Conference Review

Modern Paints Uncovered

Tate Modern, London, May 16-19, 2006

Have you ever watched paint dry? Have you ever watched paint dry in an audience and everybody clapped? We happily did that during one presentation in this exceptionally comprehensive and stimulating conference. (We were watching a time lapse microscopic view of the coalescence of acrylic emulsion medium.) Organized by the three main partners in the Modern Paints Project, the Tate, the Getty Conservation Institute, and the National Gallery of Art, Washington, MPU was the first conservation conference devoted solely to modern paints. There were 26 papers and 25 posters representing the work of conservators and scientists in the organizing institutions, other research institutes, universities, museums, and paint manufacturers. The main themes were: history of modern paints; constituents and research on the paints; history of treatment; treatments and treatment decisions; research on treatments. The last paper was followed by an open discussion. The organizers took full advantage of the London venue with tours of local factories, art supply stores, and museums – that is, Winsor and Newton, Michael Harding, Russell and Chapple, Cornelissen, and the Tate Modern. Still available on the Tate Website: podcast audio tours of ten Tate Modern paintings, discussed from the point of view of conservators and curators. The GCI plans to publish the conference papers by summer 2007. Abstracts of most of the presentations are available on the GCI Website.

Here is a very brief summary of the papers, roughly grouped by theme. I've also added a few thoughts and questions along the way.

Tom Learner, Senior Conservation Scientist at the Tate, a lead researcher in modern artists' paints and a key conference organizer, gave the opening presentation, "Uncovering the Choices." Essentially an overview of the materials and conservation issues, it served as a general introduction for what followed.

Two presentations covered aspects of the history of 20th-century commercial paints. Harriet Standeven gave a paper based on her 2004 PhD thesis at the Royal College of Art "Cover the World: A History of the Manufacture of Household Gloss Paints in Britain and the United States from the l930s to the l950s." After introducing Dupont and ICI as primary American and British paint-makers, she discussed development and commercial acceptance of semi-synthetic and synthetic paints: oleo-resinous, nitrocellulose, phenol-formaldehyde, and alkyds. As she pointed out in her abstract, this information provides a context for interpreting technical analysis of commercial paints in works of art.

Stuart Croll, Professor, Coatings and Polymeric Materials at North Dakota State University, spent twenty years at Sherwin Williams, part of that time as Director of Research. He restricted his presentation, "An Overview of Developments in the Paint Industry since l930" to "latex" paints. (Tom Learner's definition of latex in the Getty book *Analysis of Modern Paints,* p.9: dispersion of polymer, generally a rubbery material, in a liquid phase that is usually water. A reminder of our emulsion-dispersion conflation). Opening his presentation with the "movie" I mentioned, he reviewed the key 20th-century theories on which dispersion paints are based and main ingredients from the 1930s to the present. While Dr. Croll stated there is no major technical difference between commercial and artists' acrylic emulsion paints, he pointed out simple differences: commercial paints are intended to last approx. 10 years, are loaded with titanium white pigment, contain more water and less binder than artists' grade paint and are not intended to be mixed. Good to keep these and other potential differences in mind when considering treatment. His talk was also an excellent reminder that formulations in these paints change.

Three talks looked at artists' paint. One was historical. Joana Lia Ferreira, conservator from the Universide Nova de Lisboa, presented her study of vinyl emulsion paints developed in the 1950 s in Portugal by Favrel Lisbonense and used by the artist Joaquim Rodrigo. I hope I am not confused on this point, but I believe she said artists using this paint thought they were painting with acrylics. This may serve as another reminder that while artist documentation and interviews are fundamental, so is chemical analysis.

Alun Foster, Chief Chemist at Winsor and Newton, surveyed development and characteristics of Artisan Water-Mixable oil paint. This product was only developed in the 1990s and Winsor and Newton continues to evaluate its properties, short and long term.

Gregory Smith, Professor of Conservation Science at Buffalo State University, (see below for his research paper) and James Hayes, Technical Director at Golden Acrylic Paints, delivered a joint paper on the constituents (over ten) in acrylic emulsion paints and the process of modifying the "recipes" to address artists' and conservation concerns: soiling, adhesion to other surfaces (like wrapping materials), turbidity, solvent sensitivity. Like several other papers in this conference, this one made you really think about the inherent complexity of these artistically valuable paints and why they continue to challenge our understanding.

