A SURVEY ON THE USE OF ULTRAVIOLET INDUCED VISIBLE LUMINESCENCE IN PAPER CONSERVATION

INFORME SOBRE EL USO DE LA LUMINISCENCIA VISIBLE INDUCIDA POR ULTRAVIOLETA EN LA CONSERVACIÓN DE PAPEL

Aafke Weller[a], Bas Van Velzen[a], Ewout Koek[b]
[a]*University of Amsterdam, Netherlands.*
[b]*Teylers Museum, Netherlands.*

aafkeweller@mailbox.org

Abstract: paper conservators do not seem to use ultraviolet-induced visible luminescence as an examination technique as often as, for example, their colleagues in the paintings department do. This article investigates how and to what purpose paper conservators use UVL and what might help them use the technique more often in their daily routine. To this purpose, 130 book and paper conservators were consulted in an international online survey. Their answers gave valuable insights into the use of UVL in current paper conservation practice. Based on the outcome of the survey, the authors make a few suggestions for tools and guidelines that could encourage the use of UVL in paper conservation and improve its effectiveness.

Key words: ultraviolet-induced visible luminescence; paper conservation; reference collection; UV-Vis imaging; photography; survey.

Resumen: el empleo de la luminiscencia visible inducida por rayos ultravioleta es una técnica analítica poco empleada en la conservación de papel, en comparación con su uso en otros campos tales como la pintura de caballete. Este artículo investiga cómo y con qué fin los conservadores de papel usan la luminiscencia visible inducida por ultravioleta (UVL) y expone los beneficios de usar esta técnica de forma habitual en el trabajo cotidiano. Para ello, se realizó una encuesta en línea a 130 conservadores de libros y documentos a nivel internacional. Sus respuestas proporcionaron información valiosa sobre el uso de la UVL en la práctica actual de la conservación de papel. Además, a partir de los resultados de la encuesta, los autores ofrecen algunas sugerencias respecto a herramientas y directrices que podrían fomentar el uso de UVL en la conservación del papel y mejorar así su eficacia.

Palabras clave: luminiscencia visible inducida por ultravioleta; conservación del papel; atlas de referencia; imágenes UV-Vis; fotografía; encuesta.

Introduction

Ultraviolet-induced visible luminescence (UVL) is a relatively fast, simple, inexpensive, and non-destructive, examination technique. By exposing an object to ultraviolet radiation (UV), one can quickly obtain valuable information about its composition, condition, and authenticity. This is why UVL examination continues to be a valuable standard procedure in many conservation workplaces. Yet book and paper conservators do not seem to reach for the UV lamp as often as, for example, their colleagues in the paintings department do.

What is it that holds paper conservators back from using UVL? Are paper conservators less familiar with the applications of the technique, or do they find it hard to interpret UVL phenomena?

To better understand how the field of paper conservation uses UVL examination, 130 book and paper conservators were asked in an online survey how, to what purpose, and how often they use UVL[1]. Conservators were also asked whether they are satisfied with the results they obtain and what they think could help them improve their use of UVL as an examination tool. Additionally, the survey asked if and how conservators document UVL, and tried to infer the quality of UVL images produced by paper conservators as a part of their treatment documentation.

Introducción

La luminiscencia visible inducida por ultravioleta (UVL) es una técnica de examen de ejecución relativamente rápida, simple, económica y no destructiva. Al exponer un objeto a la radiación ultravioleta (UV), se puede obtener rápidamente información valiosa sobre su composición, estado y autenticidad. Esta es la razón por la que el examen UVL sigue siendo un procedimiento estándar importante en la conservación de bienes culturales. Sin embargo, el uso de las lámparas UV en conservación de papel es escaso o anecdótico, contrariamente a lo que ocurre en otros campos de la conservación de arte, como el de la pintura de caballete.

Pero, ¿qué impide a los conservadores de papel utilizar UVL? ¿Están menos familiarizados con las aplicaciones de la técnica, o es que les resulta difícil interpretar los resultados?

Para comprender mejor cómo se emplea el análisis UVL en el campo de la conservación del papel, se realizó una encuesta en línea a 130 conservadores de libros y papel a nivel internacional. En ella se les preguntaba acerca de cómo, con qué fin y con qué frecuencia usaban la UVL[1]. También se les preguntó sobre el grado de satisfacción alcanzado a partir de los resultados obtenidos así como qué consideran que podría ayudarles a mejorar el uso de UVL como técnica de examen. Además, la encuesta planteaba cuestiones relativas a la manera en que los conservadores documentan los rayos UV, en el caso que lo hicieran, al mismo tiempo que se intentaba averiguar cuestiones relativas a la calidad de las imágenes de rayos UV producidas como parte de los tratamientos y su documentación.

[1] This survey was performed in the context of an MA thesis research at the University of Amsterdam, Conservation & Restoration of Book and Paper. The research concerned the question of the need for an UVL image atlas. This is why a number of questions asked after this specific topic (Weller, 2014).

[1] Esta encuesta se realizó en el contexto de la investigación de una tesis de Máster en la Universidad de Amsterdam, Conservación y Restauración de libro y papel. La investigación pretendía conocer la necesidad de disponer de un atlas de imágenes UVL. Ello explica las preguntas planteadas en relación a este tema en concreto (Weller, 2014).

UVL in Paper Conservation

UVL can be very difficult to interpret, whether observed on paper or on any other support. As materials age, their luminescence color and intensity tend to change (Baker, 1985, p. 159; Pedersoli, Ligterink and Pietro, 2000, p. 42). Besides, materials and substances are rarely found in their pure form, which makes their luminescence susceptible to quenching when molecules interact with other materials present[2]. Furthermore, some thin and transparent layers allow UV to penetrate and can, together with underlying layers, produce complex composite luminescent images (Mairinger, 2003, pp. 80; De la Rie, 1982, p. 104). Other factors such as the spectral distribution of the radiation source, the transmission curve of the UV protection glasses and the interpersonal variation of the ability to judge color at relatively low intensities complicate interpretation even further as they influence our color judgement (Pedersoli et al., 2000, pp. 47-51). As a result, UVL cannot be relied upon as a sole means of identification, but should be used as an indication for the need for further investigation into the composition of an object.

The potential of the technique for paper conservators lies in the interpretation of specific UVL patterns in which different luminescence phenomena are seen in relation to each other. Two types of luminescence patterns are of interest. First, one can discern luminescence patterns that result from differences in luminescent behavior between different molecular structures within one artefact at a given stage. These patterns help to characterize the object, determine possible

[2] Quenching occurs when there is an interaction between molecules while electrons are in an excited state. Energy can be transferred between these interacting molecules and as a result their characteristic luminescence can diminish, disappear or the molecule can start to emit light (Lakowicz, 2007, p. 11).

UVL en la conservación del papel

La UVL puede ser muy difícil de interpretar, ya sea cuando se utiliza sobre papel o sobre cualquier otro soporte. A medida que los materiales envejecen, el color y la intensidad de su luminiscencia tienden a cambiar (Baker, 1985, p. 159; Pedersoli, Ligterink y Pietro, 2000, p. 42). De esta manera, los materiales y sustancias empleadas en las obras rara vez se encuentran en su forma pura, lo que hace que su luminiscencia sea susceptible de extinguirse cuando las moléculas interactúan con otros materiales presentes[2]. Además, algunas capas delgadas y transparentes permiten que los rayos UV penetren aun más y pueden, junto con las capas subyacentes, producir imágenes luminiscentes complejas (Mairinger, 2003, p. 80; De la Rie, 1982, p. 104). Otros factores como la distribución espectral de la fuente de radiación, la curva de transmisión de las lentes de protección UV y la variabilidad en la capacidad interpersonal a la hora identificar el color a intensidades relativamente bajas, complican aún más la interpretación de los resultados, ya que influyen en nuestra valoración del color (Pedersoli et al., 2000, pp. 47-51). Debido a ello, la UVL no se presenta como único medio de identificación, pero su uso es necesario para la investigación de la composición de un objeto.

El potencial de la técnica para los conservadores de papel radica en la interpretación de patrones UVL específicos en los que se observan diferentes fenómenos de luminiscencia entre sí. Para ello, existen dos bloques de patrones de luminiscencia de particular interés.

En el primer bloque, uno puede discernir patrones de luminiscencia que presentan diferencias en el comportamiento luminiscente entre distintas estructuras moleculares dentro de una obra en un momento determinado.

[2] La extinción se produce cuando hay una interacción entre moléculas y los electrones están en estado excitado, la energía puede transferirse entre estas moléculas que interactúan y, como resultado, su luminiscencia característica puede disminuir, desaparecer o bien la molécula puede comenzar a emitir luz. (Lakowicz, 2007, p. 11).

areas of risk during treatment, as well as detect anomalies or obscured details like faded inks, retouching, repairs, and alterations (Guilbault, 1990, p. 112; Roberts and Pedretti, 1977, p. 298; Mairinger, 1982, p. 2; Nickell, 2005, pp. 156-157; Watkins, 1990, p. 71; Grant, 1937, pp. 86-87; Becidyan, 2014). Detecting such patterns is a customary part of the initial stage in the examination of an object.

Second, there are luminescence patterns that result from differences in luminescent behavior as a consequence of a changing molecular structure observed at subsequent stages in time. These patterns can be helpful in both the evaluation of treatment and the monitoring of degradation processes. For example, tidelines, which can occur in paper as a result of an aqueous treatment, will become visible when exposed to UV even before they show in the visible range. The detection of fresh tidelines gives the conservator the chance to wash them out and prevent discoloration of the paper at the wet/dry interface at a later stage (Eusman, 1995, pp. 18-23; Hutchins, 1983, p. 58). UVL examination can also help to detect local degradation of cellulose in its induction stage, because the degradation of paper is accompanied by luminescence that shows before the paper starts to discolor in the visible range. The luminescence is a warning sign that gives the conservator the opportunity to take appropriate measures to prevent or delay discoloration of the paper. The luminescence initially increases as degradation begins, but diminishes as it progresses and eventually ceases altogether once the paper has reached full discoloration (Pedersoli et al., 2000, pp. 47-51; Manso et al., 2009, pp. 20-32; Rebrikova and Manturovskaya, 2000, p. 93; Boruvka, 2008, p. 44). When full discoloration has been reached, urgent action to protect the paper from further degradation may no

Estos patrones ayudan a caracterizar el objeto, a determinar posibles áreas de riesgo durante el tratamiento, así como a detectar anomalías o detalles ocultos, como tintas decoloradas, retoques, reparaciones y otras alteraciones (Guilbault, 1990, p. 112; Roberts y Pedretti, 1977: 298; Mairinger, 1982, p. 2; Nickell, 2005, pp. 156-157; Watkins, 1990, p. 71; Grant, 1937, pp. 86-87; Becidyan, 2014). La detección de estos patrones es habitual en el examen inicial de un objeto.

En el segundo bloque, los patrones de luminiscencia presentan diferencias en el comportamiento luminiscente como consecuencia de una estructura molecular cambiante, que se observa en etapas posteriores de análisis. Este segundo tipo de patrón puede ser útil tanto en la evaluación del tratamiento como en la monitorización de los procesos de degradación. Por ejemplo, los cercos de humedad, que pueden aparecer en el papel como resultado de un tratamiento acuoso, se harán visibles cuando se exponga a los rayos UV incluso antes de que se muestren en el rango visible. La detección de nuevos cercos de humedad da al conservador la posibilidad de aclararlos y evitar la decoloración del papel en la interfaz húmeda-seca en una etapa posterior (Eusman, 1995, pp. 18-23; Hutchins, 1983, p. 58). El examen UVL también puede ayudar a detectar la degradación local de la celulosa en su etapa de inducción, ya que la degradación del papel va acompañada de una luminiscencia que puede observarse antes de que el papel comience a decolorar en el rango visible. La luminiscencia es una señal de advertencia que brinda al conservador la oportunidad de tomar las medidas adecuadas para prevenir o retrasar la decoloración del papel. La luminiscencia aumenta inicialmente a medida que comienza la degradación, pero disminuye a medida que progresa y, finalmente, cesa por completo una vez que el papel ha alcanzado una decoloración total (Pedersoli et al., 2000, pp. 47-51; Manso et al., 2009, pp. 20-32 ; Rebrikova y Manturovskaya, 2000, p. 93; Boruvka, 2008, p. 44). Una vez alcanzada la decoloración completa, ya no son necesarias medidas urgentes para proteger el papel de una posterior degradación.

longer be of use. The detection of these different stages of deterioration can be especially helpful in monitoring particular degradation phenomena encountered in paper, such as foxing, ink corrosion, and pre-existing tidelines (Fig. 1) (Choisy, De la Chapelle, Thomas and Legoy, 1997, p. 18; Bicchieri, Pappalardo, Romano, Sementilli, and Acutis, 2001, p. 16; Choi, 2007, p. 143; Reissland, 2000, p. 69; Eusman, 1995, pp. 18-23).

The survey

For the survey, 388 conservators were actively approached. These conservators were selected on the basis of their affiliation with international and professional organizations of book and paper conservators that were willing to share the contact

La detección de estas diferentes etapas de deterioro puede ser especialmente útil en la monitorización de fenómenos de degradación particulares que se encuentran en el papel, como el foxing, la corrosión de la tinta y los cercos de humedad preexistentes (Fig. 1) (Choisy, De la Chapelle, Thomas y Legoy, 1997, p. 18; Bicchieri, Pappalardo, Romano, Sementilli y Acutis, 2001, p. 16; Choi, 2007, p. 143; Reissland, 2000, p. 69; Eusman, 1995: 18, 23).

La encuesta

Para la encuesta, se contó con un total de 388 conservadores. La selección de los mismos se realizó a partir de su afiliación a organizaciones internacionales y profesionales de conservadores de libros y documentos. Estas organizaciones estaban dispuestas a compartir los datos de contacto de sus miembros, o distribuir el enlace de

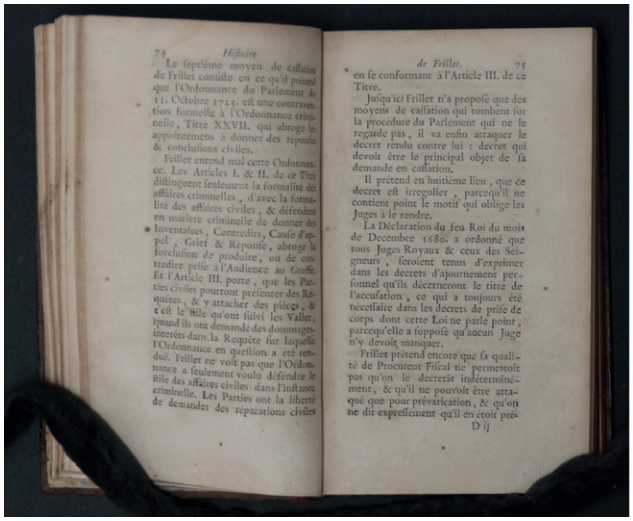


Figure 1 | A book photographed in visible light (left) and exposed to UV radiation (right). The luminescence reveals numerous tidelines that indicate a past incident in which pages were exposed to moisture. Tidelines tend to become more pronounced in visible light as the paper ages. Emission peak 365 nm. Photographed in a dedicated setup, with a regular digital camera using a Kodak Wratten 2E and Peca 918 filter. No color target, no post processing. Photo: Aafke Weller.

