoping you can then talk sense to her.*

3. *(Not recommended) Go into an angry fit and throw the books at her or beat the hell out of her.*

Once the chosen counter fallacy is completed, rational discussion might resume (although in case 3 we rather doubt it).[12]

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[12]The following is another version (by John Woods) of this example:

Mom remonstrates with daughter and daughter loses her cool and picks a fight. The fight has some factual basis. Senior people in the corporate world have limited time for children, and children often (but not always) resent it. This puts Mom at a clear disadvantage. Given that neither party seeks for a permanent and irreparable alienation, the sooner this is over the better. Dispassionate disquisition about the impact of the modern life on families isnÕt going to achieve anything quickly. Better, then, for Mom to counterattack, and the sooner she does, the sooner theyÕll make up. After that, as you say, a reasoned discussion might be resumed. (But probably not right then!)

You speak of these outbursts as emotional fallacies, but they arenÕt that in the traditional sense. In the traditional sense, an argument commits an emotive fallacy when conducted in such a way as to stir the emotions of those to which it is addressed. The *argumentum ad misericordium* is a typical example, as when a defence counsel asks a jury for mercy. But in the Mother Story, nothing like this is going on. Rather what we have there are emotional outbursts.

5.3 Intermediate Summary and time scale of proposed research

Note that our HEAL2100 logic differs from traditional rule-based logic on two counts:

- It is not just a set of axioms and rules (whether monotonic, nonmonotonic or any other traditional system) but a program of gathering information, classification and correlation of this information. It is an argumentation system of attacks and counterattack where each move and countermove is justified not by a deductive base logic but by human behaviour pattern discovered and mined by big data.

  So a logical reasoning unit is a structure of data, put together with a view to attack. It is a weaponised structured argument unit.

  The logic is what the program relying on big data tells us to respond to, sequentially.

  As the big data changes, the logic changes!

- We accept the fallacies as effective reasoning structures. We fine tune adjust them by refining them to further reasoning substructures. We use big data to do that as well as finding further reasoning to such instances of fallacies from big data.The calibration of the effective counterattack to such fallacies will be fine-tuned and enriched over time by continually maintained big data programs.

- So logic becomes time dependent as human behaviour changes.

- We may end up in the unfortunate and uncivilised situation of reasoning only irrationally by shooting fallacies at each other. (We do not believe so. Some fallacies do not work in the wrong context. If I claim I can prove the famous problem $P = NP$, and you ask to see the proof, it is no use me shouting "ARE YOU CALLING ME A LIAR?"

- It can take 4-5 years of research to do this properly

5.4 Expected Benefit

- Make people more aware/critical of false news, false arguments, etc. and thus protect our democratic processes. Now with the new media available any small group of people can cause serious problems.

- The success of terrorist arguments to recruit ordinary people in the west can be defended against using the same type of HEAL2100 appropriate counter-arguments.

HEAL2100 can be applied to all CURRENT consumer areas of logic where human behaviour is concerned.

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Appendix

A   More Background on Fallacies

The Johnson and Blair approach started the formal attempts to provide better analyses of fallacies, a programme pursued by a large number of researchers, including Govier [26] on the slippery slope, Wreen [25] on the ad baculum, Walton [27] on begging the question, Brinton [28] on the ad hominem, Freeman [29] on the appeal to popularity, and Pinto [30] on post hoc ergo propter hoc.

The next step came from John Woods and Douglas Walton [31], their claim is that, for many of the fallacies standard formal logic is inadequate to uncover the unique kind of logical mistakes in question — it is too coarse conceptually to reveal the unique character of many of the fallacies. To get a satisfactory analysis of each of the fallacies they must be matched with a fitting logical system, one that has the facility to uncover the particular logical weakness in question. Inductive logic can be employed for analysis of hasty generalisation and post hoc ergo propter hoc; relatedness logic is appropriate for ignoratio elenchi; plausible reasoning theory for the ad vercundiam, and dialectical game theory for begging the question and many questions. Woods [32, p. 43] refers to this approach to studying the fallacies as methodological pluralism.

