



### Mary and Max – an e-motional experience

In mid 2007 I had the opportunity to join Academy award winning director Adam Elliot in shooting his first feature film *Mary and Max*. Previously Adam had made short films undertaking multiple roles as writer, director, designer, model maker, cinematographer and animator. But making a feature film meant these tasks would have to be performed by a large team of specialised people. In all the production hired about 50 people for a period of 15 months. The actual animation took 12 months to film at a converted warehouse studio in Balaclava, Victoria.

To make sure the film fulfilled his vision, Adam created a bible to be followed carefully by all the model makers and set builders on the crew. He chose a specific range of colours and decreed that no colour could be used in the film other than those defined in a master palette. He drew detailed pictures all the main characters which were then sculpted in clay for approval. All the props for the film were similarly defined as well as their style, which became known as “chunky and wonky”. ie. There were to be no straight or parallel lines, and everything should have a handmade quality. Finally there would be minimal use of computer generated images. Every visual element in the film had to be made by hand and photographed in camera.

Now this is an unusual demand in the age of computer visual effects and one which begs the question – does it actually make a visual difference and will the audience notice? In general I believe it does. If you compare *Mary and Max* with mainstream stop-motion films (usually with much bigger budgets), they do look much slicker but tend to lose some of their handmade quality, to the extent that many viewers assume they are watching computer animated images. Part of the reason for this is that even when practical puppets are used, the images are frequently processed in software to remove imperfections and handling marks. Ironically these films then start to resemble computer 3d animation and lose the very qualities which were their original reason for being.

The main exception to the no CGI rule in *Mary and Max* was to removing rigging. In order for the puppets to walk and move around they required rigs made of metal rods and ball joints to support them. These had to be painted out in post-production, but didn't involve any "creation" of new elements and so fitted in with Adam's rule...



Animator Anthony "Aristotle" Lawrence creates watery magic for the camera.

Adam also prepared a detailed storyboard which was used for scheduling and a guide for the animators' timing. As DOP I would discuss the sequences with Adam and decide on how to shoot them. This mainly involved considering factors like weather, time of day, and how the individual shots would fit into the cut sequence, but also meant thinking about the overall journey of the film. To help with the daily decisions we would always have available a movie file of the storyboard. This was kept updated with new material as shooting progressed.

Shooting animation requires long, uninterrupted hours of intense concentration. Usually the maximum screen time that can be shot by one animator in one day is about 4 to 5 seconds, so decisions have to be made carefully. In live-action filming you can usually cover everything from different angles and work out the sequence later in editing, however animation does not allow this luxury. Because every frame of animation takes so much time and effort, it requires a much higher level of commitment at the time of shooting. Occasionally there may be retakes because of the puppet's "performance", or rather the animator's interpretation, and more rarely for technical reasons. In general though we are dealing with a shooting ratio approaching 1:1...

My first practical task on the production was to investigate cameras and lenses. It was decided early on to use digital cameras even though Adam had only used 16mm film previously. While there is an aesthetic difference between film and digital origination, and the handling of contrast is not the same, but I felt this would be less significant when shooting in a controlled environment.

For the animators there were two factors which made digital cameras compulsory. One was the small size of the cameras relative to the animation sets. It is typically difficult to work around a bulky camera placed close to puppets. It also tends to block lighting and limit camera moves. The other factor is the quality of visual feedback as the animation progresses. With the digital cameras animators were able to capture and review images in very high resolution, exploiting the new “live view” camera feature for the first time.

One of my intentions with the film was to make the camera intimate, that is, to replicate the same kind of relative relationship between the camera and the actor as on a live-action set. While it's easy to make big sweeping moves, working close in small sets is difficult. Since our scale was generally about 8:1, even the relatively small DSLR was the equivalent of using a 4 foot wide camera in the real world.



A huge Canon 1Ds looms over Max's shoulder.

Producer Melanie Coombs also appreciated the digital cameras. We were shooting simultaneously with 6 animators who could start and finish shots at all hours of the day.

Once shots were completed, they were processed for projection almost immediately, allowing for approval and prompt turnover of sets for the next shot.