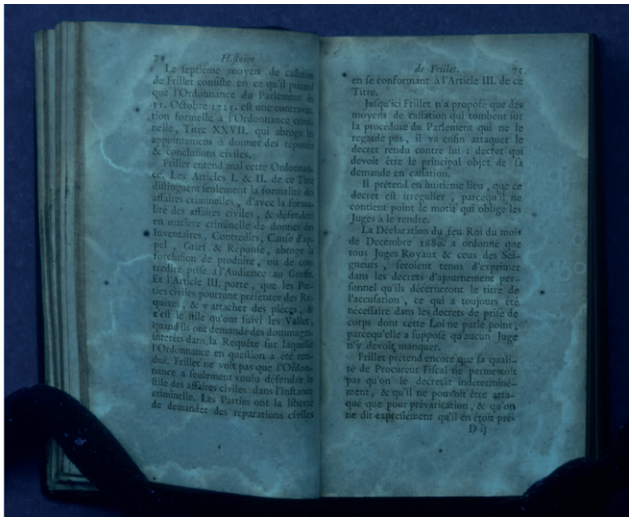


Figura 1 | Fotografía de libro con luz visible (izquierda) y expuesto a radiacion UV (derecha). La luminiscencia revela numerosos cercos que indican un incidente pasado en el que las páginas fueron expuestas a humedad. Los cercos de humedad tienden a hacerse más pronunciados a la luz visible a medida que el papel envejece. Pico de emisión 365 nm. Fotografía con una configuración específica, con una cámara digital normal con filtro Kodak Wratten 2E y Peca 918. Sin objetivo de color, sin postprocesamiento. Foto: Aafke Weller.

details of their members, or distribute the survey link to the addresses in their e-mail directory. A link to the survey was also published on the Conservation DistList, a distribution list dedicated to the conservation and preservation of cultural heritage. The survey was written in English and consisted of both multiple-choice and open questions. By default, answers were collected, stored, and processed anonymously[3]. The survey ran from the 10th of March to the 8th of April 2014.

Results

Of the 130 respondents, the largest group (41%) are working in the United States. A vast majority (81%) have a master's degree, and of those, 56% received their master's degree in the last 15 years. Most of the respondents work in a conservation studio of an institution of cultural heritage (61%), while 28% have a private studio.

The answers indicate that paper conservators do not use UVL examination on a regular basis (Fig. 2). No evident connection was found between the frequency with which paper conservators use UVL, their level of education, their country of education, or their professional environment.

When asked why they never or rarely use UVL, respondents indicated reasons that suggest a lack of knowledge and experience. Compared with respondents who rarely use UVL, respondents who never use UVL more frequently answered that they do not own the equipment (Fig. 3).

la encuesta a las direcciones en su directorio de correo electrónico. También, se publicó un enlace a la encuesta en *Conservation DistList*, una lista de distribución dedicada a la conservación y preservación del patrimonio cultural. La encuesta fue escrita en inglés y consistió en preguntas de opción múltiple y preguntas abiertas. Con este sistema automático, las respuestas se recopilaron, almacenaron y procesaron de forma anónima en todos los casos[3]. El pase de la encuesta se realizó del 10 de marzo al 8 de abril de 2014.

Resultados

De los 130 encuestados, el grupo más grande (41%) estaba trabajando en los Estados Unidos. Una gran mayoría (81%) tenía estudios de máster, y de ellos, el 56% terminó su máster en los últimos 15 años. La mayoría de los encuestados trabajaba en estudios de conservación pertenecientes a instituciones públicas de patrimonio cultural (61%), mientras que el 28% lo hace en estudios privados.

A nivel general, las respuestas indicaron que los conservadores de papel no utilizan el examen UVL de forma regular (Fig. 2). Tampoco se encontró una relación entre la frecuencia con la que los conservadores de papel usan UVL, y su nivel de formación, su país o su entorno profesional.

Cuando se les preguntó acerca del uso de UVL, los encuestados indicaron que la falta o escasez de uso se debe a un limitado conocimiento y experiencia. En comparación con los encuestados que rara vez usan UVL, los encuestados que nunca usan UVL señalaban con más frecuencia que no son dueños del equipo (Fig. 3).

[3] The full survey and a listing of all the answers given to the open questions are available in Appendixes II and III

[3] La encuesta completa así como una lista de todas las respuestas dadas a las preguntas abiertas están disponibles en los Apéndices II y III.

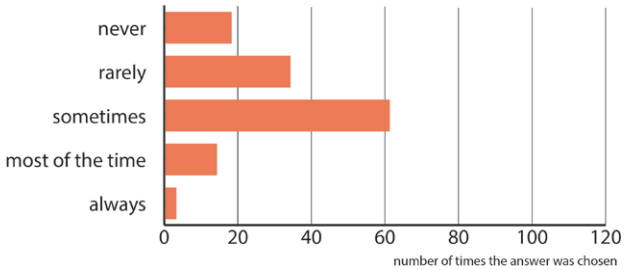


Figure 2 | When you treat or examine a paper artefact, how often do you use UVL?

Figura 2 | Cuando usted trata o examina un objeto de papel, ¿con qué frecuencia utiliza UVL?

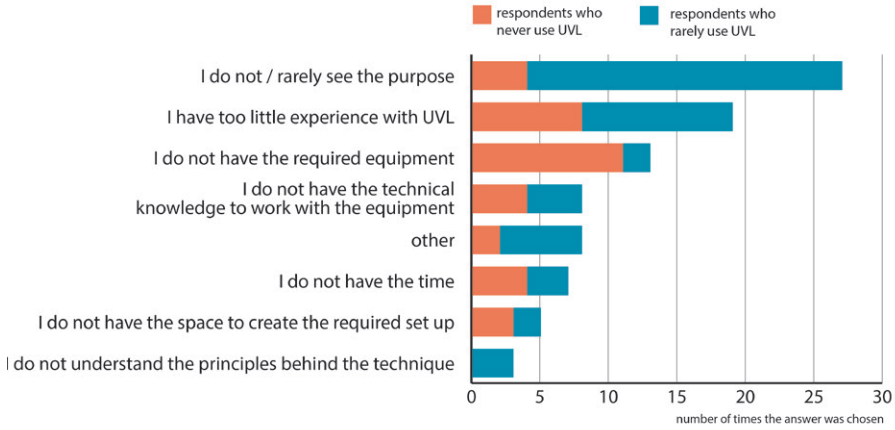


Figure 3 | Why do you never or rarely use UVL? (multiple answers possible).

Figura 3 | ¿Por qué usted nunca utiliza UVL? (múltiples respuestas posibles).

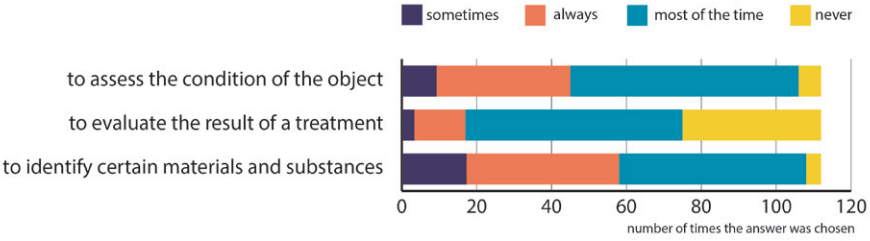


Figure 4 | For what purpose do you use UVL?

Figura 4 | ¿Para que fines utiliza usted UVL?

Respondents who do use UVL (112 out of 130) indicated that they mostly use the technique to assess the condition of the object or to identify certain materials and substances. A relatively large group (33%) answered that they never use the technique to evaluate their treatment (Fig. 4).

Por otro lado, los encuestados que utilizan UVL (112 de 130) indicaron que principalmente emplean la técnica para evaluar el estado de conservación del objeto o para identificar ciertos materiales y sustancias. Además, un grupo relativamente grande (33%) respondió que nunca ha utilizado la técnica para evaluar su tratamiento (Fig. 4).

The majority (78%) of the respondents who use UVL answered that they are satisfied with the results they obtain. However, most of the respondents also wrote that they often feel uncertain about their interpretation of UVL phenomena, or as one conservator wrote: "I do see a lot more than without the UV radiation, but I don't know exactly what I am looking at."

In an open question, respondents were asked what in their opinion would help them to get more out of UVL as an examination tool for paper artefacts (Fig. 5). Most conservators indicated that they would like more reference material and about half of this group explicitly expressed a wish for a guide that could serve as an aid in the identification of

Así mismo, la mayoría (78%) de los encuestados que usan UVL respondieron que están satisfechos con los resultados que obtienen. Sin embargo, la mayoría de los encuestados también indicaron que a menudo se sienten inseguros acerca de la interpretación de los fenómenos UVL o, como escribió un conservador: "Veo mucho más que sin la radiación UV, pero no sé exactamente lo que estoy viendo".

En una pregunta abierta, se les preguntaba sobre su opinión sobre cómo la UVL les ayudaría como herramienta de examen para las obras en papel (Fig. 5). La mayoría de los conservadores indicaron que les gustaría tener acceso a más material de referencia y, aproximadamente la mitad de este grupo, expresó explícitamente su deseo de emplear una guía que pudiera servir como ayuda

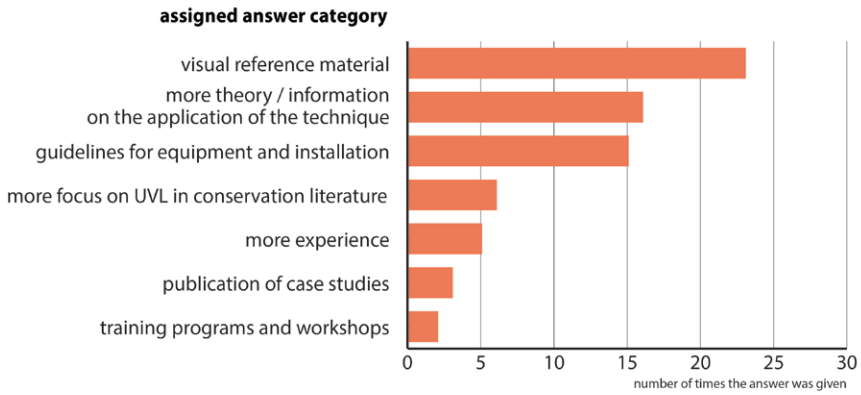


Figure 5 | What do you think would help you to get more out of UVL examination than you already do? (>300 characters).

Figura 5 | ¿Qué cree que le ayudaría a sacar más provecho del examen UVL de lo que ya hace? (>300 caracteres).

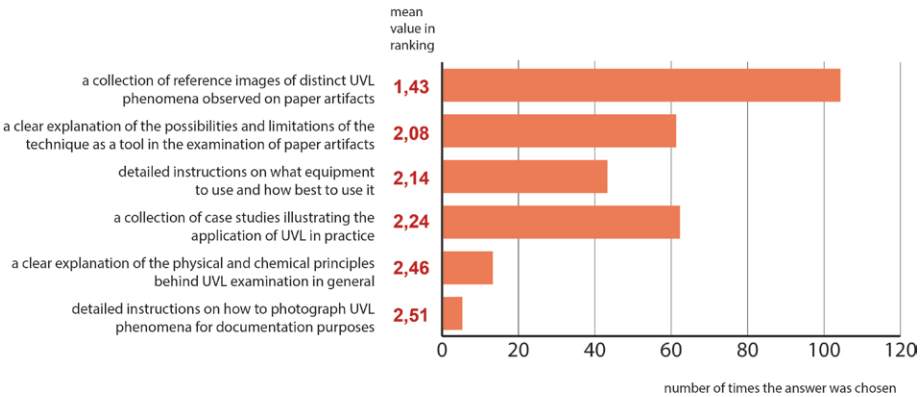


Figure 6 | For each of the following options, indicate how helpful they would be in getting better results using UVL. *Choose the three you find most useful, and make a ranking from 1 (most useful) to 3 (least useful).*

Figura 6 | Para cada una de las siguientes opciones, indique cómo de útiles serían para obtener mejores resultados usando UVL. Elija los tres que le resulten más útiles y haga una clasificación de 1 (más útil) a 3 (menos útil).

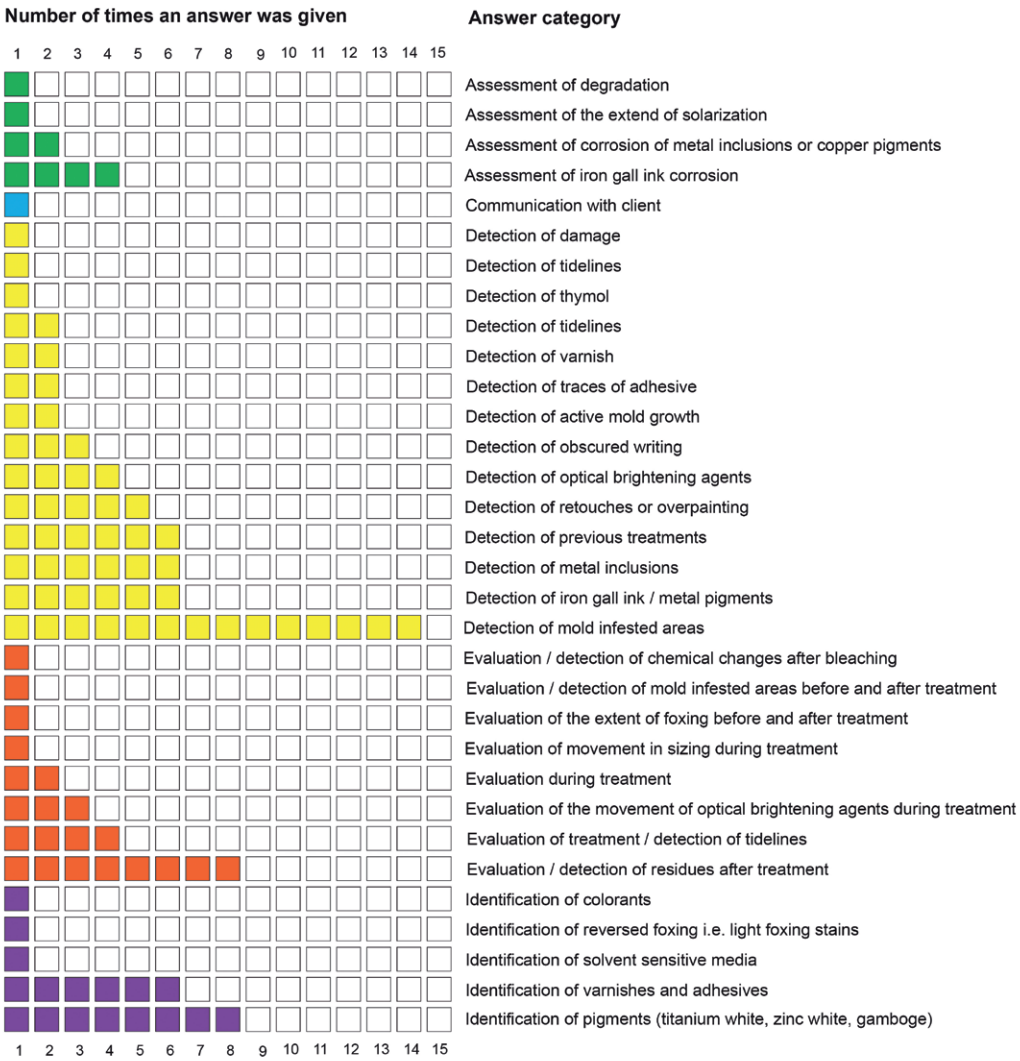
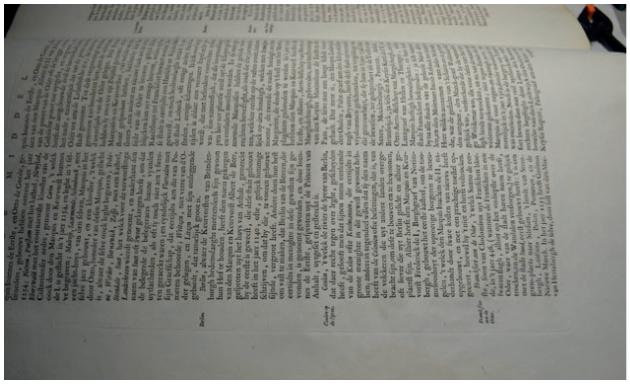


Figure 7 | An inventory of the answers to the question, "Can you recall an example from your own experience in which UVL examination was or could have been a decisive factor in the course of a treatment?" (>500 characters).