This view is perfectly compatible with the former deductive views, provided we understand "deductive" as "*New logic with mechanisms*".

Modern times, second wave

Frans van Eemeren and Rob Grootendorst [34] put forward the Pragma-dialectic approach. They start with argumentation as a procedure involving two parties trying to overcome interpersonal disagreements. The procedure is a discussion having four analytical stages: a confrontation stage in which the participants become aware of the content of their disagreement; an opening stage in which the parties agree (most likely implicitly) to shared starting points and a set of rules to govern the ensuing

discussion; an argumentation stage wherein arguments and doubts about arguments are expressed and recognised; and a final stage in which a decision about the initial disagreement is made, if possible, based on what happened in the argumentation stage.

In this context the fallacies are defined as "violation of any of the rules of the discussion procedure for conducting a critical discussionÓ [36, p. 175].

The Pragma-dialectical theory proposes that each of the core fallacies can be assigned a place as a violation of one of the rules of a critical discussion. For example, the ad baculum fallacy is a form of intimidation that violates the rule that one may not attempt to prevent one's discussion partner from expressing their views; equivocation is a violation of the rule that formulations in arguments must be clear and unambiguous; post hoc ergo propter hoc violates the rule that arguments must be instances of schemes correctly applied. Moreover, on this theory, since any rule violation is to count as a fallacy this allows the possibility that there may be hitherto unrecognised "new fallacies". Among those proposed are declaring a standpoint sacrosanct because that breaks the rule against the freedom to criticise points of view, and evading the burden of proof which breaks the rule that you must defend your standpoint if asked to do so (see van Eemeren [33, p. 194].

We note that the Pragma-dialectical rules of a critical discussion are not just rules of logic, but rules of conduct for rational discussants, making the theory more like a procedural code than a set of logical principles.[13] Accordingly, this approach to fallacies rejects all three of the necessary conditions of **SDF**: a fallacy need not be an argument, and thus the invalidity condition will not apply either, and the appearance condition is excluded because of its subjective character (Van Eemeren and Grootendorst, [36, p. 175]. See also WoodsÕ critique in chapters 9, 10 and 11 of *The Death of Argument*, 2004, listed in [17].

A key point of this approach from our HEAL2100 point of view is the fact that the Pragma-dialectical analysis of fallacies as rule-breakings in a procedure for overcoming disagreements also takes account of the rhetorical dimension of argumentation. Pragma-dialectics takes the rhetorical dimension to stem from an arguerÕs wish to have their view accepted which leads dialoguers to engage in strategic manoeuvering vis-à-vis their dialogue partners. However, this desire must be put in balance with

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[13]Note however that Dov Gabbay's algorithmic point of view included in his *New logic with mechanisms and networks*, see [23], can accept certain procedures as part of logic. So according to Gabbay, Classical Logic with Resolution formulation is not the same logic as Classical Logic with Tableaux formulation. To the extent that the Pragma-dialectical approach with its procedures can be embedded/represented within *New logic with mechanisms and networks*, then we can still maintain the view that Fallacies are "*New logic with mechanisms and networks* movements/arguments" that are actually not *New logic with mechanisms and networks* correct but nevertheless do look correct".

the dialectical requirement of being reasonable; that is, staying within the bounds of the normative demands of critical discussions. The ways of strategic manoeuvring identified are basically three: topic selection, audience orientation, and the selection of presentational devices, and these can be effectively deployed at each stage of argumentation (Van Eemeren, [33, p. 94]). "All derailments of strategic manoeuvering are fallacies", writes van Eemeren [33, p. 198], "in the sense that they violate one or more of the rules for critical discussion and all fallacies can be viewed as derailments of strategic manoeuvering". This means that all fallacies are ultimately attributable to the rhetorical dimension of argumentation since, in this model, strategic manoeuvering is the entry of rhetoric into argumentation discussions. "Because each fallacy has, in principle, sound counterparts that are manifestations of the same mode of strategic manoeuvering" it may not appear to be a fallacy and it "may pass unnoticed" ([33, p. 199]. Nevertheless, Pragma-dialectics prefers to keep the appearance condition outside the definition of 'fallacyÕ, treating the seeming goodness of fallacies as a sometime co-incidental property, rather than an essential one.

