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Creation and Control in the Photographic Process: iPhones and the emerging fifth moment of photography

Edgar Gómez Cruz.

Internet Interdisciplinary Institute, Universitat Oberta de Catalunya

Eric T. Meyer.

Oxford Internet Institute, University of Oxford

Edgar Gómez Cruz is a researcher of the Internet Interdisciplinary Institute of the Universitat Oberta de Catalunya. His research has been in Computer Mediated Communication and he has published two books and several papers on the theme. He has recently finished his doctoral dissertation, which is an ethnography of digital photography practices, and also has written papers and presented at conferences on various aspects of digital photography.
Internet Interdisciplinary Institute (IN3)
Parc Mediterrani de la Tecnologia
Av. Canal Olímpic s/n, Edifici B3
08860 Castelldefels (Barcelona) Spain
egomezcr@uoc.edu

Dr. Eric T. Meyer is a Research Fellow at the Oxford Internet Institute of the University of Oxford. His research includes the impact of research technologies on research performance, on the social impact of ICTs, and participation by Internet users in creating content and blurring boundaries between amateur and professional content creators. Meyer's PhD in Information Science from Indiana University in 2007, which was named the 2008 ProQuest Doctoral Dissertation of the Year, examined how marine biologists who rely on photographic evidence to identify individual marine mammals have seen significant changes in their everyday work practices as they switched from film photography to digital photography. He has also written papers and presented at conferences on various aspects of digital photography from a social informatics perspective.
Oxford Internet Institute
University of Oxford
1 St Giles
Oxford
OX1 3JS   Phone: +44 (0) 1865 287218
United Kingdom   Fax: +44 (0) 1865 287211
eric.meyer@oii.ox.ac.uk

Introduction

In a 2009 issue of the mainstream photography enthusiast magazine *American Photo*, an article entitled "Instant gratification" (Andrews and Chen) reported on interviews with four professional photographers. The article centered on a single photographic device, and it was not a camera: the iPhone. More recently, Annie Liebovitz, in a November 15, 2011 interview on MSNBC, called the iPhone 'the snapshot camera of today'. While these anecdotes do not by themselves indicate a trend, they are just two examples of the growing interest of mainstream photographers in new devices for image capture, and in particular the iPhone, which represent technology convergence and ubiquity. In this article, we propose that the iPhone is actually more than a single device within which multiple technologies (including phones, cameras, geo-location, and Internet browsing, among others) have converged, but is also a node of different networks that is shaping new understandings of what photography is and how it is used. The iPhone represents one of the latest developments in a long history of image creation devices, but is the first device that combines three important elements which we will discuss: the making, processing, and distribution of images. It is not the first attempt to converge elements of the image creation process, such as the once-popular but now discontinued Polaroid cameras (see Buse "Polaroid into Digital" and "Surely Fades Away") that combined the making and processing elements (but generally without the possibility of adjusting the processing) and later digital cameras that could be connected directly to home printers without the intervention of a computer, but it is the first to combine all three elements in a way that is having widespread success.

Although photography has a long and well-documented history, more than 180 years after the first photographic image was made, "we still do not know what photography is" (Kember 175). One might ask how this can be true, when nearly everyone in the developed world and many in the developing world have created photographs; furthermore, most lay photographers would likely argue that they know exactly what photography is: a technological means for recording the world as seen. However, Kember's provocative point is true in many ways because photography "is a complex technological network in the making rather than a single fixed technology" (Larsen 142).

Photography theory has worked traditionally within two epistemological axes; on the one side it has been long understood as a powerful technology for representation of reality, an idea that has been supported or criticized but that stands as a regular theme in work to understand photography's role in the world. On the other hand, there seems to be a long interest in the development of a single photographic ontology. Barthes, for example, discussed in his "Camera Lucida" that he was interested in the "essence" of photography, not in its sociology. There have also been attempts to shape the discussion of photography as a photo-technology (Maynard) or as a material object (Edwards and Hart), but those approaches have been less prominent overall.

Our approach in this paper is to understand photography not as–representation, technology, or object, but as the agency that takes place when a set of technologies, meanings, uses and practices align. The photographic object, in this sense, is nothing but the materialization of a series of assemblages, and the photographic object also enables or constrains other assemblages with its use and distribution. We propose therefore, to understand photography as a socio-technical network.

With the arrival of digital technologies, the meaning of what photography is has changed even more since new actors, elements and nodes are added to the network, while others clearly have either become peripheral or excluded entirely. New actors that are gaining presence in the photographic equipment field include companies like Sony and Samsung which were not traditionally involved in the film photography industry, but are now sharing the market with Canon, Nikon and other brands more traditionally associated with photography. At the same time, some previously dominant players like Kodak and Fuji have become increasingly marginal players as film has been almost entirely replaced by digital images. Of course, with the shift to digital, the new version of "film"

includes the software programs and tools required to access, store, manipulate, and share images. Thus, software companies like Adobe, and Internet-based photography sites such as Flickr or imageshack, along with companies for data storage like Sandisk or Kensington, are participating in the reconfiguration of the definition of what photography means in the digital era.

