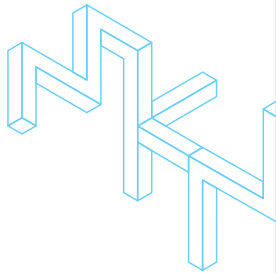


# Digital Jewellery: The democratisation of authorship and ownership

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THEME: DEMOCRATISING TECHNOLOGY

## Introduction

This paper explores jewellery that has been enabled by the advent of digital technology and computer-aided design and manufacture (CAD/CAM), analysing the extent to which authorship and ownership may have been democratised through these digital means. It identifies the ramifications of digital manufacture and the internet upon jewellery design and contemporary jewellery through an examination of the respective roles of the jewellery designer, contemporary jeweller and consumer. These are sequentially analysed through the initial stages of jewellery including design, production and consumption. In so doing, the paper aims to ascertain if and how the authorial act of creating jewellery has been democratised through digital manufacture and delivery. A complementary investigation seeks to establish whether ownership has been democratised through a reduction in production costs and online distribution.

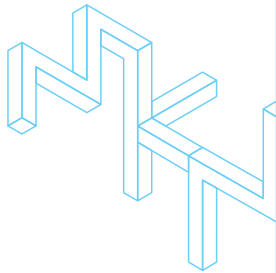
The notion of democratising access is not necessarily new, for in its origins jewellery was probably as simple as a threaded shell or found object. (Bernabei, 2011, p.2) After centuries of increasing technical sophistication in metalsmithing and stone setting, a desire to return to the rudimentary, easily available and low cost origins accompanied the post war emergence of new European approaches to jewellery. One early innovator was Margaret de Patta, who in 1946 started 'creating prototypes that could be produced at lower prices' (Cartlidge, 1985, p.75). As ideas coalesced further in the 1960s and 1970s through the movement commonly known as Contemporary Jewellery, certain jewellers even encouraged or demanded that the consumer become an agent of design through the selection and matching of multi-component works, as in the ring sets by Wendy Ramshaw. Works such as her 1971 *Ring Set*, encompassed five rings in gold, enamel, dyed acrylic, cornelians and amethysts were shown on a stand that was an integral part of the work. This enabled the consumer to view the rings before deciding how many and which rings to wear, as well as whereabouts on the hand they should be positioned. Whilst Ramshaw established the design of the components, the final composition was literally and metaphorically in the hands of the consumer.

Outcomes also extended to an explicitly acknowledged exchange of roles between author and consumer through works such as Lous Martin's *Make Your Own Brooch*, 1974, which as the title suggests, required the consumer to actually create the jewellery

## Abstract

*The paper analyses the consequences of computer-aided design and manufacture (CAD/CAM) on the authorship and ownership of contemporary jewellery. It identifies the ramifications for jewellery design and contemporary jewellery through an examination of the respective roles of the jewellery designer, contemporary jeweller and consumer. The latter focuses on the extent to which individual members of the public can become virtual craftspeople. It therefore aims to ascertain if and how the act of creating jewellery has been democratised through digital manufacture and delivery. A complementary investigation seeks to establish how far CAD/CAM has enabled contemporary jewellers to democratise the consumption of artistic jewellery through a reduction in production costs. Analyses chart CAD's gradual shift from exclusive use by expert technicians to generic deployment by amateurs manipulating user-friendly and intuitive software. They determine how its unification through web delivery in apps by companies such as Nervous Systems, effectively converts consumers into designers. Parallel investigations explore the work of jewellery artists such as Ted Noten and Christoph Zellweger who have exploited CAD/CAM to mass produce works that democratise consumption through lower purchase prices. The paper concludes by summarising the key differences and similarities between the artistic use of CAD/CAM in jewellery with those of its more commercial and design orientated counterparts. It determines the relative shifts over time in both parties' respective roles since the inception of digital technologies, identifying convergences and divergences. Finally, it assesses the relative merits of both approaches in terms of democratising ownership and authorship, as well as the consequences for aesthetic integrity.*