While studies by Tom Learner, Paul Whitmore, Jaap Boon, Michael Schilling, Marion Mecklenberg, Alison Murray, and many, many others have contributed a tremendous amount of new information and insight into modern paints (resins, pigments, additives, mechanical, and aging characteristics), there is still more to know as our profession works towards fuller understanding of optimal treatment and preventative care. So it was not surprising that 16 of the 26 papers discussed scientific research and nine looked at acrylic emulsion paints. Earlier stages of much MPU research was reported in conference papers and posters from IIC Bilbao (2004) and ICOM Rio (2002) and The Hague (2005). The need for the research addressed at MPU was excellently summarized by Jablonski, Learner, Hayes, and Golden in *Reviews in Conservation*, "Conservation Concerns for Acrylic Emulsion Paints," IIC, no. 4, 2003.

The world of modern paints is vast, complex, and ever-changing. Many instruments and considerable expertise are needed for the materials research. Five talks looked at

different questions and sets of analytical techniques, It is clear that access to sophisticated equipment at academic and conservation research centers is a basic for most advanced studies on modern materials.

Oscar Chiantore, Professor of Polymer Chemistry at the Univeristy of Turin, researches artists' and conservation materials and has recently collaborated with Tom Learner in aging studies of acrylic emulsion paints. His paper, "The Macro-and Micro Assessment of Physical and Aging Properties in Modern Paints" reviewed techniques (Attenuated Total Reflectance FTIR, Confocal Raman Micro-Spectroscopy, Atomic Force Microscopy) which analyze surface on the micron level. Since aging of acrylic emulsions seems to occur primarily at the surface, techniques such as these have the potential to monitor aging and the effects of conservation treatment.

Jaap Boon, Head of the Molecular Painting Research Group at the FOM Institute AMOLF in Amsterdam (Institute for Atomic and Molecular Physics), presented "Mass Spectrometry Applied to Modern Paints," a review of MS techniques: SIMS (Secondary Ion Mass Spectrometry); DTMS (Direct Temperature Resolved Mass Spectrometry); LDMS (Laser Desorption Mass Spectrometry); MALDI-MS (Matrix Assisted Laser Desorption Ionization Mass Spectroscopy); and Electrospray Mass Spectroscopy. Dr. Boon described the potential to analyze synthetic pigments and binders, water extracts of acrylates and surfactants, and to do so positionally so that variations in a paint film or amongst products of different makers can be differentiated.

Michael Schilling, Senior Scientist at the Getty Conservation Institute, presented "Studies of Modern Oil-Based Artists' Paint Media by Gas Chromatography/Mass Spectrometry," in which he reviewed work based at the GCI on the three classes of modern oil-based paints: drying and semi-drying oils; alkyds (oil-modified polyesters); and the relatively new water-miscible oils. By way of example, he referred to analysis of alkyd paints used by Jackson Pollock.

Suzanne Lomax, Research Scientist at the National Gallery, reminded us why it is tricky to analyze synthetic pigments and described her extensive FTIR and DTMS work on these materials.

Marcello Picollo from IFAC-CNR (Institute of Applied Physics-National Research Center) in Florence described research on modern inorganic pigments: "Modern White Pigments: Their Identification by Means of Non-Invasive Ultraviolet, Visible, and Infrared Fiber Optic Reflectance Spectroscopy." Dr. Picollo and collaborators studied 20th-century paintings in the Uffizzi (surprise to me) with a portable FORS (Fiber Optics Reflectance Spectra) unit.

Several presentations discussed collaborative studies on effects of water and solvents on acrylics, and chemical and physical changes engendered by aging. It is definitely an understatement to say one needs the postprints to fully understand the details of the experiments and conclusions, and accurately relate them to previous work. Having said that...

Bronwyn Ormsby, AXA Art Research Fellow at the Tate, presented "Wet-cleaning Acrylic Emulsion Paint Films; an Evaluation of Physical, Chemical, and Optical Changes," results to date in the cleaning section of the acrylic research project directed by Tom Learner. Cleaning is a fundamental question for acrylic emulsion paints because they soil so easily. To mention a few factors: Tg's are near room temperature, surfaces often have small pores, there are multiple additives, including surfactants which accumulate on the surface. (Previous conservation literature discusses surfactant migration to the surface and also possibly into the substrate. The process is not completely understood and there are many variables.)

