Eyes wide open
3D Tipping Points Loom

Six factors will contribute to the development of 3D entertainment, and some forms of 3D entertainment will develop quickly. But to which extent 3D will be adopted by other formats, notably television, is still uncertain.

PRICEWATERHOUSECOOPERS

Summary

Ever-improving digital technology has sharply enhanced 3D entertainment. Quality, image and visual comfort are much improved, and the established markets for video gaming and animated films demonstrate a public appetite for 3D entertainment. Recent 3D film releases in the U.S. and Europe have attracted customers who pay a significant premium. Japanese and South Korean manufacturers have been very active in 3D research for television, computer monitors and mobile phones.

Yet the potential of 3D to become the new entertainment norm, particularly in homes, seems uncertain. Two breakthroughs are needed for 3D to escape its niche and become mainstream entertainment.

One key is whether the film industry will be able to produce 3D blockbusters. James Cameron's *Avatar* (scheduled for release in December 2009) will be closely tracked, and a strong showing might prod other studios to produce 3D live-action movies. The other key is on the manufacturing side. Have consumer electronics companies learned from the format and standards battles over HD video disc and video tapes? They must now decide whether to compete to become the unique 3D home distribution standard or to agree on an industry-wide standard (either one proprietary standard or one meta-standard allowing different approaches to encoding) that can be a far greater driver of home purchases of 3D televisions.

Opportunities abound. But who will rise to embrace them – and when?

To find out, PricewaterhouseCoopers conducted a survey on 3D entertainment, interviewing more than 90 players throughout the world in different segments of the video entertainment industry. Participants included rights owners, movie studios, video-game studios, independent television production companies, broadcasters, Pay-TV operators, network operators, theatre exhibitors, technical equipment providers, consumer equipment manufacturers, industry associations and start-ups.

A brief history of 3D

What draws audiences to 3D? Realism, immersion and increased emotion are the answers consistently provided by consumer surveys and focus groups. "The audience is actually immersed into the world itself. Their feelings are amplified into it, because this is much closer to how we actually see. We see in color and in three dimensions" said Jeffrey Katzenberg, CEO of DreamWorks. One survey participant said, "I've seen details I would never have seen in 2D," while another commented, "I felt like I could touch the things."

The concept of three-dimensional popular entertainment has been around for nearly a century, surging in popularity in the 1950s, when nearly 160 3D films were made. Later on in the 80's, we all saw images of the monsters from the lagoon and the flimsy red-and-green cardboard eyeglasses distributed for home viewing. At the time, projection techniques superimposed two heavily tinted images – known as an anaglyph – that could be viewed with glasses, with one red lens and one green lens. The two prints had to be projected simultaneously, so two projectionists were needed to keep the synchronization working properly. This technique proved to be a short-lived popular gimmick, probably because wearing the eyeglasses often produced complaints of nausea, headaches and eye strain among viewers.

A brief history of 3D movies
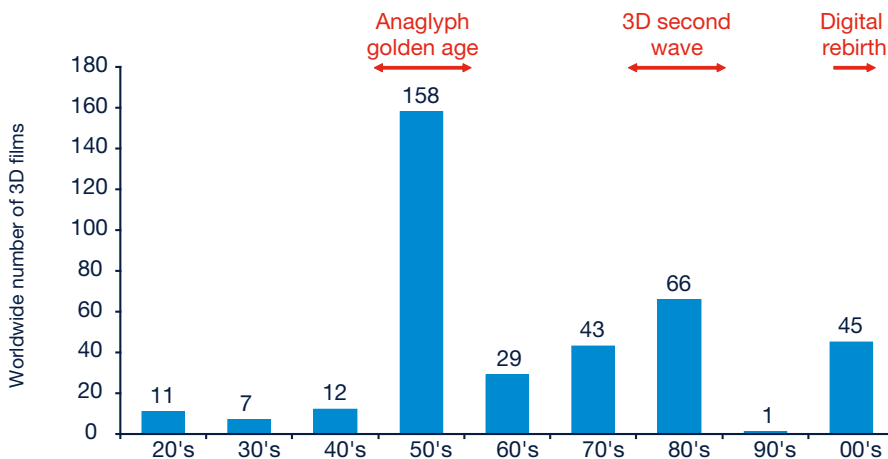
Source: PricewaterhouseCoopers analysis

Thirty years later, a much smaller 3D boom appeared, powered by IMAX. The difficulties posed by IMAX are on the projection end: the theatre screen must be very large and flat or inclined.

Recent years have brought a modest rebirth, driven by some 3D animation movies, starting with the modest and unexpected success of the 3D version of *Chicken Little* in 2005 and including *Monsters vs. Aliens* in 2009.