**Keywords:** Jewellery, democratisation, CAD/CAM.



from the supplied kit of a perforated aluminium form and pipe cleaners. Instructions were supplied, but the final design was chosen by the consumer turned maker. Lous Martin describes the work going on in Holland at the time as 'art without pretensions to uniqueness, democracy through a stress on the concept instead of materials' (Martin, 1995, p.52). The action 'to make' shifted 'to chew' with Ted Noten's participatory *Chew Your Own Brooch*, 1998. Buyers received a stick of chewing gum to be chewed into a form that was then cast into metal and transformed into a pin brooch. Allied to the emergence of these practical intentions to democratise jewellery, as noted by den Besten, were the views of the French theorist Roland Barthes in 1961, with his essay 'From Gemstones to Jewellery', where he describes the liberalisation of jewellery. (den Besten, 2011, p.22)

If the basic foundations for democratising authorship and ownership were laid during the latter half of the twentieth century, potential fruition may have been enabled by the accelerated development of digital technologies, including the advent of widespread computer-aided design and computer-aided manufacture (CAD/CAM), as well as the internet. Presently, jewellers have multiple software options for the virtual design of jewellery. GemVision's Counter Sketch Studio, allows a library of wedding and engagement rings to be altered in front of the customer prior to passing the resulting file for manufacture to partner company Stuller. In light of these new technologies, the following sections analyse the extent to which they have broadened the customer base for jewellery and how meaningfully they allow consumers to design jewellery.

### Democratising Design

The first stage of creating jewellery entails its conception and design. Invariably the consumer was previously an infrequent influence, unless seeking bespoke commissioning. The democratisation of authorship is analogous to the consumer customisation of design and production, and in particular design because digital production is often machine led. The advance of digital technology and the internet has increased the possibilities for the consumer to be innately involved in the design process and this has resulted in varying levels of personalisation. According to Lionel T Dean, academic and designer of 3D printed artefacts, these levels can be categorised as 'Individualisation, Personalisation and Full Customisation' (Molitch-Hou, 2014). Dean asserts that the control of the consumer over design ranges from basic through to complete. With 3D printing a key facilitator, it is uniquely suited to what Dean describes as 'mass individualisation', arguing that 'it costs the same amount of money to produce similar parts as identical ones using rapid prototyping, so why produce two products that are the same?' (Marshall et al., 2008, p.42)

At the most basic level, the extent of choice is

synonymous with that offered by traditional jewellers, with variations including engraving, stone and metal selection, as well as physical dimensions. Whilst made available through websites, manufacture relies on traditional modes of production at the jeweller's bench; meaning distribution is digital, but manufacture remains analogue. A pertinent example is Jewlr<sup>1</sup>, who allow consumers to progress through a series of web pages, each offering a design choice that contributes to the overall look and composition of the jewellery. Much in the same way many websites offer consumer services with add-ons that can be accepted or rejected. This helps create a familiar pathway to completion and purchase.

A more interactive development, akin to Dean's notion of 'personalisation', has resulted from the creation of software applets or apps, which have allowed mainstream mass production to become personalised in a manner that was previously less widespread and less feasible. Indeed, a potential shift from the designer as author to the consumer as author has consequently been made possible. At the intermediate level of consumer input apps such as those offered by Suuz<sup>2</sup> and Zazzy<sup>3</sup> allow consumers to choose a word or words that define the geometry of their jewellery. The software is instantly responsive, meaning visual feedback confirms on screen how a given word will look once manufactured. Text is immediately converted into the band that creates a ring or a cursive strip of mass for another typology of jewellery, such as a pendant. Tellingly, the tagline on Zazzy's website is 'You do the chic, we do the geek', meaning the consumer is free to design, but remains liberated from the taxing demands of manufacture. A similar driver of design can be the use of initials to create a monogrammed outcome, as in the service offered by Mymo.<sup>4</sup> Two initials are merged into a single form, with each remaining distinct from different viewing angles. Another option for personalisation is enabled via the upload of images that then dictate geometry, for example Suuz also provide a service whereby a photographic facial profile becomes a planar ring's silhouette. Most of these websites seek to enhance options for personalisation by allowing ring and bracelet size to be altered, font type and material thickness to change, as well as some choice over materials and finish. They seek to do so in the most simple and visually responsive manner possible, often through the use of sliders in the apps that can be moved up or down. In other words, the technical skill required to use these apps and websites is minimal and the representation of consumer's changes is instantaneous. The final fillip for ease of use and purchase is that all these products are then manufactured and delivered direct to the consumer's home.