The larger question is whether wet cleaning is appropriate for acrylic dispersion paints. This paper focused on surfactant removal from test samples of artists' paints before and after natural, light, and heat aging. The paints contained the two most common co-polymers in artists' paint: BA/MMA and EA/MMA. My sense from this presentation is that judicious swabbing with water--which definitely removes surfactant--does not cause significant change in surface appearance or major physical characteristics. (It should be stated, though some increase in gloss was noted for glossy paints and there is a slight increase in Tg when surfactant is removed-- surfactant has a plasticizing effect). In contrast, changes in temperature and RH cause much more significant changes in physical characteristics: stiff at low T and RH; plasticized at high T and RH.

However, this is an excellent example of why one will need the postprints: to compare these swab cleaning results with the Bilbao paper, "The Migration of Surfactants in Acrylic Emulsion Paint Films," which seemed to raise some reservations about wet-cleaning. Tests to date have been structured to investigate what materials are safe to use on acrylic emulsions. At some point soil – ambient dust, or worse, the all too common oily fingerprint – will be added to the mix. If it turns out wet-cleaning is safe, I wonder if there will be pH issues to consider and how we will best anticipate the inevitable differences amongst paint brands, colors, etc.

Gregory Smith, who has collaborations with Golden Acrylics and the acrylics cleaning project, has a particular interest in additives. His talk at MPU was "Aging Characteristics of Contemporary Acrylic Emulsion used in Artists' Paints." His test material was Rohm and Haas Rhoplex AC-2235 (n-butyl acrylate-co-methylmethacrylate with Triton X-405 surfactant), one of the most common acrylic emulsions used by US paint makers. Note that the test material is the medium rather than the paint. Gregory Smith looked at various physical and chemical changes before and after artificial light aging. His results generally correlated with previous research, including surfactant on the surface. However, he found surfactant remained present throughout ag ing in contrast to Learner and Chiantore who measured a decrease with prolonged light exposure. He concluded there is a need for much more research and more emphasis on natural aging in the experimental set-up. (I did begin to realize as I gathered material for this review and re-read earlier papers, that

test materials in the research projects vary: paint, medium alone, different acrylic polymers, and surfactants.)

Paul Whitmore, Director of the Research Center on the Materials of the Artist and Conservator at Carnegie Mellon Research Institute, has previously studied ageing in acrylic emulsion media. His MPU presentation" Penetration of Liquid Water through Waterborne Acrylic Coatings" examined rates at which water travels through acrylic films of measured thickness. Acrylic itself absorbs water; it is not just a matter of water physically moving through the film. The rates seemed to follow a diffusion coefficient which decreases somewhat during the first few months of curing. (Curing takes 12-18 months). Liquid water passes through rapidly; a typical paint layer is 10-50 microns thick. Liquid water diffuses through 50 microns in 10 seconds; 100 microns in 30 seconds. Water passing through has the potential to extract water-soluble components and cause staining and other changes. There are implications for exposure to elevated RH: possible leaching and staining? However, controlled swabbing is different from these circumstances and will not extract as much water-soluble material from the acrylic film.

Two more talks, given by young researchers who initially worked with Alison Murray at Queens, examined changes in acrylic emulsion paints induced by water immersion and/or changes in temperature or relative humidity.

Rebecca Ploeger, now at the University of Turin, discussed experiments to evaluate "Morphological Changes and Rates of Leaching of Water-Soluble Material from Artists' Acrylic Paint Films During Aqueous Immersion." According to this talk, while immersion represents an extreme, microscopic changes in surface texture and extraction of water-soluble components (surfactants and ionic species added by paint manufacturers) take place quickly. She recommended any aqueous treatment be used with caution and very limited exposure time. (I was not sure if "limited" could encompass judicious swabbing.)

Eric Hagen, a Conservation Scientist at the Tate, whose talk was "Factors Affecting the Mechanical Properties of Modern Paints," studied a single black Golden acrylic emulsion paint with poly(methyl methacrylate-co-ethyl acrylate) binder in order to look at factors which can lead to cracking. He reviewed components with plasticizing effect. Applying a range of different conditions (age, climate, additive leaching), he confirmed the basic finding that temperature has the largest effect on mechanical properties.

