

The Snowflake Effect: The Future of Mashups and Learning

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About the author

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Introduction

We are all unique individuals and every situation too – at work, at home, and in the community – is unlike any other; as unique as every snowflake. Yet despite this fundamental truth which has arguably been true for all time, the world seems to be designed for the opposite: sameness.

Education and training are prime examples: you start by specifying a group of students based on a set of common characteristics, creating a common curriculum, and then present it as if all students progress at the same level and are headed for the same destination. This approach of mass production and design for the masses is understandable given historic requirements for the workforce and the constraints on resources that existed prior to the current state of mass abundance and great reach that we live in today. Without a doubt, this conventional model of learning is failing more and more individuals, not because of its poor application or lack of funding or class sizes, as research shows, but because it cannot meet today's requirements and those of the future for people who need to increasingly solve unique problems.

Even as our technological capabilities and need for learning increase exponentially, learning continues to follow a linear path. For instance, current models are not helping people to enter the workforce quickly and with the appropriate skills. Even when people have the skills and knowledge required when they start a new job, their ability to maintain their readiness as the job's requirements evolve, or as they move on to new positions, is falling short. Due to the increasing rate of change, anticipating those requirements is also becoming increasingly difficult, since so much of it is new, unexpected and unknown.

Fortunately, we can change this. We now have the chance to invert our design assumptions from mass markets of similarity to singular markets of unique solutions for individuals. We now have the opportunity to adopt an approach which focuses on design for mass personalisation and uniqueness called the Snowflake Effect. This is not just an ideal. Rather, it is a realistic, achievable goal, enabled in part by the continued dynamics where our access and capabilities are increasing exponentially upward while costs are dropping exponentially downwards. While we can expect these exponential rates of change to continue, they do not themselves represent the change required. The critical change is in our approaches and the conceptual models that we use to shape and build the world around us. It is in this light that the uses of mashups, particularly as an overarching conceptual model, offer the most promise and is the focus of this article.

Mashups to the rescue?

For those who may be unfamiliar with the term 'mashup', it can simply be described as follows:

A mashup is the assembly of pre-existing bits and pieces to create a new single result.

Clearly, this idea of creating something new from existing parts is not new, but the term is. Yet by any name, the unprecedented increase in the number of mashups being produced, and more so the increased use of mashups as a very powerful and pervasive conceptual model being applied to more and more diverse domains, provides a great example of just how powerful a simple idea can be.

Technology and market forces, combined with the broad application of mashups as a conceptual model, enable us to complete the transition from a long history where mass production and sameness have permeated the collective thinking and most cultures, to a new era where mass customisation and uniqueness are the norm and the Snowflake Effect is applied daily on a global scale for all.

Mashups as currently defined¹

The ubiquitous Wikipedia provides good information about mashups [[http://en.wikipedia.org/wiki/Mashup_\(digital\)](http://en.wikipedia.org/wiki/Mashup_(digital))]:

'A digital mashup is a digital media file containing any or all of text, graphics, audio, video and animation drawn from pre-existing sources to create a new derivative work.'

To which they also add the following definition, which is relevant to our discussion here (as well as two others for music and video mashups)

[[http://en.wikipedia.org/wiki/Mashup_\(web_application_hybrid\)](http://en.wikipedia.org/wiki/Mashup_(web_application_hybrid))]:

'In web development, a mashup is a web application that combines data from more than one source into a single integrated tool.'

Adding some additional types and details on mashups, Brian Lamb does a good job of summarising the current state of mashups in his paper, *Dr Mashup, or Why*

¹ For more further background on my perspectives on mashups, you can read and listen to some of my postings and podcasts on [Off Course – On Target](#) such as [The Future is a Marvellous and Monstrous Mashup](#), [Mishmash of Mashups](#) and [Mashed up Snowflakes](#).

Educators Should Learn to Stop Worrying and Love the Remix, where he makes some additional key terms and distinctions:²

- **Remix** is the reworking or adaptation of an existing work. The remix may be subtle, or it may completely redefine how the work comes across. It may add elements from other works, but generally efforts are focused on creating an alternate version of the original.
- A **mashup**, on the other hand, involves the combination of two or more works that may be very different from one another.
- **Content remix** and **content mashups**: In this article, I will apply these terms both to content remixes and mashups, which originated as a music form but now could describe the mixing of any number of digital media sources.
- **Data mashups**, which combine the data and functionalities of two or more web applications.