Figura 7 | Un inventario de las respuestas a la pregunta: "¿Puede recordar un ejemplo de su propia experiencia en el que el examen UVL fue o pudo haber sido un factor decisivo en el curso de un tratamiento? (>500 caracteres).

materials, or as one respondent called it, "a handy chart of possible results for comparison." About 30% of the respondents who indicated that they would like more reference material also mentioned

para la identificación de materiales, o como lo llamó un encuestado, "una tabla de referencia para comparar posibles resultados". Alrededor del 30% de los encuestados que indicaron que desearían más material de referencia,



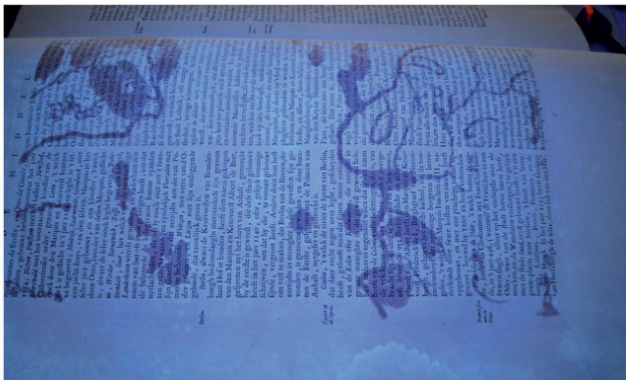


Figure 8 | A page from a volume of *"J. Blaeus grooten atlas, oft, Werelt-beschryving, in welcke 't aertryck, de zee, en hemel, wordt vertoont en beschreven"*. Blaeu, Joan, 1648. Illustrated atlas, intaglio print. Folio, 540 x 340 mm. Collection: University of Utrecht (call number: AC 64 Rariora). Left: in reflected light. Right: exposed to UV radiation (emission peak ca. 365 nm), no optical light filters, no color target, no post processing. The images were provided by Cor Knops, freelance book conservator based in Munstergeleen, The Netherlands. "The seriousness of copper corrosion", Cor Knops wrote in his response to the UVL survey, "can easily be detected with UV light. Sometimes it does not show clearly in visible light while in UV it does. This can influence the decision to treat or not to treat." The UVL image shows both the extent of copper corrosion caused by the use of a copper pigment (on the recto) and several tidelines.

Figura 8 | Página de un volumen de "J. Blaeus grooten atlas, oft, Werelt-beschryving, in welcke 't aertryck, de zee, en hemel, wordt vertoont en beschreven". Blaeu, Joan, 1648. Atlas ilustrado, impresión calcográfica. Folio, 540 x 340 mm. Colección: Universidad de Utrecht (número único: AC 64 Rariora). Izquierda: en luz reflejada. Derecha: expuesto a Radiación UV (pico de emisión aprox. 365 nm), sin filtros ópticos de luz, sin objetivo de color, sin post-procesamiento. Las fotos fueron tomadas por Cor Knops, conservador de libros freelance con sede en Munstergeleen, Los Países Bajos. "La gravedad de la corrosión del cobre", Cor. Knops escribió en su respuesta a la encuesta de UVL, "puede ser fácilmente detectada con luz UV. A veces no se muestra claramente en la luz visible, mientras que en la luz ultravioleta sí lo hace. Esto puede influir en la decisión de tratar o no tratar". La imagen UVL muestra tanto la extensión de la corrosión del cobre causada por el uso de un pigmento de cobre (en el anverso) y varios cercos.

that they find it difficult to interpret UVL and prefer an illustrated publication that takes the context of the object into account. "Would be nice," one respond wrote, "to have a manual to consult that contains colour photos, including photos of possible variations in appearance that may be characteristic of the same condition..." Answers to subsequent multiple-choice questions gave similar results (Fig. 6).

Another open question asked conservators to recall an instance from their own experience in which UVL examination was or could have been a decisive factor in the course of a treatment. The answers, which are grouped in Figure 7, provide a

también mencionaron que les resulta difícil interpretar los UVL y preferirían una publicación ilustrada que tuviera en cuenta el contexto del objeto. Uno de los conservadores encuestados señaló que "sería bueno tener un manual de consulta con fotos en color, incluidas fotos de posibles variaciones en la apariencia que pueden ser características de la misma condición". Las respuestas a las siguientes preguntas de selección múltiple dieron resultados similares (Fig. 6).

Seguidamente, se les pedía que expusieran un momento de su propia experiencia en el que el examen UVL hubiera o pudiera haber sido un factor decisivo en el curso de un tratamiento de conservación. Las respuestas a esta pregunta abierta, que se agrupan en la Figura 7,

Figure 9 | The head of an anatomic model of a horse (N 104: *Equus Caballus*). Louis Thomas Jérôme Auzoux (studio), 1879. Papier-mâché, brass wire. Ca. 470 x 530 x 150 mm. Collection: University of Wageningen. Left: in reflected light. Right: exposed to UV (emission peak ca. 365 nm), no optical light filters, no color target, no post processing. Photographs: Alexandra Nederlof. The images have been provided by Restoration Studio Nijhoff Asser in Amsterdam, the Netherlands. In her response to the UVL survey, paper and book conservator Elizabet Nijhoff Asser wrote: "(...) It was very helpful to observe the old retouches under UV light. It gave a quick overview of how thoroughly the object was retouched and coated, much better discernible than with the naked eye. It made us realize not to try to undo the old restoration. Another advantage was that our opinion was immediately understood by the client seeing pictures of the UV images."

Figura 9 | La cabeza de un modelo anatómico de un caballo (N 104: *Equus Caballus*). Louis Thomas Jérôme Auzoux (estudio), 1879. Papel maché, alambre de latón. Ca. 470 x 530 x 150 mm. Colección: Universidad de Wageningen. Izquierda: en luz reflejada. Derecha: expuesto a radiación UV (pico de emisión aprox. 365 nm), sin filtros ópticos de luz, sin color sin tratamiento posterior. Fotografías: Alexandra Nederlof. Imágenes cedidas por Restoration Studio Nijhoff Asser en Amsterdam, Países Bajos. En su respuesta a la encuesta de UVL, La conservadora de papel y libros Elizabet Nijhoff Asser escribió: "(...) Fue muy útil observar los viejos retoques bajo los rayos UV. Proporcionó una visión general rápida de la profundidad del objeto retocado y recubierto, mucho mejor discernible que a simple vista. Nos hizo darnos cuenta de que no había que intentar deshacer la vieja restauración. Otra ventaja fue que nuestra opinión fue entendida inmediatamente por el cliente al observar fotografías de las imágenes UV."

wealth of interesting case studies. The majority of these examples concern the detection of anomalies, mold-infested areas or metal inclusions[4]. Many other examples concern cases in which conservators had used the technique to monitor or evaluate their treatment. Some respondents indicated that they would like to share their case studies together with their UVL images and provided their contact details. Three of these case studies are highlighted in Figures 8, 9 and 10.

proporcionaron una gran cantidad de casos de estudio interesantes. La mayoría de estos ejemplos se referían a la detección de anomalías, áreas infestadas de moho o inclusiones metálicas[4]. Muchos otros ejemplos mostraban casos en los que los conservadores habían usado la técnica para monitorizar o evaluar la efectividad su tratamiento. Algunos encuestados se mostraron abiertos a compartir sus casos de estudios junto a las imágenes UVL extraídas de los mismos, y también proporcionaron sus datos de contacto. Tres de estos casos de estudio se muestran en las Figuras 8, 9 y 10.

4 Metal inclusions will absorb ultraviolet radiation and appear black in contrast to the paper which is slightly luminescent.

4 Las inclusiones metálicas absorberán la radiación ultravioleta y aparecerán negras en contraste con el papel que es ligeramente luminiscente.

Figure 10 | A 16th century vellum binding of the documents of De Quiros, a maritime explorer of the Pacific Ocean. Left: before treatment (above) and after treatment (below), both in in the visible range. Center and right: detail of the spine during treatment imaged in the visible range (center) exposed to UV radiation (right) (emission peak ca. 365 nm), no optical light filters, no color target, no post processing. The images were provided by James Elwing of Elwing & Gurney Archival, Book and Document Conservation Services, Blue Mountains, NSW, Australia. The vellum cover of the bound volume was severely soiled and because the writing on the spine was obscure, it was decided to clean the surface under UV radiation, using non-aqueous and aqueous solvents. After cleaning, the writing in iron gall ink was slightly retouched using a dilute tannic acid solution, again under UV radiation. In his response to the UVL survey James Elwing wrote: "UV allowed me to work around the friable manuscript and decoration to render gallotannic iron ink clearly visible. Without UV, I would not have had enough information to clean the surface.".

Figura 10 | Encuadernación de pergamino del siglo XVI de los documentos de De Quirós, un explorador marítimo del Océano Pacífico. Izquierda: antes del tratamiento (arriba) y después del tratamiento (abajo), ambos en el rango visible. Centro y derecha: detalle del lomo del libro durante el tratamiento en el rango visible (centro) expuesto a la radiación UV (derecha) (pico de emisión aprox. 365 nm), sin filtros ópticos de luz, sin color objetivo, sin procesamiento posterior. Las fotografías fueron tomadas por James Elwing de Elwing & Gurney Archival, Libro y Documento Servicios de Conservación, Blue Mountains, NSW, Australia. La cubierta de pergamino del volumen estaba muy sucia y debido a que la escritura en el lomo era oscura, se decidió limpiar la superficie bajo radiación UV, utilizando disolventes no acuosos y acuosos. Después de la limpieza, la escritura en tinta de hierro fue ligeramente retocada usando una solución de ácido tánico diluido, nuevamente bajo radiación UV. En su respuesta a la encuesta de UVL, James Elwing escribió: "La UV me permitió trabajar alrededor del manuscrito en estado friable y la decoración para hacer que la tinta de hierro galotánica fuera claramente visible. Sin los rayos UV, no habría tenido suficiente información para limpiar la superficie".

The second section of the survey dealt with the more technical aspects of UVL examination and the documentation of luminescence. It revealed that two percent of the respondents work with an improvised setup when examining objects under UV radiation. The remaining 28% use a permanent setup dedicated to UVL examination. 26% use a lamp with a dominant emission peak in the UVA region

La segunda sección de la encuesta abordó los aspectos más técnicos del examen UVL y la documentación de la luminiscencia. En esta sección se reveló que el 2% de los encuestados trabaja con una configuración improvisada al examinar objetos bajo radiación UV, mientras que un 28% utiliza una configuración permanente dedicada al examen UVL. Del mismo modo, y respecto a la tipología de lámparas empleadas, el 26% de los encuestados indicó que

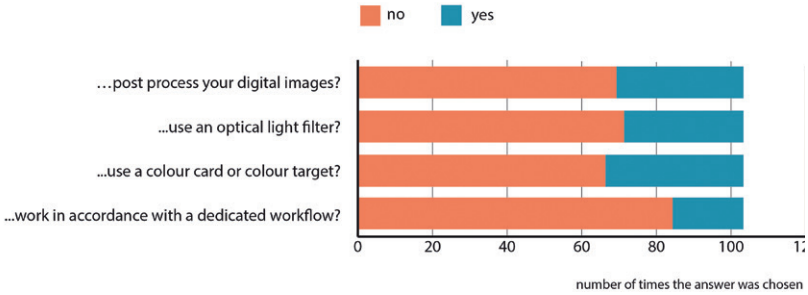


Figure 11 | When you photograph UVL phenomena do you ...

Figura 11 | Cuando usted fotografía los fenómenos UVL ¿usted....

(typically 365 nm), but most respondents (56%) do not know what kind of lamp they use.

With regard to the documentation of UVL phenomena, most conservators answered that they rarely (36%) or never (24%) take photographs. Conservators who do document their findings, mostly do so without using light filters or a color target. Nor do they follow a dedicated workflow (Fig. 11).

Discussion

Frequent examination is important for developing a familiarity with different luminescence phenomena. However, the answers in this survey indicate that most paper conservators do not use UVL on a regular basis. Whether this is due to a knowledge gap or a lack of routine is not clear, since these seem to be two sides of the same coin: conservators who never or rarely use the technique hardly see the purpose, or feel they have too little experience to correctly interpret what they see.

It is remarkable that a relatively large group of respondents never use the technique to evaluate treatment results, whereas many of the examples respondents have chosen to illustrate the significance of the technique for their work show that UV is especially suitable for this purpose (Fig. 7).

emplea una lámpara con un pico de emisión dominante en la región UVA (normalmente 365 nm), pero la mayoría de los encuestados (56%) no conocen con exactitud el tipo de lámpara que utilizan.

Con respecto a la documentación de los fenómenos UVL, la mayoría de los conservadores respondieron que rara vez (36%) o nunca (24%) realizan fotografías. En el caso de los conservadores que documentan sus hallazgos, en su mayoría lo hacen sin usar filtros de luz o una carta de color, y tampoco siguen una metodología específica (Fig. 11).

Discusión

El examen frecuente es importante para familiarizarse con los diferentes fenómenos de luminiscencia. Sin embargo, las respuestas a esta encuesta indican que la mayoría de los conservadores de papel no usan UVL regularmente. No está claro si ello se debe a una falta de conocimiento o una falta de rutina, ya que parecen ser dos hechos estrechamente ligados entre sí: los conservadores que nunca o rara vez usan la técnica en puntuales ocasiones, no ven los beneficios de su aplicación en los tratamientos de conservación, o sienten que tienen muy poca experiencia para interpretar correctamente lo que el análisis les presenta.

Cabe señalar el elevado porcentaje de encuestados que nunca usa la técnica para evaluar los resultados del tratamiento, mientras que muchos de los ejemplos que los

Although most respondents who do use UVL wrote that they are satisfied with the results they obtain with the examination technique, many also indicated that they feel uncertain about the correct interpretation of luminescence phenomena. Several respondents expect that a collection of reference images will help them to advance the interpretation of their observations.

The authors of this chapter agree that reference material is in fact hard to find; photographs of UVL phenomena observed on paper are sparse and scattered over different journal articles. With the recent introduction of a UV-target for accurate and repeatable imaging of UVL by UV Innovations™, the authors think that it is time to further explore the idea of a visual reference collection or atlas (UV Innovations™, 2018). However, they also fear that reference images could give the conservator a false sense of security, the moment his or her findings match or do not match a given reference. Therefore, a reference collection should include images of similar luminescent materials in different material contexts as well as photographs of luminescence as it appears in subsequent stages of an ageing process. Such a reference collection would help conservators develop a familiarity with both characteristic luminescence colors as well as with the variables that influence these colors and their intensity. Furthermore, reference images should always be paired with information from other sources, such as additional analysis or sources outside the object. Such images would sooner serve as illustrations of theory than as reference images.

