AI Generated Innovation

Bristows, 14 March 2019

- David Brown – Healx
- Julian Nolan – Iprova
- Fiona Stevens – GJE
- Jonny Moss – Hogarth Chambers
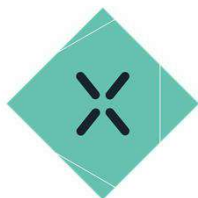- John Brunner – Carpmaels (Chair)

- Life Sciences - Healx
- Physical Sciences - Iprova
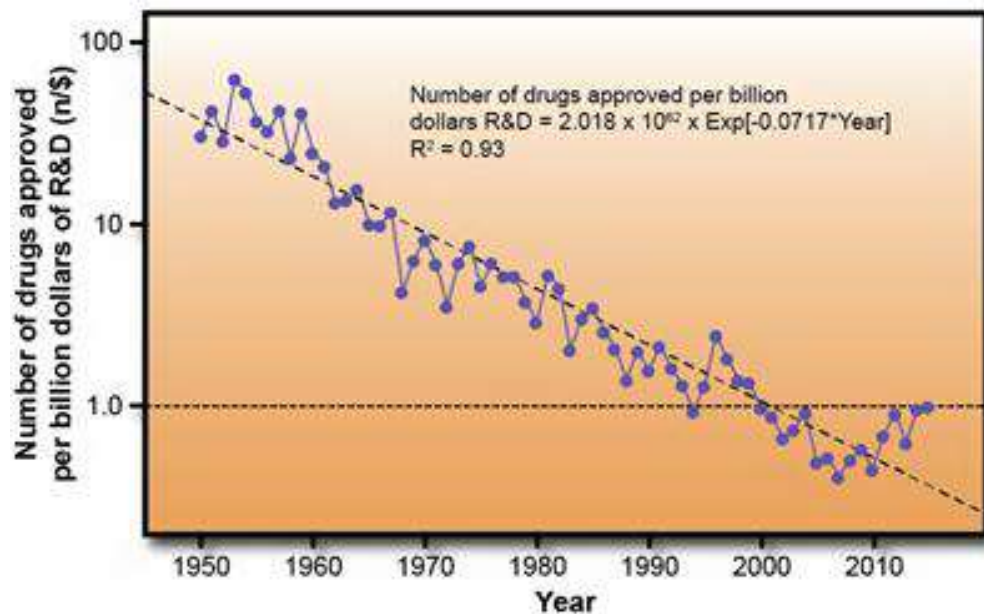- Patenting AI Generated Innovation
- Inventorship

healx

David Brown (Co-founder, Chairman & CSO)