Our point of view is to accept/ integrate (in HEAL2100) some uses of these fallacies as correct integrated moves, to be countered by other fallacies.

We note that in our New Logic 2, [23] we include argumentation and network logics as well as Algorithmic Proof theory and so the Pragma-Dialectic approach can be simulated/included in our system. However New Logic 2 supports a plurality of Logics and so it will not agree with Pragma-dialectical approach looking towards a single ideal model of argumentation. We view each argumentation procedure is another New Logic 2 system, hopefully usable in some application area.

Another important second wave approach to fallacies is the work of Biro [37, pp. 265–66]. The way we understand his examples is that in order for an argument not to be a fallacy , the assumptions are required to have factual verification or general acceptance as facts. Biro calls this epistemic seriousness. He gives the following example:

All members of the committee are old Etonians;

Fortesque is a member of the committee;

Fortesque is an old Etonian.

In this example, given the minor premise, the major cannot be known to be true unless the conclusion is known to be true. Consequently, on the approach to fallacies taken by Biro, the second argument, despite the fact that it is valid, is non-serious, it begs the question, and it is a fallacy. If there was some independent way of knowing that the major premise was true, such that it was a bylaw that only old Etonians could be committee members, the argument would be a serious one, and not beg the question. This approach does not insist that all justification must be deductive, but facts must be verifiable. Thus it allows for arguments the possibility of their

being fallacies (as well as good arguments) by non-deductive standards, something precluded by **SDF.**

We consider this idea important because watching many debates on YouTube we find a lot of false unverifiable alternative facts being introduced. See Example 5.5 below.

We now address the pragmatic approach of Doug Walton. Doug Walton has written or edited over forty-five books about fallacies, analysing them one by one, following the Woods-Walton first wave view on fallacies. As we see it, Walton responded to the Pragma-dialectic approach by offering considering argumentation dialogues. On the Walton approach, a fallacy is associated with a small local sequence of dialogue called a profile of dialogue. See [53]. This paper builds the profiles of dialogue tool into a fault diagnosis method that can be applied to problematic examples of argumentation such as those involving informal fallacies. The profiles method works by comparing a descriptive graph with a normative graph. The descriptive graph represents how a dialogue sequence actually went in the example chosen for analysis. The normative graph represents an analysis of how the sequence should ideally proceed, according to the protocols (rules) for this type of dialogue. The descriptive graph is mapped into the normative graph, so that a comparison can be made to diagnose the fault in the sequence displayed in the descriptive graph. and repair it.

These are distinct normative dialectical frameworks (persuasion dialogue, inquiry dialogue, negotiation dialogue, etc.) rather than the single model of a critical discussion proposed by Pragma-dialectics. Postulating different kinds of dialogues with different starting points and different goals, Walton claims, will bring argumentation into closer contact with argumentation reality. So fallacies happen when there is an illegal shift from one kind of a dialogue to another [38, pp. 118–23], for example, using arguments appropriate for a negotiation dialogue in a persuasion dialogue.[14]

So if I am a medical expert witness and I am asked to describe what procedures I used on the patient, I might take offence and say
Are you calling me a liar?
However, if I claim at a conference that I solved an open problem in maths (say $P = NP?$), and I am asked for the idea of the proof, I cannot say
Are you calling me a liar?

The definition of fallacy Walton proposes [38, p. 255] has five parts. A fallacy:

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[14]Note however that the view that fallacies are due to illicit dialogue shifts is pretty well abandoned in [38].

On WaltonÕs definition, no inference can be fallacious, unless an inference is a solo argument in which the roles of each contending party is played by the same person.