In this article, we will underline some aspects that relate, on the one side, to the technological devices necessary for image production and their "social meanings" and, on the other, the kind of practices that shape and are shaped by those devices. We will discuss how the relationship between production technologies and meanings have shaped different visual regimes. To do this, the article starts with a brief historical description focusing on the production of photos as a three-step process: 1) Infrastructural elements of image production (cameras, film, memory cards, etc.); 2) technologies of processing images (labs, chemicals, computers, software, expertise, etc.); and 3) distribution/showing of images.[i] Finally, we will discuss the latest socio-technological practices, and we propose that the iPhone and similar devices which will almost surely follow are possibly opening a new stage in visual technologies. Finally, we end with some reflections on the current controversies surrounding photography.

Photography as a socio-technical network: Some theoretical context
The history of photography is not best understood as a single linear chronological series of technical developments. Instead, there have been multiple forces in constant struggle to shape what photography, as a technology, is (Latour; Munir and Phillips) along with controversies and fights over the social meaning of the photograph. For instance, the fight for the recognition of photography as an art, and not only as a technique, in the beginning of the 20th Century (Christopherson; Bourdieu; Schwartz) centered on the construction of clear boundaries of what was art and what was not art.

Besides the extraordinary number of works about photography from the artistic and aesthetic point of view, there is a large corpus of works which study photography as a cultural or artistic practice in a wide set of environments. Works are situated in the traditions of anthropology, sociology, cultural studies, and visual studies, a growing field closely related to the study and use of images. This literature tends to understand photography as a cultural object (Edwards & Hart), as a commodity, or as a representation (Barthes, Sontag, Hall, Tagg). There is also a second corpus of research with a focus on the economics and business of photography that study how certain technologies were produced and diffused in different spheres (Munir; Munir & Philips). Finally, there is a growing body of research on digital photography from the computer science perspective, which understands photography in relation mostly to software developments (e.g. Van House et al.; Kindberg et al.; Ahern et al.). However, works that attempt to relate the technological perspective, the economic rationales, and the social and cultural meaning of photography are fewer in number (with some notable exceptions including Frosh and Maynard & Slater). One reason, of course, is the difficulty of such an exercise because of the multiple elements making up the photography industry: economic, political, technological, social, cultural, and so forth.
The analysis and reflections on the multiple processes involved in image creation are therefore wide and multidisciplinary, especially since photography is embedded in multiple practices and situations (ranging from tourism to forensic research and from advertising to family memories) and that makes it difficult to be studied as a single object.

Therefore, our standpoint is to think about photography as a network of agencies, as a hybrid entity. Following Larsen, we argue that:

> Photography is so evidently material and social, objective and subjective, that is, heterogeneous. It is a complex amalgam of technology, discourse and practice. Photographic agency is a relational effect that first comes into force when a heterogeneous network of

humans and non-humans is in place. (145)

This proposition is aligned with some approaches that study technological devices in a more complex way than in a single "uses and appropriations" or "diffusion of innovation" perspective. Two of these approaches are particularly useful: Science and Technology Studies (STS) and Social Informatics (SI).

STS is an approach that has its roots in understanding the sociological milieu of science and scientists, as well as with understanding an element that underlies much of scientific progress: technology. Although STS has different branches,[ii] in general what they all propose is a study of the design, implementation and social meanings of technological artifacts in a complex way, where a diverse set of elements struggle and gain alliances with each other to form fixed and stable "black boxes". Therefore, technological advances are not part of a linear and determined history[iii] but a social construction in constant movement and reshaping by the use and co-construction of technologies.

Latour in particular can help us to understand the complex nature of the camera as more than a simple piece of technology. Latour proposed the term 'actant' as a way to refer to both "people able to talk and things unable to talk" ("Mixing Humans" 83) as analysts seek to understand behavior within socio-technical networks. The inclusion of non-human artifacts as sources of action within a network is non-trivial. Sociological theory, for instance, rarely views technological artifacts as more than a peripheral element that human actors manipulate (Latour "Mixing Humans"; Star). With Latour's Actor-Network Theory (ANT), however:

> …elements of any kind may be included: humans, technological artifacts, organizations, institutions, etc. ANT does not distinguish between or define a priori any kind of elements…all networks are heterogeneous or socio-technical. There are no networks that consist of only humans or only of technological components. All networks contain elements of both. (Hanseth 118)

Latour argues that the most mundane of artifacts can be actants in socio-technical systems; his analysis of door closing mechanisms as actants is probably the clearest illustration. Latour describes how the simple technological combination of door hinges, which allow walls to temporarily and easily open, with hydraulic spring-operated door closers, which gently restore the wall to an unbroken surface, serve as relatively skilled actants in a socio-technical system allowing human actants to reversibly walk through walls and work in non-entombed but enclosed spaces.