A similar pathway is offered by Shapeways<sup>5</sup>, the online 3D printing bureau, who offer a range of jewellery apps that aid the personalisation of a design. From the relatively simple, based on text, through to the more geometrically complex Turks Head Knot. Alternatively, the Italian company Makoo<sup>6</sup> offers an

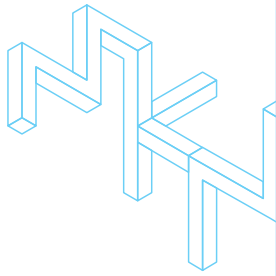
1. [www.jewlr.com](http://www.jewlr.com)

2. [www.suuz.com](http://www.suuz.com)

3. [www.zazzy.me](http://www.zazzy.me)

4 [www.mymo](http://www.mymo)

5. [www.shapeways.com](http://www.shapeways.com)



innovation in personalisation through speech or sounds. Personal sentiments can be spoken into the computer and their software transforms the captured sound waves into modulated form. Users can then further deform and disrupt the form using sliders.

Despite these innovations in the consumer input required to design jewellery, these modes of production are confined to predefined parameters of possibility. Whilst consumers' arrangement and composition may be genuine, the scope for expressive design is limited. For greater input, one needs to look towards those companies who incorporate generative algorithms into their apps, in order to effectively grow forms. Nervous Systems<sup>7</sup> might be considered an exemplar of unifying creative software, online delivery and bespoke production. The latter is implemented through simple, user-friendly applets that allow people to create complex forms by manipulating sliders and numeric counters for various parameters. Visual feedback is immediate and the resulting forms are abstract and being devoid of text or obviously personal references may even give the impression of having been designed by a professional, rather than the consumer.<sup>8</sup>

Co-founded by Jesse Louis-Rosenberg and Jessica Rosenkrantz, Nervous Systems provides evidence of how software, such as their Kinematics, Cell Cycle and Radiolaria applets, may help transform members of the public into virtual craftspeople. In this sense, the company's design creativity resides in coding the systems that allow the jewellery to be created, but its final manifestation is determined by others. It is intriguing that within the remit of personalisation that, according to Louis-Rosenberg (2014), 'there is no definitive product; instead, the many designs created allow for mass customization'. Going on to explain that 'designing algorithmically requires manufacturing digitally', making it 'a very good way to explore the concept of repetition because it is just as easy to make many things as one thing. It allows the possibility of infinite variability for the same reason' (Louis-Rosenberg, 2008). This variability confers considerable choice for those using the applets. Louis-Rosenberg believes this less to be a distinct aspiration than an innate consequence of digital production, stating that 'the ability to abstract your process and create a user interface also encourages interactivity and customization' (ibid.).

Consumers' completed designs are then manufactured by Shapeways, which makes a wide range of materials, colours and finishes available for selection. This shifts *Nervous System's* output further towards the notion of 'Full Customisation' outlined by Lionel T Dean. It cannot, however, provide full customisation given that the programmers define the apps and set the parameters of 'look', if not the exact details of geometry and material. It does become a paradigm of what the art historian Susanne Ramljak describes as 'Prosumerism'. Outlined in her essay 'A Touchy Affair: On contemporary and commercial

jewelry', where she discusses 'hybrids of production and consumption... a cross between producer and consumer behaviours' (Skinner, 2013, p.216-17). I would argue this may become a kind of self-fulfilling prophecy in which demand for personalisation from customers will increase until bespoke becomes a norm at all market levels. Key to this may well be the increased dispersion, affordability and usability of computer-aided manufacture, as will be discussed in the following section.

