

## From Stereoscopy to Tactile Photography

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Inspired by a new interest in the physicality of the artwork and our own work with tactile materials for visually impaired exhibition visitors, we propose the prolegomena for a new multisensory discipline, which we call *tactile photography*. It is based on the principles of stereoscopy and the computer-aided conversion of digital images into reliefs, which can be produced as real objects – on 3D-Printers for example. This new discipline can be especially interesting for visually impaired artists, but is not limited to “disability arts”<sup>1</sup> In this article, we want to show that *tactile photography* connects with a long-lasting interest in enhancing photography with the illusion of depth and physical space, which it shares with multi-photography,<sup>2</sup> Andrew Davidhazy’s peripheral photography (developed in the 1960s), the Lumière Brothers’ photostereo synthesis, and with *photosculpture*.<sup>3</sup> Yet, only the latter medium aims at translating photography into tactile sculptural forms. Invented in 1859 by the French sculptor and photographer François Willème, *photosculpture* is the adaption of photographic

Figure 1  
François Willème (studio),  
Maximilian,  
Erzherzog von Österreich und Kaiser von Mexiko,  
Photosculpture, cast bronze  
60,7 x 21,6 x 21,6 cm, 1864  
(photograph by Jean-Luc Ikelle-Matiba, Bonn).  
LETTER Stiftung, Cologne.



1. According to a generally agreed definition, disability arts is art made by disabled people which reflects the experience of disability, “made with some sort of aesthetic purpose, [...] not a hobby to keep the cripples’ hands busy. And it is not therapy.” Cf. What is Disability Arts? Allan Sutherland, < <http://www.disabilityartsonline.org.uk/what-isdisability-arts> > (15.01.13).

2. Cf. Lars Blunck, ‘Chimären im Spiegel. Anmerkungen zur so genannten

Multifotografie’, in: *Fotogeschichte*, vol. 94, 2004, 3-14.

3. Cf. Gunnar Schmidt, ‘Die Simultaneität der Blicke. Über ein medientechnisches Dispositiv’, in his book *Visualisierungen des Ereignisses. Kultur- und Medientheorie*, Berlin, 2009, 128; Angelika Beckmann, ‘Fotoskulptur. Überlegungen zu einem Bildmedium des 19. Jahrhunderts’, in: *Fotogeschichte*, vol. 39, 1991, 3-16.



Figure 2  
*Raffaels Madonna of the Meadow*  
 as a 2.5D textured relief,  
 Tactile Paintings Project by VRVis for  
 Kunsthistorisches Museum in Vienna 2010  
 (photograph by Stephan Mantler/VRVis  
 – Zentrum für Virtual Reality  
 und Visualisierung Forschungs GmbH).

portraits to the construction of three-dimensional portrait-sculptures. The sitter was positioned in a rotunda, surrounded by an array of 24 cameras at fifteen-degree intervals that took simultaneous photographs. These profiles were then transferred by means of a pantograph to a pillar of clay rotating on a turntable. The result was trimmed and touched up by the artist, and then transferred into other materials. LETTER Stiftung's photosculpture of *Maximilian, Erzherzog von Österreich und Kaiser von Mexiko* – apparently made in 1864 – is a good example both of Willème's advanced production process and his clientele (fig. 1).<sup>4</sup> The entire process was firmly based on the idea that the sum of all its profiles would yield the volumetric whole.<sup>5</sup> The new medium met with a euphoric reception by some as it promised "l'immense avantage de la ressemblance vraie"<sup>6</sup> to the portrayed subject. Others were more reserved and saw it not as a medium of its own value, but as an auxiliary medium for the artistic process, or at best in a "place exceptionnelle" between the two.<sup>7</sup> *Photosculpture's* closeness to reality also meant a lack of hierarchy between the more and the less important, an acceptance of nature as-is, without artistic expression;<sup>8</sup> an *art mécanique* of petrified photography<sup>9</sup> produced by body-copying-machines (Körperkopiermaschinen<sup>10</sup>). Despite technical improvements such as Antoine Claudet's *Photoplastigraphie*,<sup>11</sup> *Photosculpture* was too expensive as a means for self-representation and not accepted as an art medium in its own right. Clients preferred to acquire dozens of *cartes de visite* for the same price as one bulky sculpture, and Willème's enterprise lasted only about six years. It was not until recently that *photosculpture* celebrated a comeback, thanks to enhanced body-scanning and 3D-Printing technologies.