Snapshot of 3D Entertainment as of January 2009

	Films	TV content	Live content	Video games	Other
Movie theatre	38 3D films between 2000 and 2008		Several trials in the US (NBA, NFL, NHL) BBC rugby trial in the UK Orange football and opera trials in France		Several trials of 3D ads
TV	Telefonica anaglyph IPTV VoD trial	Japanese BS11TV channel	BskyB rugby trial Orange trial at French Open tennis		
Home video	40 DVD titles available				
Game console				Possible with current consoles	
Mobile phone				Some 3D-ready games	
PC	3D PC exists in Asia, Europe and USA			~300 3D-ready PC games Several 3D versions of online games available	
Several 3D versions of online games available					
Other displays					Existing 3D Out-of-Home advertising screens

Primer on 3D

People perceive depth with two-dimensional objects appearing at a slightly different angle to each eye. The brain processes the two two-dimensional views, works out the difference between them and translates the information into a 3D image. Entertainment media with 3D rely on the same technique: slightly different images appear at the same time on the screen, with only one image seen by each eye.
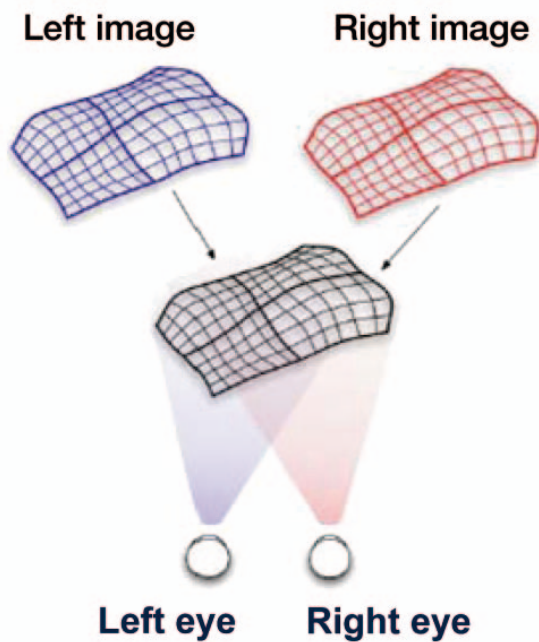
A 3D image can be created in three fundamental ways:

- Time sequential: the left and right eyes are displayed one after the other
- Co-located pixels: the left and right eye pixels overlay in space at the same time
- Spatial separation: the location of the pixels for the left and right eye images are separated in space

Stereoscopy is the most common method for capturing and delivering 3D video (see table below). It involves capturing stereo pairs of images in a two-view setup, with cameras mounted at the inter-pupil distance of human eyes. In stereoscopic display technologies, the viewer wears 3D glasses, which force the line of sight so that each eye sees only one picture. *Auto-stereoscopy* does not require any glasses; it uses multiple 2D images on a screen, and the viewer perceives a different image with each eye – if the head is held in the proper viewing position. A newer approach is multi-view capture, which uses arrays of many cameras to capture a 3D scene through multiple independent video streams. But multi-view technologies are not yet ready for the mass market.

Family	Glasses	3D by		Technology	Maturity
Stereoscopic	Yes passive	Colour filter	Broadband	Co-located pixel	Mature
			Narrowband	Time sequential	Emerging
		Polarisation	Circular / Linear	Co-located pixel	Mature
			Circular/Linear	Time sequential	Emerging
	Yes Active	Alternative frame sequencing		Time sequential	Mature
Auto-stereoscopic	No	Parallax barrier		Spatial separation	Experimental
		Lenticular		Spatial separation	Experimental

Auto-stereoscopic technology, which frees consumers from having to wear special 3D glasses, has thus far been held back by several factors:

- "Sweet spots" on the screen produce an appropriate 3D effect only from certain viewing angles. This might require viewers to stay in a particular posture or position for a long period, which is likely to lead to discomfort.
- The cost of auto-stereoscopic TV screens is much more than those of stereoscopic ones.
- Main theatre groups have adopted the stereoscopic 3D formats and screens.
- True multi-view technologies require far more transmission capacity than stereoscopic technologies, which require no more than 50% additional capacity (multi-views can require more than 200%).

Auto-stereoscopy is therefore likely to be adopted only by some niches, such as digital signage and mobile screens. This is reflected in the decision by Philips in 2009 to stop supporting auto-stereoscopy and to adopt stereoscopy for its mass-market television screens.

The growth drivers

With increasing frequency, hit films involve animation or computer-generated imagery. What promise does this rebirth of 3D hold? Is a new and different phase unfolding, in which 3D will take its place as mainstream entertainment? Or will it subside once more, as the novelty wears thin?

To find out, PricewaterhouseCoopers conducted a survey on 3D entertainment, interviewing more than 90 players throughout the world in different segments of the video entertainment industry. Participants included rights owners, movie studios, video-game studios, independent television production companies, broadcasters, Pay-TV operators, network operators, theatre exhibitors, technical equipment providers, consumer equipment manufacturers, industry associations and start-ups.

The survey identified six factors that may contribute to a growing 3D market. PricewaterhouseCoopers concludes that some forms of 3D entertainment will develop relatively quickly, but how rapidly 3D will extend to other formats, notably television, is uncertain.

What is different now? In addition to the always present interest of consumer electronics manufacturers in accelerating the replacement of existing video equipment, PricewaterhouseCoopers has identified six factors that could make 3D entertainment successful this time:

1. The introduction of digital 3D display technologies and the improvement in image quality offer a significantly better customer experience and ease of use. Furthermore, digital 3D requires only relatively minor theatre upgrades to digital screens and is much easier to use compared with the older systems, because of the digital synchronisation between projectors. Multiple consumer surveys and focus groups have consistently found that the two benefits provided by 3D entertainment are "3D is the natural way of perceiving the reality" and "3D increases viewer immersion into the content".