The concern

Although their potential is great, mashups as currently defined are unfortunately associated with technology and are only being applied to data and web programming. This perception is unnecessarily constraining the power of mashups. To realise their full potential, we need to see mashups as a very broad and overarching conceptual model that can be applied to much more than just data and code. It needs to include such things as manufactured goods, project teams, event, design, human roles, and learning itself.

Mashups and the Snowflake Effect on learning

The dramatic increase in the focus on the personalisation of learning is an excellent example of the Snowflake Effect taking hold. In the UK alone, three noteworthy reports concluded that personalised learning is the direction for education in the UK.³ So the debate in learning, education and training would no longer seem to be about

² *Dr Mashup or Why Educators Should Learn to Stop Worrying and Love the Remix*, paper by Dr Brian Lamb
[<http://connect.educause.edu/Library/EDUCAUSE+Review/DrMashuporWhyEducatorsSho/44592>].

³ *2020 Vision: Report of the Teaching and Learning in 2020 Review Group*
[<http://publications.teachernet.gov.uk/eOrderingDownload/6856-DfES-Teaching%20and%20Learning.pdf>].
DfES report, *Learning About Personalisation: How Can We Put the Learner at the Heart of the Education System?* [<http://www.innovation-unit.co.uk/images/stories/files/pdf/Learningaboutpersonalisation.pdf>].
DfES report, *The Shape of Things to Come: Personalised Learning Through Collaboration*
[<http://www.innovation-unit.co.uk/about-us/publications/the-shape-of-things-to-come.html>].

whether we should move towards personalisation of learning, but of how we should get there.

The promise of Web 2.0 technologies, including the current use of mashups, as a means of moving towards personalised learning in education and the workplace seems promising, but this technological approach, while necessary, is insufficient. Instead, the adoption of mashups as an overarching conceptual model that can be applied to most aspects of personalised learning (and most other domains), rather than just a specific kind of content or a particular type of technology, is one of the best and most effective ways of doing so. Nowhere else are both the promise and the power of mashups, as well as the need for fundamental and immediate change, more prevalent than in learning, education and training.

At the conceptual level, mashups can provide a multiplying effect for learning, education and training, since mashups are effective for both those who use them and those who design and create them. As we have already seen, one of the defining characteristics of mashups is that the mashups are very often created, designed and used by the same person – all of us!

Equally important, one of the key characteristics of personalised learning is the inclusion of everyone involved into the process – from the learner to the broad range of others assisting with the learning directly or indirectly. Mashups by definition, especially the expanded one being promoted here, are extremely inclusive; as with personalised learning, they tend to put the power and the responsibility more and more at the end of the model, that is, at the point of use and at the point of learning.

In the few years since their inception with music, mashups continue to grow in popularity and diversity of application. While certainly suffering at times from excessive amounts of hype, mashups are neither a fad nor a short-term phenomenon. As columnist Bill Thompson put it in his BBC article, *The Mashup Future of the Web* [<http://news.bbc.co.uk/2/hi/technology/6375525.stm>]:

‘The real transformation comes from having the ability to take other people’s content and then filter, refine, recombine and reuse it in interesting and innovative ways.’

The great promise for personalised learning is both in these new assemblies of content as effective learning resources and the transition to having learners (and a supporting cast such as teachers) active in creating them.

Mashups as a broad conceptual model: Learning by today’s examples

As noted previously, the true power of mashups will be realised when we treat them as an overarching conceptual model that we apply, where appropriate, to more and

more domains and uses. Here is a sampling from a broad spectrum of some of the newer types of mashups and applications of a mashup model to a diverse range of domains which help illustrate how this trend has already begun.

Map mashups

Mapping continues to be one of the most prevalent examples of the use of mashups and they continue to improve in sophistication and breadth of application. Mapping represents an early example of not only mashups but of the value of visualisation of data and the ability to identify patterns and trends within large data sets which are otherwise difficult to see or go unnoticed. Uses of mapping mashups in learning, education and training are, initially, relatively obvious and traditional for subjects such as geography and history. However, as we see the notion of maps and mapping extend beyond those of geography to include maps of data itself, and as we see maps as one form of visualisation, the applications and the value grow exponentially:

- **HousingMaps** mashes together data from Google Maps and Craigslist, making it easy to find a place to rent or buy in your area.
[<http://mashupawards.com/housing-maps>]
- **RealEstateFu** maps median home prices and real estate trends, and mines median housing prices from the weekly pricing reports of major newspapers.
[<http://mashupawards.com/realestatefu>]
- **Quality of Living Survey**
[<http://www.findmapping.com/bestcities/qualityliving.php>]
- **World Travel Mashup**
[http://www.videomashups.ca/world/vm_world_home.shtml]

Visualisation mashups

As noted in the previous section on map mashups, one of the major growth areas and values for mashups is their application to visualisations, especially those which assist with pattern recognition, predictions and trending. The use of visualisation to help us deal with and comprehend overwhelming volumes of data is becoming ever more important. These mashups also offer new opportunities for spotting trends and patterns that can help us see things in entirely new ways or help guide us towards new solutions. The good news is that data mining and pattern recognition are dependent on mass amounts of data, and the even better news is that tools to do just that are now trickling down into our hands, so we will see an exponential growth in the customisation of pattern recognition and visualisation.