Today's rising interest in enhancing purely visual media with multisensory experiences<sup>12</sup> coincides with the promise of 3D printing to transform our contemporary lives and foster "a new industrial revolution".<sup>13</sup> Apart from industrial and commercial use, there is a

4. This work is owned by LETTER Stiftung, Cologne and will soon be published in detail. The piece is extensively documented in the Foundation's records, which were kindly made available to the authors through the mediation of Uwe Schögl, Vienna. <<http://www.letter-stiftung.de>> [15.01.13].

5. Robert Sobieszek, 'Sculpture as the Sum of its Profiles: Francois Willème and Photosculpture in France, 1859-1868', in: *The Art Bulletin*, vol. 62, 1980, nr. 4, 618–622.

6. Ernest Lacan, 'Exposition photographique', in: *La Revue Photographique*, 1863, vol. VIII, 143.

7. Jean-Luc Gall, 'Photo/sculpture', in: *Études photographiques*, vol. 3, November 1997, available at <<http://etudesphotographiques.revues.org/index95.html>> [10.01.13].

8. Schmidt 2009 (reference 3), 120.

9. Cf. A. Hermant, 'La photosculpture', in: *Le Monde illustré*, 31 décembre 1864, 426, cited after Gall 1997 [reference 7].

10. Albert Kümmel, 'Körperkopiermaschinen. Francois Willèmes technomagisches Skulpturentheater (1859-1867)', in: Gundolf Winter, Jens Schröter, Christian Spies (eds.), *Skulptur. Zwischen Realität und Virtualität*; Paderborn, 2006, 191-211.

11. Johann Gottfried Dingler, 'Claudet's Photoplastigraphie', in: *Polytechnisches Journal*, vol. 182, no. XLIV, 1866, 153-155.

12. Elkins summarizes this new interest in the insight that "Seeing is embodied, and it should no longer be separated from touching, feeling, and from the full range of somatic response", yet he also asks for a more rigorous approach when thinking about this materiality, cf. James Elkins, 'On Some Limits of Materiality', in: *ArtHistory, Das Magazin des Instituts für Theorie*, vol. 31, 12/2008 (special issue on 'Taktilität: Sinneserfahrung als Grenzerfahrung'), 25–30.

13. Cf. 'Print me a Stradivarius. How a new manufacturing technology will change the world', in: *The Economist*, February 12-18, 2011.



Figure 3  
LD-Converter in the Museum of Technology  
in Vienna and a 1:50 scaled 3D print of  
the LD-converter for ArteConTacto, 2011  
(photograph by Andreas Reichinger).

fast-growing community of people who use 3D printers to produce small series of impressions at home. Today's 3D printers for domestic use can only print in one or two colours, but this might just be a question of time, and there actually are some companies that offer the conversion of digital images into photographic reliefs (such as BumpyPhoto), as well as 3D printouts of full body scans (such as ThreeDee-You).<sup>14</sup>

Our own approach, tactile photography, is based on stereoscopy, a technique that has been said to share an *inquietante affinité*<sup>15</sup> with *photosculpture* and is currently celebrating a Renaissance in the entertainment industry with 3D cinema. Stereoscopy has also entered the consumer market, in the form of digital "3D cameras" for photography and video.

Stereoscopy is distinguished by its ability to capture not only colour but also encode the depth at every point, i.e., the plasticity, the surface. Nowadays, computer algorithms can extract this depth<sup>16</sup> and form the basis of our approach. However, current algorithms are not perfect, as our experiments have pointed out: The captured scene has to be sufficiently textured. Single-coloured objects, over- and under-exposure, reflections and transparencies have to be avoided, and a high depth of field should be maintained to get good results.