Just as Latour's door-closers translate the major effort of walking through brick walls into a minor effort of pushing open a door, cameras translate the major effort of manually creating a detailed and naturalistic image of a scene through painting or etching into the minor effort of pushing a button and developing the latent image, or having others develop it for you. Digital photography in turn translates the relatively complex and labor-intensive chemical processes of traditional photography into a relatively simple and accessible set of steps required to view the resulting images on a computer or print them out for viewing. Traditional film-based cameras can be considered analogous to Latour's doors that required grooms to await people who may want to pass through the doors, while digital cameras are like Latour's automatic door closers that allowed human actors to walk through walls without additional human input once the socio-technical system was in place. Traditional cameras generally speaking require photo lab technicians and an array of human actors associated with the developing and printing process, but digital cameras reduce the number and types of human actors required to go from a scene-in-the-world to an image that in some sense represents that scene. By standing in for human actors, the digital camera is an actant in terms of its contribution to the socio-technical network and in terms of its role in the mutual shaping that occurs

among actants in the system.

Social Informatics offers an additional perspective for our purposes, because it has a greater focus on technologies-in-use rather than technologies-in-design, and is focused on understanding the "uses and consequences of information technologies [and] takes into account their interaction with institutional and cultural contexts" (Kling 1). In particular we draw on the Socio-Technical Interactions Network (STIN) perspective (Meyer "Socio-Technical Interaction Networks"; Kling, McKim & King) that shares with STS the complex understanding of socio-technical networks that, ultimately, are embodied in different practices (Schatzki, Knorr-Cetina, & Von Savigny). The social informatics perspective, in brief, argues that to understand how technologies are used by people, one should privilege neither the technical nor the social *a priori*, but instead must be open to the possibility that sociotechnical assemblages can be driven by technological developments, by social construction, or by an iterative process of mutual shaping between the two. This position rejects blind technological determinism of the form "technology caused X to happen", but also rejects pure social shaping views that all technology can be understood as purely social phenomena. Instead, social informatics sensitizes the researcher to understand that in particular instances, either the technical or the social may have had a larger role to play in determining the final ways to which technology is put to use by human actors. The STIN approach, in particular, does this by focusing on actors both included and excluded by new technological assemblages, and looking at how they interact with each other and with technology, in particular when they reach what are called 'architectural choice points' where decisions about technology adoption, use, and repurposing occur.

The goal of this paper is not to develop a complete theoretical framework for photography with all the elements mentioned above, particularly since others have already made strides in this area (Larsen; Meyer "Socio-Technical Perspectives"; de Rijcke and Beaulieu; Latour "Visualization and Cognition"), and one of the authors of this article has recently completed his dissertation on the topic,[iv] but to establish some elements of the analysis of photography as a socio-technical network by questioning the visual and aesthetic forms that are being shaped by it. In order to do that, we will somewhat artificially separate the history of photography as a socio-technical system into four moments at which significant shifts occurred. Our approach is to review historically the combination between infrastructures (technologies), discourses, and social uses of photography in different moments in order to understand the sociotechnical network that lies beneath the social understanding of photography and the practices in each moment. While this is certainly overly reductionist, and may at times seem to fall prey to deterministic views of technology, the exercise serves to underline the relationship between different sociotechnical networks during the history of photography and to analyse current trends in photographic practices. The time-frames we discuss are not fixed and seamless "eras" or historical movements, but are instead more of a general guide to illustrate the ebb and flow of the technologies of photography and the social meanings and uses attached to these technologies. Some of them coexist today in different forms so they are not completely excluded from each other. This exercise will help to show the relationship between technologies of image creation and visual regimes made up of practices, objects and the possibilities of image creation. In this framework, the socio-technical history of photography could be seen as a pendulum constantly moving and swinging through cyclic changes between the know-how necessary to create images, and the artifacts used for that purpose. Throughout these cycles, there are also ongoing trends that persist, for example the miniaturization of equipment to support mobility and increasing ease of access to a wider set of technical features; these trends also shape visual images and social uses. Changes in technology, professional practices, and public uses are continually converging and diverging over time. But ultimately, the combination of all those elements with socio-historical conditions shapes what is understood as "photography" in different times and contexts. This seems especially relevant in the digital era since, following, Lister (2007) we have to:

begin an account of (new) technology's role in producing a changed environment for photography; to consider how photography continues to be put to work within a cultural, institutional and even a physical landscape that is pervaded and altered by information and its technologies (252)

And this because, as Hand states: "technologies are inseparable from institutional and organizational cultures' and therefore, 'we would expect digitization to bring alternative cultural conventions and practices into being" (6). To understand these alternative conventions and practices, we must first turn our eye to how photography developed.

The history of Photography as socio-technical pendulum
First moment (19th Century)

