

## What is Changing in Jewellery Making and Are We Keeping Pace

I want to thank the organizers of this Goldsmith's Congress for giving me the great privilege of giving the first presentation. My presentation today will be in two parts. First, I want to speak about the Santa Fe Symposium and then I will get to my main topic about our changing world and the jewellery Industry.

The reason I have the honour of being on your podium is because I organized the Santa Fe Symposium on Jewellery Manufacturing Technology along with my friend Dave Schneller 33 years ago. However, I am not at all comfortable taking credit for the success of the Santa Fe Symposium. In large part, that credit belongs to the people who wrote the papers we published and presented their work at the symposium. I want to bring to your attention the very valuable contribution made by your countrymen and women. To date, there have been 777 presentations given at the Santa Fe Symposium and 112 of those came to us across the ocean from the United Kingdom. In particular I want recognize Dr. Chris Corti who has presented 29 times. Mark Grimwade with 25 presentations and Dr. John Wright who entertained us with wit and wisdom 12 times.

Now I want to speak to the young people here about why this Congress is important and how they can benefit from attaching themselves to it. Anyone can do research. Anyone can contribute something valuable. That was advice given to me back in 1986 when Dave and I were first thinking about starting our symposium and I had doubts about what I could contribute. Fast forward a few decades and I can tell you from my experience what you get from participating as a speaker in a congress or symposium such as this. You get a rare opportunity to know the other speakers in a special way and learn from them while they learn from you. There are 16 presentations in this congress and 10 of us are friend because we met as speakers at the Santa Fe Symposium. That means that I have had the opportunity to rub shoulders with and learn something from nine people here who I may have never met otherwise. Your education is never over, and one of the best ways to become a real continuous learner is to teach. When you teach, you gain better understanding of what you know. You don't have to have grey hair to be valued, there are a lot of young people here who could teach me something and I would be delighted to be able to learn from you.

In 1989, Professor Samuel Beizer, who was the Chairman of the Jewellery Department at the Fashion Institute of Technology in New York City wrote to me about an idea for a conference and exhibition dedicated to ancient and historical methods of jewellery making. As I was going through my files after my retirement, I found his letter and was struck by the following paragraph.

*"The philosophy of the exhibition will be that Jewelry is one of the few crafts that is still essentially being practiced in the same manner as in ancient and historical times. Anyone*

*working in a jewelry workshop today, whether in London, Paris, New York or Rome, could walk into a workshop of medieval Roman, Greek or present-day India or Arizona and recognize sufficient machinery and equipment to be able to sit down and work.”*

The question that came to mind when I read that letter again after 30 years is: What if we turned that proposition around and asked if a jewellery maker from 1989 was suddenly transported to 2019, would they recognize sufficient machinery and equipment to be able to sit down and work? To start I want to look back at how true Professor Beizer’s supposition might be. I will not attempt a comprehensive history but here are some highlights.

If we go back to the industrial revolution, we probably see the first dramatic change in the tools available to jewellery makers. Major advances would be rolling mills and improved machinery such as lathes and forging equipment. Fast forward to the early 20<sup>th</sup> century, the electric motor, electric furnace and electro plating would be new tools employed. In the 1930’s the ancient practice of lost-wax casting was reinvented. The rubber mould for making wax patterns was a very disruptive technology, which greatly lowering both the cost of entry and production. It was also the start of a huge shift in the jewellery market. Most Jewellery made in the 19<sup>th</sup> and early 20<sup>th</sup> centuries was either hand made at the bench or it was made with steel dies in drop hammers or presses. The cost of tooling for machine-made jewellery required large volume production in order to recoup the investment and turn a profit. Wax injection into rubber moulds allowed short run production to be profitable. Complex designs hard to make any other way, became simple and one-off bespoke jewellery could be quickly carved in wax and cast. In the 1960’s ultrasonic cleaners were introduced. They replaced the boiling pot of an ammonia solution used to clean jewellery after polishing in my father’s shop. I remember smelling those fumes a hundred meters away as I walked to his shop after school. While we all appreciated not smelling ammonia, the introduction of ultrasonic cleaners wasn’t really that disruptive.