Video games

	Strongly agree	Somewhat agree
3D is what I would like at home	21%	31%
3D makes games more compelling	22%	35%
3D effects make games more enjoyable	27%	33%

Movies

	Strongly agree	Somewhat agree
3D made the story more compelling	17%	29%
3D is something that I would like at home	19%	28%
3D effects make movies more enjoyable	23%	32%
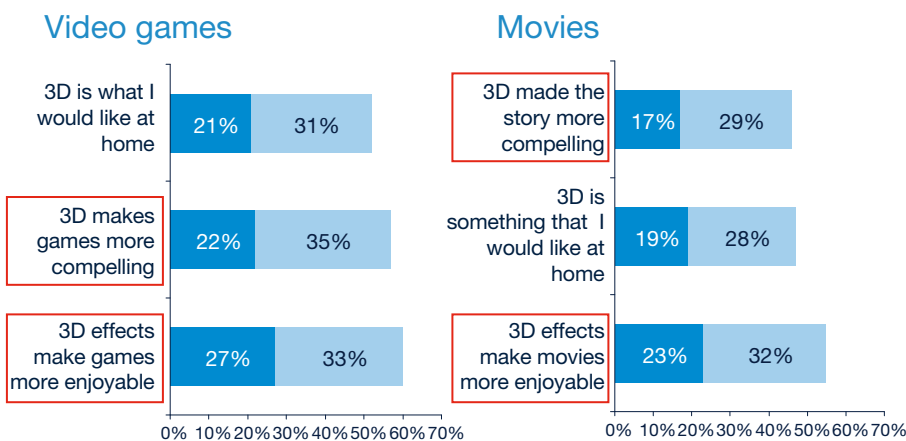
Source: Quixel, PricewaterhouseCoopers analysis

■ Strongly agree   ■ Somewhat agree

2. Consumers in the US and in Europe have demonstrated a willingness to pay a premium for 3D content. For the 3D version of the Hannah Montana concert film, tickets sold for $US15 to $US25, while average US ticket prices are approximately $US7 for a traditional movie and $US40 for a concert. This proves that the immersive power of 3D for recorded live performance content creates a customer experience whose value falls in between a traditional movie and a live concert. Incremental revenue generated by 3D has been the key driver behind the current digital cinema deployment around the world. (While Asia has been at the forefront of innovation for 3D equipment, evidence has not yet emerged of commercial success for 3D content.)

3D generates higher admission and revenue per screen than 2D for traditional movie genres...

Historical performance of 3D movies on opening week end

USA — Monster vs. Aliens

	# of screens	Box Office
3D	72%	45%
2D	28%	55%

France — Up

	# of screens	Box office
3D	81%	68%*
2D	19%	32%*

*: Estimate
Source: Press, Interviews, PricewaterhouseCoopers analysis

■ 2D ■ 3D

...and even more for concert movies and live sport broadcasting events
(e.g. Hannah Montana concert film)

Price (in US$)

In addition, 3D Box Office revenues 20% higher than CD+DVD ones

	Price
Average 2D theatre ticket price	6,9
Average 3D theatre ticket price	15 – 25
Average Concert ticket price	40

3. The upgrade to HD (from SD, or standard definition) has removed many technical obstacles for the 3D roll-out, especially in terms of upgrading post-production equipment.

	Content creation	Capture	Post-production	Distribution	Reception
SD / HD upgrade		▪ Need for new cameras and for new shooting techniques	💣 Need for new expensive equipment	💣 Approx. +100% incremental bandwidth requirement vs. SD	💣 New for a new expensive TV screen 💣 Standard issue
2D / 3D migration	💣 Need for a new "cinematographical grammar" (scenario, storyboard, …)	▪ Need for new cameras and for new shooting techniques	▪ Manageable impact on the edition and the integration of visual effects	▪ 0 to 50% incremental bandwidth requirement vs. HD	▪ Need for a new TV screen but limited price upgrade 💣 Standard issue

No / limited impact **Manageable impact** **Potential barrier**

4. A quantity of attractive 3D-ready content, which requires neither prohibitive production costs nor distribution standardization, is available. Toy Story and Quake (both 1995) used 3D Computer Generated Images (CGI) and changed the way animated films and video games were made, even before they were released in 3D. Now, the increasing use of CGI in films and video games provides significant material that could be converted into 3D with limited incremental production costs.

5. Significant progress is being made on the issue of standardization, a sharp improvement from the situation before the standardization of HD DVDs.