To achieve this, Post Production supervisor Henry Karjaleinen developed a new system with software engineers at the Victorian company XDT so data could be transferred directly across a network to a central server while the animators were still shooting. This system was integrated with the animation capture software developed by another local company “Stop Motion Pro”. Once the shots were completed they were processed automatically and usually ready in 30 minutes for screening on a high definition projection system.

So what cameras to use? The best choice at the time was Canon since they could be easily adapted to a wide variety of lenses including Nikon, Olympus, Leica and Zeiss. Initially I looked at the Canon 1D and the 5D. They both had full frame sensors, which meant we would be shooting the equivalent of a full Vistavision format. I particularly liked this aspect – to a still photographer it’s the equivalent of using 2 ¼ square in place of 35mm. It’s a better look for portraits with nice out of focus backgrounds. The general softening of backgrounds, even with wider lenses, tends to focus attention more on the characters and makes the sets look better.



Mary in a lighter moment.

If you compare Mary and Max with the 3D stopmotion film Coraline, the difference is quite obvious. They took the approach of using RedLake industrial cameras with a 2/3 inch image area and short focal length lenses – in the general range of 16mm film lenses. Hence their focus is very deep. This may have been a deliberate decision to help with the 3D plus reduce the need for intricate focus pulls, or it may have just been circumstantial. Having seen the film recently, the sets are a very impressive part of the experience so this may have influenced the choice.

Unfortunately at the time we were readying for production, the Canons did not have live video preview, hence we needed a custom video assist system to look through the viewfinder. I investigated several alternatives, but anything of reasonable quality was going to cost nearly as much as the cameras again. Luckily at the last minute Canon released the 1Ds mkII with live view. Initially there was concern that using this system would mean the cmos sensor in the camera was actually on constantly and could potentially overheat. As it turned out the fears were not realized and the 1DsMkII became the tool of choice. At lower light levels there were a few more hot pixels than normal but only visible under minute examination. XDS actually went to the extent of writing custom software which mapped the hot pixels in each camera body and deleted them automatically during processing. This could be considered just a little obsessive, though I am told that some countries such as Germany can actually reject Hdef masters if they find too many hot pixels!

Having chosen the cameras I needed lenses – lots of them. Most modern stills lenses have auto iris control and focus, which makes them unsuitable for animation. Autofocus can be disabled but the iris generally can't, and the action of closing down each exposure leads to uneven exposures or flicker. Also they would need solid focus mounts since we would need to motorise them. In order to keep on budget I sourced most of the lenses second hand on Ebay, with Leica and Zeiss being the favorites and Nikon and Olympus OM for general use. I especially liked the feel of the Leica lenses despite being initially suspicious of the hype. Technically they tend to have a warm colour bias, but they have a look that seemed to work well with animation, plus their focus scales are broadly spaced like motion picture lenses. Our available focal length range was from 18mm to 100mm, though the bulk of shots were taken in the range of 35mm – 60mm. The 60mm was my favorite, which is about equivalent to 40mm in conventional 1.85 film format.



One of the many scenes of New York filmed in a studio the size of a garage.

For lighting there was a familiar problem to deal with – flicker. Running from mains power meant gradual variations in voltage through the length of a day. In animation time this can cause flicker or pops in the exposure levels. To control this I came up with the idea of using industrial low voltage power supplies similar to those used in computers. A 12 or 24 volt unit of 600 watt could easily run 3 Dedo lights and could even be trimmed to fine tune the colour temperature. They were also much cheaper than genuine Dedo power supplies, which do not accurately regulate the voltage.

We also used some 300 watt fresnel lamps which were converted to take 24v 250w lamps. For “really big” sets we needed to use 1K fresnels. It was not possible to use low voltage lamps so they were powered by pairs of 600 watt PSU’s driving an inverter, which gave 1200 watts of regulated 240v. Not the most elegant solution but it did work!