An image atlas could also take the form of a collaborative online image archive that is compiled and maintained by a community of users and by open and transparent consensus. Such an atlas might avoid the issue of authority that clings to an

encuestados han elegido para ilustrar la relevancia de la técnica en su trabajo demuestran que el UV resulta especialmente adecuada para este propósito (Fig. 7).

Aunque la mayoría de los encuestados que utilizan UVL indicaron que están satisfechos con los resultados que obtienen con la técnica de examen, muchos también indicaron su inseguridad en la correcta interpretación de los fenómenos de luminiscencia. Varios encuestados indican que la existencia de una colección de imágenes de referencia les ayudaría a avanzar en la interpretación de sus observaciones.

Los autores de este capítulo están de acuerdo en que el material de referencia es, de hecho, difícil de encontrar, ya que las fotografías de los fenómenos UVL observados en papel son escasas y se encuentran dispersas en diferentes artículos de revistas. Con la reciente introducción de una guía UV para obtener imágenes precisas y repetibles de UVL por UV Innovations™, sus autores creen que es hora de explorar más a fondo la idea de una colección de referencia visual o atlas (UV Innovations™, 2018). Sin embargo, al mismo tiempo temen que las imágenes de referencia puedan dar al conservador una falsa sensación de seguridad; concretamente, en momentos en que sus hallazgos coincidan o no coincidan con una referencia específica presentada en la guía. Por tanto, una colección de referencia debe incluir imágenes de materiales luminiscentes similares en diferentes contextos, así como fotografías de su luminiscencia en etapas posteriores a un proceso de envejecimiento. Dicha guía ayudaría a los conservadores a familiarizarse tanto con los colores característicos de la luminiscencia UV, así como con las variables que pudieran influir en estos colores y su intensidad. Además, las imágenes de referencia deberían siempre acompañarse de información procedente de otras fuentes, como análisis adicionales o fuentes externas al objeto. Más allá de ser imágenes de referencia, tales imágenes servirían como ilustraciones de la teoría expuesta.

El atlas de imágenes también podría presentarse mediante una plataforma de imágenes de colaboración en

atlas that is compiled under supervision of an expert editorial board and would encourage conservators to trust their own judgement rather than simply compare reference images.

A collaborative atlas could be feasible, as this survey has shown that many conservators are willing to share their experiences with UVL examination. Based on the survey results, it is highly unlikely that the images produced in the work field have an image quality that makes them mutually comparable. Recent studies have developed methods, targets and workflows that help create reproducible and mutually comparable UVL images suitable for scientific publication (Dyer, Verri, and Cupitt, 2013; Frey, 2011; UV Innovations™, 2018). Still, the financial investments these solutions require and the standards these studies pursue, might discourage the average conservator. However, it could well be that even though the images conservators produce do not meet these standards, they nonetheless contribute to the visual reference frame conservators need to interpret UVL phenomena. The images sent in by conservators in response to this survey are good examples of the communicative potential of images made in field (Fig. 8, 9 and 10). Future projects could therefore help establish a minimum standard that is sufficient for the daily communication of luminescence phenomena relevant to paper conservators and help develop a realistic, inexpensive photography workflow that enables conservators to build their own image archive or contribute to a collaborative archive.

For a start, the authors would like to share their suggestion for a simple DIY (do-it-yourself) set up for UVL viewing and photography. The design is included in an appendix to this chapter. This *studio box* presents an affordable and easy-to-use option that accommodates the majority of two

línea, compilada y mantenida por una comunidad de usuarios y bajo un consenso abierto y transparente. En la compilación de tal atlas, se intentaría evitar el problema de la autoridad ligado a los atlas compilados bajo la supervisión de un comité editorial experto, y animaría a los conservadores a confiar en su propio juicio a la hora de analizar las imágenes, en lugar de servir simplemente como comparativa de imágenes de referencia.

La encuesta ha demostrado que esta tipología de atlas de colaboración podría ser viable, ya que muchos conservadores se han mostrado dispuestos a compartir sus experiencias con el examen mediante UVL. A partir de los resultados de la encuesta, es muy poco probable que las imágenes producidas presenten una calidad que las haga comparables entre sí. Estudios recientes han desarrollado métodos, objetivos y métodos de trabajo que ayudan a crear imágenes UVL reproducibles, comparables y adecuadas para publicaciones científicas (Dyer, Verri y Cupitt, 2013; Frey, 2011; UV Innovations™, 2018). Sin embargo, la inversión que requieren estas propuestas así como los estándares que persiguen estos estudios podría desalentar al conservador promedio. Aun así, en el caso de que los conservadores que participasen en el estudio produjeran imágenes que no cumplieran con los estándares, su contribución sería igualmente empleada como un marco de referencia visual para la interpretación de los fenómenos producidos por rayos UVL en otros estudios. Las imágenes enviadas por los conservadores en respuesta a esta encuesta son un buen ejemplo para demostrar el potencial comunicativo de las imágenes realizadas en este campo de la conservación (Figs. 8, 9 y 10). Por lo tanto, los futuros proyectos podrían ayudar a establecer un estándar mínimo, suficiente para la comunicación diaria de fenómenos de luminiscencia relevantes para los conservadores de papel y, al mismo tiempo, ayudar a desarrollar un flujo de trabajo de fotografía realista, aplicable y económico que permita a los conservadores crear su propio archivo de imágenes o contribuir con un archivo de colaboración.

dimensional objects and books treated by book and paper conservators[5].

Conclusion

The answers to the survey indicate that most paper conservators do not use UVL on a regular basis and do not always seem to use the technique to its full potential. To develop an understanding of the potential as well as the limitations of UVL examination, paper conservators need to build up routine in using the technique. Comprehensible guidelines could encourage conservators to build a simple, dedicated set-up that allows for quick UVL viewing and imaging. Such a set-up could make it easier to establish the routine needed. When possible, theory should be accompanied by reference images that help conservators interpret their findings. A collaborative image atlas may present an interesting model for the dissemination of UVL images, as it encourages conservators to trust their own perception whilst developing a familiarity with different luminescence phenomena.

Acknowledgements

We thank all conservators who have taken the time to complete the online survey. In addition, we would like to thank the following people for their invaluable contributions: Marjolijn Bol; René Gerritsen; James Elwing; Walter Henry; Cor Knops; Jennifer McGlinchey; Thomas Michelsen; Alexandra Nederlof; Elizabet Nijhoff Asser; René Peschar; Melissa Potter; Birgit Reissland; Jos Schrijen; Stephanie Welten; Heleen van Santen.

[5] Although the costs for building materials can vary, the whole set-up (including the optical filters, but camera excluded) can be assembled for less than € 500,00.

Como punto de inicio, los autores desean compartir su propuesta de configuración de este sistema de análisis para la visualización y fotografía UVL. Su diseño está incluido en un apéndice de este capítulo. Este *kit de estudio* presenta una opción asequible y fácil de usar que se adapta a la mayoría de los objetos bidimensionales y libros tratados por conservadores de papel[5].

Conclusión

Las respuestas de la encuesta indican que la mayoría de los conservadores de papel no usan UVL regularmente, y no siempre usan la técnica en todo su potencial. Para entender tanto el potencial como las limitaciones del examen UVL, los conservadores de papel deberían comenzar a emplear la técnica de forma rutinaria. La propuesta de unas pautas comprensibles podrían alentar a los conservadores a construir una configuración simple y adecuada que permitiese una visualización e imagen UVL rápida. Tal configuración podría facilitar el establecimiento de la rutina en el empleo de la técnica. Al mismo tiempo y cuando fuera posible, la teoría debería ir acompañada de imágenes de referencia que ayudasen a los conservadores a interpretar sus hallazgos. Un atlas de imágenes colaborativo podría ser un modelo interesante para la difusión de imágenes UVL, ya que alentaría a los conservadores a confiar en su propia percepción al tiempo que se familiarizarían con diferentes fenómenos de luminiscencia.

Agradecimientos

Queremos dar las gracias a todos los conservadores que dedicaron su tiempo a completar la encuesta en línea. Además, nos gustaría agradecer a las siguientes personas por sus valiosas contribuciones: Marjolijn Bol; René Gerritsen; James Elwing; Walter Henry; Cor Knops; Jennifer McGlinchey; Thomas Michelsen; Alexandra Nederlof; Elizabet Nijhoff Asser; René Peschar; Melissa Potter; Birgit Reissland; Jos Schrijen; Stephanie Welten; y Heleen van Santen.

[5] Aunque el coste de los materiales de construcción pueden variar, toda la configuración (incluidos los filtros ópticos, pero excluyendo la cámara) se puede ensamblar por menos de € 500,00.

References | Bibliografía

Baker, C. A. (1985). A Comparison of Drawing Inks Using Ultraviolet and Infrared Light Examination Techniques. In P. A. England (Ed.), *Application of Science in Examination of Works of Art; Proceedings of the Seminar: September 7-9*, pp. 159–163. Boston: Museum of Fine Arts.

Becidyan, A. N. (2003). The Chemistry and Physics of Special-Effect Pigments and Colorants for Inks and Coatings. *Paint & Coatings Industry Magazine*. Retrieved 3 December 2018, from https://www.pcimag.com/articles/85016-the-chemistry-and-physics-of-special-effect-pigments-and-colorants-for-inks-and-coatings

Bicchieri, M., Pappalardo, G., Romano, F. P., Sementilli, F. M., and Acutis, R. D. (2001). Characterization of Foxing Stains by Chemical and Spectrometric Methods. *Restaurator*, *22*(1), pp. 1–19.

Boruvka, N. (2008). The Development of Foxing Samples of Book Paper After Accelerated Ageing. *Journal of the Canadian Association for Conservation*, *33*, pp. 38–45.

Choi, S. (2007). Foxing on Paper: A Literature Review. *Journal of the American Institute for Conservation*, *46*(2), pp. 137–152.

Choisy, P., De la Chapelle, A., Thomas, D., and Legoy, M. D. (1997). Non-Invasive Techniques for the Investigation of Foxing Stains on Graphic Art Material. *Restaurator*, *18*(3), pp. 131–152.

Dyer, J., Verri, G., and Cupitt, J. (2013). *Multispectral Imaging in Reflectance and Photo-induced Luminescence Modes: A User's Manual*. Version 1.0. The British Museum. Retrieved 3 December 2018, from http://www.britishmuseum.org/pdf/charisma-multispectral-imaging-manual-2013.pdf

Eusman, E. (1995). Tideline Formation in Paper Objects: Cellulose Degradation at the Wet-Dry Boundary. *Conservation Research 1995* (Vol. 51, pp. 11–27). Washington: National Gallery of Art.

Eusman, E. (2018). Iron Gall Ink - History. Retrieved 3 December 2018, from https://irongallink.org/igi_index8a92.html

Frey, F. (2011). *The AIC Guide to Digital Photography and Conservation Documentation* (J. Warda, Ed.). Washington, D.C: American Institute for Conservation of Historic and Artistic Works.

Grant, J. (1937). *Books and Documents: Dating, Permanence, and Preservation*. London: Grafton and co.

Guilbault, G. G. (1990). *Practical Fluorescence* (2nd ed.). New York: Marcel Dekker.

Hutchins, J. K. (1983). Water-Stained Cellulosics: A Literature Review. *Journal of the American Institute for Conservation*, *22*(2), pp. 57–61.

Lakowicz, J. R. (2007). *Principles of Fluorescence Spectroscopy* (3rd ed.). New York: Springer Science.

Mairinger, F. (1982). Sichtbarmachung Verblasster Schriften und Mikrochemische Analysemethoden für die Untersuchung Graphischer Kunstwerke. *Arbeitsunterlagen zum IADA-Seminar 29.9.-1.10.1982*. Institut für Angewandte Botanik, Organische Rohstofflehre und Technische Mikroskopie der TU Wien.

Mairinger, F. (2003). *Strahlungsuntersuchung an Kunstwerken*. Leipzig: E. A. Seemann Verlag.

Manso, M., Pessanha, S., Figueira, F., Valadas, S., Guilherme, A., Afonso, M., Rocha, A.C., Oliveira, M.J., Ribero, I., and Carvallo, M. L. (2009). Characterisation of Foxing Stains in Eighteenth to Nineteenth Century Drawings Using Non-destructive Techniques. *Analytical and Bioanalytical Chemistry*, *395*(7), pp. 2029–2036.

Nickell, J. (2005). *Detecting Forgery: Forensic Investigation of Documents*. University Press of Kentucky.

Pedersoli, L., Ligterink, F., and Pietro, G. di. (2000). Browning of Paper: Fluorescense Changes Accompanying the Discolouration of Artificially Aged Paper. *Papier Restaurierung: Mitteilungen der IADA*, *1*(suppl.), pp. 47–51.

Rebrikova, N. L., and Manturovskaya, N. V. (2000). Foxing: A New Approach to an Old Problem. *Restaurator*, *21*(2), pp. 85–100.

Reissland, B. (2000). Visible Progress of Paper Degradation Caused by Iron Gall Ink. In *Post prints of the iron gall ink meeting*. Newcastle upon Tyne: Conservation of Fine Art.

Rie, E. R. de la. (1982). Fluorescence of Paint and Varnish Layers (Part III). *Studies in Conservation*, *27*(3), pp. 102–108.

Roberts, J., and Pedretti, C. (1977). Drawings by Leonardo da Vinci at Windsor Newly Revealed by Ultra-Violet Light. *The Burlington Magazine*, *891*, p. 396.

UV Innovations™ | Ultraviolet Photography Standards | Workflows. (2018). Retrieved 3 December 2018, from http://www.uvinnovations.com/getting-started

Watkins, S. (1990). Chemical Watermarking of Paper. *Journal of the American Institute for Conservation*, *29*(2), pp. 117–131.

Weller, A. (2014). *Operating in the dark: An exploration of an atlas for ultraviolet induced visible fluorescence examination of paper artefacts* (Master thesis). University of Amsterdam, Amsterdam.

Appendix I: Suggestion for a DIY UV studio box

Anexo I: Sugerencia para una caja de estudio DIY UV

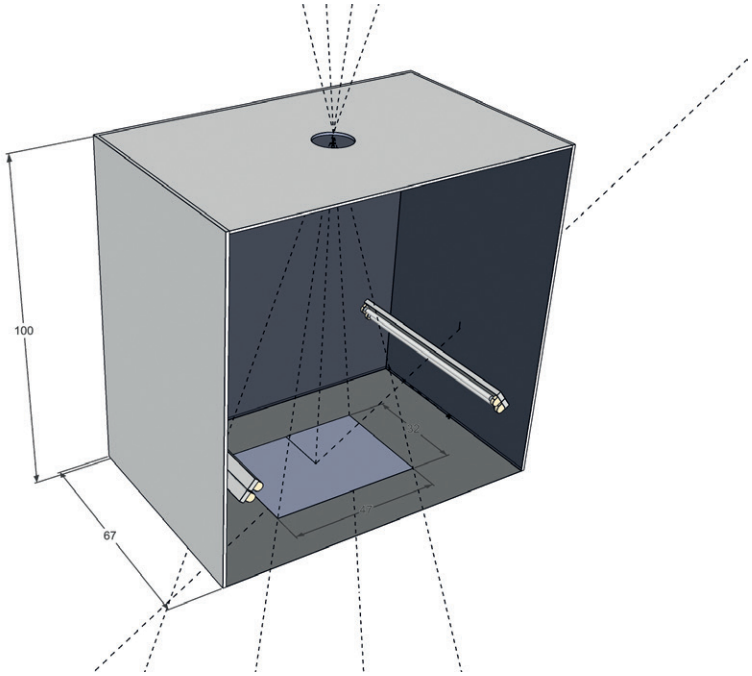
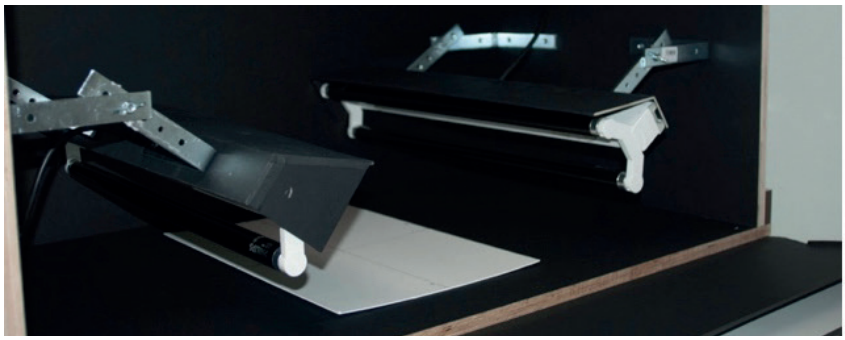


Figure 1 | Design drawing of the studio box. The round hole in the ceiling of the box is where the camera lens will be placed. The dotted lines represent the angle of view and the angle of the UV-lamp to the object.