Putting such visualisation mashup tools and capabilities in the hands and minds of learners and teachers promises to be especially powerful. Acquiring high degrees of

[<http://www.wunderground.com/wundermap/?lat=25.1&lon=-74.2&zoom=6&type=hyb&rad=0&wxsn=0&svr=0&cams=0&sat=0&riv=0&mm=0&hur=1&hur.wr=0&hur.cod=1&hur.fx=1&hur.obs=1&fire=0&ft=0&sl=0>]

- **Havaria Information Services Alert Map** (courtesy of The Horizon Report 2008): This interactive map displays data relating to severe weather conditions, epidemic alerts and seismic incidents around the world. Created by the National Association of Radio-Distress Signalling and Infocommunications (RSOE) in Budapest, Hungary, the map draws from over 200 news sources for the information it displays.
[<http://hisz.rsoe.hu/alertmap/index.php?lang=eng>]

Timeline mashups

Relatively straightforward, but no less powerful, is the increasing ability to add time and timelines to other data, as shown in the examples below. The dinosaur timeline is also an example of the use of a timeline 'widget' or tool that can be used to add the dimension of time to any other mashup someone wants to create. It takes little time or imagination to start to come up with a long list of ways that this can be used to create great learning resources:

- **Newsline**: Mashup placing news articles on a timeline.
[http://www.dipity.com/mashups/newsline/compare/Newsline_Article_Search_Obama,Newsline_Article_Search_Mccain?query1=obama&query2=mccain]
- **TimeTube**: YouTube videos on a timeline.
[<http://www.dipity.com/mashups/timetube>]
- **Tickr**: Flickr photos on a map.
[<http://www.dipity.com/mashups/tickr/Sunsets/World>]
- **Earthquake Mashups with Google Maps**: A work in progress creating a mashup-making tool that combines earthquake data with Google Maps using a timeline.
[http://www.oe-files.de/oefiles/gmaps/eqmashups_html]
- **Dinosaur Timeline**: Shows timeline of geological-scale events (recommended to be viewed on a large monitor).
[<http://simile.mit.edu/timeline/examples/dinosaurs/dinosaurs2.html>]

Education targeted mashups

These are all from the recent Mashup Awards, which can be accessed at <http://mashupawards.com/category/education>. Here are two examples:

- **LazyLibrary**: This mashup pulls in book data from Amazon and filters out anything with more than 200 pages. Add to that an exceptional user

interface and you have one solid service for anyone looking to get more out of reading less.

- **Find the Landmark:** A maps mashup game where the objective is to find a randomly assigned landmark within a Google Maps view of the world. Compare your score with others and rate landmarks that you locate. If you have not already thought of it, this shows how mashups can be also be used to create effective testing resources.

Mashup browsers and browsing

The newest generation of browsers, perhaps the single most commonly used program of all, provide evidence of the application of mashups as a concept. New browser features – such as Ubiquity for Mozilla, for example – enable users to create their own ‘commands’ quickly and easily, without the need for programming skills and directly within the browser.⁵ These commands are in themselves mashups that are available to you, and that you can make available to others.

Significantly more powerful examples are found in other new capabilities within the new generation of browsers, such as the concept of mashups and microformats rolled into one – what the new Microsoft Internet Explorer 8 calls ‘web slices’ [<http://www.microsoft.com/windows/internet-explorer/beta/features/web-slices.aspx>].

These trends offer the potential for not just user-generated content (unless we want to refer to code as ‘content’), but user-generated tools. While it is unlikely that everyone will do so, it is now possible for anyone using common tools such as browsers to create tools for creating more content and more tools; again enabling exponentially scalable solutions.

Mashups of our collective intelligence via photos

A particularly compelling example of the power of mashups is the recent release of a combined set of tools (in itself a mashup) called Photosynth, which was developed by the University of Washington and Microsoft Research.⁶ Photosynth can take a large collection of photos (gathered through a browser search, for example), analyse them for similarities, and display them in a reconstructed, three-dimensional space

⁵ The video on this [announcement of Ubiquity by Aza Raskin](#) is worth watching to get a fast understanding of what Ubiquity does and how it works.