1. an argument (or at least something that purports to be an argument) that

2. falls short of some standard of correctness;

3. is used in a context of dialogue;

4. has a semblance of correctness about it; and

5. poses a serious problem to the realisation of the goal of the dialogue.

Let us stress that Walton's approach depends on context, not on structure alone. Our tolerance of the above claim, "you are calling me a liar", depends also on context and not only on its irrelevant meta-level (personal) aspect. The Pragma-dialectic approach can string together several of Walton schemes to form a logic and then claim a fallacy if they are not put together correctly. Both approaches can be embedded in the *New logic with mechanisms and networks* concept.

Modern times: issues in fallacy theory

Quoted from the scholarly and most valuable article "Fallacies" in the Stanford Encyclopaedia of philosophy (SEP by H. V. Hansen) There are four major questions to be addressed by the Fallacies research community according to SEP:

- The nature of fallacies

- The appearance condition

- Teaching of Fallacies

- The role of Biases

Since this is the view (according to SEP/H. V. Hansen) of how the current fallacies research community would like to go forward, we think it is best to simply integrate and almost quote what SEP says about these plans. In the next subsection we will present our own plans for integrating the fallacies and compare with the fallacies communities plans. We hope and look forward for co-operation. Our own comments in the quote are in boldface

> **The nature of fallacies**
> A question that continues to dog fallacy theory is how we are to conceive of fallacies. There would be advantages to having a unified theory of fallacies. It would give us a systematic way of demarcating fallacies and other kinds of mistakes; it would give us a framework for justifying

fallacy judgments, and it would give us a sense of the place of fallacies in our larger conceptual schemes. Some general definition of ÔfallacyÕ is wanted but the desire is frustrated because there is disagreement about the identity of fallacies. Are they inferential, logical, epistemic or dialectical mistakes? Some authors insist they are all of one kind: Biro and Siegel, for example, that they are epistemic, and Pragma-dialectics that they are dialectical. There are reasons to think that all the fallacies do not easily fit into one category.

. . .

In the community fallacies have been identified in relation to some ideal or model of good arguments, or good argumentation, or rationality.

Aristotle's fallacies are shortcomings of his ideal of deduction and proof, extended to contexts of refutation. The fallacies listed by Mill are errors of reasoning in a comprehensive model that includes both deduction and induction. Those who have defended **SDF** as the correct definition of 'fallacy' take logic *simpliciter* or deductive validity as the ideal of rationality. Informal logicians view fallacies as failures to satisfy the criteria of what they consider a cogent argument. Defenders of the epistemic approach to fallacies see them as shortfalls of the standards of knowledge-generating arguments. Finally, those who are concerned with how we are to overcome our disagreements in a reasonable way will see fallacies as failures in relation to ideals of debate or critical discussions.

We note that the authors (Gabbay-Rivlin) approach to fallacies (which we may call *New logic with mechanisms, networks and fallacies* approach), is that we consider a fallacy any effective instrument of argumentation currently used in the social media and politics which is not a *New logic with mechanisms and networks* instrument!

The standard treatment of the core fallacies did not emerge from a single conception of good argument or reasonableness but has rather, like much of our unsystematic knowledge, grown as a hodgepodge collection of items, proposed at various time and from different perspectives, that continues to draw our attention, even as the standards that originally brought a given fallacy to light are abandoned or absorbed into newer models of rationality. Hence, there is no single conception of good argument or argumentation to be discovered behind the core fallacies, and

any attempt to force them all into a single framework, must take efforts to avoid distorting the character originally attributed to each of them.

The appearance condition

From Aristotle to Mill the appearance condition was an essential part of the conception of fallacies. However, some of the new, post-Hamblin, scholars have either ignored it (Finocchiaro, Biro and Siegel) or rejected it because appearances can vary from person to person, thus making the same argument a fallacy for the one who is taken in by the appearance, and not a fallacy for the one who sees past the appearances. This is unsatisfactory for those who think that arguments are either fallacies or not. Appearances, it is also argued, have no place in logical or scientific theories because they belong to psychology (van Eemeren and Grootendorst, [36]. But Walton (e.g., [39]) continues to consider appearances an essential part of fallacies as does Powers [19, p. 300] who insists that fallacies must "have an appearance, however quickly seen through, of being valid.Ó If the mistake in an argument is not masked by an ambiguity that makes it appear to be a better argument than it really is, Powers denies it is a fallacy.