Figura 1 | Diseño del kit de estudio. El agujero en la parte superior de la caja es donde se colocaría la lente de la cámara. Las líneas de puntos representan el ángulo de visión de la lámpara UV al objeto.

Figure 2 | The camera is levelled provisionally using pieces of cardboard and a bubble level with a hot shoe. On the inside you see the camera lens protruding through the ceiling of the box, fitted with a filter holder that contains a Kodak Wratten 2E filter.

Figura 2 | La cámara se nivela provisionalmente con piezas de cartón y un nivel de burbuja con una zapata. En el interior, se ve la lente de la cámara que sobresale por techo de la caja, equipada con un filtro Kodak Wratten 2E.



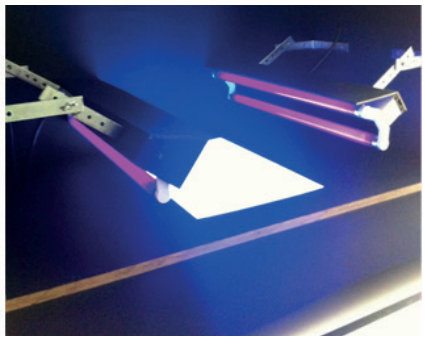


Figure 3 | The lamp holders are fitted with custom made cardboard hoods lined with black non-fluorescent paper. The lamps are mounted inside the box using simple iron squares in which extra holes have been drilled allowing adjustment of the lamp angle.

Figura 3 | Los portalámparas están equipados con campanas de cartón hechas a medida con papel negro no fluorescente. Las lámparas se montan dentro de la caja utilizando cuadrados de hierro simples en los que se han perforado agujeros adicionales que permiten el ajuste del ángulo de la lámpara.

Figure 4 | The result. A front page of a children's book photographed in visible light (left) and while exposed to UV (right) inside the UV studio box. The UV target is a prototype of the UV reference target developed by UV Innovations™. The image is post processed according to the directions that accompany the UV reference target[1]

Figura 4 | El resultado. Una portada de un libro infantil fotografiado con luz visible (izquierda) y expuesto a los rayos UV (derecha) dentro de la caja de estudio UV. El objetivo UV es un prototipo del objetivo de referencia UV desarrollado por UV Innovations ™. La imagen se procesa posteriormente de acuerdo con las instrucciones que acompañan al objetivo de referencia UV[1].

1 UV Innovations™, 2018.

1 UV Innovations™, 2018.

Table 1 | Technical Specifications.

Tabla 1 | Especificaciones técnicas.

Box *Caja*	Dimensions (LxHxW) / *Dimensiones (LxAxA)*:	100x100x67cm
	Outer material / *Material exterior*:	Plywood / *Contrachapado*
	Inner Material / *Material interior*:	Savage Super Black, non fluorescent background paper/*papel de fondo no fluorescente*[2]
	Covering (front) / *Cubierta (frontal)*:	Black cloth (non fluorescent) / *Tela negra (no fluorescente)*
Camera *Cámara*	Type / *Tipo*:	Nikon D80, unmodified digital, mirror reflex camera/*digital sin modificar, cámara réflex de espejo*[3]
	Sensor width / *Ancho del sensor*:	23.6 mm
	Sensor height / *Alto del sensor*:	15.8 mm
	Focal Length / lens / *Distancia focal / lente*:	50 mm
	Subject distance / *Distancia del objeto*:	100 cm
	Horizontal Angle of view / *Ángulo de visión horizontal*:	26.56˚
Camera accessories *Accesorios de la cámara*	Remote control / *Control remoto*:	Camera dependent / *Depende del tipo de cámara*
	USB digital camera cable / *Cable USB para cámara digital*:	Camera dependent / *Depende del tipo de cámara*
	Levelling / *Nivelación*:	Bubble levelling with hot shoe / Nivelador de burbuja con hot shoe
	Filter holder and/or lens adaptation ring (optional) / *Portafiltros y/o anillo de adaptación de la lente (opcional)*:	Filter and camera dependent / *Depende del filtro y de la cámara*
Filter *Filtro*	Option 1 / *Opción 1*:	PECA 918 + Kodak Wratten 2E
	Option 2 / *Opción 2*:	B+W 486 IR cut filter / *Filtro atenuador IR B+W 486*
Subject dimensions *Dimensiones del objeto*	Horizontal coverage / *Cobertura horizontal*:	32 cm
	Vertical coverage / *Cobertura vertical*:	47 cm
	Diagonal coverage / *Cobertura en diagonal*:	57 cm
UV Lamps *Lámparas UV*	Blacklight blue lamp / *Lámpara azul con luz negra* (4x):	Philips TL-D BLB, low-pressure mercury-vapor fluorescent lamp / *Philips TL-D BLB, lámpara fluorescente de vapor de mercurio de baja presión*[4]
	Technical lamp wattage / *Potencia de la lámpara técnica*:	18 W
	Emission peak according to manufacturer / *Pico de emisión según fabricante*:	360 nm[5]
	Overall length / *Longitud total*:	60.4 cm
	Lamp regulator / *Regulador de lámpara*:	Philips TMX204 2xTL-D18W HFR CFL.
	Length / *Longitud*:	61.6 cm
	Angle to subject / *Ángulo con respecto al objeto*:	32˚

2. Frey, 2011, p. 154.

3. Sensor width and height can differ according to the type of camera. Together with the focal length of the lens and the distance to the subject, they determine the dimensions of the field of view. The internet provides several calculators that help you calculate the field of view for your particular camera. The size of the box can be adjusted accordingly.

4. The intensity of the Philips TL-D Blacklight Blue is less than that of a high pressure mercury vapor lamp, but a serial arrangement of two or more lamps will effectively irradiate a surface area of this size (32 x 47 cm) for examination or photography. The TL-D Blacklight Blue lamp is not ideal as it tends to leak visible light, especially in the 405 and 435 region, but unlike most of the high pressure mercury vapor alternatives, they are affordable, do not require a transformer, and they can be turned on and off as desired as they need no extensive warm up or cool down time. Frey, 2011, p. 153.

5. Philips Lighting, 2014.

2. Frey, 2011, p. 154.

3. El ancho y la altura del sensor pueden variar según el tipo de cámara. Junto con la distancia focal de la lente y la distancia al objeto, se determinan las dimensiones del campo de visión. El Internet proporciona varias calculadoras que le ayudan a calcular el campo de visión de su cámara en particular. El tamaño de la caja se puede ajustar en consecuencia.

4. La intensidad del Philips TL-D Blacklight Blue es menor que la de una lámpara de alta potencia de vapor de mercurio a presión, pero una disposición en serie de dos o más lámparas irradia eficazmente una superficie de este tamaño (32 x 47 cm) para su examen o fotografía. La lámpara TL-D Blacklight Blue no es ideal ya que tiende a fugar luz visible, especialmente en las regiones 405 y 435, pero a diferencia de la mayoría de las alternativas de vapor de mercurio a alta presión, que son asequibles, no requieren un transformador, y se pueden encender y apagar según se desee, ya que no necesitan mucho tiempo de calentamiento ni de enfriamiento. Frey, 2011, p. 153.

5. Philips Lighting, 2014.

References | Bibliografía

Frey, F. (2011). *The AIC Guide to Digital Photography and Conservation Documentation*. (J. Warda, Ed.). Washington, D.C: American Institute for Conservation of Historic and Artistic Works.

UV Innovations™ | Ultraviolet Photography Standards | Workflows. (2018). Retrieved 3 December 2018, from http://www.uvinnovations.com/getting-started

Phillips Lighting (2018). *TL-D Blacklight Blue TL-D 18W BLB 1SL/25*. Retrieved 3 December 2018, from https://www.assets.lighting.philips.com/is/content/PhilipsLighting/fp928048010805-pss-global

Appendix II: Survey Questions

This appendix contains all questions with question number (Q) as distributed online.

Anexo II: Preguntas de la encuesta

Este anexo contiene todas las preguntas con el número de la pregunta (P) tal como se distribuyen en línea:

Introduction

Q1. Dear participant,

Thank you for choosing to participate in this survey on the use of Ultraviolet Visible Fluorescence examination (UVF(vis) examination) of paper artifacts in the conservation workplace. This survey is a preliminary inquiry into your habits, wishes and skills when it comes to the use of an ultraviolet lamp as a tool in your everyday work.

The survey is part of my Master's research project under guidance of the University of Amsterdam and the Cultural Heritage Agency of the Netherlands. Its key objective is to develop a concept of an atlas of ultraviolet images as a diagnostic tool to aid conservators working with paper heritage. Before you start and answer my questions, however, you might have some of your own:

Why should I participate in this survey?

You will help me get an insight in the way conservators of paper and books use UVF(vis). With this information I will get an idea of how I could help conservators, like yourself, to get the most out of this technique.

What will happen with my answers?

Your individual answers will be treated anonymously and will not be passed onto third parties. The overall result of the survey will be distributed to all respondents who have indicated they'd like to be kept informed. You can leave your email address at the end of the survey.

How long will it take me to complete this survey?

Depending on your answers, completing this survey can take up to 20 minutes. The average time it takes to complete the survey, however, is no more than 12 minutes. Your willingness to take your time to contribute to this research is very much appreciated.

Can I respond at a later time?

No problem if you like to wait until a more convenient time for you to complete this survey. The survey program remembers your answers until you press "send" and allows you to stop halfway and continue at a later time. However, since this survey is part of a Master's project there is a set time frame within which your link to this survey is active. After the 8th of April 2014 it is no longer possible to complete this survey.

What if I have any other questions or remarks?

You can always contact me on my email address:
aafkeweller@gmail.com

I hope you enjoy completing this survey. With kind regards,

Aafke Weller

Master student

Restoration and Conservation of Cultural Heritage

UNIVERSITY OF AMSTERDAM

Cultural Heritage Agency of the Netherlands
Ministry of Education, Culture and Science

Metadata

Q2. What is your profession?

- ☐ Conservator
- ☐ Conservation
- ☐ student
- ☐ Other:

Q3. What is your (main) specialization?

- ☐ Books
- ☐ Paper (includes archival materials, works on paper etc.)
- ☐ Books and paper
- ☐ Other: .....

Q4. Thank your for choosing to participate in this survey. Unfortunately this survey is designed for conservators and students in conservation only. Would you like to be kept informed about the results of this survey?

- ☐ Yes, keep me informed via e-mail on the following address:
- ☐ No, thank you

Metadata Students

Q5. What is your specialization?

- ☐ Books
- ☐ Books and paper
- ☐ Paper
- ☐ Other: .....

Q6. Thank your for choosing to participate in this survey.

Unfortunately this survey is not designed for conservation students specializing in {choice made in Q5}. Would you like to be kept informed about the results of this survey?

- ☐ Yes, keep me informed via email using the following address
- ☐ No, thank you

Q7. In which country do you currently study?

.....

Q8. What is the degree you current study for?

- ☐ Bachelor or equivalent
- ☐ Master or equivalent
- ☐ Doctorate
- ☐ Other: .....

Refresh?

Q9. Would you like a short introduction to the principles of UVF (vis) before you continue?

☐ Yes, refresh my memory before I start this survey.

☐ No, thank you. I would like to proceed to the survey right away.

Q10. Introduction to the principles of UVF(vis)

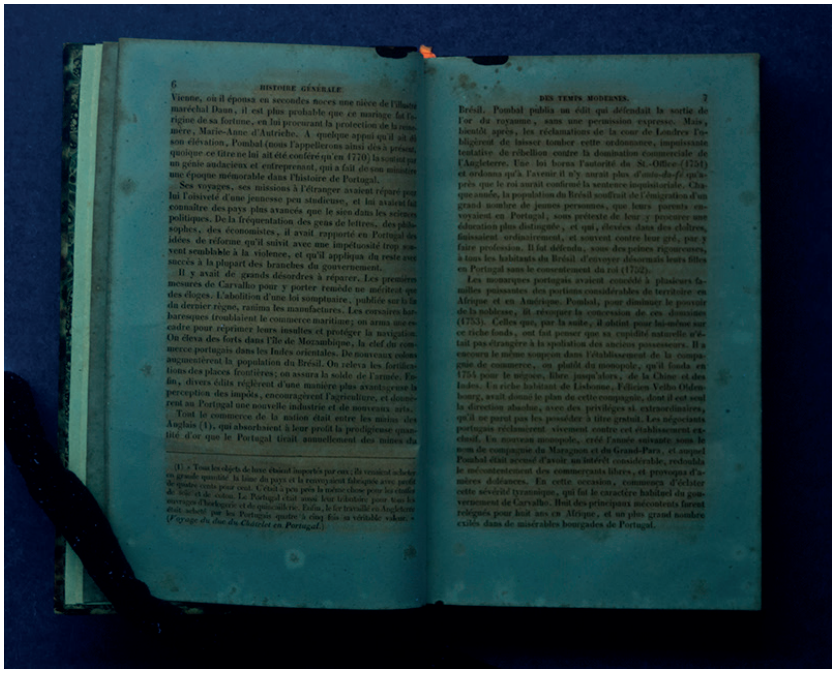
Ultraviolet visible fluorescence examination allows qualitative analysis of an object simply by irradiating the object with ultraviolet light. Note that visible ultraviolet fluorescence examination is different from ultraviolet visible spectrophotometry or fluorescence spectroscopy, fluorometry etc. These techniques allow quantitative analysis of the fluorescent spectrum that can be visualized in, for example, a graph. This survey only concerns the ultraviolet induced fluorescence image as it is observed with the naked eye:

An image of ultraviolet induced, visible fluorescence of a book taken from the study collection of the University of Amsterdam:

Ragon, F. *Histoire Générale Des Temps Modernes*. Vol. 3. Paris: Louis Colas Libraire, 1845: p. 6 – 7.

Photographed under UV light (355 nm)

Picture: Aafke Weller



Ultraviolet fluorescence is a phenomenon that results from the ability of certain molecules to absorb a part of the light in the ultraviolet region of the electromagnetic spectrum. The light is absorbed as energy in electronic transitions causing molecules to form excited states. These excited molecules rapidly loose the excess electronic energy by converting it into vibrational energy (heat) or the emission of a photon of light (radiation). Because the re-emission of ultraviolet light as radiation is always of a longer wavelength than the absorbed radiation, it often occurs in the visible part of the electromagnetic spectrum. Thus, if viewed in the dark, this re-emitted radiation can be perceived with the naked eye as a colorful luminescence that will last as long as the object is irradiated. In organic substances, the electrons involved in this process are the π-electrons, the occasionally, non bonding (n-) electrons and especially those in conjugated and aromatic systems. Given this connection between the molecular structure of the irradiated substance and the perceived luminescence, UFV(vis) can give an indication of the composition or condition of the irradiated object.