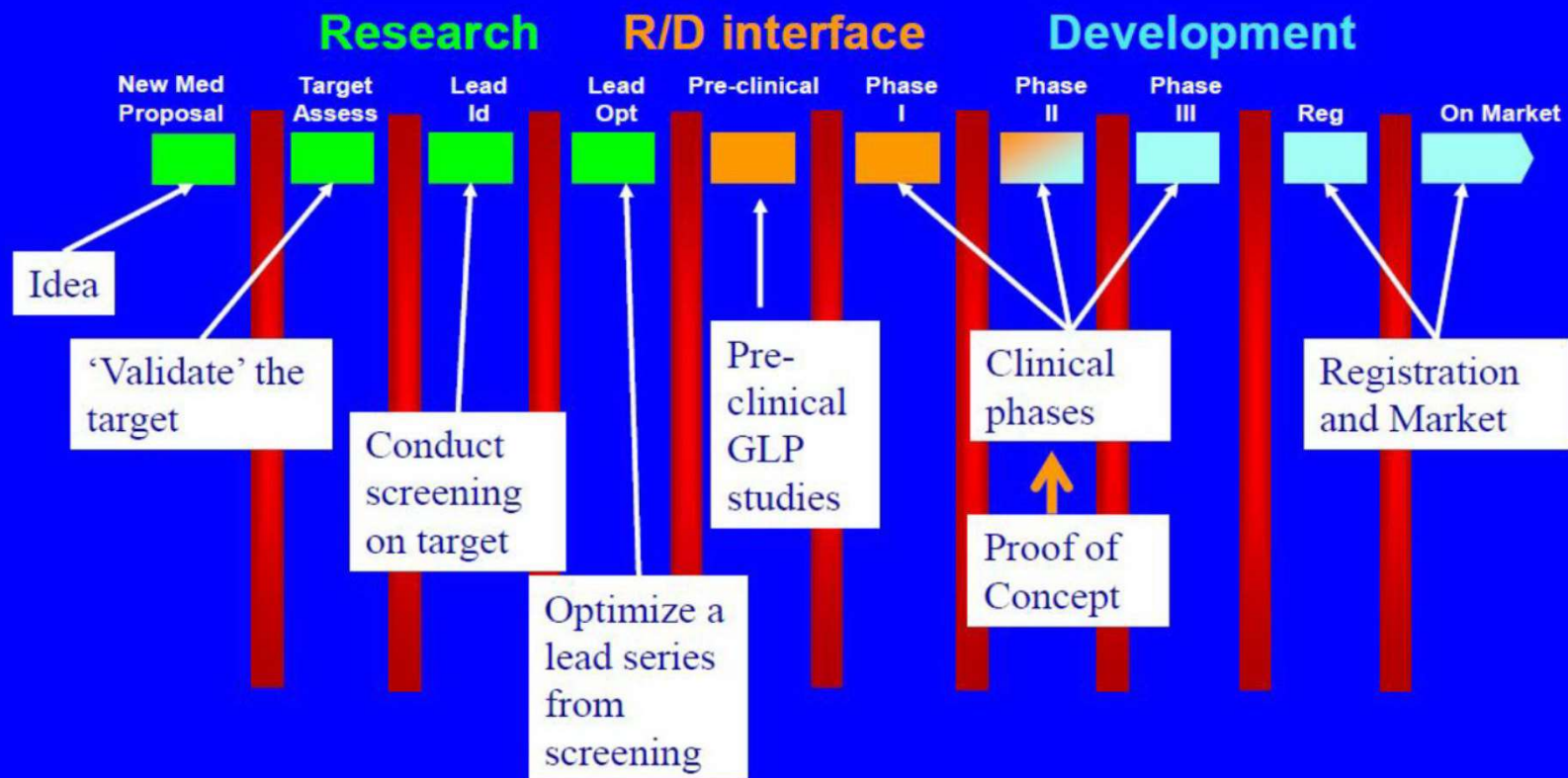# AI use in new drug discovery
Patent implications

AIPPI meeting, 14 March, 2019

Why AI is essential in Pharma / Biotech

Number of drugs approved per billion dollars R&D = 2.018 x 10^{82} x Exp[-0.0717*Year]
R^2 = 0.93

MOORE'S LAW
EROOM'S LAW

	Research				Development				
Idea	Target Selection	Lead ID	Lead Opt	Pre-Clinical	Phase I	Phase II	Phase III	Reg	On Market
Rate (%, Median)	63	60	63	57	58	45	58	85	
Cumulative Success Rate (%)	1.7	2.7	4.6	7.3	13	22	49	85	
Projects (for 1 drug Approval)	57	36	22	14	8	4.5	2	1.2	1

# The Application of AI within the Drug Discovery Process

Technologies increasing efficiency and reducing manual work

- aggregation and analysis of biomedical information
- improved decision-making
- form and qualify hypotheses
- analyze medical records to find patients for clinical trials

Development of new therapeutic molecules

- small molecules and biologics
- efficacy prediction
- drug combinations
- drug repositioning
- protein features and characteristics
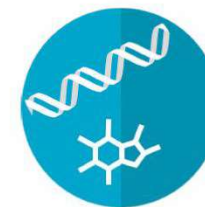
Identification of new pathways and targets using "omics" analysis

- generate novel biomarkers and therapeutic targets
- personalized medicine based on omics markers
- discover connections between drugs and diseases

AI in Healthcare:

- Drug Discovery
- Wearables
- Medical Imaging and Diagnostics
- Research
- Mental Health
- Lifestyle Management
- Digital Health Monitoring
- Patient Data and Risk Analytics
- Virtual Assistants
- Surgery
- Hospital Management
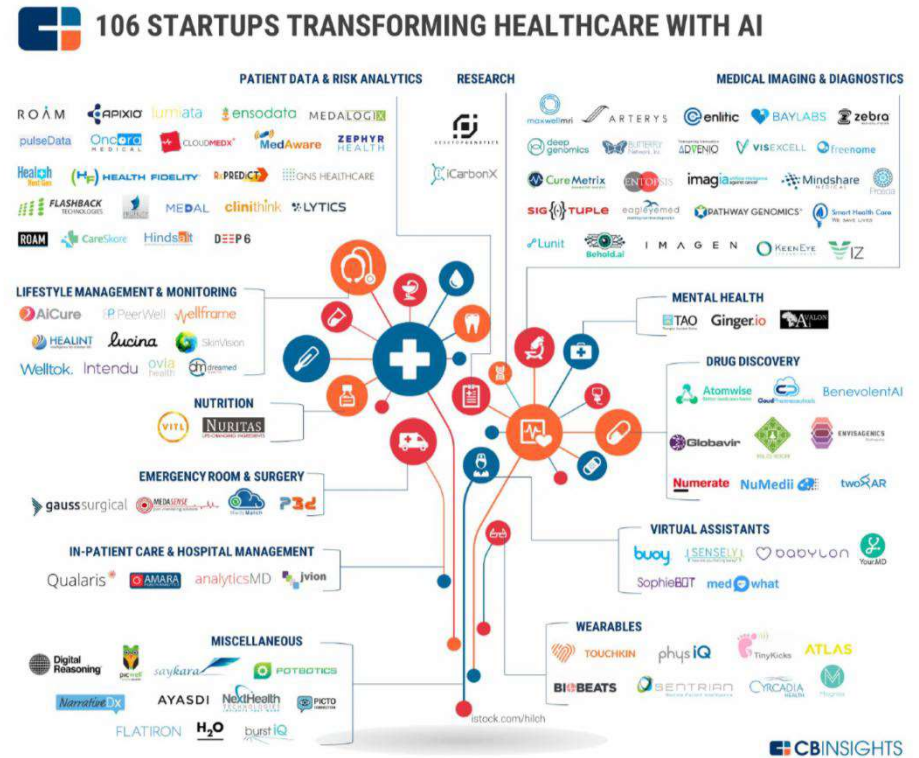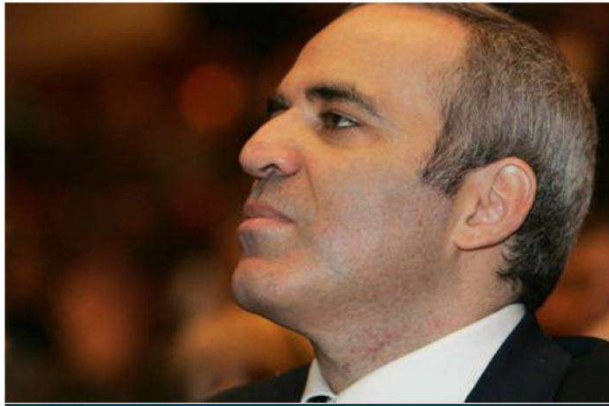
Man + machine will beat either alone

On **February 10, 1996**, Deep Blue beat Garry Kasparov in the first game of a six-game match—the first time a computer had ever beat a human in a formal chess game

Don't try and beat AI, merge with it says chess champ Garry Kasparov

Getting beaten by Deep Blue seems to have had an effect

By Katyanna Quach 10 May 2018 at 22:45   19 💬   SHARE ▼

The Age of Centaurs

Instead of building smarter machines, let's build machines that make us smarter.

AI helps us sort data, make connections, make decisions faster, better, cheaper – that's all

Human intervention remains essential ('supervised machine learning')

We still have to test the ideas we select from the AI output – no certainty

We file patents on new drug inventions identically to non-AI discoveries

AI is not mentioned in the patent.

We provide exactly the same level of proof of invention, novelty, etc

It's a long way off, but will the day come when a machine can do it alone?

Data-driven invention

- Iprova has developed machine learning and other technologies bring a **data-driven approach** to the creation of technical inventions in the physical science domain.

- **Hundreds of patents filed** based on Iprova's inventions; granted patents cited by companies which include Apple, Google, IBM and Microsoft.

- Technology company with offices in Lausanne, Switzerland and London, UK (sales in Tokyo and San Jose).

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We live in a data-driven world, so why is invention still left to 'analog' chance in an ever faster, ever converging world?

- Limited breadth of information review
- Limited speed of information review
- Low agility

Inevitability of invention

Transistor
Scientists at AT&T Bell labs won a Nobel prize for inventing the transistor in 1948. Two months later two German physicists independently invented a transistor at a Westinghouse laboratory in Paris.

Inkjet printer
Invented in Japan in the labs of Canon, and the US at Hewlett-Packard. Key patents were filed by each company within months of each other in 1977.