According to the taxonomy we have established for tactile media,<sup>17</sup> *Tactile Photography* would lie in the continuum between 2-dimensional and 3-dimensional media. We use the term 2.5D, borrowed from visual computing, to denote a bas-relief that raises every point above the

14. "BumpyPhoto specializes in custom-made photo reliefs to bring your photos to life making them memorable and beautiful. Founded in 2011, BumpyPhoto.com operates from Portland, Oregon, USA and London, UK and uses cutting-edge PCT patent pending manufacturing and computer graphics technologies", see: <<http://bumpyphoto.com>> [10.01.13]. ThreeDee-You, "the global pioneer company of Photo-Sculpture", in Madrid, describes their franchise model this way: "The files acquired at the studio are electronically passed to ThreeDee-You's central office where image post-production will take place and sculptures will be produced, see: <<http://www.3d-u.com>> [10.01.13].

15. Michel Frizot and Dominique Païni (eds.), *Sculpteur-photographe. Photographiesculpture*, Actes du colloque organisé au Louvre, Éditions Marval/ Musée du Louvre, Paris 1993, 9.

16. D. Scharstein and R. Szeliski. 'A taxonomy and evaluation of dense two-frame stereo correspondence algorithms', in: *International Journal of Computer Vision*, 47(1/2/3):7-42, April-June 2002.

17. Andreas Reichinger, Moritz Neumüller, Florian Rist, Stefan Maierhofer, and Werner Purgathofer, 'Computer-Aided Design of Tactile Models. Taxonomy and Case Studies', in: *Computers Helping People with Special Needs, Lecture Notes in Computer Science*, Volume 7383, 2012, 497-504.





Figure 4  
*De Krijtberg* in Amsterdam  
 in a digital photograph 2010,  
 as a 2.5D textured relief  
 and as a "Tactile Photograph", 2012  
 (photograph and modelling  
 by Andreas Reichinger).

planar photograph to its extracted height; this is similar to terrain models. In contrast to full 3D, a 2.5D object only works from a limited set of views. 3D features like undercuts or reverse sides are not represented, as is the case in stereoscopy. From the technical point of view, this technique has several advantages over full 3D photo sculptures in data acquisition, storage, computation and production. The absence of undercuts makes them easy to produce (e.g. with simple 3-axis milling machines, or 3D printers), and to reproduce (e.g. using the thermoform process). Furthermore, this medium allows the photographer to point a (twin-lens) camera at the world, using its photographic (and stereoscopic) virtues, instead of having a virtual eye spin around an object to produce a shadow-less scan linked to the "Zentroramatisches Dispositiv".<sup>18</sup> Photographers including Jacques Henri Lartigue have used stereography on a large scale (there are about five thousand glass stereo negatives in his archives, the vast majority taken between 1905 and 1928) to produce some of their most famous images<sup>19</sup> and cities such as Paris have been photographed in "3D" for the last 150 years<sup>20</sup>.

*Tactile photography*, as we envision it, should be conceived as an easy-to-use and affordable technique based on the idea of a 3D capturing system capable of recording depth information together with a conventional digital photograph. It should be an open field of research and artistic practise, rather than a paid service based on franchising, and accessible to everybody, including blind and visually impaired photographers.

This last point could have been the first one mentioned, as the idea for tactile photography was born of our experience with tactile representations for museums, such as the Kunsthistorisches Museum in Vienna in the project *Tactile Paintings*,<sup>21</sup> and the adaptation of exhibitions by ArteConTacto.<sup>22</sup> Multi-sensory approaches in the field of photography include,

18. Schmidt 2009 [reference 3], 128.

19. Interview with Bill Hibbert, in 2007, published at <<http://www.galeriephoto.com/jacques-henri-lartigue-stereo-photography.html>> [10.01.13].

20. Françoise Reynaud, Catherine Tambrun, Kim Timby (eds.), *Paris in 3D. From Stereoscopia to Virtual Reality 1850-2000*, Exhibition Catalog, Paris: Musée Carnavalet 2000.

21. Andreas Reichinger, Stefan Maierhofer, Werner Purgathofer, 'High-Quality Tactile Paintings', in: *ACM Journal Comput. Cult. Herit.* 4, 2, article

5, November 2011. VRVis [Zentrum für Virtual Reality und Visualisierung Forschungs GmbH] is Austria's leading research company in the field of Visual Computing. Together with the Institute of Computer Graphics and Algorithms at the Vienna University of Technology and the Visualization Commission of the Austrian Academy of Science VRVis forms one of the largest computer graphics research groups in Europe. Project website: <<http://www.vrvis.at/projects/running-projects/tactile-paintings>> [15.01.13].