Rolling mills, electric motors and rubber moulds surly were disruptive technologies to jewellery making. Anyone who didn’t adopt these new technical advancements were at a disadvantage. Metal could still be hammered out from an ingot to a sheet, drilling and polishing without an electric motor produced the same result, but only if the time required was not counted. In the USA, casting was another matter. In my opinion, the first half century of modern lost wax casting lead to a general decline in the art of jewellery making there. Anyone could buy the equipment and start production without regard to knowledge needed to make quality castings, let alone quality jewellery. In addition, rubber moulds invited the unscrupulous to copy anything and everything they could get their hands on. Because the quality was low and the designs not original, price competition dominated. I think lost-wax casting had less impact in the UK and Europe in those years.

The Romans used mass-media finishing. They polished armour parts by putting them in a barrel with smooth pebbles. Then the barrel was rolled back and forth by ocean waves until the parts were polished. The electric motor made mass-media finishing a real time saver and therefore a new disruptive technology. In the 1980's high energy machines such as centrifugal-barrel and centrifugal-disk machines started to become popular and cut the batch time from hours to minutes. Advancements in mass-media finishing continue to push the capabilities much closer to hand polished goods. The latest addition to mass-media finishing is the magnetic-pin finisher and today, even very small shops employ some form of mass-media finishing.

There were other changes taking place as well. Technology enabled specialization and out of this grew industry suppliers who, because of economy of scale, could cost effectively supply semi-milled precious metals such as sheet, wire and tube. Findings became another specialist field. The high cost of equipment and expertise makes a high barrier to entry and hand-made findings can't compete in cost and precision. Gas (bottled and piped) replaced liquid fuel and charcoal.

However, the jewellery bench didn't change much. Yes, the gas torch replaced the blowpipe but someone who knows how to solder can do it with either heat source and a little practice. The same is true of the flex shaft and the bow drill. So, while there were changes, especially after 1760, I think Professor Beizer's statement is basically true.

What has happened in the 30 years since? In 1996 Chris Corti gave a keynote speech at the 10<sup>th</sup> Santa Fe Symposium titled: *Towards Innovation: The Changing Scene in the Gold Jewellery Industry*.

Reading that speech now is interesting. As an industry, we might have been in a golden age of research and learning. In particular, knowledge surrounding lost wax casting was hugely advanced. As Chris said at the time: "Investment casting has come a long way in the recent past". To a great extent, it was funds from the World Gold Council, which were directed by Dr. Corti at the time, that paid for the research done in Germany at the Precious Metals Institute (fem). The result was a definite improvement in the knowledge needed to make better cast jewellery. In addition, we had the publications *Gold Technology* and *Gold Bulletin*. Sadly, both the publications and the research funds from World Gold Council are absent now.

Innovations that were highlighted in Chris's speech were low-temperature gold electroforming and precious-metal clay from Mitsubishi. Lasers for jewellery making were another innovative but costly product. He talked about metal injection moulding of powder metal and liquid glass metals back then too. Of course, CAD/CAM was gaining popularity and rapid prototype machines were all the rage for those few who could afford them.

What of these innovations have stuck? Electroforming didn't take over casting as the primary volume production method for jewellery making as predicted by some at the time. Precious-metal clay has continued to grow both in volume and artistic excellence. But rather than replace existing techniques it formed its own niche in the market place. CAD is here to stay and CAD proficiency is a high priority in jewellery schools now. Metal injection moulding of precious metal is suitable for high volume production of simple shapes such as wedding bands but really isn't much of a factor in the total jewellery market.

Laser welders are ubiquitous in the US today. Even 15 years ago at a bench jewellers conference in the US, the audience was asked how many had a laser welder at their place of employment and nearly every hand went up. Every jewellery worker can make money with a laser welder, so I was surprised by the lack of lasers found in the goldsmith's survey result that I will discuss later.