The appearance condition of fallacies serves at least two purposes. It can be part of explanations of why reasonable people make mistakes in arguments or argumentation: it may be due in part to an argument's appearing to be better than it really is. The appearance condition also serves to divide mistakes into those that are trivial or the result of carelessness for which there is no cure other than paying better attention, and those which we need to learn to detect through increased knowledge of their seductive nature. Without the appearance condition, it can be argued, no division can be made between these two kinds of errors: either there are no fallacies or all mistakes in argument and/or argumentation are fallacies, a conclusion that some are willing to accept, but which runs contrary to tradition. One can also respond that there is an alternative to using the appearance condition as the demarcation property between fallacies and casual mistakes, namely, frequency: fallacies are those mistakes we must learn to guard against because they occur with noticeable frequency. To this it may be answered that Ônoticeable frequencyÕ is vague, and is perhaps best explained by the appearance condition.

Teaching

On the more practical level, there continues to be discussion about the value of teaching the fallacies to students. Is it an effective way for them

to learn to reason well and avoid bad arguments? One reason to think that it is not effective is that the list of fallacies is not complete, and that even if the group of core fallacies was extended to incorporate other fallacies we thought worth including, we could still not be sure that we had a complete prophylactic against bad arguments. Hence, we are better off teaching the positive criteria for good arguments/ argumentation, which will give us a fuller set of guidelines for good reasoning. But some (Pragma-dialectics and Johnson and Blair) do think that their stock of fallacies is a complete guard against errors because they have specified a full set of necessary conditions for good arguments/argumentation and they hold that fallacies are just failures to meet one of these conditions. Another consideration about the value of the fallacies approach to teaching good reasoning is that it will tend to make students overly critical and lead them to see fallacies where there aren't any; hence, it is maintained we could better advance the instilling of critical thinking skills by teaching the positive criteria of good reasoning and arguments (Hitchcock, [40]). In response to this view, it is argued that, if the fallacies are taught in a non-perfunctory way which includes the explanations of why they are fallacies — which normative standards they transgress — then a course taught around the core fallacies can be effective in instilling good reasoning skills (Blair [41]).

We have a new method of teaching called DADI (Data Driven Instruction) which can be used for teaching about the Fallacies. See Appendix C

Biases
Recently there has been renewed interest in how biases are related to fallacies. Correia ([42]) has taken Mill's insight that biases are predisposing causes of fallacies a step further by connecting identifiable biases with particular fallacies. Biases can influence the unintentional committing of fallacies even where there is no intent to be deceptive, he observes. Taking biases to be Òsystematic errors that invariably distort the subjectÕs reasoning and judgment,Ó the picture drawn is that particular biases are activated by desires and emotions (motivated reasoning) and once they are in play, they negatively affect the fair evaluation of evidence. Thus, for example, the Òfocussing illusionÓ bias inclines a person to focus on just a part of the evidence available, ignoring or denying evidence that might lead in another direction. Correia ([42, p. 118]) links this bias to the fallacies of hasty generalization and straw man, suggesting that it is

our desire to be right that activates the bias to focus more on positive or negative evidence, as the case may be. Other biases he links to other fallacies.