Christina Young, Conservation Scientist and Lecturer at the Courtauld, presented "The Interfacial Interaction of Modern Paints Layers." Her research group has examined mechanical interaction amongst oil, alkyd, and acrylic emulsion grounds on canvas supports with paint layers in the same three media. How do the mechanical properties of each layer and adhesion between the layers effect overall behaviour of the system? Basically this work confirms that in room temperature ranges, acrylic paints and grounds crack less than oil and alkyds. That statement is an oversimplification of the material in the paper. The published form will provide many useful details of the paint-ground combinations and test results.

Moving away from water, Stefan Zumbuhl, focused on organic solvents. His talk, "The Solvent Action on Dispersion Paint Systems: Influence on Morphology and Latex Microstructure" looked at effects of these solvents on acrylic and other co-polymer artists' dispersion paints. While many of us know this from experience, the visual material in this talk provided a vivid picture of what happens on the microscopic level when solvents stronger than the mildest hydrocarbon contact dried films. You get a squidgy mess.

One research paper looked exclusively at 20th-century oil paints. Klaas Jan den Berg of the ICN (The Netherlanads Institute for Cultural Heritage) and Aviva Burnstock from the Courtauld presented "Cleaning Problems of Matte and Water-Soluble Paints in a Triptych (*Untitled*, l964-65) by Jasper Johns," part of a technical study of the painting. The medium of the paints was oil, but many colors were sensitive to water in surface cleaning tests. They related analysis of paints in the Johns to other 20th-century oil paintings and established that water soluble additives were likely a significant factor: aluminum, zinc, and magnesium salts added to excess as pigment dispersants. It is surprising how often we encounter this kind of solvent sensitivity in 20th-century oil paints. If paint is underbound, physical manipulation may be a factor as well. It can be tricky to resolve how far to proceed if some paints in a work are sensitive and others are not.

This group of presentations provided a sense of the current state of scientific research on modern paints, running on so many fronts and at such a high level. For acrylic emulsion paints in particular I am hopeful that this work may lead to more tailored guidelines for preventative conservation, including conditions in transit. Treatment issues will be more complicated. This was illustrated in question/response discussions relating to surfactants on the surface of acrylic emulsion paints. Surfactants inevitably come to the surface. Presumably dirt gets stuck in them as well as the (plasticized?) copolymer resins. The surfactants are water-soluble. If you are cleaning the surface with water you are removing surfactant. Should they be removed? Is it appropriate to remove what is essentially original material? After removal, would surfactant continue to come out and prompt repeated cycles of cleaning? Would water removal of surfactants cause long term effects we do not yet perceive?

The final group for this review are the seven treatment papers. Two looked at the history of treatment or attitudes about treatment of modern paintings.

Patricia Smithen, conservator at the Tate and a primary conference organizer, presented "A History of the Treatment of Acrylic Paintings." Much of the talk focused on past attempts to clean acrylic paintings and the fact that this is the essential treatment problem conservators face with them. Two thirds of the Tate's 174 acrylic paintings show some

dirt on the surface, and many paintings are heading to the 50-year mark with dirt retention becoming more obvious. These facts alone underscore the importance of the cleaning research. She mentioned two past overall treatments (one overall washing), another with dry surface cleaning and loose lining to illustrate the shift from desire to return to perceived original appearance to acceptance of change.

Jim Coddington, Agnes Gund Chief Conservator at the Museum of Modern Art in New York, gave a talk entitled "Modern Paints, Conservation of" the title being a reminder of the inevitable historicism of our work. He returned to the acrylic paintings survey undertaken twenty years ago at MOMA by Carol Stringari and Ellen Pratt to validate the usefulness of the survey, including the artist interviews, and assess condition change since the survey. In general the condition of the paintings remained similar, although it seemed most of these had been in storage much of the intervening time. He also discussed a treatment of a damaged work by David Navros and the practical and ethical issues involved in the decision for the artist to repaint part of it.