		Production format	Distribution format	Visualisation format
Theatre	Stocked movie content	■ No format issues as no standardisation is required	■ Compression and encoding formats are already largely standardised by DCI and only some minor issues remain	■ 3 visualization formats (RealD, Dolby, Xpand) ■ No format issues, no standardization required
	Live broadcast	■ MPEG2 or 4 compression, no real-time encoding standard ■ One real-time encoding format (Sensio) is the most often used by broadcasters		
TV	Stocked movie content	■ No format issues, no standardisation required	■ Approximately 10 different encoding formats, but HDMI 1.4 should handle 6 different standards ■ Lack of standardisation is a serious limitation to 3D production on TV	■ Images are displayed following numerous visualisation formats ■ HDMI 1.4 specifications require that 6 standards should be accepted by 3D TV
	Live broadcast	■ Limited risk as 3D live TV programs should initially be broadcasted by players controlling the distribution standard through their head-end and set-top box ■ Some risk for feed produced and encoded by other players		
Video games	Console games	■ Proprietary standards	■ Standardized by HDMI	
	PC and online games	■ No standard issue considering the number of existing 3D players available on the Internet		■ Multiple visualization standards can be managed by GPUs

6. Most screens, both TV and film, could easily become 3D-ready in the long term (although it is highly unlikely that all content will become available in 3D). The 3D chipset price is estimated at a very modest US$20 per TV screen and could be further reduced by manufacturing. The business case for digital and 3D cinema, which was already obvious from a value chain perspective, is incrementally improved by the higher attendance and revenue per seat generated by 3D films.

Is 3D likely to become the new Entertainment standard?

A number of factors should limit 3D adoption:

- Approximately 20% of people who attended a 3D movie did not like it, citing eye fatigue, the eyeglasses and other issues
- About 5% of people are "stereoblind" and cannot see in relief
- Stereoscopic 3D is not compatible with consumer habits for TV viewing; wearing 3D glasses interferes with preparing and fetching snacks, multitasking with a laptop or PDA, or having a conversation with someone in the room.
- Even in developed countries, the majority of TV purchases are driven by price, making even the small $US20 premium too high for some households
- 2D content cannot be qualitatively converted into 3D and 3D offers no benefit for content in which immersion plays little role
- 3D requires film directors to rethink the entire film production process from the script writing to the shooting and the post-production and the example of digital camera shows that adoption requires time
- "The negative production costs of a 3D movie are between 5 and 10% higher for computer-generated animation movies and 10-15% higher for live-action movies" according to Sony Image Works, explaining why many live-action movies are likely to use 3D Computer Generated content (*e.g., Avatar*).
- And "only a minority of films will be able to justify the 5-15% incremental negative production costs, even in 10 years." states David Wertheimer, CEO of USC Entertainment Technology Center states.

So with all the progress made in 3D video games and cinema, the massive home television market will be harder to crack.

Which form of 3D entertainment ?

A 3D cost/benefit analysis for different entertainment formats highlights that some should rapidly adopt 3D, while the benefits for others are less obvious:
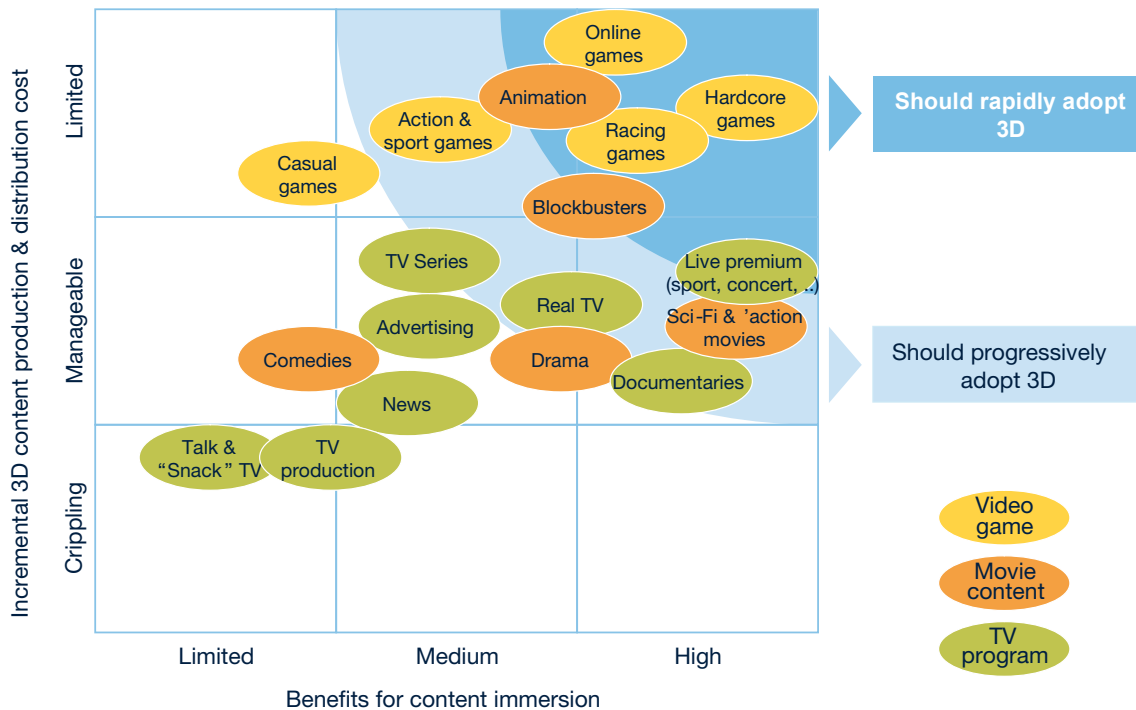
We feel that 3D will quickly prove popular with some customer segments:

- Hardcore gamers (those who play heroic fantasy, action racing or fighting games, for example). According to Ubisoft, car racing games are particularly adapted to 3D, as they increase players' immersion (first-person-shooter games are not adapted to 3D as they require too-rapid movements, especially side to side.