22. Project website: <<http://www.artcontacto.org>> [15.01.13].

on the one hand, the conversion of photographs for a blind public and, on the other, the art produced by visually impaired photographers.

One example of the first group can be seen in James Patten's attempts to directly convert brightness information into height using a laser to carve wood and artist Lisa J. Murphy's *Tactile Mind Book*, a collection of erotic photographs created as touchable reliefs using a thermoform process.<sup>23</sup> Perhaps the best known initiative is Alain Mikli and Yann Arthus-Bertrand's joint exhibition *Touch and See*,<sup>24</sup> where several examples of Arthus-Bertrand's famous aerial photographs were converted into bas-relief largely based on brightness and then carved into cellulose acetate.<sup>25</sup>

Photographic production by visually impaired artists has increased considerably in recent years<sup>26</sup> and has even been shown in prominent museum exhibitions. In most cases, though, the photographs remain invisible to the image-maker, and the editing process is performed by a seeing person. According to Simon Hayhoe, this field of artistic production follows two major trends. The first has been developed by blind and visually impaired collectives, such as the *Seeing With Photography* collective, New York, or *Ojos Que Sienten* in Mexico,<sup>27</sup> while the second form observed by Hayhoe is a more novice approach, mainly with school-aged students. Each of these students is given a simple camera without any adjustable parts and asked to take photographs of different elements of their everyday lives. Prominent examples are Tony Deifell's organization *Seeing Beyond Sight*, founded in San Francisco in 2002, and Partho Bhowmick's *Blind With Camera* in Mumbai, India.<sup>28</sup> Both forms can be seen in the context of photography's role as a medium for democratization and empowering socially weak groups.

The individual efforts of blind photographers are not mentioned by Hayhoe, but are noteworthy. The most prominent museum exhibition of the work of photographers with visual impairments to date was *Sight Unseen: International Photography by Blind Artists*, curated by Douglas McCulloh for the California Museum of Photography in 2009. It consisted of "111 photographs and 8 tactile illustrations" by 12 artists, mainly from the USA, but also from Mexico and France.<sup>29</sup> In all of these cases, however, the artwork remains invisible to the visually impaired person, until edited and then converted by a seeing interpretation artist.

*Tactile Photography* should therefore help to include blind photographers in the editing phase and give them more control over the whole artistic process. But it should also give seeing photographers the possibility to experiment with a new medium, test its limits and "play against the apparatus", to use Flusser's famous words.<sup>30</sup>

23. < <http://www.jamespatten.com/tactilephoto> > and < <http://www.tactile-mindbook.com> >, respectively [10.01.13].

24. < <http://www.yannarthusbertrand.org>, [www.mikli.com](http://www.mikli.com), and <<http://www.behance.net/gallery/Alain-Mikli-Yann-Arthus-Bertrand-Tactiles-images-1/592244>> [10.01.13].

25. These tactile diagrams, which have been mounted in public spaces and museums, are based on the findings of Hoëlle Corvest from the Cité des Sciences et de l'Industrie in Paris, who has developed an image literacy program for people who were born blind.

26. "Photography by blind and visually impaired artists is fast developing into a new genre in the field of contemporary art": S. Hayhoe, 'Blindness, Photography and Art', in: <<http://blog.blindphotographers.org/blindness-photography-and-art/>> [10.12.12].

27. <<http://seeingwithphotography.com>>, and <<http://www.sightofemotion.org>>. Some of these groups are web-based, rather than locally organized, as is the case with <<http://photos.blindphotographers.org>>, <<http://blindwith-camera.org>>, <<http://www.theblindphotographer.com>>, <<http://www.blind-photography.com>>, and the flickr group <[http://www.flickr.com/groups/blind\\_photographers](http://www.flickr.com/groups/blind_photographers)> [all of them last visited 15.11.2012].

28. <<http://www.seeingbeyondsight.org>>, and <<http://www.blindwithcamera.org>> [10.01.13].

29. <<http://www.cmp.ucr.edu/exhibitions/sightunseen>> [10.01.13].

30. Vilém Flusser, *Für eine Philosophie der Fotografie*, Andreas Müller-Pohle (ed.), Göttingen 1997, 72.