During the early years after the invention of photography, the expertise needed to create images required a sophisticated set of technical skills: the preparation of the chemical emulsions that were often prepared in the field and applied to glass plates, tin plates or paper, the use of complicated heavy and bulky equipment, and detailed knowledge regarding times of exposure, light conditions, and so on. It is interesting that in the book edited by Allan Trachtenberg, the essays of the "pioneers" of photography including Niepce, Daguerre and Fox Talbot all are notable for their scientific explanations of which chemicals in what proportions work best to reach the goal of creating technically superior photographs. Photography, at the time, was a scientific development, or, as Edgar Allan Poe argued (in his essay reprinted in the Trachtenberg collection): photography was "the most important and perhaps the most extraordinary triumph of modern science" (37). The techniques and technologies available to these early photography pioneers constrained the photographic possibilities of early photographers. Technique constrained visual thinking and experimentation. For example, the relationship between the characteristics of the chemicals and the materials used, along with the timing of processing, was closely related to a certain type of photography (for example, the lack of "night photography" or people photographed on the street or in the type of journalistic views which would later become common). The modern photographic portrait was in its infancy, and was an extremely painful and uncomfortable experience for the subjects who had to remain still for a long period of time because of the primitive quality of the chemicals for light exposure. Hence, Fox Talbot thought about photography as "the pencil of nature" in relation to the types of objects to be photographed. Framing was only one of several complicated skills required to succeed in the successful creation of a photograph. During this first moment, all of this knowledge was needed prior to creating a single image, and, as a result of this, not everyone was able to do photography, even if they had access to the equipment. If we think about the characteristics of photography at the time, the equipment was big, which, among other things, reduced mobility. The skills and knowledge to produce images were highly specialized, the technical possibilities were very limiting and the time invested in the creation of even a single image was very long. The distribution and possible uses of photography had still to be developed. Early distribution channels included the traveling photographer selling portraits (often cheap tintypes), stereoscope images (which were especially popular with the Victorians), and as photographic visiting cards (*carte-de-visite*). The first networks that shaped (and were shaped by) photography were the scientific networks where enthusiasts and amateurs participated actively in the development of new optical and chemical advances.

Second moment (ca. 1900-ca. 1930)

With the introduction of the Kodak camera at the end of the 19th century with the advertising slogan "you press the button, we do the rest", what used to be a technical skill (and as a result, predominantly male, highly specialized, and oriented to the upper classes) started to reach a general audience. In that way, a "public" for photography was created (Olivier; Jenkins; Murray; Coe and Gates). The mass market for photography was being shaped: the "amateur market was explored, extracted, and constructed from heterogeneous social groups which did not as such exist before

Eastman. The new amateurs and Eastman's camera co-produced each other" (Latour 117). This led to a creation of new forms of visual expression, for example the so-called "snapshots", casual and "home-made" photographs without more pretension than to keep records of the good and happy moments in the life of one's self, and one's family and friends (Chalfen).

With the emergence of cheap and easy-to-use cameras, people were suddenly able to produce photos, and thus what were considered accurate representations of the world around them, without any technical skill whatsoever. What the Eastman Company achieved was to translate a range of complex processes; knowledge and skills into, quite literally, a "black box". Nevertheless, the possibilities for creativity were limited: framing, timing, and the position of the photographer were the only elements that the amateur photographer wielding her Kodak Brownie could control. Photographers relinquished control over later aspects of the image creation process since the post processing and printing was something that occurred not even in the presence of the photographer, but in the distant factories where the cameras containing the film were sent after exposure.

It is worth noting that a necessary network for supporting the success of this process doesn't have anything to do with image itself: the postal service. This socio-physical network, requiring post offices, mail carriers, sorting facilities, and all the other elements of a ubiquitous postal service, were a necessary requirement for the success of cameras such as the Kodak Brownie. While postal services were not established with any intention of supporting mass-market image creation, without the cheap, ubiquitous delivery options the post offered, Kodak could not have succeeded. At the same time, there were already enough conditions for photography to reach a wider audience; and, like the postal office; some of them were not even strictly related to photography itself. For instance, a key element was that new technical capabilities of the press that at the time made the diffusion of photographs available for a wider public in the newspapers and magazines (Marien).

In this second moment, all the elements of the photographic process were improved, particularly from the point of view of the amateur photography enthusiast: the equipment became less specialized, more affordable, smaller, and thus more portable, all of which contributed to photography becoming a "mobile" practice, resulting in the embedding of photography into the social practices of activities like tourism (Robinson & Picard; Urry) and family celebrations (Hirsch). The networks where photography operated and were needed to sustain it were once again reshaped, this time with the participation of the media. Photography shifted from being an activity limited to specialists to one open to more casual users since the skills needed to create images were basic and "so simple they can easily [be] operated by any school boy or girl".[v] Still, the quality by today's standards was fairly low and the possibilities were limited. In parallel to these developments in the amateur photography market, professional equipment also underwent significant changes: it also became smaller, with better and different types of optics and low light films becoming available. And, although the time of exposure decreased dramatically for shots to be taken, the actual time needed to get the paper copies increased even more. General users never had the same control over the image creation as the photographers of the first moment and photography became a network between users, equipment and companies that deliver the rolls and then develop and print them.

At the same time, different and diverse channels for distribution and showing of photography started to be shaped and the media begin to use images. Photographs regularly appeared in newspapers, starting around the turn of the 20th century, and photographs increasingly appeared in public shows and galleries. Photographs of the distant and exotic became more accessible via outlets such as National Geographic, while at the same time mundane snapshots were shared with friends and family via albums. Photography began to be part of everyday life.