Papers on recent or proposed treatments dealt with paintings and sculpture. In addition to the historical and materials issues, there was the base question-- sometimes explicit, sometimes implicit-- why do this treatment? Artists' intent is a primary factor. So is the impress of our times.

Two papers described difficult, meticulous treatments intended to reverse damage thought to fundamentally impair intended meaning. In one case, it was the artist, Ellsworth Kelly, who prompted conservators to find a more effective treatment for cracks which imposed patterns on his unmodulated planes of color. Mary Gridley from the Dana Cranmer studio in New York presented "Unforgiving Surfaces; Treatment of Cracks in Contemporary Paintings," which described the rationale and technique. The treatment materials are "classic": ethanol or isopropanol, animal or plant glue, humidification, warmth, and weight. In their experience these materials were most effective on oil paint on acrylic grounds.

Christa Haiml, working at the Menil Collection in Houston, presented "Restoring the Immaterial: Study and Treatment of Yves Klein's IKB 42," one of the ultramarine blue paintings from l956-l962 in which the artist intended to create a surface which conveyed the immaterial. Christa Haiml described the genesis of International Klein Blue, (synthetic ultramarine pigment in a PVA resin, deliberately underbound), and described the structure of the Menil painting. It is canvas on plywood with the original paint layer applied by roller. The accumulated damages led to the decision at the Menil to reintegrate the surface through inserts and selective application of sprayed paint. (There is an overall sprayed layer of blue paint which is likely not original.) Many of the MPU talks focused on analysis using refined thinking and instrumentation. These two talks remind us of the day-to-day importance of accumulated experience and refined treatment by the conservator.

Carol Stringari, Senior Conservator of Contemporary Painting at the Guggenheim, gave the talk "Laser Cleaning of a Study Painting by Ad Reinhardt and the Analysis/Assessment of the Surface after Treatment." *Black Painting*, 1960-66, seriously damaged and declared a loss by AXA Insurance Corporation, who paid out the full value and donated it to the Guggenheim for study on treatment of monochrome surfaces. For several years now Carol Stringari has led research and given presentations on this painting (materials, condition, likely past treatment), and experiments to laser clean unoriginal restoration layers. The conclusion from her MPU talk: the current state of laser technology (in this case an ultraviolet excimer laser) does not allow sufficient control to ablate unoriginal material from this finely textured surface. This talk focused on technical adjustments in the cleaning set-up and the cleaning at Art Innovations in Holland. Do re-read the Bilbao paper for a particularly evocative discussion of the ethical considerations of repainting and cleaning monochromatic paintings.

Repainting was a main theme in both of the sculpture talks. Narayan Khandekar, Senior Research Scientist at the Straus Center for Conservation in the Harvard University Art Museums, presented "The Re-Restoration of Donald Judd's *Untitled*, l965." The sculpture, which belongs to the Whitney Museum of American Art, is a large scale interior piece – an anodized aluminum tube with ten spray-painted aluminum boxes attached in a progression. Designed by Judd (there are detailed preparatory sketches) it was fabricated for him by a company in Long Island City. Following surface damages incurred on exhibition, the Whitney decided in l976 to have the original paint removed and repainted at a car repair shop in New York. In 1990 Judd expressed dissatisfaction with the restoration. This prompted the detailed research and analysis on the original materials and technique, the restoration paint, and removal of the restoration paint discussed in this paper.

Abigail Mack, an Objects Conservator at the National Gallery of Art, reported on the latest stage of a comprehensive research project at the Gallery to develop a sturdy but aesthetically acceptable black matte paint for exterior metal sculptures, such as those by Tony Smith and Alexander Calder. (They focused on black because it is common, usually easily damaged, and difficult to recreate.) Exterior sculptures routinely suffer extensive damages, and it is usually considered appropriate to repaint them with guidance from the artist or estate. The goal of the National Gallery group is to find a paint which would require less frequent repainting. Their research and experimentation on a large group of paints, determined that one, originally developed for military camouflage use has the best potential to meet the physical and aesthetic requirements. The Gallery is now working with Spectrum Coatings in Rhode Island to develop a final version of the paint, then patent and distribute it in a range of glosses.

Modern Paints Uncovered was a tremendously successful conference and a great credit to all the organizers and speakers, as well as those who presented posters. In the meantime, keep your eyes posted for a very important publication!