⁶ As is often the case, seeing is believing and worth a lot of words, so I would strongly encourage you to first take a few minutes, 7 minutes and 42 seconds to be precise, to watch this video of a TED Talk [http://www.ted.com/index.php/talks/blaise_aguera_y_arcas_demos_photosynth.html] given in 2007 by Blaise Aguera y Arcas, one of the main developers of the technology. You can also read more details and get more demonstrations in this Wikipedia overview of Photosynth [http://en.wikipedia.org/wiki/Microsoft_Live_Labs_Photosynth].

with each of the individual photos properly registered to their respective location in the 3D model.

Photosynth provides an enormous enhancement of automated registration and metadata tagging, finding the commonality of images, the creation of these 3D models and the network effect that comes from combining photos from any source. You can:

- zoom in from outer space down to Earth using Google Earth and MS Virtual Earth. Then when you get to street level, you can look around any area not only with satellite imagery, but with the added information drawn automatically from the millions of photos that are being uploaded daily by anyone on any of the many online photo storage services.
- go inside buildings by 'seeing' things through all the photos that are stitched together to create 3D models, and have each photo registered in the right place.⁷

How could this form of a mashup-creating tool be applied to teaching and learning? You and your students could build some amazing history, geography, art or other subject learning resources 'on the fly' on an as-needed basis. You could reconstruct a field trip after the fact or set out on a field trip with the express purpose of capturing a location of interest, and then construct these highly detailed models from all the photos. Just imagine the new collections (or 'synths', as they might be called) that will start showing up in the thousands and then millions as this kind of technology catches on. You can do this right now! Download it [<http://livelabs.com/photosynth/>] and take it out for a spin!

The most powerful takeaway is that the merging of individual bits of knowledge – in this case, photos – creates both better and unexpected new results, such as 3D models. The information one can glean or discover is a huge step forward in human knowledge. Take some time to both wander around in some of these examples and ponder the potential of these new developments.

Mashup tools for creating more tools

We are already seeing tools and services for not only creating mashups themselves, but also the software to create mashup makers, that is, tools which can be used to create other tools that create mashups. This multiplying effect is critical for addressing the kind of exponential scaling that is needed to achieve the mass personalisation of learning, education and training globally.

⁷ Again, seeing is both believing and much better than text descriptions and you can see a demo of a scenario like this in this video showing how this is already possible [<http://www.youtube.com/watch?v=CmoKB1mbNM0&feature=related>].

From merely mixing two or more bits of data together, the next step for mashups is providing simple tools that enable almost anyone to take existing components, such as feeds of data, and combine these to create dynamically changing mashups. There is already a vast choice of these types of tool-creating tools, including some from almost all of the major players in the IT industry: Google, Microsoft, Yahoo!, IBM/Lotus, Intel and Adobe. In the interest of space, and in the spirit of mashups, I will refer you to this well-done review, *Mashup Maker Smackdown* by Stan Schroeder, for more details on many of these recent examples [<http://mashable.com/2007/07/08/mashups>].

A final example is provided by none other than the UK Government, which offers more proof that this trend of the broad application of mashups is already underway. The Power of Information Taskforce [<http://powerofinformation.wordpress.com>] has been very active in soliciting good ideas from the public for 'new products that could improve the way public information is communicated'. To do so, they have been running the Show Us A Better Way competition with a '£20,000 prize fund to develop the best ideas to the next level' [<http://showusabetterway.com>]. Some of the ideas generated from the competition can be seen at <http://www.showusabetterway.co.uk/call/ideas/index.html>.

It is particularly noteworthy how the Government, which has made vast amounts of data available to be used in mashups, also added a Prototype contest: 'If you can build it, even better – we have an additional £20,000 cash to give you.' In their reference material for this prototype contest, they noted the Wikipedia definition of mashups and several of the mashup-making tools mentioned previously in this article, such as Yahoo! Pipes and Microsoft Popfly, to help contestants get started.