Questions for Students in Book and Paper Conservators

Q11. How much attention is given to the following aspects of UVF(vis) examination in the curriculum of your current studies?

1) Physical principles behind UVF(vis) examination.

- ☐ None
- ☐ Little
- ☐ Some
- ☐ A Lot

2) Chemical principles behind UVF(vis) of paper artifacts in particular.

- ☐ None
- ☐ Little
- ☐ Some
- ☐ A Lot

3) Practice of UVF(vis) examination of museum objects in general.

- ☐ None
- ☐ Little
- ☐ Some
- ☐ A Lot

4) Practice of UFV(vis) examination of paper artifacts in particular. Practice of photographically documenting UVF(vis) images.

- ☐ None
- ☐ Little
- ☐ Some
- ☐ A Lot

Q12. When you examine or treat an object in an educational context, how often do you use UVF(vis)?

- ☐ Never
- ☐ Rarely
- ☐ Most of the Time
- ☐ Always

Q13. With what purpose do you use UV?

1) To assess the condition of the object

- ☐ Never
- ☐ Sometimes
- ☐ Most of the time
- ☐ Always

2) To evaluate the result of your treatment

- ☐ Never
- ☐ Sometimes
- ☐ Most of the time
- ☐ Always

3) To identify certain materials and substances

- ☐ Never
- ☐ Sometimes
- ☐ Most of the time
- ☐ Always

⏮ {if answer to Q12 was "never}

Q14. Do you expect to use UVF(vis) before you graduate?

- ☐ Yes
- ☐ No

Quizz 2

Q15. Thank you for helping me so far. The final round of this questionnaire is a small quiz testing your knowledge of UVF(vis). You will be shown two UVF(vis) images of paper artifacts. For each of the image you will be asked to identify certain fluorescence phenomena. The correct answers to the questions are given at the end of this survey.

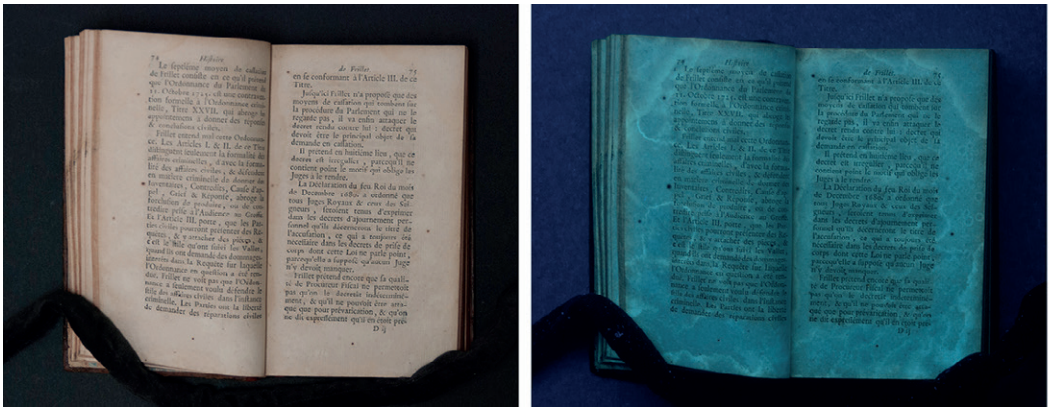
Would you like to take this quiz?

- ☐ Yes, this sounds like fun!
- ☐ No, thank you; I am running out of time.
- ☐ No, thank you; I do not feel comfortable taking a quiz.

Q17. 1. Above you see three images of the same page of a children's book published in 1878.
The left image is taken with visible light, the two right images are made under ultraviolet light (355 nm).

Q18. a: How would you interpret the fluorescence indicated with the dotted line at no. 1? (>50 characters)

Q19. b: Which phenomenon is encircled at no. 2? (>50 characters)



Q22. 2. Above you see two images of the same page from the *Causes célèbres et intéressantes* (...) published in 1737. The right image is taken under ultraviolet light (355 nm).
You can discern two distinct phenomena, one of the two is indicated by the yellow arrows. Write down the two phenomena you discern. (>100 characters)

Subject Descriptors: Conservators

Q24. Do you have a degree in conservation?

- ☐ Yes
- ☐ No

Q25. What is your highest degree in conservation?

- ☐ Bachelor's degree or equivalent
- ☐ Master's degree or equivalent
- ☐ Doctorate degree
- ☐ Other:

Q26. In which country did you receive your {choice Q25 }?

Q27. In what year did you receive your {choice Q25 }?

⏮ {if answer Q24 was "no"}

Q28. How many years have you actively practiced conservation?

Q29. Which description best describes the working environment you currently work in?

- ☐ I am an employee in a private conservation studio.
- ☐ I work in the conservation studio of an institution of cultural heritage.
- ☐ I work in my own, private conservation studio.
- ☐ I work on a freelance basis without my own studio.
- ☐ I do not work as a conservator at the moment.

Q30. In which country do you currently work?

Questions for Book and Paper conservators on UV Viewing

Q31. When you treat or examine a paper artifact, how often do you use UVF(vis)?

- ☐ Never
- ☐ Rarely
- ☐ Sometimes
- ☐ Most of the Time
- ☐ Always

⏮ {if answer to Q31 is "rarelt"}

Q32. Why do you rarely use UVF(vis)? (multiple answers possible)

- ☐ I do not have the required equipment.
- ☐ I do not understand the principles behind the technique. I rarely see the purpose of examining objects with UV.
- ☐ I do not have the space to create the required set-up. I have too little experience with UVF(vis).
- ☐ I do not have the technical knowledge to work with the equipment. I rarely have the time.
- ☐ Other:

Q33. With what purpose do you use UV?

1) To assess the condition of the object

- ☐ Never
- ☐ Sometimes
- ☐ Most of the time
- ☐ Always

2) To evaluate the result of your treatment

- ☐ Never
- ☐ Sometimes
- ☐ Most of the time
- ☐ Always

3) To identify certain materials and substances

- ☐ Never
- ☐ Sometimes
- ☐ Most of the time
- ☐ Always

Q34. How satisfied are you with the results you obtain using UVF(vis) as an examination tool for paper artifacts?

- ☐ Very Dissatisfied
- ☐ Dissatisfied
- ☐ Satisfied
- ☐ Very Satisfied

Q35. What, do you think, would help you to get more out of UVF(vis) as an examination tool for paper artifacts than you already do? (>300 characters)

Q36. Indicate for each of the following items how useful they would be to help you get better results using UVF(vis):

1) Detailed instructions on how to photograph UVF(vis) images for documentation purposes.

- ☐ Very Useless
- ☐ Useless
- ☐ Useful
- ☐ Very Useful

2) A collection of case studies illustrating the application of UVF(vis) in practice.

- ☐ Very Useless
- ☐ Useless
- ☐ Useful
- ☐ Very Useful

3) A clear explanation of the possibilities and limitations of the technique as a tool in the examination of paper artifacts.

- ☐ Very Useless
- ☐ Useless
- ☐ Useful
- ☐ Very Useful

4) A collection of reference images of distinct ultraviolet induced fluorescence phenomena observed on paper artifacts.

- ☐ Very Useless
- ☐ Useless
- ☐ Useful
- ☐ Very Useful

5) Detailed instructions on what equipment to use and how best to use it.

- ☐ Very Useless
- ☐ Useless
- ☐ Useful
- ☐ Very Useful

6) A clear explanation of the physical and chemical principles behind UVF(vis) examination in general.

- ☐ Very Useless
- ☐ Useless
- ☐ Useful
- ☐ Very Useful

Q37. Again consider the items from the previous question. Now check 3 items that you find most useful should you want to get better results using UVF(vis).

Q38. Drag and drop the three choices you made earlier in a ranking from 1 (most useful) to 3 (least useful):

Q39. What would be your medium of preference to receive the desired information on UVF(vis) examination of paper artifacts?

- ☐ A reference book explaining UVF(vis) from A to Z. Concise, technical instructions.
- ☐ An interactive educational tool on the web.

- ☐ An online database of reference images organized as a 'wiki' (a web application which allows people to add, modify, or delete content in collaboration with others).
- ☐ An atlas of reference images (either online or on paper).
- ☐ A workshop on UVF(vis) examination of paper artifacts.
- ☐ Other:

Q40. Which description best describes the set-up you use for the examination of objects under ultraviolet light?

- ☐ A permanent, ready to use set-up
- ☐ An improvised set-up

Q41. When examining a paper object under ultraviolet light, what kind of UV lamp do you use?

- ☐ A lamp with a dominant emission peak in the UVA region (typically 365 nm)
- ☐ A lamp with a dominant emission peak in the UVB region (typically 306 nm)
- ☐ A lamp with a dominant emission peak in the UVC region (typically 254 nm) I choose my lamp in accordance with the phenomenon I expect to observe
- ☐ I do not know the dominant emission peak of the lamp I use
- ☐ Other:

Q42. Can you recall an example from your own experience in which UVF(vis) examination was (or could have been) a decisive factor in the course of treatment?

Think of situations in which phenomena observed under ultraviolet light pointed you in a direction you would otherwise not have taken. You might also recall treatments that took an unexpected and undesired turn that could have been prevented had you examined the object under ultraviolet light. Remember: your answer will be processed anonymously.

Please summarize your recollection in a few sentences. (<500 characters)

Q43. Did you make pictures of the ultraviolet induced fluorescence in question?

- ☐ Yes
- ☐ No

Q44. Case studies are excellent examples to illustrate the use of UVF(vis) in practice. Would you be willing to share your case study with the work field?

- ☐ Yes, you may contact me if you think this case study could be of use in your research. My answers will still be processed anonymously: my name or contact details will not be given to third parties in relation to this specific case study.
- ☐ No, I would rather not share this case study with fellow conservators.

Q45. Thank you for wanting to share your experience. On what e-mail address can I contact you?

⏮ {if answer to Q31 is "never"}

Q46. Why don't you use UVF(vis)? (multiple answers possible)

- ☐ I do not have the time.
- ☐ I do not understand the principles behind the technique. I do not have the space to create the required set-up.
- ☐ I do not have the required equipment.
- ☐ I do not have the technical knowledge to work with the equipment. I do not see the purpose of examining objects with UV.
- ☐ I have too little experience with UVF(vis).
- ☐ Other:

Questions for Books and Paper Conservators on UV Photography

Q47. When examining objects under ultraviolet light, how often do you photographically document the UVF(vis) images?

- ☐ Never
- ☐ Rarely
- ☐ Sometimes
- ☐ Most of the Time
- ☐ Always

Q48. Which description best describes the set-up you use to photographically document ultraviolet induced fluorescence?

- ☐ A permanent, professional image lab
- ☐ An improvised set-up

Q49. When you take pictures of UVF(vis) images, do you work in accordance with a manual or prescribed workflow?

- ☐ Yes
- ☐ No

Q50. What type of camera do you use when making UVF(vis) images?

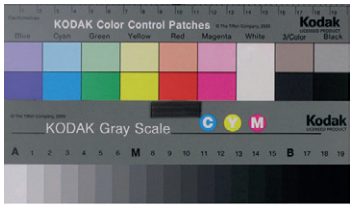
- ☐ A modified digital camera i.e. a camera that is sensitized to UV light by removal of the internal filter
- ☐ An analogue camera
- ☐ A regular digital camera
- ☐ A multispectral camera

Q51. Do you use a color card or color target when creating UVF(vis) images?

- ☐ Yes
- ☐ No

Q52. What kind of target do you use?

- ☐ A Kodak separation guide and greyscale (Q13) or equivalent



- ☐ A fluorescence scale designed for forensic purposes

- ☐ An improvised matt board coated with shellac
- ☐ A Gretag Macbeth ColorChecker (TM) or equivalent
- ☐ Other:

Q53. Do you use an optical light filter?

- ☐ Yes
- ☐ No

Q54. What kind of optical light filter do you use?

- ☐ Kodak Wratten 2E filter
- ☐ Schneider B+W 486 UVIR cut
- ☐ Kodak Wratten 2B filter
- ☐ Baader UVIR Rejection filter
- ☐ Schneider B+W 415 UV cut
- ☐ Other:

Q55. Do you post process your digital UVF(vis) images?

- ☐ Yes
- ☐ No

Q56. Do you post process your images making use of a mathematical model or profile especially designed for the post processing of UVF(vis) images?

- ☐ Yes
- ☐ No, I post process my images judging by eye

⏮ [if answer to Q47 is "never"}

Q57. Why don't you photographically document ultraviolet induced visible fluorescence? (multiple answers possible)

- ☐ I do not have the required equipment
- ☐ I do not have the technical knowledge
- ☐ I do not have the time
- ☐ I do not have the required software
- ☐ I do not have the space to create the required set up
- ☐ I do not have enough experience
- ☐ I do not see the purpose
- ☐ Other:

End of survey

Q23. You have reached the end of this survey.

Would you like to be kept informed about the results of this survey?

(Your e-mail address will not be linked to your answers and will not be given to third parties.)

- ☐ Yes, you can put me on the mailing list. My e-mail address is:
- ☐ No, thank you.

Appendix III: Survey Results

Table 1 | Inventory of the answers to Q35.

(The answers are not edited and may include typing and spelling errors).

Anexo III: Resultados de la encuesta

Tabla 1 | Inventario de las respuestas a las P35. (Las respuestas no han sido editadas y pueden incluir errores de escritura y ortografía).