Thagard [43] is more concerned to stress the differences between fallacies and biases than to find connections between them. He claims that the model of reasoning articulated by informal logic is not a good fit with the way that people actually reason and that only a few of the fallacies are relevant to the kinds of mistakes people actually make. Thagard's argument depends on his distinction between argument and inference. Arguments, and fallacies, he takes to be serial and linguistic, but inferences are brain activities and are characterized as parallel and multi-modal. By "parallel" is meant that the brain carries out different processes simultaneously, and by "multi-modal" that the brain uses non-linguistic and emotional, as well as linguistic representations in inferring. Biases (inferential error tendencies) can unconsciously affect inferring. "Motivated inference", for example, "involves selective recruitment and assessment of evidence based on unconscious processes that are driven by emotional considerations of goals rather than purely cognitive reasoning" [43, p. 156]. Thagard volunteers a list of more than 50 of these inferential error tendencies. Because motivated inferences result from unconscious mental processes rather than explicit reasoning, the errors in inferences cannot be exposed simply by identifying a fallacy in a reconstructed argument. Dealing with biases requires identification of both conscious and unconscious goals of arguers, goals that can figure in explanations of why they incline to particular biases. "Overcoming peopleÕs motivated inferences", Thagard concludes, "is therefore more akin to psychotherapy than informal logic" [43, p. 157], and the importance of fallacies is accordingly marginalized.

In response to these findings, one can admit their relevance to the pedagogy of critical thinking but still recall the distinction between what causes mistakes and what the mistakes are. The analysis of fallacies belongs to the normative study of arguments and argumentation, and to give an account of what the fallacy in a given argument is will involve making reference to some norm of argumentation. It will be an explanation of what the mistake in the argument is. Biases are relevant to understanding why people commit fallacies, and how we are to help them get past them, but they do not help us understand what the fallacy-mistakes are in the first place — this is not a question of psychol-

ogy. Continued research at this intersection of interests will hopefully shed more light on both biases and fallacies.

B   Applications: Internet of Things

This is a possible application. It is not essential or influential to our new concept of 2100-logic, but it is related and who knows what its future impact could turn out to be.

From Wikipedia: `https://en.wikipedia.org/wiki/Internet_of_things`

> "The Internet of things (IoT) is the inter-networking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and other itemsÑembedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as "the infrastructure of the information society." The IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Experts estimate that the IoT will consist of almost 50 billion objects by 2020.
>
> Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine (M2M) communications and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices (including smart objects), is expected to usher in automation in nearly all fields, while also enabling advanced applications like a smart grid, and expanding to areas such as smart cities.

Equipped with HEAL2100 we can offer better logic at the service of the IOT. The IOT systems are complex inter-related components each of which are intelligent

to some degree and based on logic. The need of HEAL2100 for IOT is a necessity not just another application!

We give an Example:

Imagine we want to improve protection against Phishing. If we use traditional logic in building protection we use rules, as in the following case: Email filters: a message you receive is analysed by the mail program which then adds to the subject line a warning that this may be phishing or spam. Such warnings already exist.

If we open the email and we see a very convincing service message from Paypal that our account has they paid $30 to an unfamiliar company, we then have to consider whether the message is or is not malicious. However, our reaction to this unexplained apparent disappearance of money from our account is emotional, faster and more immediate than reasoning. Worried that even more money will disappear and seeing a button saying "cancel transaction" it is quite likely that we would be panicked into clicking on it almost before we realise what is happening.

What we need is an equally emotional warning, like a flashing button in red and yellow blinking the message "SPAM—STAY AWAY!" It may not be difficult for a mail program to do this if it realises the underlying principles of our HEAL2100 logic — that is that the object is TO WIN, not to reach a consensus.

C DADI: Data Driven Instruction, A New Method of Teaching Logic and Fallacies

We developed a new teaching method capable of writing joint research papers with first year students as joint authors. The philosophy of the teaching/research approach is outlined below.

It is especially suited for teaching logic and fallacies.

We observed that Phd students conducting research for the purpose of writing a thesis, need to go through four stages:

1. read and familiarise themselves with a relevant area of research;

2. have a good new idea for pushing the frontier of the area forward;

3. develop the details of the idea;

4. write it down as a paper/thesis, and this includes knowing the scientific language and structure for writing their ideas.

The received wisdom about Phd studies is that you need 3 (BSc)–4 (MSc) years of university study to be able to approach a thesis.