Having decided on cameras, lighting and lenses left one final element – camera moves. The most obvious thing I noticed about Adam’s earlier films was that the camera never moved. In Mary and Max there are mostly scenes with one character on screen. To shoot everything as locked off would have made much of the film feel like a slide show rather than a moving picture. As soon as I told Adam I could provide motion control equipment he was very excited

Within a modest budget I managed to get four motion control rigs operating simultaneously. To help with the extra overhead, the other camera staff gradually learnt the art of motion control programming. In stop motion everyone on the camera crew has to multitask. We have to become our own gaffers, grips, motion control programmers and focus pullers. While this became an added responsibility, which increased preparation time, the extra dimension it provided the film proved important.

At the start of production I had an existing crane rig that I designed and built myself for live action work, but I soon realized the production would need smaller rigs built to the scale of the puppet world. I found an excellent solution in the form of Foba studio camera stands. These have a hexagonal column with a very smooth, counterweighted sliding mechanism and a cross sliding arm giving two axes of linear movement. It was a simple matter to attach belt drives to motorise the Fobas, and a third axis was added in the form of an industrial linear slide. For pan and tilt I commissioned three custom L-heads built by Leith Greig in Adelaide. These were like baby versions of fullsize remote heads. Our local engineer Gary Sneesby also contributed with a range of gadgets for driving focus as well as moving sets and lights.

My favorite challenge was a scene with a subway train, where we needed to emulate the rocking and rolling movement of a carriage, as well as passing gridwork, distant buildings and lighting effects. Almost everything in the shot was motion controlled other than a can rolling on the floor and Max reacting to the motion.



Max is asked to take a chair and he does – literally.

There are also several scenes involving rain in the film, which like smoke and fog and snow are much easier to create either as CGI additions, or else to shoot as real-time elements and composite in later. But due to the directorial decree there would be none of this. For the foreground and distant rain one of the animators came up with the idea of using Perspex tubes animated in a large frame. In order to place them in the scene a large piece of glass was arranged to reflect the image of the rain from a greater distance, hence out of focus as well as making the streaks more transparent. For the more distant horizon we used sheets of steel wire mesh to diffuse the background and create a moody atmosphere. Once the animators added the little splashes of water and Mary struggling against the rain the whole scene became surprisingly realistic.



One of Max's many parcels sits in the rain...

Working on *Mary and Max* posed many interesting challenges and introduced me to new ways of doing things using both old and new technology. In the past I'd had experience with creating effects in camera, but most films now pass this responsibility on to post production. Fortunately, Adam had a policy of achieving 99% of his vision the traditional way. Even the stars in the sky had to be real. Sometimes this led to situations where you wondered if it was really worth the trouble and would anyone really notice? But overall it gave the film a unique feel.

Lighting miniatures generally can be a challenge. You are constantly concerned with creating a consistent believable level of realism with puppets, which while beautifully made, are just lumps of clay and silicon. The lighting needs to enhance some qualities and obscure others. Using hard direct light in animation can be unforgiving. Many of the techniques that work with human faces just do not work with the less translucent and harder surfaces of a puppet. I was also wary of the limited dynamic range of the digital cameras. Even so, there were situations where the rule of restraint could be broken and it was possible for high contrast to work.