Third moment (1930-1990)

During the third moment, the technical features of cameras became more or less fixed: portable camera bodies, fixed or interchangeable lenses, and roll films for professional cameras and portable, cheap and easy to use cameras for everyone.[vi] During the third moment, photography reached a massive audience, but another distinction grew that in some ways echoes the very origins of photography: that between professionals, amateur hobbyists and snapshooters. This distinction was not "natural" and it took a lot of effort to be created by linking photography with other art forms, which led to:

> The transformation of photography from a medium accessible to a mass audience into an exclusive symbolic code linked it with painting, sculpture, and drawing (as Alfred Stieglitz had intended), limiting widespread participation through the creation and maintenance of social and aesthetic boundaries. (Schwartz 190)

Some other works address this issue (Bourdieu; Christopherson). This distinction between amateurs and professionals, especially with photography as art, was not only a matter of technique and the right equipment but also a matter of style, composition and lab access and expertise. Nevertheless, some of the most famous art approaches were based on techniques and therefore knowledges (Ansel Adams, Paul Strand and Edward Weston with their f/64 technique, Alfred Stiglitz with pictorialism, etc.). At the same time, the type of equipment used for each kind of photography played an important role in shaping (and therefore was also shaped) by this distinction. It was clear that professional photography (whether done as art, advertising, or journalism) had specific equipment (expensive SLRs, multiple lenses, lighting, professional films, and so forth), and just a few amateurs could afford the same type of equipment. That way, the combination of techniques, equipment and associations created a network that supported the idea of photography as art, and later, the professionalization of photography.

One of the key elements was the creation of distribution circuits that reinforced the distinction between professional photography and the photographs that anyone could create with their inexpensive camera. Using magazines, newsletters, galleries, newspapers, associations and unions, the new professional photographers reinforced their privileged position as professionals. This had, as a consequence, the separation between the folk art of the amateurs and the fine art of the "photographers" (Christopherson). But while this separation was being shaped, on the opposite side of the spectrum people were increasingly creating snapshots of happy moments in their everyday life, with cheaper equipment and without any intention of circulating them outside the family circle. And, although these photos can be understood as sophisticated constructs of reality, the circulation and meaning largely was limited to the small circles consisting of one's family and close friends (Bourdieu; Chalfen). As we can see, the visual shaping of specific kinds of images was part of an inscription of those images in networks of knowledge-power (professional, amateurs), which, at the same time, used specific types of technologies, some more specialized and expensive, some more general and easy to use.

This third moment practically shaped our social understanding of photography and almost all of the former problems related to mobility, techniques and possibilities appeared to the participants of the time to have been solved. Everybody above a fairly basic economic level in the developed world was able to buy an inexpensive camera and could learn how to create quality images for the different purposes to which they wanted to put photography, from snapshots to the creation of professional images. These separations between the amateur and professional (see Meyer "Digital Photography") increased and photography was institutionalized in different realms with fixed characteristics for each one. The distribution and use of photos followed those separations too: family albums and shoeboxes for snapshots; magazines, journals and galleries for professional photography. The question of control over the entire process was still related not only to the technical elements (cameras, rolls, batteries and so on), but also to different companies and

networks (photography shops, photo processing labs, money, time, etc.) needed to produce those images. The amount of time between capturing the latent image and seeing the printed result relied on a network of companies, and the cost of accelerating those services became one of "natural" constraints of photographic creation. This situation began to change with digital technology.

Fourth moment (1990-present)
When digital technology arrived, the field of photography underwent a tremendous transformation and it seems that the previous networks had been reshaped, inscribing photography, with its new array of elements, in a different network linked with the newly ubiquitous personal computer (Meyer "Framing"). New players arrived with their interests, discourses and technologies, challenging the traditional photographic institutions like Kodak, Fuji, Canon, Nikon, Minolta, etc.[vii] The field of photography changed with the arrival of digital. Not only have the photographic artifacts themselves changed as they switched from physical media to electronic media, but the methods for showing and distributing photographs was altered massively thanks to the rapid growing of a closely related digital technology: the Internet. Just as the socio-physical network of the postal service enabled the growth of film processing, the socio-technical network of the Internet has enabled the growth of means for sharing and displaying images free of the constraints of film and paper. The key to this moment was the union of photographic devices, computers and the Web, particularly social networking websites. Cameras became ubiquitous: the camera was transformed from a precious family object shared among family members on special occasions, to a personal and constantly carried object of visual creation. This increased dramatically again with the arrival of mobile phones capable of taking digital photos.

But one of the most important changes brought by digital technologies, one of many that we want to underline here, is that the knowledge needed to produce images, and the needed equipment, radically changed. This means, the knowledge economy and power networks where photography used to operate were reconfigured, and these changes could be understood in three spheres – control, distribution and knowledge – to which we now turn our attention.

User control
In the second and third moments, only those who pursued photography as "serious leisure", such as those who were members of camera clubs or owned home darkrooms, were able to control the whole process of image creation. With the emergence of digital technology, this changed in several ways. As in the earliest days of photography, photographers could control the entire process of photograph production, but unlike the pioneers did not need carts full of equipment to do it. Without having to rely on labs to develop and print their rolls of film and photographs, photographers now take, process and distribute images once they have the proper equipment. In addition, in the digital moment everyone, not just professionals and serious amateurs but also casual snapshooters, can have this control, and at almost zero marginal cost once the initial equipment has been acquired.