We conjectured that the 3–4 years are required for item 1 above.

We asked ourselves, what if the area where the research to be done is so familiar that first year student already have the background knowledge to move to item 2 above?

Can first year students have a good new idea leading to a research paper?

Of course first year students do not know how to write a paper nor do they know any research methodology, but neither do PHd students — for this we have a supervisor. So all we need to experiment with this idea is to choose a topic which

- First year students are familiar with

- Good ideas are forthcoming

- It connects with known international research area.

Then all we need to do is for say, Dov, to present the question to the students and let them develop a model. This is no different from offering a topic of research to a new Phd student. Dov Gabbay accepted teaching at Ashkelon Community College and conducted such courses.

Description of the experiment:

Class of 2015/2016. In 2015 Gabbay was teaching general logic to a first year class of 15 students. At the time there was much debate in the media and politics in UK and Israel, about young couples unable to join the housing ladder. In simple words:

Flats are too expensive and young couples cannot get the initial minimum funds to enable them to get an affordable mortgage to buy a home. The political solution was to offer such young couples cheap mortgages and help.

Gabbay asked the student to formulate principles (known from the media) for qualifying for this help Using one arrow connective

(If x is true and y is true) $\Rightarrow$ do z.

Gabbay formulated known rules from the media based on government data. Then he posed a problem to the class: How to stop young couples from using the benefits and buying two flats in parallel? The class participated in modifying the rules to stop such abuse. There were creative in cheating the system as well as creative in fixing it.

The reader will observe that Gabbay developed action logic and cyber security principles for guarding against hacking. Gabbay applied the systems we got for the cyber security intelligent home and wrote the paper [45]. We were invited to

submit to an OUP international Journal, on Cyber Security. The key to this is that the students knew how to write rules and knew how to cheat the system — they understood the need to get your own flat and were creative in dealing with it.

Class of 2016/2017. This year the first class had 49 students. We again chose a familiar topic to the students. This year the media and the law was concerned in Israel and UK with sex offenders. Many famous figures were accused by victims of sex offences and every week there was a new scandal discovered. The students had detailed knowledge of such cases. Dov Gabbay presented the question of **How many complaints does it take for us to decide that there is need to investigate?**

The view was of a survival game of the sex offenders where each offender had a number of lives before it is dead. The students were also familiar with T.V. survival games. So we started developing a model based on their knowledge of the numerous sex offender cases going on in the media. We developed a basic model in the area of argumentation. We wrote papers [46, 47] and are invited to submit to the IOS journal Argument and Computation.

The students are able to develop points *1–*3 above and the teacher needs to write point *4.

NOTE THAT THE DADI METHOD IS ESPECIALLY SUITABLE FOR TEACHING FALLACIES BECAUSE NOWADAYS THE SOCIAL MEDIA IS FULL OF DEBATES AND POLITICS AND ISIS, ETC USING FALLACIES AS WEAPONS. THE STUDENTS ARE VERY FAMILIAR WITH THEM.

Limitations of the method.

1. The students cannot deal with abstraction. So if they construct a model for a certain area (with which they are familiar), they cannot recognise the same abstract model in another area, even when the similarities are clearly pointed out to them.

   The students recognised and defined the many lives abstract argumentation model in the sex offenders area. The same model applies in the nutrition area, where various foods (e.g. alcohol) attack parts of the body (e.g. the liver). This was pointed out to them and they were given a lecture by a nutritionist and yet they did not see the connection.

2. The students found difficulty in understanding abstract set theoretical definitions but could easily understand definitions by algorithms. So to define a set we must give an algorithm for constructing it.

3. The best approach to teaching/developing a theory or a model is to present it as an algorithmic game or a puzzle.

4. We plan to address the use of some of the fallacies (ad hominem) in the class of 2017/2018. The students are familiar with political debates, personal attacks and counterattacks especially in the Trump era. It is a strategic survival game and we shall see if next year's students can model it.