"The whole history of invention is one endless chain of parallel instances. There may be those who see in these pulsing events only a meaningless play of capricious fortuitousness; but there will be others to whom they reveal a glimpse of a great and inspiring inevitability which rises as far above the accidents of personality."
Alfred Kroeber (1876 – 1960), anthropologist

Inventions are inevitable. They are a product of their time – of social, market and technological circumstance – rather then necessarily individual genius. Hence it is not the invention which is important, but the timing of it.

Example Invention

Time of flight based imaging system using display as illumination source - US8810647B2

Invention

- Gesture recognition using Time-of-Flight needs illumination source

- Invention covers the use of a backlit display as a source of illumination for a ToF system

- Saves cost, power and space by reusing components for an unintended purpose

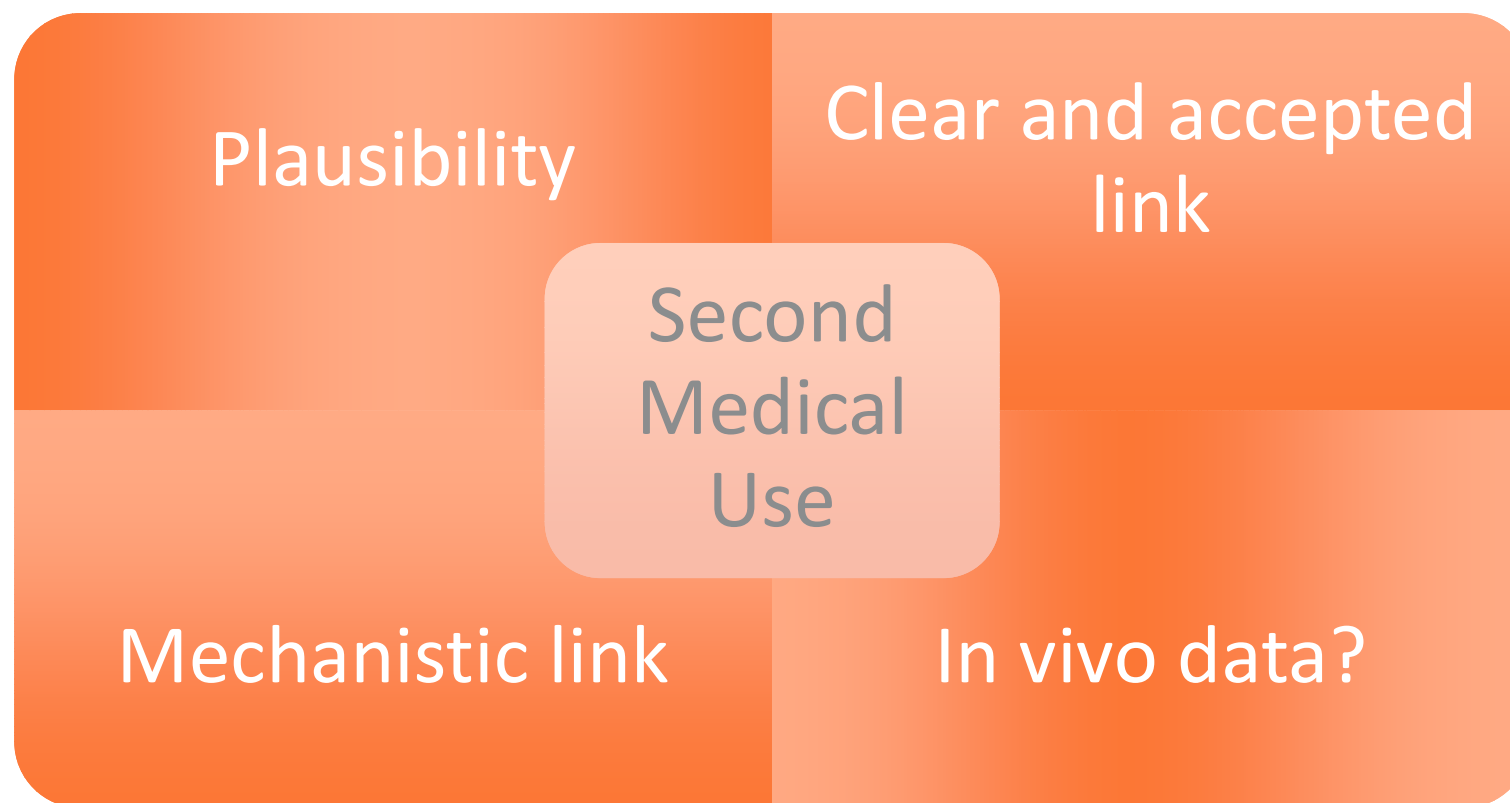- Impacts high volume consumer products including mobile devices, games consoles and televisions.
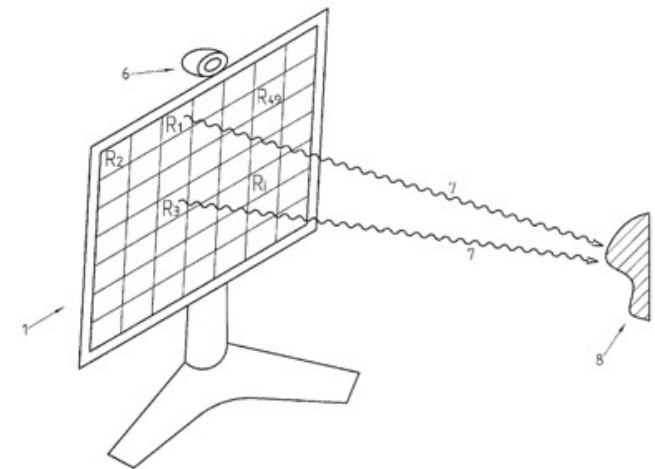
Granted patent cited by Texas Instruments, Intel, Google, Amazon, ST Micro and many other companies.

