The Intellectual Property Implications of 3D Printing – Past, Present and Future

David Humphries MBE
Head of Research Development
United Kingdom Intellectual Property Office

Intellectual Property Office is an operating name of the Patent Office
The Provision of Research for 3D Printing and Intellectual Property: Why did the UK IPO Commission?

• The IPO recognises that emerging / disruptive technology impacts on IP law (e.g. saw this with the internet and music/films etc.);

• The IPO is committed to ensuring that IP law is up to date and relevant;

• But will only change if there is good evidence to suggest change is needed - evidence based policy etc.
The Provision of Research for 3D Printing and Intellectual Property: What did the UK IPO Commission?

- Limited literature on the current situation; lack of empirical evidence
- A quantitative analysis of online sharing platforms dedicated to 3D Printing
- The research focused primarily on copyright
- A qualitative analysis of the use, adoption and impact of 3D printing in selected industrial sectors:
  - (1) replacement parts industry;
  - (2) customised goods and
  - (3) high-value small status goods
The Research Team – an academic and industry collaboration:

• Dr Dinusha Mendis (Principal investigator, Bournemouth University);

• Dr Phil Reeves (Co-Investigator, Econolyst Ltd; now Stratasys Consulting Ltd); and

• Dr Davide Secchi (Co-Investigator, Bournemouth University).
A Legal and Empirical Study of 3D Printing Online Platforms and an Analysis of User Behaviour
A Legal and Empirical Study into the Intellectual Property Implications of 3D Printing

Executive Summary
3D printing research reports including executive summary, online platforms and user behaviour, industrial sector use.

Documents

Executive summary: A legal and empirical study into the intellectual property implications of 3D printing
PDF, 647KB, 16 pages

Study 1: A legal and empirical study of 3D printing online platforms and an analysis of user behaviour
PDF, 1.81MB, 64 pages

Study 2: The current status and Impact of 3D printing on intellectual property

From: Intellectual Property Office
First published: 29 April 2015
Part of: Intellectual property research: IP in general
3D Printing and Online Platforms

- Data was collected for the period 2008-2014
- Selected 17 online platforms
- Growing every year

- File tags and categories
- License schemes
- Downloads
- File views
- Price
<table>
<thead>
<tr>
<th>Website</th>
<th>Things</th>
<th>Percentage</th>
<th>Users</th>
<th>Percentage</th>
<th>T/U</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 123D</td>
<td>65,326</td>
<td>0.169</td>
<td>31,974</td>
<td>0.306</td>
<td></td>
<td>2.043</td>
</tr>
<tr>
<td>2. 3dlt</td>
<td>514</td>
<td>0.001</td>
<td>88</td>
<td>0.001</td>
<td></td>
<td>5.841</td>
</tr>
<tr>
<td>3. cgtrader</td>
<td>1,789</td>
<td>0.005</td>
<td>133</td>
<td>0.001</td>
<td></td>
<td>13.451</td>
</tr>
<tr>
<td>4. cubehero</td>
<td>143</td>
<td>0.0004</td>
<td>82</td>
<td>0.001</td>
<td></td>
<td>1.744</td>
</tr>
<tr>
<td>5. cubify</td>
<td>1,610</td>
<td>0.004</td>
<td>383</td>
<td>0.004</td>
<td></td>
<td>4.204</td>
</tr>
<tr>
<td>6. cuboyo</td>
<td>124</td>
<td>0.0003</td>
<td>27</td>
<td>0.0002</td>
<td></td>
<td>4.592</td>
</tr>
<tr>
<td>7. GrabCad</td>
<td>108,663</td>
<td>0.282</td>
<td>20,632</td>
<td>0.198</td>
<td></td>
<td>5.267</td>
</tr>
<tr>
<td>8. i.materialise</td>
<td>822</td>
<td>0.002</td>
<td>308</td>
<td>0.003</td>
<td></td>
<td>2.669</td>
</tr>
<tr>
<td>9. kraftwurx</td>
<td>378</td>
<td>0.001</td>
<td>89</td>
<td>0.001</td>
<td></td>
<td>4.247</td>
</tr>
<tr>
<td>10. leopoly</td>
<td>12,241</td>
<td>0.032</td>
<td>5,997</td>
<td>0.057</td>
<td></td>
<td>2.041</td>
</tr>
<tr>
<td>11. ponoko</td>
<td>360</td>
<td>0.001</td>
<td>106</td>
<td>0.001</td>
<td></td>
<td>3.396</td>
</tr>
<tr>
<td>12. sculpteo</td>
<td>32,002</td>
<td>0.083</td>
<td>15,486</td>
<td>0.148</td>
<td></td>
<td>2.066</td>
</tr>
<tr>
<td>13. shapeways</td>
<td>91,489</td>
<td>0.237</td>
<td>12,327</td>
<td>0.118</td>
<td></td>
<td>7.422</td>
</tr>
<tr>
<td>14. sketchup</td>
<td>500</td>
<td>0.001</td>
<td>129</td>
<td>0.001</td>
<td></td>
<td>3.876</td>
</tr>
<tr>
<td>15. the pirate bay</td>
<td>159</td>
<td>0.0004</td>
<td>69</td>
<td>0.001</td>
<td></td>
<td>2.304</td>
</tr>
<tr>
<td>16. thingiverse</td>
<td>68,505</td>
<td>0.178</td>
<td>16,385</td>
<td>0.157</td>
<td></td>
<td>4.181</td>
</tr>
<tr>
<td>17. youimagine</td>
<td>491</td>
<td>0.001</td>
<td>176</td>
<td>0.002</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
These are the three online platforms with the highest number of registered users. They are governed by USA laws and do not give effect to any conflict of law principles. The platforms have absolved themselves of all liabilities. All liabilities lie with the user for uploaded content.