Rapid prototype machines became 3D printers and then additive manufacturing machines. The price of these machines fell off a cliff. At the same time, print quality improved and the cost of operation went down. This year at the Santa Fe Symposium there was a paper by Gary Dawson on how a jeweller in a one-man shop used a 3D printer to reconstruct the gallery on the side of an old ring.

A more recent innovative technology is selective laser melting of precious-metal powder. It will be interesting to see where this technology goes. At the moment it looks like it is headed in the direction of service bureaus because of the high cost to entry and low output. Selective laser melting seems to have the most promise for platinum jewellery where the economics are better compared to older production methods.

In any case, the prerequisite to additive manufacturing, whether the printing is in wax, resin or directly in metal is a CAD image. I think that is why so many schools have made CAD training a requirement in their jewellery programs. The next step is slicing that image into print layers to make what is called a STL file. According to a survey presented by Nanz Aalund at the last Santa Fe Symposium, employers in the US jewellery sector want new hires to have the ability to create and troubleshoot a STL file. Then there is the support and scan strategem that must be contended with. While there are attempts to automate this task, an experienced person can generally do a better job by using fewer supports and therefore reduce the finishing time required. Although CAD was emerging in 1989, none of this is was common in jewellery making then.

Before we conclude that our industry has abandoned our roots completely I would like to share the results of the survey that many of you participated in. The survey was conducted by the Goldsmiths Company in March of this year.

The first question: How many people are employed in your company?

1 to 5	= 92.37%
6 to 20	= 4.58%
21 to 50	= 1.53%
50 +	= 1.53%

It is obvious that the participants are overwhelmingly small shops. If this survey is representative of the jewellery industry in England (and I don't think it is), then we should conclude that the industry is highly fragmented and that can be seen as a healthy state of affairs.

The second question: What best describes you or your company?

I/we make and sell our own designs	90.08%
I/we design and sell products made by others	4.58%
I/we sell products others design and make	1.53%
I/we are traditional service bureau (casting, polishing, etc.) for the trade	3.82%
I/we are a service bureau providing advanced technology (CAD, 3D printing) to the trade	0.00%

This second question is very telling. Overwhelmingly this group is small shops of designer/makers with a clientele. I know that there are service bureaus in the UK, so the fact that none are represented shows that the people surveyed fit into a category and other categories are excluded. The answers out are only as good as the data in.

Question three: How many years have you or your firm been in this industry?

This is very interesting data to me. We had 128 people respond. Six respondents said they have been working in this industry for one year. The oldest wrote "Self 32 years, business 116 years".

0 to 5	43 = 33%
6 to 15	33 = 26%
16 to 30	29 = 23%
Over 30	23 = 18%

Using the number of years working in jewellery rather than the age of the people involved in the survey isn't a true indicator of population age. However, if we assume a correlation between age and years making jewellery, it seems the population is quite young. One third are

in the business five years or less and 2/3, fifteen years or less. Only 18% is in what we might call the aging out category. I think this is another sign of industry health for this group.

Question four: Is a CAD system used in your company?

No	101 = 78%
Yes, in-house	13 = 10%
Yes, via a service	16 = 12%

A hundred and thirty out of 132 survey respondents answered this question. I can imagine that two old timers who never used a computer were the holdouts. One hundred and one, or almost 78%, said no to this question. Thirteen or 10% have CAD inhouse and 16 or 12% use an outside CAD service bureau. I think this is a predictor that we shall discuss latter.

Question five: Is a laser welder used in your company?

No	101 = 77%
Yes, in-house	13 = 10%
Yes, via a service	18 = 14%

One hundred and one out of 132 said no. This was a real surprise to me based on how useful lasers welders are and how easy it is to learn to use one. Typically, a person becomes proficient using a laser welder in a few hours practise and expert in a few months. I'm not trying to sell lasers but I can't think of any tool that can save a bench jeweller more time than a laser. There are a thousand ways to do the work better and faster with a laser. In addition, lasers broaden design possibilities because they provide the opportunity to execute designs that are impossible using a torch.