- Young moviegoers, particularly those with a preference for animation, horror films or concert movies

- Early adopters willing to pay for live event broadcasts on TV. Interviews conducted by PwC with various broadcasters throughout the world, including Fox Sports, NHK, BBC, Sky and Orange, all confirm that live sport and live music should be the most appropriate programs for 3D TV.

- Home theatre fans who want to replicate the theatre experience in their homes

For 3D to move beyond these customer segments and be adopted by other populations and entertainment formats – action or sci-fi films, other action and sports video games, television programs – will depend on two tipping points:

- 3D encoding standardization – will competitors join together to create a unique or interoperable standard, or will each compete to have its own standard win out?

- Will high-visibility 3D projects achieve commercial success and generate additional investment in 3D content? In addition to James Cameron's *Avatar*, Tim Burton's *Alice in Wonderland* and Steven Spielberg's live-action *Tintin*, will surely draw attention to the possibilities of 3D. Other commercial initiatives that could boost 3D adoption include 3D iPod, PS4 and Xbox 720, 3D Blu-ray and 3D blockbuster video games (such as the 3D version of *Assassin's Creed*).

Our scenario for 3D entertainment

Our expectation is that 3D entertainment will have a modestly successful takeoff in 2011 with 3D movies being the most advanced segment. We do not expect the mass adoption of 3D TV before 2012, in line with London 2012 Olympic Games and the availability of next-generation 3D-Ready game consoles.

3D Movie

The development of 3D movies is conditional on the production of quality 3D movies, by the penetration of digital cinema and by the share of 3D screens amongst digital screens.
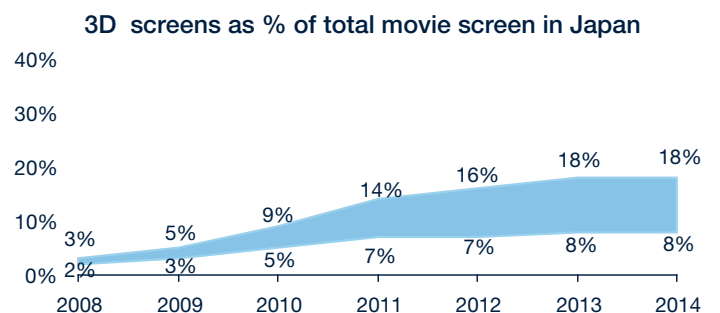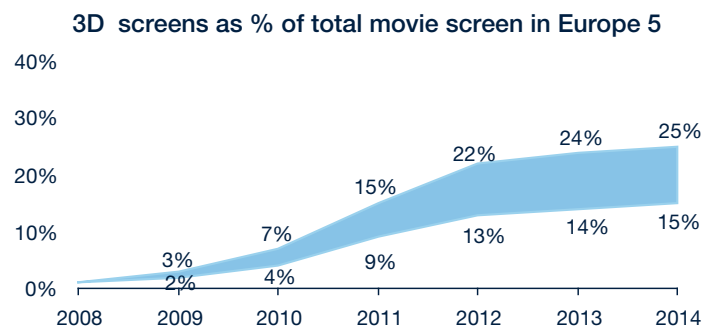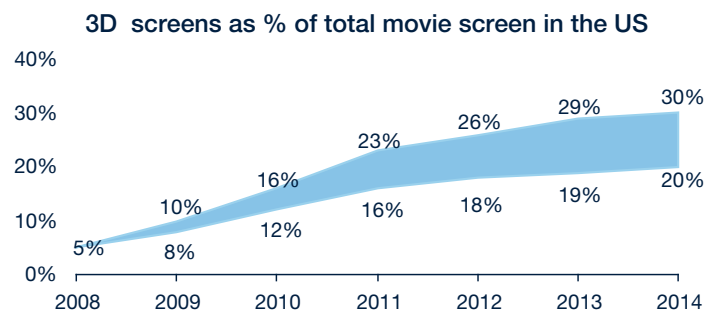
Our scenario for the production of 3D movies anticipates the following:

- The two main US animation studios (Pixar and Dreamworks) have already committed to produce a 3D version of all their animation movies from 2009 onward

- The commitment of most US majors will depend on the future success of these films and is expected to remain marginal compared with their film slate (i.e., limited to some blockbusters and to some content categories such as horror, sci-fi or concert movies)

- The production of 3D movies outside the US (in Europe 5 and in Japan) will remain limited to some animation movies and some trials (e.g., "Fly me to the moon")

- By 2014, 3D incremental production costs will continue to be dissuasive for some production budgets but the main barrier will continue to be 3D adoption by directors

Overall our scenario anticipates that 3D movies will represent 10 to 15% of the films released each year in the different countries.