It is important to understand that photography has become part of new ICT-based networks that are different from the networks for film photography. Much of the equipment required to manipulate and process photographs is not specialist photographic equipment comparable to a darkroom with an enlarger and stocks of chemicals, but instead is general purpose equipment including computers and printers that had already been purchased specifically for their more general uses. Adding the specialist software required to work with photographs is a comparatively inexpensive (or even free) undertaking. This has many consequences in photographic practices. Beyond the obvious effects such as the quantity of photos taken, concepts like privacy become harder to grasp since the objects of photography had become more personal and intimate (Lasén and Gómez-Cruz), as we will see more in the following sections.

New distribution and circulation environment

Photography as an object stopped having nearly as many constraints of time and place because of the change from being a physical object to being a digital one. People can do several things with their photos, none of which limit the possibility of using the same photo for other purposes: they can send them by email, copy them as many times as they want, print them, and perhaps more importantly, they can upload those photos to social networking sites, opening new channels for image distribution. Giving away a photograph is no longer a subtractive process, but an additive one. During the era in the 1980s and 1990s when photographic labs pushed "double print" offers as a way to share a single copy of an image without losing one's own copy, shared ownership of and access to images was a scarce resource. Today, giving away a photograph doesn't involve the same careful social calculations as was required when deciding who should be given a copy of a photograph. Uploading a photograph to Facebook means that multiple friends can see one's photographs, as well as comment on them and see then again in the future.

Some of these sites are devoted to photography (like Flickr or photobucket), others are more generic sites that include photographs as art (such as deviantart), and others are sites where photography plays a key role in the identity staging and social interaction (such as Facebook or Myspace). This brings two clear consequences; people create more photos because they have a place to share them (Cohen), and these sites form a new circuit for sharing and showing photography. Digital circuits are at the same time reshaping traditional circuits; for example stock photography, photojournalism and fashion photography are undergoing dramatic changes partly as the result of pressures from microstock[viii] photography sites, the wide availability of Creative Commons licensed images, and the rise of citizen journalism (Ritchin)

New technical know-how and the creation of photographs

An important element in this fourth moment is that, because of the change from a light-chemical process to a light-electronic one, a completely new technical know-how has become embedded in the creation of photographs: the use of post-processing computer software. As a result of this shift, new actors gained interest in photography, namely those experts in the use of computers who became drawn to photography as a technically interesting area. The lab skills centered on chemicals and enlarging techniques were replaced by the computer skills wielded by Photoshop experts. Far more people are able to use at least the basic features of Photoshop or other programs than the number of people who ever were able to print and retouch photographs by hand in the past. To be a software expert requires heavy training and constant updating of this knowledge since the software changes with much greater frequency than darkroom technology did. This shift to computers is part of what has been argued elsewhere is a "computerization movement" (Meyer "Framing"). Camera companies, therefore, developed strategies to inscribe "knowledge programs" and incorporate them in almost every digital camera. Although the programs to set the right combination for shooting common objects (portraits, landscapes, sports, etc.) were already incorporated in analogue cameras, the design of digital cameras took this logic further and also incorporated "simulations" of former combination between processes and equipment (black and white, sepia, vignettes, "old photo" looks, etc.). The camera inscribes, using algorithmic computer routines, complex photographic processes that are transformed into choices that appear simple to the photographer. Thus, with the advent of digital technology, photography users gained control over the process while new knowledge and economic and power connections were made with computer and technological companies. At the same time, new distribution-showing circuits were generated and are rapidly becoming key actors in creating photographic meaning.

With the convergence of digital cameras and mobile phones, the situation is changing even more as the new devices "mash up" two of today's most powerful tools: a communication-connection device, and an audiovisual production tool. Visual content is playing a key role in a socio-technical communication environment as smartphones are increasingly capable of connecting to the Internet

anytime and anywhere. Smartphones add another level to digital possibilities: the connection and sharing of images in real time. Some authors pointed that this possibility changed the objects and moments of photography; from the ritualistic and important moments of family life (Chalfen) to the everyday common and banal things (Okabe & Ito; Petersen; Burgess; Koskinen). This sharing of the "banal" was also related to the technical features of cameraphones, since the type of images that these phones produced, were very limited in several ways (resolution, light conditions, poor lenses, etc.).[ix] We could say that cameraphones are no more a "camera", but a "raw" low-quality image producing and sharing device. The economic rationale plays an important role since people with flat rates on calls, messages and internet tend to use these services just for the fact that they can (Gomez Cruz).

From cameraphones to Apple´s socio-technical network

One of the cameraphones[x] that has become the flagship of this revolution is no doubt Apple's iPhone. In the presentation of the iPhone 4, Steve Jobs stated, "It's like a beautiful old Leica camera," explicitly attempting to inscribe a meaningful relationship between the iPhone and one of the classical symbols of high quality photographic devices. In this way, Apple, as a company that sells not only products but "experiences" (Tsai) is helping to shape the current meaning of photography, as we'll show later. This has important power implications within the network.