Patenting AI Generated Innovation

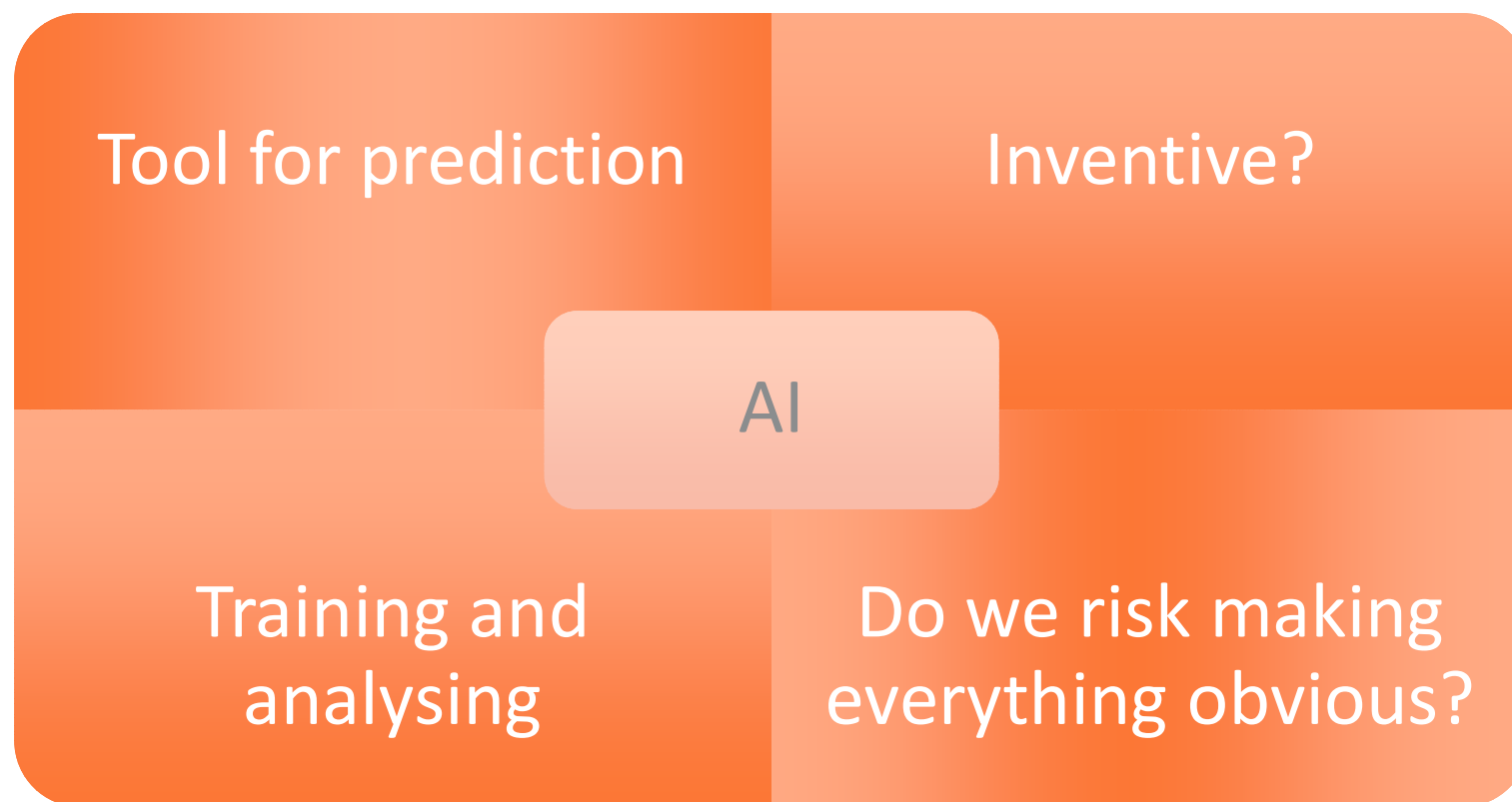- Technical Character (EPO Guidelines for Examination G-II, 3.3.1)
    - AI *per se* – abstract models devoid of technical character
    - Technical use / purpose