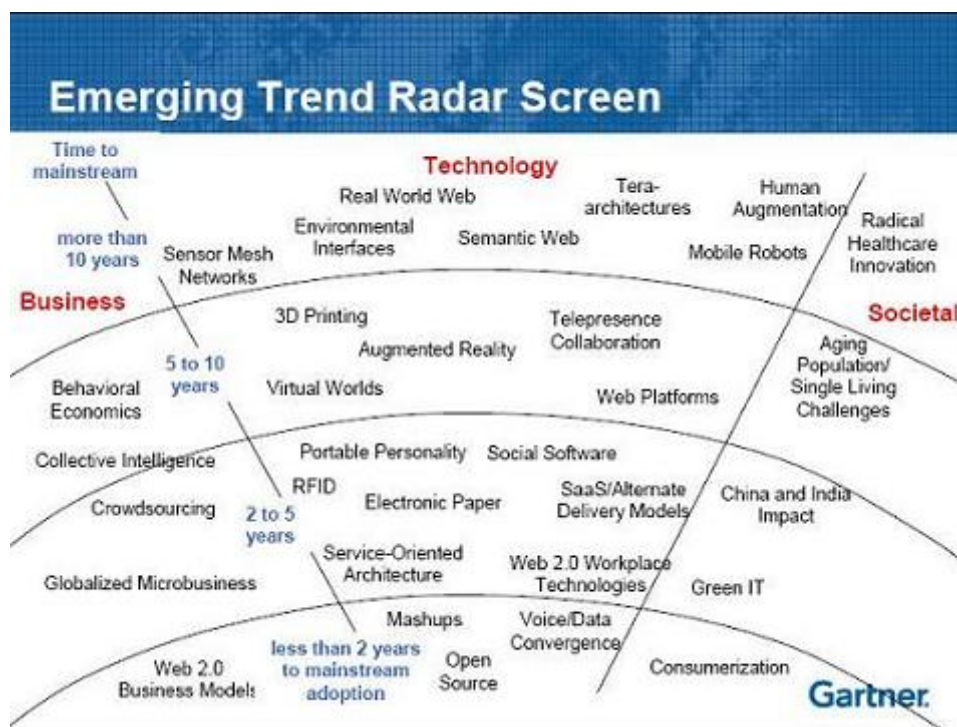
As you consider all these current examples and applications, imagine how much more relevant and engaging learning might be when learners and teachers create their own learning and teaching resources rather than being limited to those provided by static textbooks and publishers?

Emerging trends

At the Gartner ITxpo Emerging Trends 2008 conference [<http://www.gartner.com/it/page.jsp?id=681107>], Gartner predicted:

'By 2010, Gartner predicts that web mashups, which mix content from publicly available sources, will be the dominant model (80 per cent) for the creation of new enterprise applications.'

Gartner has created a useful graphical summary (see below) of its predictions of the emerging trends and their timing.



Used with permission by Gartner. Source: Gartner Emerging Trends Radar 2008
[\[http://www.episteen.nl/kennisbank/Knowledge%20Base/Emerging%20Trends%20Radar.pdf\]](http://www.episteen.nl/kennisbank/Knowledge%20Base/Emerging%20Trends%20Radar.pdf)

In addition to citing mashups specifically, a closer look at this Emerging Trend Radar Screen and the Gartner list of Top 10 Disruptive Technologies 2008-12 shows an even larger pattern of emerging trends that add to the power and potential of mashups as an overall conceptual model, as well as their application to learning [\[http://www.gartner.com/it/page.jsp?id=681107\]](http://www.gartner.com/it/page.jsp?id=681107). In particular, consider some of the following from the list:

- Social networks and social software
- Ubiquitous computing
- Contextual computing⁸
- Electronic/digital paper
- Semantics
- Augmented reality.

Imagine the potential uses of the mashup concept when paper is no longer a static medium and this continuously appealing and intuitive media becomes fully digital.

⁸ Moving from WYSIWYG: What You See Is What You Get, to WYNIWYG: What you *Need* Is What You Get.



For example, digital paper creates almost ubiquitous display surfaces, making animations or movies 'on paper' a possibility. Or as augmented reality becomes increasingly available, imagine a field trip to a historic site where you see not only the real remains of ruins but also have this reality overlaid with historical data that recreates the whole original buildings which you can 'walk through' and with virtual people and vehicles filling the streets.

Considering these broader contexts and using a larger mosaic of all these related trends, we begin to see a future where the concept of creating a mashup, where we assemble existing bits and pieces to create a new solution, becomes extremely pervasive and powerful.

Preview of the future of mashups

To help you see, understand and believe in the power and broad benefits of mashups when taken at the conceptual level and to provide a preview of the future, here are a few ways we can expect to see mashups used as an overarching concept.