We argue that the iPhone, in this moment, is key to understanding how photography's role in the networked society is evolving. First, it is important to notice how the iPhone has been able to "enroll" different interests – from companies and users via mass media to photographers and software developers – without investing nearly as much effort as other companies that entered the photographic arena.[xi] Since it was launched, the device captivated the press and the users. It was cheered as "the invention of the year" (Grossman) and a device capable of a revolution in PC culture (Zittrain).

In relation to photography, it is interesting to note that the iPhone´s camera was (and remains) clearly technically poorer than much of the competition. This was one of the critiques when the phone was launched, since the incorporated camera was considerably less technologically advanced compared to those available on other mobile phones in the market. Nevertheless, even though the iPhone has not entered the so-called "megapixel race" that some manufacturers have used to attract purchasers, it is clear that the relationship between Apple's device and image creation is exploding. Furthermore, this lack of image quality is perceived by some more as a creative incentive than a technological limitation. In the *American Photo* article, for example, photographers relate the iPhone with other types of cameras that, instead of "quality" had other "fun" characteristics like instantaneity (similar to the Polaroid), discretion (similar to Spycams) or playfulness (like Lomo cameras with their "don't think, just shoot" philosophy). What is clear is the growing number of photographers that are using the iPhone, or the cameraphone, as an alternative for image creation. To put numbers in this trend, iPhones are the most used image creation devices in Flickr at the moment,[xii] more than any camera. While only indicative, because Flickr is able to tell from EXIF (Exchangeable image file format) data the equipment upon which a photograph was made, these data are a good thermometer for current photography practices.

The iPhone as a Socio-technical network: a fifth moment?

One of the key elements for the success of the Apple iPhone is not directly related to photography production but to image distribution: the simplicity of uploading photos from the device to websites. This makes the iPhone the perfect tool for the growing practice of many people that are interested in showing and sharing photographs of their everyday lives (Cohen; Petersen).[xiii] This simplicity is partly due to the design and affordances of the iPhone itself, but is also tied to two main external factors. First, mobile connections are increasingly fast, especially as a result of the now widespread use of 3G technology. Second, the introduction of the iPhone worldwide also

ushered in a new type of contract with mobile operators since the internet connection is included, obligatory, as a flat rate connection with the iPhone. Thus, everyone with an iPhone has unlimited internet access.

Just as the shift from expensive 36-exposure film rolls, with a relatively high per-shot cost, to digital memory cards, with essentially a zero per-shot cost, greatly increased the number of photos people take since the decision to press the button once more has few consequences from an economic perspective, the shift to unlimited internet access changes the calculus people do in their heads when deciding whether to upload and share a photograph, now that they can do it quickly, and for essentially no additional cost. This changes the relationship between the people and their devices. In the words of one of the informants in Gomez's work: "I take so many photos just because I can, or when I get bored". Although many of the current smartphones have installed interfaces to access social network sites, the applications specifically created for the iPhone are notable for their quantity and diversity.[xiv] There are multiple different applications ranging from funny applications to transform the photo to a comic-like drawing to apps that are capable of remotely controlling an SLR camera. Nevertheless, some of the most successful applications are small pieces of software to process images, from small things like cropping and bright balance to more stylish controls and filters, to "simulations" of cross-processing, type of lenses, cameras, etc. In fact, one company specializing in such effects, Instagram, was purchased by Facebook for a reported $1 billion in 2012. The important thing to note is that Apple's iPhones and iPods have short-circuited the need for expertise in computer post-processing software. Now users have the ability to download (in most cases for a small price) small pieces of software that allow one to modify photographs without having any computer skill, in an intuitive way, and upload them directly to the Web or send them by email. This is a key feature, the possibility of nearly real time distribution. The iPhone apps are thus part of the ecosystem, or socio-technical network, that is emerging during this fifth moment of photography.

For the first time in photographic history, a single device has made it possible to control the whole process, not only of image production and distribution of those images (like any mobile phone) but also the possibility of processing those images, in the same device, to obtain different results. As a consequence, the process itself has changed. The approach to the final image can be randomly experimental rather than pre-planned. Instead of imagining the final result in advance, photographers increasingly can design or sculpt their images in the same device on which they were captured. In short, a more fluid practice, a playful relationship with the possibilities of the programs that changes completely the creation process and make possible that anything, anytime, could become subject of photography.

In Bourdieu´s study, he argued that photographic objects were determined socially; for example, when he shows a picture of a leaf to some French peasants, they critique the image because: "you don't photograph what you see on a daily basis" (Bourdieu 72) . With the possibilities opened by digital technologies, that seemed to change (Okabe). Devices like the iPhone, combined with applications like Instagram, add a whole range of filters and tools to modify the poor quality pictures of the cameraphone into a more "artsy" images. This changes the politics of seeing the banality of images of everyday life. And this makes sense because mobile phone photography, and especially the iPhone, is increasingly becoming part of the common practices of established social networks (e.g. Facebook and Flickr) and, even more important, there are communities that are being formed around iPhone use, not only on social network sites but on other specialist sites that are emerging (e.g., http://thebestcamera.com).