Users are encouraged to licence their content through Creative Commons licence or GNU public licence. Thingiverse and 123D require their users to waive their moral rights with respect to attribution of authorship of their content.

Almost every year since 2008 the number of files uploaded in the 3D platforms doubled.

A CAD file is considered a copyright work in UK and the view is supported by CJEU and UK cases. In the US, it is not considered a literary work as reasoned by M. Simon, B. Rideout, M. Nimmer and D. Nimmer.
The easiest way to get started with 3D
Discover free apps to take you from photos to modeling to making. To get the most out of these free apps, sign up for free account.

<table>
<thead>
<tr>
<th>App</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>123D Catch</td>
<td>Capture places, people and things in 3D using your iPad or iPhone. Share your catches, or 3D print a real object.</td>
</tr>
<tr>
<td>123D Circuits</td>
<td>Design, complete, and simulate your electronic projects online.</td>
</tr>
<tr>
<td>123D Creature</td>
<td>Have a perfect character idea in your head? Bring it to life with this free app for iPad.</td>
</tr>
<tr>
<td>123D Design</td>
<td>123D Design is a free, powerful yet simple 3D creation and editing tool which supports many new 3D printers.</td>
</tr>
<tr>
<td>123D Make</td>
<td>Turn your amazing 3D models into even more amazing do-it-yourself projects. Download the free app now.</td>
</tr>
<tr>
<td>Meshmixer</td>
<td>Meshmixer is the ultimate tool for 3D mashups and remixes. Mash, mix, sculpt, stamp or paint your own 3D designs.</td>
</tr>
<tr>
<td>Tinkercad</td>
<td>Get started with basic 3D modeling—no downloads required.</td>
</tr>
<tr>
<td>The Sandbox</td>
<td>Here you'll find some technology in progress—is stuff we're working on or experimenting with.</td>
</tr>
</tbody>
</table>
How were Econolyst involved in this project?
So what were the six case studies?

(1) The automotive aftermarket – 3D printing parts

(2) The domestic appliance aftermarket – using home 3DP

(3) Engaging the consumer – when we all become designers
So what were the six case studies

(4) Scanning & reverse engineering – tangible to electronic

(5) Realizing the virtual to the physical – CG & CGI

(6) How to protect & monetize digital assets – the designers view
What did the researchers consider in the case study reviews?

- Current commercial adoption and existing evidence base
- Business drivers and reasons for technology change and adoption
- Technical barriers to 3DP adoption (scale, materials, enabling data, supply chain)
- Economic and social benefits and barriers to 3D printing adoption
- Technology and material development roadmaps preventing or enabling future adoption

- Desk based research
- Face-to-face interviews with industry players
- Focus groups
The automotive aftermarket

- Adoption of additive manufacturing within the automotive aftermarket is significantly constrained by the lack of technology capability making it almost impossible to produce any usable parts.
- For any significant number of parts, industrial AM processes will not be technically or economically viable for at least a decade.
- Only the highest value (super car) OEM’s are currently using Additive Manufacturing and only for a small number of parts.
- The industry believes that only parts designed to be made using AM/3DP will ever become after market parts due to compliance.
- Low volume executive car markets do not expect to be using AM within the next 10-years, taking the potential after market out beyond this point.
- The industry expect AM/3DP to one day be integrated across dealers and networks, but not for at least 15-years.
The domestic appliance aftermarket

- The domestic appliance after market is highly fragmented and based on low value high volume sales channels not suited to 3D printed parts
- The vast majority of aftermarket parts are complex ‘systems’ such as controllers, pumps and motors, which cannot be 3D printed
- There is very little enabling 3D CAD data available from which to produce parts of the accuracy needed to repair appliances
- It is possible to scan and reverse engineer many domestic appliance parts, but this is a very laborious and time consuming process with questionable quality results
- Domestic appliances are manufactured from a wider variety of ‘functional materials’ with specific properties relating to usage, such as freezing temperature, extreme heat, water and detergent. Suitable materials are not available for consumer 3D printing
Engaging the consumer – all designers