### Democratising Production

Once design has been finalised the inevitable next step is its production, and in this context there appear to be two potential strands for the democratisation of authorship through digital technologies. The first concerns the consumer turning creator in an act of DIY craft, and a second, whereby digital design requires machine manufacture. Both have consequences on craftsmanship and the extent to which traditional making skills are required.

For those consumers with some basic software knowledge there is a proliferation of online manufacturing bureaus offering 3D printing, laser cutting, laser etching and digital photo etching. Costs are fixed pro-rata according to volume or area, and pricing is automatically revealed on file upload. This, along with the increasing user-friendliness of CAD software, means ease of use is becoming a reality. Access to expensive equipment is democratised through collective contribution. With this access and ease of process, the argument then goes, why pay someone else to design jewellery for you, when you, as the consumer can become the designer and create your own fully customised jewellery? These websites are answering that question through the digital manufacture of jewellery with home delivery; meaning that the distinction between amateur and professional is softening. Furthermore, when so doing, the consumer is no longer confined to the preordained parameters set by the aforementioned apps.

Examples include Ponoko<sup>9</sup>, who enable images or illustrator files to be laser cut from plastic or other materials and Shapeways, who offer the 3D printing of materials including metals, wax, plastics and ceramics. Shapeways are clearly seeking a global market, offering a worldwide service, as well as creating an online community of makers and designers through their galleries, forums, blog and individual users' shops. Not only can a user's work be manufactured, their designs can be offered for sale to all, with the added bonus of not having to invest heavily in stock thanks to print on demand.<sup>10</sup> Shapeways simultaneously enable complex production and promote worldwide sales. It may appear that traditional making skills are being negated, and one might argue that this in turn means production becomes democratised by being made available to all because the machine creates the object.

The counter argument suggests that despite machine printing jewellery the extent to which skill is

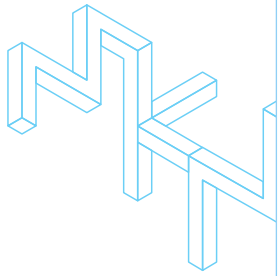
6. [www.makoojewels.com](http://www.makoojewels.com)

7. [www.n-e-r-v-o-u-s.com](http://www.n-e-r-v-o-u-s.com)

8. Jewellery production apps' affordable price needs to be combined with the ability to co-create the work, mirroring the fun making aspect of *Make Your Own Brooch*. In this way the jewellery also encompasses the collaborative nature of its production.

9. [www.ponoko.com](http://www.ponoko.com)

10. Print on demand can also function in traditional manufacturing where jewellers and collectives produce on demand after purchase rather than producing large quantities of stock.



still required essentially correlates to the aesthetic and geometric complexity of the resulting jewellery. In other words, digital technology is no panacea and whilst in this ambit there may have been a shift from traditional hand making skills to digital production, the necessity to acquire and hone high levels of craftsmanship persists. It just pertains to the digital realm of computer-aided design, for that is where the geometry and aesthetic of the jewellery is primarily decided, even if some post-production does occur after 3D printing.

Support for this notion of digital excellence is provided by those jewellers who appear to have developed a high level of digital design acumen. Exemplars include Joshua Demonte, who creates architectonic headdresses and other body pieces of considerable scale and intricacy. Stefania Lucchetta prints in metal by exploiting Direct Metal Laser Sintering (DMLS) to create tightly latticed forms in titanium that would be extremely challenging to hand manufacture. Along with Dorry-Hsu, who exploits Stereo Lithography (SLA) to create complex and translucent animal-like forms. One might argue that the geometric accuracy of 3D printing means that even professionals are excused the need for hand skills. Therefore, access to the manifestation of complex forms is open to anyone, so long as they have the skills to model in CAD. Thereafter, digital solutions can also assist the transition to marketplace, as will be investigated in the following section of the paper.