- Inventive Step
    - Closest prior art – which technical field?
    - The skilled person – a team?

- Sufficiency

SUFFICIENCY AND AI

Plausibility

Clear and accepted link

Second Medical Use

Mechanistic link

In vivo data?

GJE
INTELLECTUAL PROPERTY

SUFFICIENCY AND AI

Tool for prediction

Inventive?

AI

Training and analysing

Do we risk making everything obvious?

GJE
INTELLECTUAL PROPERTY

Inventorship

AI devised inventions:

- Can an AI be an inventor?

- This calls into question the very basis of the intellectual property system.

- Is public policy against having an AI as an inventor (or co-inventor)?

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Inventorship - EPC

- Article 60 EPC states that the right to a European patent shall belong to the inventor or his successor in title. If the inventor is an employee, the right to a European patent shall be determined in accordance with the law of the State in which the employee is mainly employed.
  - Fudge "employee" based on local legislation?
- Art 58 EPC states a European patent application may be filed by any natural or legal person, or *any body equivalent to a legal person by virtue of the law governing it.*
  - Local legislation designating an AI with legal personhood?
- Article 60(3) states that in proceedings before the European Patent Office, the applicant shall be deemed to be entitled to exercise the right to a European patent.

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Inventorship – Patents Act 1977

7   **Right to apply for and obtain a patent.**

(1)   Any person may make an application for a patent either alone or jointly with another.

(2)   A patent for an invention may be granted—

     (a)   primarily to the inventor or joint inventors;

     (b)   in preference to the foregoing, to any person or persons who, by virtue of any enactment or rule of law, or any foreign law or treaty or international convention, or by virtue of an enforceable term of any agreement entered into with the inventor before the making of the invention, was or were at the time of the making of the invention entitled to the whole of the property in it (other than equitable interests) in the United Kingdom;

     (c)   in any event, to the successor or successors in title of any person or persons mentioned in paragraph (a) or (b) above or any person so mentioned and the successor or successors in title of another person so mentioned;

   and to no other person.

(3)   In this Act "inventor" in relation to an invention means the actual deviser of the invention and "joint inventor" shall be construed accordingly.

(4)   Except so far as the contrary is established, a person who makes an application for a patent shall be taken to be the person who is entitled under subsection (2) above to be granted a patent and two or more persons who make such an application jointly shall be taken to be the persons so entitled.

36   **Co-ownership of patents and applications for patents.**

(1)   Where a patent is granted to two or more persons, each of them shall, subject to any agreement to the contrary, be entitled to an equal undivided share in the patent.

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Inventorship and Obviousness

- European Parliament resolution of 16 February 2017 points out AI cannot be held liable for infringement.

- Pragmatic approach: "Steal" the AI's invention or say "jointly owned"

- Like most countries the law is that the individual entitled to an invention is the first to file.

- Assessing an AI's invention will be difficult – and related potentially to the question of obviousness.

- Provided you own and control the AI system there are no issues regarding prior disclosure (**NB** importance of contractual restrictions).

- Relevance of other IP rights (in relation to the data input or testing of a suggested output) to secure rights if ownership/obviousness become problems.

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