Our scenario for the penetration of 3D screen anticipates the following:

- The adoption of digital distribution is expected to be strong among the multiplex and large urban theatres and more limited among the small theatres

- Multiplex and large theatres are expected to have at least one large 3D and one smaller 3D screen per site

- Flexible 2D/3D solution could also be adopted by some theatres

- High 3D penetration in 2008 combined with the continuation of the VPF mechanism drive the 3D screen penetration in the US

- Physical 3D screens have not been considered in our scenario

3D screens as % of total movie screen in the US

Year	2008	2009	2010	2011	2012	2013	2014
Upper	5%	10%	16%	23%	26%	29%	30%
Lower	5%	8%	12%	16%	18%	19%	20%

3D screens as % of total movie screen in Europe 5

Year	2008	2009	2010	2011	2012	2013	2014
Upper		3%	7%	15%	22%	24%	25%
Lower		2%	4%	9%	13%	14%	15%

3D screens as % of total movie screen in Japan

Year	2008	2009	2010	2011	2012	2013	2014
Upper	3%	5%	9%	14%	16%	18%	18%
Lower	2%	3%	5%	7%	7%	8%	8%

3D TV

The development of 3D TV depends mainly on the availability of quality 3D content and the adoption of 3D TV by end users.

Our scenario for the availability of 3D TV content anticipates the following:

- The consumption of 3D content on TV will be mainly driven by 3D video content, 3D console games and 3D TV programs

- The development of 3D video will depend on the production of 3D movies (which are expected to represent 10 to 15% of the films produced each year) and the release of 3D versions of some blockbusters such as Star Wars. 3D video will be available on both the physical format (Blu-ray) and the digital format (VoD)

- 3D console games are expected to be available from 2011 and 2012 onward

- The main 3D programs which will be broadcasted will likely be limited to live-performance events (e.g.,premium sport games, concert, opera)

- Sky among other broadcasters is expected to launch 3D TV channels by 2010 (3D VOD and insert of 3D programs in 2D channels) and to be very aggressive for London 2012

- These contents are expected to be distributed in premium Pay-TV packages (on satellite, cable and fibre) and on Internet

- The adoption of 3D by other TV content categories should remain limited

Our scenario for the adoption of 3D TV anticipates the following:

- 3D TV is already available in the US (Samsung and Mitsubishi)

- The standardization of 3D home distribution is expected to be finalized by 2011/2012

- Considering the low incremental price for the 3D TV model (3D chipset price is expected to be lower than 20 US$), most high-end TV models will be 3D-ready even though this functionality is not used by end-users

- The proportion of households with one hardcore gamer is around 10-15% in each country

- The same ratio exists for home theatre fans

- The scenario anticipates a worldwide 3D TV promotion campaign in 2012 for the London Olympics
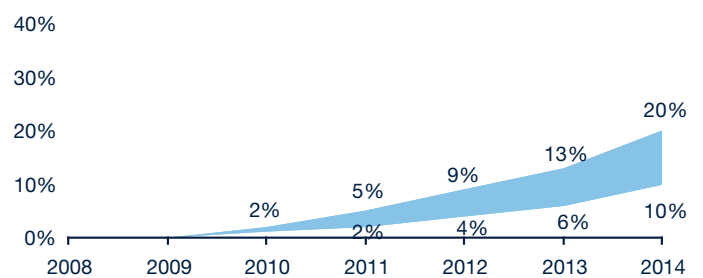
3D TV penetration of US households (in %)
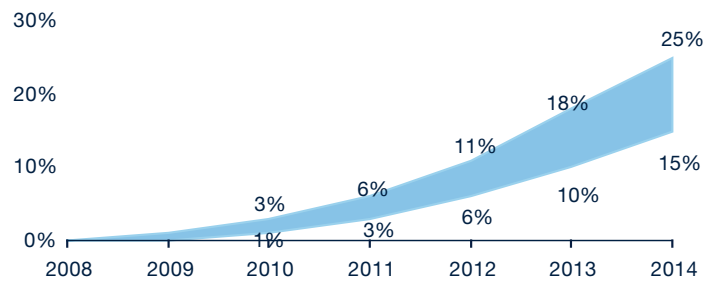
3D TV penetration of Europe 5 households (in %)
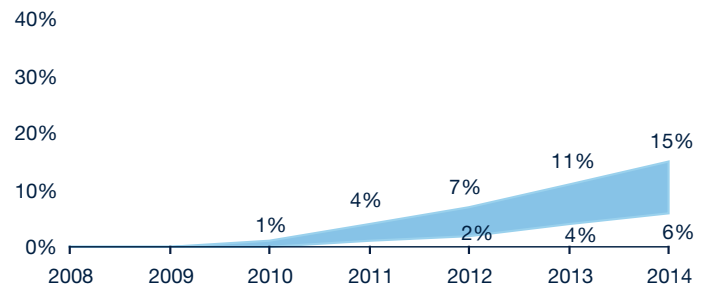
3D TV penetration of Japanese households (in %)

3D PC

The development of 3D PC is mainly conditional on the availability of quality 3D Internet content and PC games content and by the adoption of 3D PC monitors by end users.