### Democratising Consumption

In pre-digital times jewellery would traditionally have been distributed and sold through networks of shops, traders, catalogues and galleries. As previously discussed, the digital realm has enabled production and distribution to merge through a union of the internet and computer-aided manufacture, as amply demonstrated by Shapeways. Digital manufacturing has also had consequences upon contemporary jewellery and its tendency to favour one-off pieces. Perhaps the biggest revolution in terms of democratising access to artist produced jewellery has been the reduced unit cost that CAM technologies such as 3D printing, laser cutting and digital photo-etching can procure. Lower prices steer these pieces of jewellery away from high-end objects of desire towards accessible and more readily purchasable items, where the quality of design is not reduced by lower prices. As Jesse Louis-Rosenberg of Nervous Systems notes, 'we make very affordable things. If I make something that costs \$10 to \$20 then I can sell that to basically anyone' (Substratumseries.com, 2011).

This relative affordability extends to some recent work by contemporary jewellers such as Christoph Zellweger, Ted Noten and Noon Passama. As well as lowering production costs, the innate reproducibility of digital designs lends itself to serial production as limited or unlimited editions. These jewellers therefore appear to build on the democratic aspirations of earlier multiples

that were embedded in the 'utopian vision of the sixties and seventies' (Ober, 1978, p.24) A period when mass-produced components were used to aid cost reduction, as in Charlotte van der Waal's Suitcase Snap Bracelet (1972); composed of two parts with suitcase snaps so consumers could easily select different colours. Subsequently, Dutch jewellers Lous Martin and Hans Appenzeller produced *Serie Sieraad* a series of twenty-three inexpensive editions between 1973 and 1974 with the ambition of broad dissemination through affordable prices. Despite the democratic aims, according to Appenzeller, the results suggested that endless cheap copies were not the solution, stating that 'if you want to conquer the market with a rubber bracelet in 1973, you'd better off making ten than a hundred' (Martin, 1995, p.52).<sup>11</sup> Dutch consumers seemingly accorded value to the prestige of one-off or tightly limited production at that time. Perhaps their works might have achieved more widespread success had they been produced in the digital age, in which worldwide publicity is a real possibility.

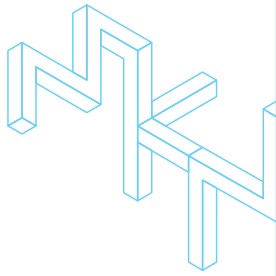
An early example that exploits digital manufacture is Christoph Zellweger's *Data Jewels* (2001), digitally photo-etched from thin sheets of stainless steel to create pendants. He outlines their development by explaining how 'in 1998, I experimented with a program called Processing, which finally led to the work *Data Jewels*, work I produced industrially in stainless steel but developed on AutoCAD. It was a first attempt to create easy wearable jewellery that can carry individually customised information. The ornaments referred to the kind of chips found in credit cards, or to QR codes or patterns on circuit-boards, yet at the same time some aspects in the design appeared organic' (Zellweger, 2014). In this context, *Data Jewels* was a forerunner to the subsequent emergence of *Nervous Systems*, a paradigm of its commissioner's (Chi ha paura...?) aspiration to create designs of intelligence that can be made relatively affordably through serial production. Finally, Zellweger's work also constitutes a predecessor for Ramljak's Prosumerism concept.

The next example concerns the elegant and elemental 3D printed brooches *Extra Button, Edition III*, (2011), by Noon Passama. These offer both the artist and consumer a range of finishes from sprayed to electroplated, meaning digital production contributes to works that are both customisable and affordable; notwithstanding their luxurious appearance (den Besten, 2011, p.26).

The exploitation of the relatively low cost of 3D printing can also enable projects in which consumer participation becomes vital to its success. Ted Noten's *Wanna Swap Your Ring*, (2010) Tokyo project involved the production of 500 3D printed Miss Piggy Rings, which were then hung on nails arranged in the shape of a gun and offered to viewers willing to exchange one for a piece of their own jewellery. Over the course of the installation the work shifted from an unadulterated plethora of Noten rings to a panoply of

11. Subsequently, another Dutch jeweller, Gijis Bakker, went on to argue that even 'if you see the same jewel worn by several different people it is still intelligent design'. (den Besten, L., (2010); *Chi ha paura*. Stuttgart, Arnoldsche. p.15.) Thus, reproduction does not necessarily detract from the concept of a work.