Q35. What, do you think, would help you to get more out of UVF(vis) as an examination tool for paper artifacts than you already do? (>300 words)	Atlas	Atlas / identification	More experience	More knowledge	Equipment	Set up	Training course	Case study	Off topic or unclear	Specifics
I used portable UV-vis molecular fluorescence for the characterization of pigments and lakes on medieval manuscripts, papers and parchments. The weak results were mostly forged or hidden by the high fluorescent spectra from the surface below or the organics additives in the formulation of the paper									●	
A refresher course or booklet (webpage) on the different possible florescence colours for different materials commonly present in paper artworks (i.e: hide glues, iron gall inks, gums, etc).	●	●								
I have too little experience in interpreting the results of UVF, which is also the reason I rarely use it - an evil circle you could say. I'm sure it could be very useful if I knew more about what to look for. The idea of an atlas like you mention sounds absolutely wonderful to me!	●		●	●						
A training course demonstrating the advantages and use of the method in practice				●			●			
I would love a reference book or guideline that shows what certain fluorescence indicates depending on what you are looking at (for example, shellac fluoresces orange, gelatin fluoresces purple/blue, etc.). Sometimes I'm not quite sure how to interpret what I see.										
More focus on the theme and if the use in media art was obvious									●	
Although they may exist, I think images of UV fluorescing materials would be great to see as an online reference. Examples could be paper additives, adhesives, pigments, dyes, even images taken pre- and post-treatment.	●	●						●		
To learn more about the practical use of the lamp that I own. But it is very old and I don't know exactly how to use it.					●					
More knowledge as to what I am looking at	●			●						

Q35. What, do you think, would help you to get more out of UVF(vis) as an examination tool for paper artifacts than you already do? (>300 words)	Atlas	Atlas / identification	More experience	More knowledge	Equipment	Set up	Training course	Case study	Off topic or unclear	Specifics
Having a dedicated set up for UVF examination would be great, space is always an issue though. Also having a compendium of likely outcomes (e.g. what colors certain pigments fluoresce) would be very useful for new graduates.						●				
I primarily use it to identify either the presence of modern materials in an otherwise very old looking item, or to help confirm the presence of iron gall ink. If I knew of other uses, I might well use them						●				
A handbook with photographs and comments to map and explain what is observed.	●									
I would find a poster of pictures showing all the major conditions and materials UVF can reveal on paper objects very useful.	●	●								
Readily accessible result charts.									●	
There are interesting observations of UV visible fluorescence of materials in/on paper. Some are identified or understood. Most of them are still ambiguous for interpretation. Until there is a database of the UV visible fluorescence behavior gathered, it is difficult to make conclusive analysis.	●	●								
Results are often difficult to ascertain, as for instance a small oil spot and a foxing spot may both fluoresce orange. The halo created around iron gall ink is easier to verify. (Some phenomena are actually easier to see with the naked eye.)	●									
A good article in conservation literature				●						
More published articles outlining what pigments do and don't fluoresce, how media binder affects the fluorescence and how fillers and sizes in paper affect fluorescence.		●		●						
Probably. I sometimes use UV-Vis to identify iron gall ink or to make it more readable. I hardly know how I should use it in daily practice, except for illuminating whiteners and fungi.									●	
Knowlegde of the advantages				●						
I think an online resource that includes photos of various conditions with explanations of what the UV fluorescence means would be a great addition to paper conservation.	●									
It would be nice if one could deduct, a bit, the activity of moulds-suspected papers										Mould

Q35. What, do you think, would help you to get more out of UVF(vis) as an examination tool for paper artifacts than you already do? (>300 words)	Atlas	Atlas / identification	More experience	More knowledge	Equipment	Set up	Training course	Case study	Off topic or unclear	Specifics
A reference database with examples and images of some kind, which could aid in the identification and interpretation of materials and condition phenomena. Knowing that interpretation of results from technical examination is rather subjective.	●	●								
I can see differences in the paper, tidelines are always quite easy to see, but what do you do with the information you see? How will you use it for conservation treatment and how do you let it way in your choice for treatments? And what is it exactly what you see? these are always my questions.	●			●						
I very rarely used UV light for any of the above purposes. In my experience it was almost always used to read faded ferrogallic inks.									●	
More use of UV would not change my treatments. Access to a more specific range of known UVfrequencies might yield more information. I mostly use UV for examination of parchment and vellum during the cleaning process to enable me to work without disturbing manuscript and cleaning albumen prints.									●	
A better understanding of how to interpret UV-Vis in different contexts.				●						
Investing in the right equipment. Following a training course. Spending more time reading up on				●	●		●			
the subject.										
UV chart to know substances and variants with images.	●	●								
Dedicated set-up for examination and photography.						●				
Maybe a study that is dedicated to the subject, with fine photographs and examples.	●									
Having a series of cards with pigments, tapes, conservation materials etc. out on it to use for comparative purposes.	●	●								Reference collection
A catalogue with what different colours of fluorescence mean.	●	●								
Better knowledge about what different kinds/colours of fluorescence mean. I can often see that something is there or is different, but I can't make any further conclusions.	●									

Q35. What, do you think, would help you to get more out of UVF(vis) as an examination tool for paper artifacts than you already do? (>300 words)	Atlas	Atlas / identification	More experience	More knowledge	Equipment	Set up	Training course	Case study	Off topic or unclear	Specifics
More examples of the way fluorescence looks and its meaning (all this in context)	●									
More knowledge				●						
An on-line atlas of images or wiki and case studies or examples of applications	●							●		
A printed chart showing the effects of UVF on different pigments, mould stains, water stains, metal particles, foxing spots etc. could be a useful tool to demonstrate to students.	●									Education
Better light source, mount for light source, better workspace in low/no lighting						●				
I do not think about it and know it badly; I use it in the presence of microorganisms, mold to support a visual examination with normal light; but I do not use this data afterwards									●	
It would be interesting to be able to interpret results better and to compare them to 'known' examples. An atlas would be incredibly helpful for visual reference. Which materials fluoresce in which color?	●	●								
I would like to know more about the patterns of fluorescence and the absorbance of UV radiation of heritage materials, and the influence of time on these patterns. I do see a lot more than without the UV radiation, but I don't know exactly what I am looking at. Sharing knowledge would be fruitful	●			●						
More information to help identify (rule out the presence of) a particular phenomena or material, e. .g residues left by bleaches, optical brighteners in blotters/towels etc. I am aware of some uses based on personal experience. If these experiences were crowd sourced it would be a more powerful tool.	●									Crowd-sourced experience
Guidelines, charts like for instance that shellac colours green under UV-Vis, etc.	●	●								
-									●	
If I knew how to interpret the image I get, i.e. how to identify adhesives, former treatments etc.	●	●								
Probably, to have a reference guide to compare. Now, I use UVF only to identify basically fungus or old repairs.	●									

Q35. What, do you think, would help you to get more out of UVF(vis) as an examination tool for paper artifacts than you already do? (>300 words)	Atlas	Atlas / identification	More experience	More knowledge	Equipment	Set up	Training course	Case study	Off topic or unclear	Specifics
Lack of understanding of the interpretation of the observations	●									
Since there are so many variables in terms of materials that can affect their documentation and interpretation, it would be useful to have an accessible database of information following a set of basic standards. Text and photos with metadata would be helpful. This has been done regionally.	●									
Maybe a database with pictures of the characteristics of materials and substances in paper	●	●								
It would help to have better guides written about how materials look under UVF, for identification purposes.	●	●								
Availability of a standardized reference scale so the color or intensity of the fluorescence can be described clearly in written reports (I believe such a scale is being developed by Photograph Conservator Paul Messier, but it is not available yet).										Target
A visual dictionary of images to help decipher what I see when I am looking at works under UV	●	●								
I use it just to "look" another way of seeing. It does not usually correspond to direct information, direct materials, or direct condition –but it is very useful, even though it rarely means anything.									●	
A better understanding of the causes for what I see.				●						
I think that things like this survey are important for making this a more useful tool. As most of my UV(vis) examinations are qualitative, having access to a range of observations by other conservation professionals would be useful.	●									Crowd-sourced
An easier to handle UV-source with different wavelengths to choose.					●					
A single lamp with selections of different ranges (long, medium and short range spectra) so I could refine my viewing depending on what I am looking for.					●					
As you have mention in the introduction, an atlas of possible visual results would be helpful and educational to some extent. The estimation of the impact of the irradiation on fragile materials would also be helpful.	●			●						Education
A reference library of images of substrates, media and condition problems (mold, etc) viewed in UV	●									

Q35. What, do you think, would help you to get more out of UVF(vis) as an examination tool for paper artifacts than you already do? (>300 words)	Atlas	Atlas / identification	More experience	More knowledge	Equipment	Set up	Training course	Case study	Off topic or unclear	Specifics
The ability to take a photograph of the artifact under UVF light and have the image capture a true representation of what the eye sees.										Target
Don't know. No strong ideas.									●	
Sure, when I will have the time, I would like to expand my known material samples (adhesives mostly) to compare. If there are known stain samples that would be very helpful too. I use UV-vis to identify mold too.	●	●								
Better equipment					●					
Yes.									●	
Having a list of substances that fluoresce and corresponding timelines of when they were introduced if man-made.	●									
More reference samples of materials with which to compare appearance. More convenient location of dark room (too far from studio). Better photographic set up. More expertise with digital imaging for UV. More use in evaluation of treatment.	●		●			●				Photography
More published examples of use and obtainable results.	●			●				●		
A damage atlas might be helpful.	●									
Color target for UV photography with known fluorescent pigments to use as a standard for comparison and color balancing. images.										Target
The only way I could get more out of it is if I could trade the cones in my eyes for those of a bee so that I could read UVF without the aid of a lamp!									●	
More understanding of the behaviour of specific materials, especially adhesives and binders when viewed with UV, especially at different wavelengths. Access to light sources with a greater range of wavelengths of UV.	●				●					
More engaged discussion and standardization of UV/vis imaging techniques as they relate to photographs and works on paper.				●						Target / discussion in field
?									●	

Q35. What, do you think, would help you to get more out of UVF(vis) as an examination tool for paper artifacts than you already do? (>300 words)	Atlas	Atlas / identification	More experience	More knowledge	Equipment	Set up	Training course	Case study	Off topic or unclear	Specifics
A book about the uses of UVF in paper conservation. I would like to add that I only use UVf in the studio and with the help of a painting conservator to assess the condition of cadastral maps (1st half of the 19 century) that have been varnished at the end of the 19 C. century.				●						
Usually long-wave UV is more revealing, although short wavelengths can be helpful to discern information regarding the item viewed. As a visually subjective method, it is very helpful to have a ready reference chart of known materials to check against.	●	●								Reference chart
Using narrow wavelength LED illumination might result in different fluorescence from the same material thus help to discriminate / identify more precisely the substances observed (media, stains, spots). I don't know if it already exists along with an identification / discrimination tree.	●	●			●					
Reference images of known condition problems / substances photographed using long and short wave UV to use as a comparison with the material currently being examined.	●	●								
I can't think of anything. Materials either fluoresce or they don't									●	
Sometimes it is hard to integrate the UVF lamp in the working process. The possibility to integrate the UVF in the working desk so that there is the chance to use the the UV without having irritations on the objects/ material/artefacts...						●				
A quicker, better expertise on the subject (on my own part) so trotting out the UV light each time doesn't require a re-education.			●							
Probably to use it more frequently, and in time see the possible benefits of its use and understand what to look for when using it.	●		●							
A handy chart of possible results for comparison would be helpful. I don't use it as much as I would like because I don't have a dedicated dark area in my studio.	●		●			●				
I would like to have more references of the assessment of condition of an object. Better equipment, handy and mobile. And more knowledge of examination with UV.	●			●	●	●				
I am satisfied now.									●	
Would be nice to have a handbook with color photos, including photos of possible variations in appearance that may be characteristic of the same condition, such as a natural resin coating or ink with a shellac binder.	●	●								

Q35. What, do you think, would help you to get more out of UVF(vis) as an examination tool for paper artifacts than you already do? (>300 words)	Atlas	Atlas / identification	More experience	More knowledge	Equipment	Set up	Training course	Case study	Off topic or unclear	Specifics
I am just worried of the effects of UV radiation on the fibers of paper materials especially the fragile items. I believe UV is an effective tool for the examination of inorganic materials (because they are often more resistant than organic ones).										Damaging effects of UV
To understand its proper use				●						
Total	64	18	5	19	8	7	2	15	3	
Respondents	89	89	89	89	89	89	89	89	89	
Percentage (total: number of respondents) x 100	52%	2%	6%	21%	9%	8%	2%	3%	17%	

Table 2 | Inventory of the answers to Q42.

Think of situations in which phenomena observed under ultraviolet light pointed you in a direction you would otherwise not have taken. You might also recall treatments that took an unexpected and undesired turn that could have been prevented if you had examined the object under ultraviolet light. Remember: your answer will be processed anonymously. Please summarize your answer in a few sentences. (<500 characters). (The answers are unedited and include typing and spelling errors.)

Tabla 2 | Listado de respuestas al cuestionario Q42.

Piense en situaciones en las que los fenómenos observados bajo luz ultravioleta le indicaron una dirección que, de otro modo, no habría tomado. También puede recordar tratamientos que tomaron un giro inesperado, y no deseado, que podrían haberse evitado si hubiera examinado el objeto bajo luz ultravioleta. Recuerde: su respuesta se procesará de forma anónima. Resuma su respuesta en unas pocas frases. (<500 caracteres). (Las respuestas no han sido editadas y pueden incluir errores de escritura y ortografía).

Q 42: Can you recall an example from your own experience in which UVF(vis) examination was (or could have been) a decisive factor in the course of treatment?	Identification of specific materials	Detection of type II patterns	Detection of type I patterns	Evaluation of treatment	N/a or unclear	Specifics
1. I could identify the green pigments verdigris (Cu Resinate) and the purple Chrozophora tinctoria in old illuminated manuscripts in a non-invasive way with fluorimetric technique by matching the lab standards with the unknown papers and the results were successful where other spectroscopic techniques (Raman and XRF) were limited. I could locate the biotic decay on papers that were colorless under visible light.					●	–

Q 42: Can you recall an example from your own experience in which UVF(vis) examination was (or could have been) a decisive factor in the course of treatment?	Identifica tion of specific materials	Detection of type II patterns	Detection of type I patterns	Evaluation of treatment	N/a or unclear	Specifics
2. I was working on a print on Japanese paper with staining around the edge, it appeared to be hide glue and fluoresced under UV. Once the treatment was thought to be finished (there were still stains but the 'crusty' areas appeared to be gone and could not be felt) I reexamined the piece under UV and there were traces of florescence still present. Further washing was carried out and the spots were removed. Under final UV all the florescence was removed.			●	●		Detection of traces of adhesive
3. I had a late 19th century color lithograph with some hand- painting (watercolor). At some point in its history, someone had painted over the sky with what appeared to be house paint. UVF(vis) examination suggested that the primary pigment in the overpaint was the rutile form of titanium white, so clearly this paint was not contemporaneous. With the curator's approval, I was able to remove this overpaint and reveal the lithograph and its original hand-coloring.	●		●			Detection of overpainting Identification of titanium white
4. Sorry, no answer.					●	
5. Usually it is most useful to me in furniture repair, particularly to understand what resins were used and where on the artifact they were used.					●	
6. I was trying to identify whether I was removing leather dressing that soaked into paper or if I was only removing the gelatin sizing when coming up with a treatment plan. It appeared that I was removing the dressing and not just the sizing, which influenced how I proceeded with further tests.					●	
7. "UV helps in so many ways – zinc white; to distinguish between metallic inclusions and foxing; to observe the extent of solarization a paper object received in its lifetime, previous treatments or the migration of optical brighteners"	●	●	●	●	●	Identification of pigments Identification of Zinc White Detecting metal inclusions Detection of previous treatments Evaluation / monitoring movement of OBA during treatment Assessment of the extent of solarization (?)
8. No, I rarely use it.					●	
9. The identification of pigments prior to washing and also looking at effectiveness of washing treatments after spot bleaching.	●			●		Identification of pigments Evaluation / detection of residues (bleach) after treatment
10. I have used UV examination to determine whether objects have been treated in the past for example old master prints that may present facsimile repairs. I also use it to see if an organic solvent has been rinsed out properly after a tape removal treatment.			●	●		Detection of previous treatments Evaluation / detection of residues (solvent) after treatment