Mashups of manufacturing and design

Manufacturing, arguably the originator and home base of mass production, is being transformed by mass customisation and redefined as the production of 'standard' components which are subsequently and independently assembled or combined into unique, highly customised, ultimately personalised products. What is important to note is the shift of responsibility for the design of these products. If they are going to be customised and personalised, the end user, the consumer or the 'person' in personalised must become a significant part of the design process from the beginning, and in many instances also a part of the making or manufacturing process itself. The tremendous growth of the DIY market offers one example of this trend.

In addition to things like flexible manufacturing, we are already seeing the beginning of the next wave of mass personalisation in manufacturing as 3D scanning and 3D printing become mainstream capabilities. Both of these technologies are following the typical cost/performance curves mentioned at the beginning of this article, where the capabilities go up and the costs come down at exponential rates. On the input side of the equation, 3D scanners, which are available as both stationary and handheld models, allow the design process to start with full 3D models of any existing object and thus enable the mashup of design. At the other output end of the process, 3D printers can now 'print' a complete assembly such as an internal

combustion engine.⁹ This same approach is also being used in the building industry where there are already examples of 3D printing of full walls. While it is still early in the evolution of these technologies and there are limits as to the size and materials which can be used, as they progress and become ever faster, they will enable the designs in our heads to be delivered as real products into our hands in an instant.

And what will be the effects on learning, and on our homes and shops, as these changes in manufacturing capabilities become mainstream? First, the use of these new 'on-demand' design and manufacturing capabilities for creating learning materials, examples, explorations and discovery will have a huge effect on teaching. Imagine the potential for helping someone understand how an internal engine works by having students quickly design and print in 3D a working model themselves, rather than simply showing them flashy overheads and worn-out cutaways? There will be even more significant effects on education and training as manufacturing shifts from producing finished products from raw materials to manufacturing pre-built components and/or assembling these. As this happens, 'made in country X or by company Y' will not matter much any more, but instead 'designed in country X or by company Y' becomes very significant!

Mashups of equipment

On an even grander scale of not only product size but also the extent to which the mashup concept is evolving, we are seeing examples such as navies and large shipbuilders in many countries which are now creating entire ships that are fully configurable mashups. This entirely new approach to ship design and building is based on the modular design of ship hulls as basic platforms onto which can be assembled almost infinite combinations of specific components. For example, a ship might be initially configured as an optimal coastline security vessel; then when it is assigned to a completely different mission of providing aid after a major natural disaster, it can be taken apart, reconfigured and reassembled for this very different assignment and environment.

How does this affect learning, education and training? It completely changes the training requirements of the crews of these ships. These new reconfigurable ships require a complete rethinking of almost everything on the human side of the equation, and not just the mechanical shipbuilding side. And how have navies decided to deal with this challenge? Mass personalisation of learning! From admirals to deck hands, their learning, assessments and promotions are now all customised to match them as unique individuals.

⁹ For more details on 3D printing and scanning, see *Coming Soon to a Desktop Near You: Massive Amounts of 3D for the Masses* [http://waynehodgins.typepad.com/ontarget/2007/04/coming_soon_to_.html].

This increased need to have people and organisations with high degrees of ‘readiness for the unexpected’ is becoming more and more prevalent and even the norm in some domains such as the military and medicine, where the situations and problems which need to be solved are either previously unimagined or come without much advanced warning. Readiness for the unexpected, therefore, requires people with great adaptability and the skills and competencies to respond in near or actual real time to these new and continuously changing job roles, projects and teams. Learning, education and training is increasingly being called upon to assist in building these kinds of highly personalised competencies and skills with students. This is yet another example of the combination of mashups and personalised learning.

Holistic and haptic mashups

The previous examples help to alert us to the need to take a more holistic view of mashups and their downstream effects. Let’s take this one step further and look at an even more holistic mashup example which includes extremely diverse types of elements. This type of mashup combines human senses, feedback loops, technology, multiple data types, and more.

For this I must sincerely thank my friend and colleague, Tom King, for providing the following mashup scenario:¹⁰

‘Imagine you need to pick the route of a roadway. A complex task to do quickly and efficiently. Now imagine the factors are weighted into a haptic feedback system... a joystick “resists” expensive routes. The data fed into the system included property values, construction costs (simple road, bridge, tunnel, marsh, bedrock), and population density and employment density. All that is integrated into a map with terrain data. A road that is close to the population (or where they work) is desirable, but property values may be higher. Crossing a river or mountain may reduce property costs, but increase construction costs. Expensive approaches increased the resistance and employment/population densities were “magnetic” with a gravity of sorts drawing the path towards them somewhat. It turns out people using the natural bio-feedback of their hand/musculature/nervous system responding to “force” came up with good solutions quite quickly. Considerably faster and quite similar to “expert” solutions. Nice mash-up: geographic data, biological data and system (human user),

¹⁰ For more information and ideas from Tom King, see his excellent blog at <http://mobilemind.net>.

economic data, demographic data, mechanical system, and a computer. Take out just one component and see how it works though.'