jewellery of different kinds, styles, aesthetics, materials and value that came to represent the host city. The low cost of digital production meant producing and exchanging so many copies of the same ring became financially viable; essentially democratising access to Noten's work. It is a possibility that evidently appeals to Noten, given he previously created the laser cut pin, *St James Cross Revisited*, (2005). A large edition of 1500, each costing roughly £20, and also constituted an early exploitation of a website for the purposes of promotion, distribution and 'conceptual completion' of the work. The latter because its dedicated website allows consumers to upload images of their edition being worn or placed in a setting of their choice.<sup>12</sup>

Another way in which consumers can actively contribute to increasing access to innovative jewellery is crowdfunding. In exchange for pledges of money, consumers receive samples according to their level of support. Examples include *Human Chromosome Jewellery*, (2014), by Louise Hughes.<sup>13</sup> Whilst consumers admittedly receive jewellery or related artefacts in exchange for donation, they effectively *buy into* the idea of the work, becoming involved in design and production by proxy. Consequently, patronage democratises community ownership. This seems particularly beneficial to Josh Harker whose various projects to fund sculpture and body ornaments were oversubscribed on Kick-starter. Clearly an advocate, he reveals his belief that 'Crowdfunding is democracy at its core. It provides public empowerment through participation' (Harker 2012).

The final possibility for the digital democratisation of ownership concerns the emergence of website repositories such as *YouMagine*<sup>14</sup> and *Thingiverse*<sup>15</sup> that store, collate and freely offer uploaded 3D files for download and printing. Submission requires acceptance of creative commons licence and the relinquishing of copyright and authorship. This effectively means consumers need only pay for production costs with a bureau of their choosing. Or, should they have a home printer, print it themselves. Given the falling costs of purchasing a machine, this will be an avenue increasingly open to more consumers.<sup>16</sup> In a paradigm of open access, MakerBot's *Thingiverse* community has designers freely distributing customisable ring software for use with a MakerBot 3D printer.<sup>17</sup> The contemporary jeweller Christoph Zellweger believes this has potential for innovation given that he already observes 'wonderful ideas (as downloadable files for print out) coming from sensitive jewellery designers and artists that are studying now. Intelligent and beautiful pieces I can print out before a dinner party that I will wear again and again' (Zellweger, 2014). At the same time he cautions against over production and the need for greater development of three dimensional forms and jewellery with embedded content. Stating that designs tend to be 'limited and often lack quality on many levels, especially when it comes to the final surface finishing. Designs are still very flat. We also need more

designers and artist who use the technologies available to develop intelligent and forward looking products that express strong ideas based on sound concepts; ideas that go beyond building aesthetic variations, ideas that are focused on content too' (Zellweger, 2014)

## Conclusions

There can be little doubt that digital technologies have revolutionised how jewellery can be designed, produced, distributed and sold. The question remains as to whether these developments have democratised authorship and ownership, and if so, the extent to which this may have occurred. The potential for consumers to meaningfully contribute to design and production is mixed. Whilst company websites, including Suuz, allow for design individualisation, the extent of customisation is somewhat limited, with consumers selecting from a palette of options to build a package. Increased consumer input is facilitated by the apps of companies such as Nervous Systems and Shapeways. However, setting the parameters of design is beyond the consumer. Instead, much of the creativity resides with those who programme the code to produce the apps, for they determine the parameters of aesthetics through which the jewellery can emerge. This even applies to the generative apps developed by Nervous Systems, which seemingly allow consumers to grow their own jewellery in CAD. The *look* of the pieces is pre-defined, if not the details of size, material and precise geometry; so the consumer experience is still restricted by what the designers have conceived. That said, these apps do appear to put a degree of creative potential within reach of most consumers, without the need for acquiring extensive technical knowledge or making skills.