Q 42: Can you recall an example from your own experience in which UVF(vis) examination was (or could have been) a decisive factor in the course of treatment?	Identifica tion of specific materials	Detection of type II patterns	Detection of type I patterns	Evaluation of treatment	N/a or unclear	Specifics
11. I wished to remove old mending paper that had been treated with Thymol. The mends were numerous and not easy to find. UVA allowed me to assess the extent and location of these mends.			●	●		Detection of thymol. Evaluation during treatment
12. I used UVFs to detect the methabolism of microorganisms on paper but have never found anything interesting... Seems like there's more into it! So, please, let me know about the results of your work! Good luck!		●				Detection of mould infested areas
13. I hardly use UV-Vis. See previous answer					●	
14. UVF examination revealed that a surface coating was not a simple natural resin varnish, which explained why my solubility testing was so frustrating.	●					Identification of synthetic varnishes
15. What springs to mind is treatment concerning so-called foxing. Whether it is a result of mold or metal particles and one is planning on using reducing bleaches to treat discoloration in these areas. Once UV also showed adverse effects of a foxing treatment, with pronounced halos around treated area.		●	●	●		Detection of metal inclusions Evaluation of treatment / detection of tidelines
16. No, I have never let the UV take part of my decision in a conservation treatment. This is exactly what I am interested in: how do you let the UV examination take part in your treatment decision? Because most phenomena are also visible with the naked eye once you have seen it with the UV. And why would you treat something in paper if you cannot see it with the naked eye, who wants to pay for a treatment where you can see no result with the naked eye only under UV?					●	
17. Not applicable					●	
18. I have used it to make sure that chemical residues from treatment have been removed and sometimes I have needed to wash again when I thought I was done.				●		Evaluation / detection of residues (chemical) after treatment
19. Writing on the dirty vellum spine of the De Queros (a maritime explorer) bound documents was obscure. UV allowed me to work around friable manuscript and decoration to render gallotannic iron ink clearly visible. Without UV, I would not have had enough information to clean the surface.			●	●		Detection of obscured writing Detection of iron gall ink Evaluation during treatment
20. An oriental painting contained an area with metal that appears to have corroded. It was not recognizable as metal - it resembles a black pigment. Had this been known the subsequent application of aqueous treatment may have been modified, reduced or rejected. As an indication of the presence of iron gall ink, UV has been very useful although more confirmation is usually desired. Iron gall ink usually means erring on the side of caution rather than attempting conventional treatments.			●			Detection of metal pigments Detection of iron gall ink

Q 42: Can you recall an example from your own experience in which UVF(vis) examination was (or could have been) a decisive factor in the course of treatment?	Identifica tion of specific materials	Detection of type II patterns	Detection of type I patterns	Evaluation of treatment	N/a or unclear	Specifics
21. I use UV examination mostly for mold, to trace the extent of affected areas and the effectiveness of the treatment. I also use UV examination during adhesive removal, again to check the effectiveness of the treatment. Finally, I use UV to detect optical brighteners on paper.	●	●	●	●		Detection of mould infested areas Detection of traces of adhesives Detection of OBA
22. I do not have time to give a long written answer.					●	
23. The object was mostly retouched. With UVlight you could see exactly where the object was retouched. Retouched parts absorbed the UV light. The original paint reflected the UV light as yellowish. I was able to make a retouching mapping for the whole object. During an examination of a pastel drawing I wasn't sure if it was a pastel or a crayon drawing. With UVlight I could see a varnish and new it was a pastel drawing.			●			Detection of retouches Detection of varnish
24. I can't think of any that took an unexpected turn as a result of UV examination, but I have used it to monitor the existence of tidelines (from stain reduction) and to look at various unidentified varnishes/ adhesives.	●			●		Identification of varnishes and adhesives Evaluation of treatment / detection of tidelines
25. Research into effects of binding media in paper					●	
26. Discovery of text not evident with normal light			●			Detection of obscured writing
27. To distinguish which surface is varnished or unvarnished, to see where are retouching area, to identify shellac varnish	●		●			Detection of varnish Identification of shellac
28. UVF displayed water tide-lines, which showed to me that the artwork had been treated previously and could have been detrimental to treat it again. Previous repairs and retouching fluorescing under UVF alerted me about areas of damage not visible with the naked eye. This proved that the work had undergone earlier treatment and was not perfect as originally perceived A print was partially 'over-painted' by an artist and sold as an original. Under UVF it was easily shown not to be so.		●	●			Detection of tidelines Detection of damage Detection of retouches
29. Examination of copper pigments and their interaction with paper support; Examination of paper after washing, to determine the extent of sizing remaining and its movement within the paper. Also, I have used the digital microscope as a tool for treatment, when mechanically removing dirt accretions over manuscript text. It allowed me to distinguish between the ink and the dirt so I could do the maximum cleaning without damaging the ink layer.		●	●	●	●	Assessment of copper corrosion Detection of undesired movement in sizing
30. The analysis with UV-Vis does not change my treatments envisaged before ... by pure misunderstanding!					●	

Q 42: Can you recall an example from your own experience in which UVF(vis) examination was (or could have been) a decisive factor in the course of treatment?	Identifica tion of specific materials	Detection of type II patterns	Detection of type I patterns	Evaluation of treatment	N/a or unclear	Specifics
31. It has been useful in several instances to detect the use of bleach (residual) from previous treatments, in which case the owner can be informed about the increased risk of treatment. It has been helpful for the detection of forgeries in terms of the presence of optical brighteners. I use it mostly to see the extend of mold damage.	●	●	●	●		Evaluation / detection of residues (bleach) after treatment Detection of OBA Detection of mold infested areas
32. I primarily use UV light to record the change in tideline staining.		●				Evaluation of treatment / detection of tidelines
33. We had to treat a large object, that had been treated in the 1980s without a trace of documentation. It was very helpful to observe the old retouches under UV light. It gave a quick overview of how thoroughly the object was retouched and coated, much better discernible than with the naked eye. It made us realize not to try to undo the old restoration. Another advantage was that our opinion was immediately understood by the client seeing pictures of the UV images.			●			Detection of retouches Communication with client
34. If I am going to bleach something UV examination is a must to look for not or minimally visible metal so in daylight. I have experienced that metal inclusions, can cause very small foxing to develop in the weeks after oxidative bleaching, even with some rinsing. A week borohydride application followed by water rinsing can fix this. In one case where aggressive bleaching was desired, the bleaching treatment made small holes in the paper where the metal (copper?) was.			●			Detection of metal inclusions
35. Helped me identify a shellac varnish so I know what to do if the client wants to have it removed for further treatment	●					Identification of shellac
36. It is not so much that I have not treated an object, because I saw spots under UV-Vis light that I had not seen in daylight. I usually use UV-Vis to confirm what I already suspected with the naked eye in daylight. It is 23 years that I have been in the profession I looked at an object under UV light about 5 times and I saw strange spots or metal particles that I had not seen in daylight. I wish I could detect more with UV-Vis than what can be seen with it in practice					●	
37. A general fungus infection on a photograph collection. The diagnosis leaded to change the enviromental conditions and to relocate the archive.		●				Detection of mold infested areas
38. The last examination carried out: finding a work arrived for a temporary exhibition in a museum and for which there was suspicion of mold. UV-Vis examination allowed me to avoid the risk of microbiological attack,		●				Detection of mold infested areas
39. I identified shellac as the varnish on a drawing and was able to design my treatment with an effective approach. The treatment was successful.	●					Identification of shellac

Q 42: Can you recall an example from your own experience in which UVF(vis) examination was (or could have been) a decisive factor in the course of treatment?	Identifica tion of specific materials	Detection of type II patterns	Detection of type I patterns	Evaluation of treatment	N/a or unclear	Specifics
40. The seriousness of copper corrosion can be easily detected with UV light. Sometimes in normal light is does not show clearly while in UV it does. This can influence the decision to treat or not to treat.		●				Assessment of copper corrosion
41. Examination of a print with foxing revealed that the paper was full of embedded metal particles, the most I have ever seen in artist's paper. Because of that, I used a chelating agent to remove the metal, which is a treatment I do not often perform. It was a very successful treatment, visually reducing the foxing and preserving the paper from further damage by metal oxidation.			●			Detection of metal inclusions
42. UV light examination is extremely useful when identifying pigments and subsequently choosing the appropriate aqueous or non-aqueous conservation procedure to treat the item (e.g. identifiying gamboge as a pigment and therefore avoiding the use of alcohol in treatments due to colour change). It is also a vital tool in identifying active mold growth which fluoresces under UV light.	●					Identification of pigments Identification of gamboge Detection of active mold growth
43. I have treated manuscripts with UV induced fluorescent halos around iron gall ink lines, because it indicates diffusion of ferrous metals that have caused (and will continue to cause) oxidation of the paper. Generally, I will choose to wash (adding ethanol to water as needed to limit solubility problems) the manuscript and use a phytate and/or alkalizing agent such as calcium bicarbonate.		●				Assessment/detection of ink corrosion
44. No example comes to mind					●	
45. I use sodium borohydride a lot and it helps me check that it is rinsed out. If not, there are white deposits that fluoresce under UV. I also have found very helpful looking at stains and seeing how different they are.			●	●		Evaluation / detection of residues (sodium borohydrate) after treatment Identification of types of stains
46. A total lack of flourescence helping to identify iron gall ink.	●					Identification of iron gall ink
47. I have used UV to examine lines from water events to determine extent damage to the paper substrate. It has hanged the way I might poultice an adhesive so I don't drive some material or the stain into the paper fibers. There are great articles out there about this		●		●		Evaluation of treatment / detection of tidelines
48. Used to identify airbrushed overpaint in vintage posters. Photos and documentation used by purchaser in a lawsuit against the dealer and auction houses for misrepresentation. Used to identify reverse foxing that was liable to result in white spots if the paper was washed and bleached.			●			Detection of over-painting Identification of reversed foxing

Q 42: Can you recall an example from your own experience in which UVF(vis) examination was (or could have been) a decisive factor in the course of treatment?	Identifica tion of specific materials	Detection of type II patterns	Detection of type I patterns	Evaluation of treatment	N/a or unclear	Specifics
49. I've observed haloing of iron gall ink, even after employing a fixative (cyclododecane), encouraging me to not consider this a way to access aqueous treatment in the case of a minor iron gall ink inscription on an artifact that would otherwise benefit from wet treatment.		●		●		Evaluation of iron gall ink corrosion after treatment. Detection of Iron gall ink
50. UV light as an aid in identifying colorants/pigments helps determine appropriate treatments which won't affect them adversely. In revealing the extent of degradation to support caused by certain pigments or possible additives to the support that might not be visible in normal light, it helps me decide if additional support to a fragile area should be added, or if immersion treatments are suitable (additives can precipitate out from certain modern papers in pH altered water or some solvents).	●	●				Identification of colorants Identification of pigments Assessment of the extent of degradation
51. A decision to remove a varnish and change of overall color tone of the artwork.					●	
52. To determine the condition of iron gall ink and therefore decide whether the item should be treated with calcium phytate or if preventative conservation measures should be employed instead.		●				Assessment of the extent of ink corrosion
53. To discover if mold on an object is active or dormant.		●				Detection of active mold growth
54. First, if I were doing stain reduction, I would check the stain under UV, either oil based, water based or other so that I can prepare solutions depends on the observation with UV. Sometimes UV can also tell you if the stain was previously treated. UV lamp is also useful to check the mold related problems on the paper.	●	●	●			Identification of types of stains Detection of previous treatments Assessment of mold infested areas
55. I would never rely solely on the results of one test or one method of examination. If I use UV it's probably in relation to a surface coating or dry mount tissue, and I'll also do microtests for solvent solubility and look at things under magnification. I have never had something unexpected happen that could have been prevented with examinaton under UV light.					●	Detect surface coating
56. In cases where I am not sure if I am seeing mold residue, the UVF evidences that mold hyphae has had an impact on the course of treatment I have chosen.		●				Detection of mold infested areas
57. The examination is used to give further information on the condition and composition of the object. It is not used as a definitive test to decide treatment options.					●	
58. I am usually looking to determine if pages or plates are original to the book or are facsimiles.			●			Detection of previous treatments
59. UV indicated phenomena have never changed a proposed treatment.					●	
60. I have used it to determine if an item containing iron gall ink has received a prior water-based treatment: used to observe lateral migration of the ink.		●				Assessment of ink corrosion

Q 42: Can you recall an example from your own experience in which UVF(vis) examination was (or could have been) a decisive factor in the course of treatment?	Identifica tion of specific materials	Detection of type II patterns	Detection of type I patterns	Evaluation of treatment	N/a or unclear	Specifics
61. Not in conservation treatment, but reading faded text and photographing it.			●			Detection of obscured writing
62. No					●	
63. UV examination has helped identify parts of tide lines that were not visible under normal illumination. These areas would have not been treated otherwise. UV has also helped determine whether chemicals used for stain reduction have been fully rinsed from the paper. UV examination has also shown alterations in organic dye-based lithography ink after light bleaching treatment that was not noticeable in normal illumination.		●		●		Detection of tidelines Evaluation / detection of (chemical) residues after treatment Detection of chemical changes after bleaching
64. I cannot recall a specific example, but we often using UV to determine the presence of optical brightening agents in photographs, mold and/or previous conservation treatment. All of these can be significant factors in treatment.		●	●			Detection of OBA Detection of mold infested areas Detection of previous treatments
65. UV vis examination can help decipher the history of an item that is brought in for treatment, such as was it bleached before, does it have stilbene optical brighteners, history of mold exposure, particular coatings or media or layers that might be sensitive to water or particular solvents, among other things. After treatment, you can see how effective reduction of unwanted things or retention of desired things has been. the quality of your own work, are you leaving tidelines, etc.?	●	●	●	●		Detection of previous treatments Detection of OBA Detection of mold infested areas Detection of surface coating Detection of solvent sensitive media
66. I use UVF (vis) routinely to discriminate between foxing from metal inclusion or foxing with biological origin in order to decide how / if I should address the spots. I recently treated a modern colored ink drawing on Eastern paper, very straightforward localized treatment to water remove a wet stain on suction table. That went very well. I assessed the result of stain treatment afterwards and had a look under UV to realize my hands were fluorescing a light yellow color -as did the verso of my object.		●	●	●		Detection of metal inclusions Detection of mold infested areas
67. I have examined the use of various solvents for removing Post-it notes from an inkjet photo print. For some solvents no normal visual change was obvious, but all solvents caused movement of the optical brighteners in the paper when viewed under UV. I have also used UV to evaluate local solvent use during stain reduction in an art print paper that seemed to have some sort of fluorescent additive in the paper.				●		Evaluation / monitoring movement of OBA during treatment
68. I examined and photographed many types of late 19th and early to mid-20th century photoreproductions under UV light, and then repeated the photographs after various treatments. This was part of a research project, and it informed my findings on safe treatments for this type of object, and how these treatments affect the object.				●		

Q 42: Can you recall an example from your own experience in which UVF(vis) examination was (or could have been) a decisive factor in the course of treatment?	Identifica tion of specific materials	Detection of type II patterns	Detection of type I patterns	Evaluation of treatment	N/a or unclear	Specifics
69. I used the UV to be more certain if a paper artifact had previously had mold damage		●				Detection of mold infested areas
70. I frequently use it to note the amount of sodium borohydride remaining in the paper between rinses. I also use it to confirm the presence or absence of metals or mold in foxing.		●	●	●		Evaluation/detection of residues (sodium borohydrate) after treatment Detection of metal inclusions Detection of mold infested areas
71. Sorry, almost no experience in using UV. Only a little bit when examining mold.						Detection of mold infested areas
72. I cannot think of any.					●	
73. 1. Confirmation that the ink binder in some broadsides was shellac, which was initially indicated by solubility in alcohol. As a result I avoided the use of alcohol when washing the broadsides. 2. I use UVF examination to determine if a yellow pigment is gamboge. If so, that limits or prevents the use of water and solvents. Humidification must be gentle or the gamboge will bleed. 3. I use UV-Vis to examine mold, foxing, and optical brighteners, before and after treatment.	●	●	●	●		Identification of shellac Identification of gamboge Evaluation / detection of mold infested areas before and after treatment Evaluation of foxing before and after treatment Evaluation / monitoring movement of OBA during treatment
74. I used to the laminated cabinet for observing the varnish conditions on the painting (it was on the canvas). I also used it for observation of glue which was used for the pottery. restoration.					●	
75. Used only to identify iron gall ink from carbon based ink	●					Identification of iron gall ink
	18	27	27	21	20	