- The capability of browser based design tools and cloud based software will enable increased adoption of consumer design
- 3D printing is seen as an important tool by designers in enabling the mass customisation workflow, but it is considered far more important to develop usable customers interfaces and robust value propositions (no one cares its 3D printed)
- In the short term (5-years) consumer enabled design coupled with 3D printing will be limited to only high value, low status products
- Increasing productivity and better materials will make AM/3DP highly capable of producing a wide variety of consumer products within the next 10-years
- It is anticipated that the flow of data used to print these objects will be either encrypted or streamed in real-time
Realizing the virtual to the physical

• There has been very little impact to date resulting from the integration of computer games or film content with 3D printing.
• Companies who are offering 3D printed content from computer games have negotiated licences with IP owners and have developed closed loop production processes to ensure data tractability.
• A number of companies are now following a similar pathway with film content, where the 3D representation is generated and approved for sale under licence.
• One company is developing an RFID solution to track the provenance of 3D printed models, linking them back to IP owners and brands.
• The current IP framework appears to be working within this field, with methodologies in place to protect IP and allow commercial exploitation.
Protecting & monetizing digital assets

- Following precedent in the music and film sectors, small businesses and digital artisans are acutely aware of the implications of digital piracy
- Some designers are ambivalent to piracy and use it as a marketing and brand awareness tool
- Designers place the loss of identity and creativity above potential financial loss
- Designers appear more concerned about infringing the rights of others than protecting their own IP as it is very expensive to launch new products only to have them ‘taken down’
- There appears to be widespread confusion about IP protection and infringement among the designer maker community using 3D Printing & additive manufacturing technology
Main Findings

• Nothing to indicate that the 3D printing online platforms leading to piracy / counterfeiting is a mass phenomenon YET!
Key Recommendations

For Government

• “Wait and see” approach should be adopted

• Over-hasty legislation could stifle creativity and the right of manufacturers and content creators to protect their livelihoods

• It will be prudent to take steps to cultivate a climate better suited to tackling impending IP issues more successfully and in a manner, which takes into account the interests of all stakeholders
Key Recommendations

• However the growth of 3D scanning and 3D printing means that piracy and counterfeiting is beginning to happen

• Recommend that the UK IPO establish a Working Group to assess and examine individual IP rights in light of 3D printing / 3D scanning

• The working group could be led by UK IPO or by another organisation
Key Recommendations

For Intermediaries (Online Platforms)

• Online platforms provide more awareness and understanding of the different types of licences and assign the most appropriate licence as a default with ‘opt-out’ being an option

• As online platforms and user-numbers continue to grow it is recommended that spin-offs and by-products offered by the online platforms be monitored
Key Recommendations

For Industry

• Consider new business models:
  – secure streaming of 3D files such as pay-per-print by companies such as Authentise, Secure3D, ToyFabb; Hasbro/Shapeways initiative

• Manufacturers could also consider licensing design files more widely, thereby opening up doors to a range of outlets selling 3D files

• This will avoid locking the manufacturer into an agreement through a system such as a ‘one-stop-shop’
What Next?

The UK IPO has commissioned new research on 3D printing

The team is an international collaboration –

•  Dr Angela Daly - Queensland University of Technology
•  Dr Thomas Birtchnell - University of Wollongong
•  Professor Thierry Rayna - Novancia Business School Paris
•  Dr Ludmila Striukova - University College London
Research Objectives

This research will cover all intellectual property rights and aims to consider:

• How 3D printing is being deployed now and in the future, in order to better understand the potential impact of new technologies and materials.

• It will particularly focus on how 3D Printing will interact with existing intellectual property laws, and how these laws are enforced internationally.

• The project will look at the IP frameworks in the US, Europe, India, China and Russia and will host workshops in all of these territories bar the US.
Research Objectives

Important to understand developments in 3D printing from:

• High end, high specification manufacture of tools and medical implants

Through to

• Desk top, low specification and accessible 3D printing
How to engage with the Research

The research team are keen to build a network of interested stakeholders. They aim to do this through:

• A dedicated Twitter Page and Blog
  – Twitter: https://twitter.com/3DPIPFutures
  – Blog: https://3d pipfutures.com/
Project Timelines

• The research team plan to host workshops in China, possibly Hong Kong, India, Russia and in a number of countries in Europe – still to be decided.
  – These workshops will be held during the summer and autumn of 2017 and will look to attract industry, legal and academic experts who are working locally.

• The research is due to be completed in Autumn 2018.

• The research team will be pleased to hear from you.
Thank you very much and questions?!

David Humphries MBE
Head of Research Development
David.humphries@ipo.gov.uk