In the issue of *American Photo* mentioned at the beginning of this article, the interviewed photographers talk about how the iPhone had opened new creative possibilities, not only because it is the "camera that is always with you", but because it is discrete and gives you the freedom to just

shoot. What it is interesting is how again mobility, discretion and opportunity, along with the processing capabilities and almost real time possibility of showing the pictures, makes this the perfect urban image device. As one of the informants in Gómez Cruz work said: "there are no more Cartier-Bressons, we all are Cartier-Bressons now!" (202-203). It is interesting to notice how the poor quality of the mobile phones resembles the beginnings of the Kodak camera. But limitations can, turned on their head, become opportunities: the iPhone is increasingly becoming a powerful tool for artistic expression as it is pushed by many artists and everyday users. There are blogs specializing in photography applications, artistic movements[xv], books and complete galleries are increasingly based on "iPhoneography".[xvi] We're not trying to suggest that the iPhone is the only "artistic" cameraphone, but that the device is probably the among the best contemporary examples of how a single device has been capable of enrolling different actors to create a subfield that is growing and gaining presence. The iPhone acts more as a platform and a node for different networks than as a single device. Like a chameleon, iPhone camera can emulate or simulate a black and white camera, different kinds of Lomo, a pinhole camera, and many others using software. It serves as a platform between companies developing applications and users of them, and even more, it is a social tool based in image sharing and showing, making computer mediated social interactions more visual every day. Therefore, we suggest that we are witnessing a generalized fifth moment of photography, that of complete mobility, ubiquity and connection.

Conclusions
The history of photography can be understood as a complex network of interactions between technological devices, the knowledge needed to produce images, the companies which build technologies, and the people who use them, and this sociotechnical network of photography has periods of rapid change that is often linked to the development of new technologies alternating with periods of relative stability in practices and therefore types of visual objects. The development of photography could be seen as a pendulum that, swinging back and forth, negotiates new technical possibilities with the knowledge required to use them and the other systems (social, physical, and virtual) with which picture creating devices interact. While there have been generally consistent trends such as miniaturization and an increasing tendency to integrate more features in cameras, the total control of the image production has been primarily reserved for professionals or highly skilled and devoted amateurs. For almost a century, the final processing of snapshot photographs relied on photo labs. With the arrival of digital photography and the inkjet printer, and more recently of the mobile phones and online sites for distributing photographs, many of the assumptions about photography are blurring and changing. The iPhone is, among all the current devices, one of the most important, not only because of the technical features that gives control to the photographer of the entire process, but because it has been able to enroll different actors to give it a social meaning: professional and amateur photographers, the media, software companies, social networks, and general users. While mobility and ease-of-use had been important elements in the development of photographic devices, mobile phones add a new element: connectivity. Among the increasing mobile phone use for photography, the iPhone (and other devices like Samsung's Galaxy) adds even one more layer of complexity, the possibility of post processing the images in the same device. In a recent article in the New York Times,[xvii] it is suggested that smartphone photography will replace (or at least transform) point and shoot cameras. Whether this signals the emergence of a fifth moment in photography or is merely an elaboration of the fourth "digital" moment, however, remains to be seen.

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Notes:

[i] For a discussion of how 'visual knowing' is changing, seeBeaulieu and de Rijcke.

[ii] Inside STS there are different sub-categories like Actor-Network Theory (ANT) or Social Construction of Technology (SCOT).

[iii] What Wajcman, from a feminist perspective, criticized as "histories of men inventing and mastering technology" (Oudshoorn and Pinch 4).

[iv] Gomez-Cruz has recently defended his PhD dissertation: "From Kodak Culture to Flickr Culture: An ethnography of digital photography practices", now published as a book (see references).

[v] From a Kodak advertisment featuring the Brownie camera in 1900.

[vi] Although the major elements were fixed, there were minor modifications throughout this period in all of those elements, for example the use of slides or prints, and different types of films formats: 110mm, 35 mm, etc.

[vii] For an extensive and interesting account on this changes, see Munir.

[viii] "Microstock Photography is one of the common names given to the low priced royalty free stock Photo industry" From http://www.microstockphotography.com/

[ix] There are, nevertheless, some clear improvements done to cameraphones. These improvements point clear evolution toward more sophisticated visual equipment.

[x] The definitions of "cameraphones" or "smartphones" are more descriptive than theoretical but we are using them because of the wider literature that uses them.

[xi] Nokia for example, with the introduction of their model N95, hired famous directors to shoot shortfilms, or organized contests in order to promote their telephone as an audiovisual device.

[xii] http://www.flickr.com/cameras/ (search performed 11/09/09)

[xiii] Currently, with the proliferation of smartphones, not only the iPhone is capable of this but it was no doubt an important tool for shaping photosharing as a serious photographic practice.

[xiv] A search on the Itunes Store for the word "photography", delivers more than 160 applications.

[xv] http://www.eyeem.com/

[xvi] The concept "iphoneography" is used by Glyn Evans in his blog: iphoneography.com, and the concept has been used also in flickr groups and in a forthcoming publication.

[xvii] http://www.nytimes.com/2010/12/04/technology/04camera.html