Our scenario for the availability of 3D Internet content and PC games anticipates the following:

- Quality 3D PC games are expected to be commercially available before the next generation 3D-ready consoles
- Some 3D Internet content will be progressively developed but its adoption is expected to remain limited to the early-adopter segment
- The availability of 3D camera will allow the development of 3D content (photos)
- The development of semi-professional User Generated video content will also marginally develop and drive some usage

Our scenario for the adoption of 3D PC anticipates the following:

- Fixed monitors can easily be upgraded to 3D as long as they have a 120 Hz frequency
- Most hardcore gamers are expected to upgrade their PC to 3D
- The availability of 3D-ready laptops will remain limited, as 120hz models will have a prohibitive price premium and will require better performing batteries
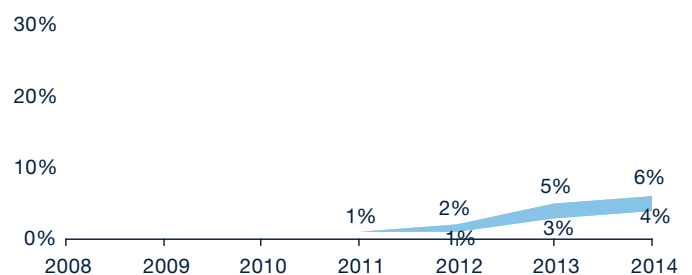
3D PC penetration of US households (in %)
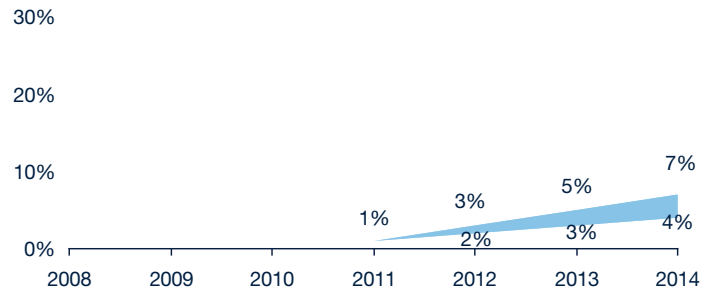
3D PC penetration of Europe 5 households (in %)
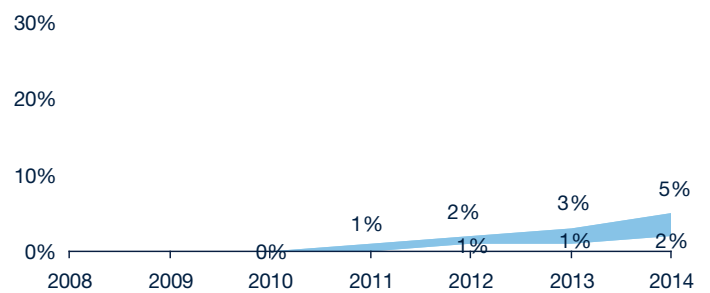
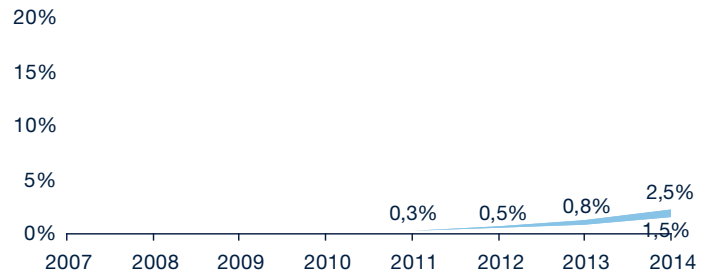**3D PC penetration of japanese households (in %)**

3D Mobile

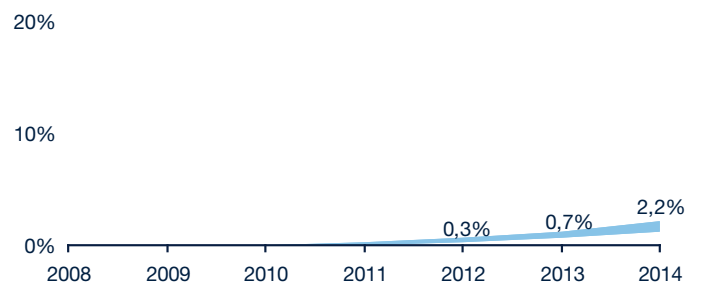The development of 3D mobile phones is expected to remain marginal for two main reasons:

- The limited incremental benefits provided by 3D
- The lack of interoperability between the different standards (a 3D picture captured by one model cannot be displayed on another 3D model from a different manufacturer)

The first 3D mobile phones are already available in Japan but have had so far a very limited success.
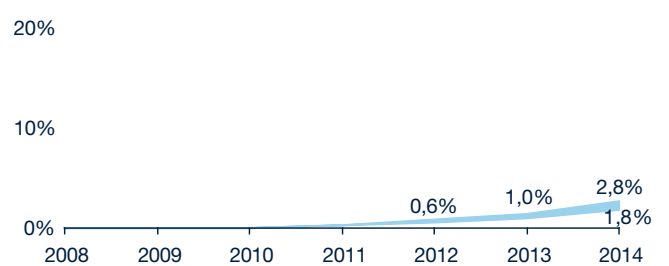
3D mobile phone penetration in the US (in %)