Mashups of events

The broader concept of mashups can be applied to the increasing popularity of mashup events. The 'unconference', for example, tends to be driven by the attendees who do everything from coming up with the topics and sessions they most want to be a part of, voting on these, and then attending and contributing to these sessions, many of which have just been created from this process. You can see one example of how this has been happening for the past few years at Mashup Camp [<http://www.mashupcamp.com>].

Some of the most effective conferences I have been a part of have been even more of a mashup in that they have included a full spectrum of session types from traditional conference components, such as keynote speakers and large general sessions, all through a full range to small highly customised and impromptu sessions created in the 'unconference' method. I believe we will see the application of mashups to events, which will infiltrate the conferences and conventions of most domains including those for learning, education and training. (Let's hope!)

Mashups of people, teams and competencies

Perhaps one of the greatest potentials for the application of mashups as a concept lies with us: the mashup of people. Because our jobs are becoming less and less standard, we are having more and more difficulty answering the simple question: 'What do you do for a living?' This change is also reflected in the increasing meaninglessness of job titles and job descriptions, which do not seem to reflect an individual's actual roles and responsibilities. We have a significant need and opportunity to apply the concept of mashups to finding and assembling the right people at the right time.

Imagine, for example, if it was common and easy for any of us to find 'just the right' people – with the right combination of skills, abilities, availability, costs, locations, and so on – to form a team we needed for anything from projects to sports to communities of interest and practice? While not trivial, all this would require is a significant increase in volume and access to what we might call 'personal metadata' – the vast amount of highly granular data that would fully describe all the skills, knowledge, abilities, experience, competencies and attitudes that all of us possess. This constantly growing list of attributes would change as individuals acquire new skills and experience, lose skills due to lack of use, or 'unlearn' and relearn things. This personal metadata, combined with recommender systems and other support, would increase our ability to find just the right person. We could find the right person to ask a question of, the right person to put on our project team, the right person's

presentation to listen to, and so on. Job titles, job descriptions and grouping of individuals by functional departments would all be replaced by a metadata-driven mashup model of project team formation and function.

Mashups of roles and responsibilities

The concept of mashups also works very well for people in the context of roles and responsibilities. In the case of personalised learning, it's not about simply providing the tools/technology as in: 'Give 'em a blog, wiki, mashup creator and get out of the way!' While learners are increasingly in control of all this, teachers, parents, coaches, friends, co-workers and others will still play enormous and critical roles as resources for assisting learners. However, as the control and responsibility for learning shifts to the learner, the roles and responsibilities of all involved with supporting and facilitating learning needs to shift to ones of facilitation, guidance and support rather than ones of command and control.

Using the term mashup is new but this notion of a large-scale blending of roles and responsibilities is not. In the 1960s, for example, Alvin Toffler wrote of his vision for a future where societies would change from one that was neatly divided into producers and consumers, to one of what he called 'prosumers', where each of us would be producing and consuming simultaneously.¹¹

Mashups are accelerating this trend towards a more 'prosumer' society and economy, which is much more inclusive and participatory, and specifically where we are involved in the full spectrum from design to production to consumption or use. However, the transformation to mass personalisation necessitates that we redefine the traditional product/consumer model to one of connected co-production, co-design and co-development. This change is particularly relevant for learning, education and training and is found throughout the literature and programs advocating or guiding the movement toward personalised learning.

For example, there are multiple direct references to this transformation of roles in one of the reports – *Learning About Personalisation*, published by the then DfES – referred to at the beginning of this article:

'How can we put the learner at the heart of the education system?'

'...how personalised learning could become a characteristic and culture of a whole learning system which responds directly to the needs of each individual learner.'

¹¹ Alvin Toffler books: *Future Shock*, ISBN-10: 0553277375, ISBN-13: 978-0553277371; *The Third Wave*, ISBN-10: 0553246984, ISBN-13: 978-0553246988.

‘What would happen if we started to imagine personalisation at a “deeper” level, whereby users began to take on some of the role of the producers in the actual design and shaping of the education system?’

‘At its most radical, personalisation would need not only to make users consumers and commissioners, but ultimately co-producers and co-designers.’