Question six: Is a CNC machine tool used in your company?

No	118 = 90%
Yes, in-house	6 = 5%
Yes, via a service	7 = 5%

Here 118 out of 131 or 90% said no. Six have inhouse capability and seven said they use a service.

Question seven: Is 3D printing of resin or wax used in your company?

No	100 = 76%
Yes, in-house	7 = 5%
Yes, via a service	25 = 19%

In this case 100 or 76% said no. Seven respondents have inhouse capability and 25 respondents or almost 19% say they use a service. Since CAD is a prerequisite to 3D printing these numbers should match up with question four and they do.

Question eight: Does your company use direct to metal additive manufacturing such as selective laser melting or laser sintering of powdered metal?

No 125 = 95%

Yes, in-house 0 = 0%

Yes, via a service 6 = 5%

Nobody surveyed has inhouse capability and only six respondents use an outside service. Really, this is not surprising considering that this technology is still in the early implementer side of the bell curve.

Question nine: How important is social media to your marketing?

Not at all important 29 = 22%

Somewhat Important 48 = 36%

Very important 55 = 42%

Of the 132 respondents, only 29 or 22% said not at all. Forty-eight say social media is somewhat important and 55 say it is very important. That would suggest that 78% of the surveyed are using social media for marketing their goods and services. This too is not a surprise considering the age demographics that can be assumed based on the results of question three.

Going back to the original question, would a jeweller who was suddenly transported 30 years into the future to land in London today be able to walk into your workshop and be able to recognize sufficient tool to sit down and go to work? Based on this survey, I think the answer is overwhelmingly yes. And that does not match my hypothesis at all. I thought that CAD would be wider spread and based on the long learning curve of CAD and it being a prerequisite to 3D printing and generally for CNC machining of jewellery, that these technologies would be over the head of the poor 1989 jeweller. Well, based on this survey, I was wrong and that might be thought of as a good thing.

If you remember how advances in lost wax casting influenced the jewellery industry in a negative way, at least in the US market. Computer aided design and manufacturing has the potential to have the same negative affect by enabling people to design and manufacture jewellery that is not suitable for the purpose and has no soul. Gary Dawson wrote a thought-provoking paper for the 2017 Santa Fe Symposium titled: *Finding Your Voice, Finding Our Voices, New Tools In The Box*. The paper is mainly his musings about jewellery design and designers. Gary is an accomplished designer-goldsmith with 40 years under his belt. He is well versed in CAD design and 3D printing. However, he worries about CAD-based jewellery designs having a limited vocabulary; namely mirroring, arraying and perfect symmetry. CAD/CAM and

3D printing have already produced volumes of look-a-like commercial jewellery designs and as the CAD systems become more automated it is likely to get worse rather than better.

Although, the sample is small, it seems that at least the community surveyed may be avoiding the calamity that rubber moulds brought to jewellery design in the US, half a century ago. Perhaps England will become, or already is, the go to place for well-crafted handmade jewellery, but I would argue that that does not preclude using advanced technology to get there.

The question is, should computer aided technology have a place in jewellery production? In my opinion, the answer is absolutely yes. I feel certain that my survey does not tell the whole story of jewellery making here. Names like Lionel Dean and Grant Mc Donald are top of mind as people who are on the cutting edge using advance technology in jewellery design and manufacture and Frank Cooper has spent years educating his students in the use of computer aided technology.

There will always be exceptions, but in general we are not far away from a time when the jeweller from 1989 would not be able to function in a modern jewellery shop. Computer aided design will be the prerequisite to jewellery making and those who don't embrace it will be in the same place as jewellers who rejected the rolling mill and continued to hammer sheet from ingots, they will find it hard to compete. My message and hope is, that the emphasises is on creativity and we don't repeat the days when lost wax casting degraded our output.

Thank you for your time and attention.