	2007	2008	2009	2010	2011	2012	2013	2014
					0,3%	0,5%	0,8%	2,5% / 1,5%

3D mobile phone penetration in Europe 5 (in %)

	2008	2009	2010	2011	2012	2013	2014
					0,3%	0,7%	2,2%

3D mobile phone penetration in Japan (in %)

	2008	2009	2010	2011	2012	2013	2014
					0,6%	1,0%	2,8% / 1,8%

Implications of 3D
for the industry

Yet there are four reasons why the 2D-to-3D transition may be more than just a technical upgrade and may transform 3D entertainment by accelerating some latent trends in the telecom/media ecosystem:

1. The trend toward digital media and media delinearization could be accelerated by 3D, as the Internet environment is less constrained by standards or bandwidth.

2. Game console manufacturers are better placed than TV manufacturers to address the 3D home video market, thanks to the strong fit between 3D and the gamer population, their position in the video-on-demand market and the performance of the current generation of fixed consoles, which are already 3D-enabled.

3. The introduction of 3D broadcasting could accelerate the roll-out and adoption of high-capacity broadcasting networks (such as digital cable, satellite and fibre) at the expense of capacity-constrained systems such as traditional land-based broadcasting, analogue cable or standard-definition Internet protocol TV

4. 3D could provide the opportunity for movie theatres to re-invent their value proposition to customers by developing offers around live 3D broadcasts that would complement the film exhibition business.

Concluding remarks

Should these changes take hold, a vast market awaits. But many questions remain to be answered, and PricewaterhouseCoopers can help you navigate through the challenges by findings answers. Among the key questions:

Movie producers must determine when to start massive investments in 3D production. This will depend on their analysis of what technology is available, which genres are most enhanced by 3D presentation and which audiences are likely to respond most enthusiastically.

They must ask, "Where will our 3D expertise come from?" Expert practitioners will be needed in both shooting and production: should this expertise be brought in-house, subcontracted out or obtained through the acquisition of specialty firms? Among the other issues the studios must find answers to are the integration of special effects in a 3D movie, whether continuing online piracy will jeopardize the investment in 3D and how quickly 3D can be integrated with BluRay technology, enhancing the appeal of each. As talks continue within each studio and among competitors about how best to establish 3D broadcasting standards, each will have to decide where it stands and where to find allies and sympathetic parties.

Game studios must assess the potential of 3D games – for the PC, for mobile devices and for the online environment. In each case, the studios must calculate how best to time product introduction.

Internet companies must grapple with the issue of User Generated Content, and how well it meshes with 3D. Can they introduce content of value, or should their focus be on the professionals and semi-professionals who create UGC?

Channel operators must assess the potential revenue of 3D video on demand (VoD), and how best to develop it. They will do this as they are assessing the potential digital dividend for European land-based broadcasters.

Pay-TV distributors must consider how to acquire 3D content rights. That, in turn, will be shaped by their choice of distribution technologies, which will shape their attitude toward 3D broadcasting standards. How will the content be most profitable: premium channel, pay-per-view, VoD and subscription VoD? With the rights in hand, what strategy is best for distributing the content: should they seek partners? And where should the content come from: should it be purchased, contracted for or developed? Among the factors to be calculated are the trade-off between the promise of 3D and the capabilities of the installed base. How quickly should the transition be made from the two-images-made-into-one-by-stereoscopy to the new digital 3D technologies, as they emerge? How long will that transition take?

Also to be considered is the competition: connected devices – game consoles, video players and television sets – and online distribution, each with the ability to capture a share of the VoD revenues.

Broadcasting networks must quickly develop strategies for high-capacity networks, and, like the TV channel operators, assess the potential digital dividend for European land-based broadcasters. The interplay of 3D broadcasting standards and constraints on network capacity is a complexity to be resolved.

Movie theatre operators must work out how to finance the modifications needed for 3D and how to price 3D to recoup their investment. Whether and when to diversify with live 3D broadcasting must be established.

Game console manufacturers must determine when to roll out their next-generation 3D-ready consoles. At the same time, they must consider the competition from 3D online games and whether 3D will enhance their ability to penetrate the European VoD market.

Consumer electronics manufacturers must first see if they can agree on a 3D TV standard in the common interest. They must calculate how to price 3D TV sets for a very price-conscious marketplace of consumers. And they must work out their relationships with the connected TV ecosystem. In parallel, they will have to assess the potential of new 3D entertainment such as 3D cameras, of live TV or video 3D coding or of 3D head-mounted display.

About PricewaterhouseCoopers

PricewaterhouseCoopers is a leading professional services organization for the Communications, Entertainment & Media and Technology industries, providing industry-specific advisory, assurance and tax services to help clients manage risk, maximize shareholder value and support M&A activities. Our practice offers a diverse industry-dedicated team of professionals that provide solutions to critical issues facing companies across these convergent industries.

PricewaterhouseCoopers can help you prepare and navigate the changes by providing advice and assistance based on our strategic, economic, financial, analytical and business process skills in the development and implementation of your strategy.

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