‘...personalisation cannot be realised without the active participation of learners in shaping the service they receive through choice, voice and, ultimately, “co-production”.’

This also requires the inclusive involvement and engagement of all within the design and development process, not a producer versus consumer model, nor a separated design/build/deliver/consume/use model. As per the other DfES paper, *The Shape of Things to Come*:

‘The point is to engage them (learners, parents, etc) far more in designing, producing and creating the learning they seek.’

All of these point towards a future of learning that is dependent on the application of the concept of mashups to not only data but to human roles and responsibilities as well.

Some challenges to the future of mashups

Understanding mashups as a concept

If we limit our understanding and use of mashups to their current definitions and use, we could easily miss their true value and potential. For me, whether the term mashup endures is not important. That we see the power and ubiquity of the underlying conceptual model is critically important to a bright future of improved learning, education and training for *all* of us.

Changing fundamental assumptions

Mashups are neither a magical nor a singular solution and we need to guard against assuming that mashups are the only choice or that everything needs to become a mashup. Instead, let’s become skilled at deciding when mashups are the right choice. More importantly, we need to change our own design assumptions from those remaining from an era of mass production and mass sameness, to one of mass personalisation and uniqueness.

More so than the content, we need to understand that when the concept of mashups is applied to personalised learning, the result is an infinite number of unique

approaches: how the learning occurs and what it looks like. As the term Snowflake Effect implies, each learner and each learning situation will be unique and different. For example, we need to be careful to *not* assume that all learners are the same in even basic ways such as being equally self-motivated. Most of the components of mashed-up learning will come from pre-existing models and approaches.

Think reuse and repurposing, not elimination

Personalisation of learning and the Snowflake Effect are about putting a focus on our uniqueness, such as helping each individual learner (all of us) to discover and design the best way of learning what they want when and where they want and need it. The uniqueness of a new assembly is a function of the combinations of previously existing parts; it does not require that all parts of the assembly itself are new. Therefore, increased use of mashups does *not* mean that traditional resources are no longer needed or are eliminated. As with past examples of how television did not eliminate radio, airplanes and cars, and e-learning did not eliminate teachers and classrooms, neither will the increased use of mashups eliminate all past forms of content, programs, applications and teaching. Instead, mashups will utilise components of these historic models and resources, typically in smaller size 'chunks' to create assemblies that are new and unique even though most or all will be composed of 'old' pre-existing parts. We can expect then that mashups will dramatically increase the reuse and repurposing of what already exists, making this a sustainable model as well.

Unlearning and relearning some historic principles

By definition, mashups are based on the reuse and repurposing of existing 'bits and pieces', and most of these will have therefore been created by others. As reuse and repurposing reaches down to ever lower levels of granularity and up to ever higher quantity and commonality, especially within learning, education and training, there will be a flood of very challenging issues to be addressed such as:

- What makes something original? Is there any such thing any more?
- Are there changes to the notion of 'authoritative source'?
- What constitutes plagiarism when most everything can be seen as a combination of pre-existing work of others?

Regrettably, there is not sufficient space in this article to address these critical questions, so I will simply raise your awareness and recommend you research this further yourself. However, I can specifically recommend that you read Brian Lamb's 'Dr Mashup' article in last year's *Educause* journal, which was previously referenced. Brian's paper has a section – 'An Assault on Originality?' – where he covers some of the concerns that mashups create, especially in education, over such things as the legal and fair use of pre-existing components to create a new derivative work. These

concerns will certainly be a part of the future of mashups and their use in learning, education and training.

The promise

The Snowflake Effect focuses on mass personalisation and unique solutions which enable the creation of just the right combinations of pre-existing components for just the right person at just the right time in just the right way. Applying this to personalised learning at a truly global scale, where every snowflake on the planet experiences 'just the right' learning every day, is as exciting in its potential as it is daunting in its enormity.

Yet as the examples and perspectives presented here have hopefully shown, mashups provide an extremely powerful, scalable and sustainable conceptual model with which to pursue these grand visions. By continuously demanding, designing and applying conceptual models such as mashups, the vision of personalised learning for all becomes a realistic and obtainable goal. The current rates of growth and spread of the mashup concept provide indications that this transformation has already begun and we only need to continue to push our expectations and applications of this powerful conceptual model as we apply it to learning, education and training.

If you believe, as I do, that the realisation of this vision for mass personalisation of learning at a global scale is as achievable as it is audacious, then the real question is: 'Can we afford *not* to pursue it?' I think not, and I hope that you do too, and will join in transforming the Snowflake Effect on mashups and learning from a vision for the future to a current reality.