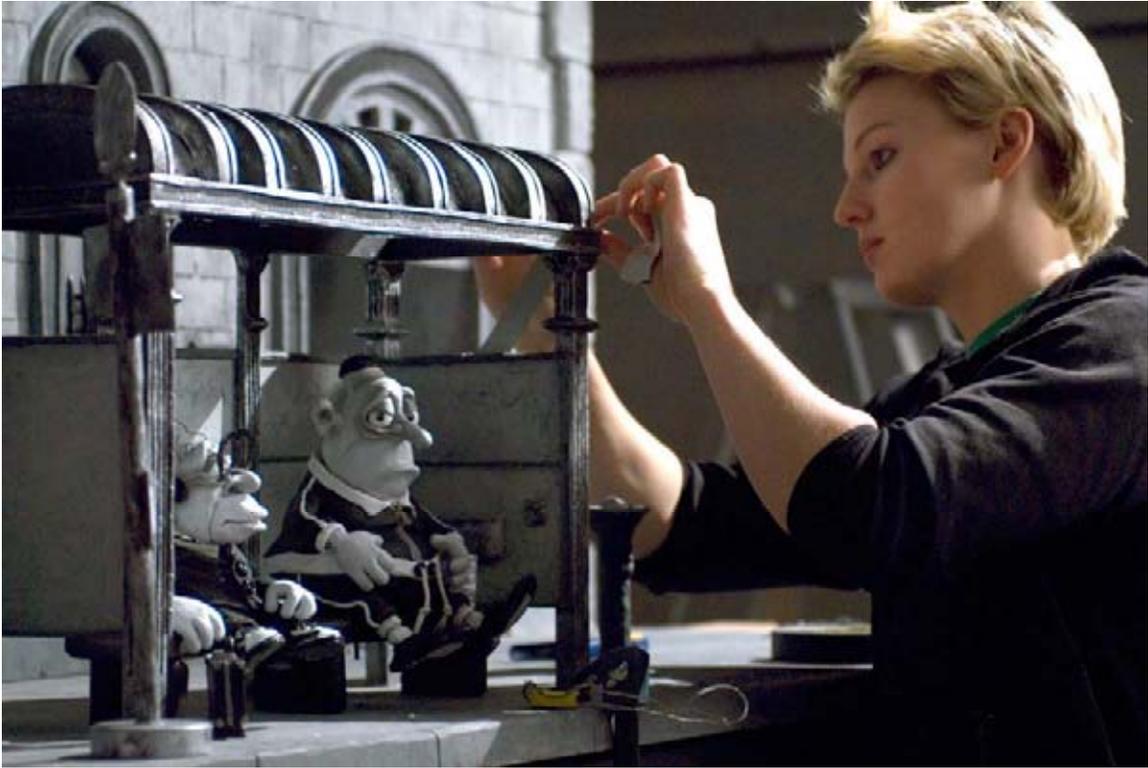
With Max's apartment scenes I tried to create a look that would provide a convincing natural look, yet enhance the appropriate dramatic mood. As the film progressed, his scenes became generally darker with deeper shadows reflecting his descent. In the final scene it is dusk and still dark but the final rays of the sun reach into the apartment and add the necessary level of optimism to enhance the poignancy of the moment.



Max enjoys a chocolate hotdog, wearing a touch of Mary's world – a red pom-pom.

In contrast to Max's monochrome world are the bleached colours of Mary's suburban existence in Australia. Adam's decision to restrict the palette of her world to warm tones meant a special challenge for exteriors. At first I found it difficult to visualize a world without blue skies. Everything seemed to sit unfamiliarly without much sense of depth. This was exacerbated by initially trying to use painted backdrops in cramped studios. Eventually we were able to improve this situation by using more physical props and utilizing tricks such as hanging gauze to diffuse backgrounds.

Unlike users of other cinema digital cameras, we had no established route for converting raw files to film output. We were committed to complete the colour grade in Lustre at Digital Pictures, and to do this a DPX 2k format was required. But working out how to convert the files efficiently was without direct precedent. The main problem was how to treat the gamma curves, since the original captures are in a proprietary raw camera format (CR2). Because XDT wanted to automate the processing, they also needed to use conversion software that was accessible to a scripting language. They could not use Canon software or Lightroom for example. Instead XDT had to create a custom, hard coded lookup table to convert the raw image files into the logarithmic DPX files. To create the LUT we shot grey scale charts with above peak white and super black areas. These were then put through a process that was essentially part scientific and part trial and error, to arrive at an output that retained as much information as possible from the original raw frames right through to the final colour grade.



One good thing about puppets is they stay still for lighting. Calista Lyon trims a shadow.

Throughout the production I had support and trust from Adam and an excellent crew to back it up. The first assistant was Calista Lyon, who also happens to be an accomplished discus thrower in her spare time. This meant that moving the motion control rigs around posed no problems for her. We also needed a lot of practical lighting so I had Scott Venner who could do wiring as well as having a film and special effects background. There was also a rotating team of lighting camera crew including John Billington who also had extensive stop-motion experience.

Somehow we got to the end and retained some measure of civility and sanity. As a result of the dedicated work of all the crew and Adam's vision we made a unique film which has been awarded at major international festivals and struck a chord with diverse audiences.