Overall, it may be surmised that democratisation has begun, and for those willing to participate, there is potential for the amateur to seemingly act like the professional. These sites offer services that are the first steps towards broad consumer participation in the design process. However, the notion of total customisation remains a mirage. If you wish to master design in the digital realm, you are required to develop an extensive skill set of digital modelling techniques.

In terms of production, digital manufacture has to a degree, induced what I describe as 'technical liberation'. By which I mean that 3D printers' ability to accurately replicate complex geometry can supersede the need for handcraft. Makers are liberated from the extents of their technical skills and bound only by their ability to model in CAD. This applies across the board to both professional users and amateur consumers. Indeed, the latter have amplified DIY jewellery through prosumerism: a cross between producer and consumer behaviour. Aided by online distribution, access to complex and expensive equipment has been facilitated through the collective usage of multiple individuals, be they amateur or professional.

It is perhaps for consumption that digital

12. [www.stjamescrossrevisited.com](http://www.stjamescrossrevisited.com)

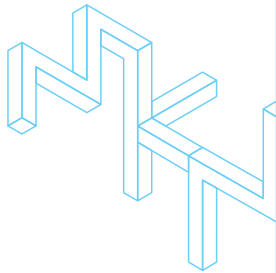
13. [www.kickstarter.com/projects/1627392371/human-chromosome-jewellery-collection](http://www.kickstarter.com/projects/1627392371/human-chromosome-jewellery-collection)

14. [www.youmagine.com](http://www.youmagine.com)

15. [www.thingiverse.com](http://www.thingiverse.com)

16. [Maplin now sell plug and play 3D printers for under £700.](#)

17. [www.thingiverse.com/thing:290279](http://www.thingiverse.com/thing:290279)



technologies have done most to democratise access: partly through the decreased cost per unit and partly through internet sales, distribution and promotion. Contemporary jewellers have sought to harness digital technology to extend the language of jewellery, as exemplified by Christoph Zellweger's *Data Jewels* and Ted Noten's *Wanna Swap your Ring*. Allied to the fiscal means to purchase, consumers have also benefited from easy access to new work through the websites of organisations like Chi ha paura...? or Shapeways. Each in their own way has also promoted contemporary jewellery to a wider audience, which itself is a form of democratisation. Shapeways has taken this further through their community forums, where community creators can exchange ideas and tips for designing and making.

In conclusion, I maintain that the democratisation of authorship has commenced due to the advance of digital technology, yet its further progression relies on increasing the user-friendliness of CAD software. Otherwise, design will remain a collaboration between the consumer and those who create the jewellery ap or software. In contrast, ownership has become more democratised and therefore leads the way to innovation, which authorship may follow in due course. Nonetheless, digital technologies appear to have democratised access to jewellery, its techniques and subsequent acquisition.

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**Roberta Bernabei** is a jewellery maker and historian whose work has been exhibited at various national and international venues, including Birmingham Museum and Art Gallery; Victoria & Albert Museum; National Museum of Modern Art, Tokyo; and the Museums of Decorative Arts in Berlin and Turin. In addition to institutional hosts, her jewellery has been featured in various private and commercial galleries, as well as entering both private and public collections; the latter including Birmingham Museums and Art Gallery; Bilston Craft Gallery; Museo del Gioiello, Padua, Italy; and Museum of Contemporary Craft, Portland, Oregon, USA.

Since 1989, she has shown her jewellery throughout Europe; largely exploring body decoration issues through a wide range of media. Her recent studio practice has shifted emphasis to explore digital technologies and how they may be seamlessly united with traditional goldsmith techniques, including the manipulation of CAD/CAM, rapid prototyping, precision photo etching and digital embroidery. Attempts are currently being made to humanise the 'perfection' of digital manufacture through hand finishing, subverting intended materials and incorporating visual and tactile illusions.

Roberta has chaired several exhibition panels and conferences including the annual Conference of the Italian Association for Contemporary Jewellery in Trieste; Juror of "Eine Handvoll Glasperlen" jewellery competition organised by Museum fuer Weltkulturen, Frankfurt; and most recently, as a member of the selection panel for LUSTRE, the Contemporary Applied Art fair held at Lakeside Arts Centre in Nottingham.