Investigations into semiotic theory usually draw on the classic pronouncements of the founder of the discipline, the American philosopher Charles Sanders Peirce (1839-1914), especially on his celebrated triad of iconic, indexical, and symbolic signs (Peirce 1998). The usefulness of Peirce’s triad has been demonstrated time and time again by subsequent semiotic research: any sign used in communication between sentient creatures, animal or human, can indeed be classified into 1/ icons, in which the form of the sign resembles its referent (as in animal mimicry or linguistic onomatopoeia); 2/ indexes, which are basically physical changes, or traces, left behind by objects (e.g. footprints or personal odours); and 3/ symbols, in which the form of the sign is chosen arbitrarily and bears no perceptual resemblance to its referent (as in human verbal language, phonetic alphabet, or mathematical notation) (Sadowski 2009; 2010; Jappy 2013).

Just as useful as Peirce’s semiotic triad are investigations into interconnections between different semiotic categories, found in signs whose communicative functions combine more than one category. To start with, any sign, whether categorised primarily as icon, index, or symbol, is by default an index (trace) of its sender. A painted portrait may be an icon of the sitter but the painting itself is an index of the painter. Depending on the type of communicative situation either the portrait’s iconic content or its indexical origin may be more important. For example, Hans Holbein the Younger’s portraits of King Henry VIII and Sir Thomas More provide invaluable iconic evidence for political historians of what these famous personages probably looked like, just as Holbein’s portraits of unidentified ladies from the early Tudor period are equally invaluable for art historians, museum curators, auctioneers and art collectors, simply because they were painted by Holbein.

Similarly, the main reason for the emotive power of photography lies in the way
the medium combines the effects of both iconicity and indexicality (Sadowski 2011). In semiotic terms a photograph is an iconic index, as are the related media of film and television. The indexicality of photographic images derives from their physical connection (via light) with the represented objects, which ensures a more compelling sense of directness in reflecting the outside world than that found in purely iconic media such as painting or sculpture. On the other hand the iconicity of photography offers a higher degree of resemblance between image and object than that usually provided by iconic media. Even in painting from life, a painted scene reflects only the painter’s belief of what is there, whereas a scene in front of the camera is not affected by the photographer’s beliefs. In other words, the indexical images of photography depict realities that already exist (although of course only the artist’s choice can disclose them), whereas the iconic images of painting create physically non-existent if plausible realities.

A related example of a sign straddling the categories of icon and index is the cast shadow. Unlike photography, which is a highly technological medium combining the optical features of the camera obscura with the photosensitive properties of silver nitrate, the cast shadow is primarily a natural phenomenon, a ubiquitous side effect of light falling on opaque objects and producing an area of comparative darkness on a surface opposite the source of light. As indexes shadows do not therefore have an independent existence; their presence, shape and intensity depend on the source of light that creates them, on the shape of the object that intercepts the light, and on the colour, texture, and shape of the surface upon which the light falls. Shadows are visible but at the same time they do not appear to be a part of the material world, because they lack solidity and substantiality. They are both physical and ethereal, always there as inseparable companions (in the right light conditions) of solid objects that occupy our living space: trees, houses, vehicles, animals, and of course people, including ourselves (Casati 2009: 329; Currell 2007: 7).

We all experience shadows: on a sunny day with a clear sky we are accompanied all the time by our dark equivalent, especially visible when projected on a bright surface such as a wall or pavement. Our shadow is real (because visible) but at the same time strangely elusive: we cannot touch or feel it, it may be on the ground in
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front of us but we cannot jump over it or shake it off, and if it is behind us we cannot run away from it. The shadow as our contiguous indexical extension has also iconic qualities: it can be long and thin, or short and fat; it can be dark and crisp, or faint and hazy; it may appear graceful or clumsy, shapeless, grotesque, mysterious and sinister.

Shadows can also be almost exactly like us in outline: when the ground is even and the rays of the sun fall at an angle of about forty-five degrees, the shadow will produce an undistorted image of ourselves, our dark double that is always at our side, imitating our appearance and movements, at the same time remaining curiously transparent and immaterial, unlike our solid bodies. If the light is diffuse, the shadow can vanish altogether, or it will appear blurred and fuzzy, just an irregular dark cloud superimposed on a light surface. But on a clear day or in the directional light of a lamp the shadow will have a clear, sharp outline and, as the psychologist of art Rudolf Arnheim reminds us, it will no longer be perceived as a casual superimposition on a light surface but as an independent dark shape and an actual part of that surface (Arnheim 1960: 252). In other words, the shadow can sometimes be perceived as having a substance and a life of its own, independent of its owner. The ancient Greeks believed that those who took their leave of this world continued their existence in Hades, a mysterious place populated by living ‘shadows’ of dead people. Attached to a person during her lifetime, the immaterial soul can survive its carrier to dwell forever in the land of shadows, which is how Homer describes the Greek other world, visited by Odysseus anxious to embrace the elusive figure of his dead mother (Homer 1980: 115). In modern Indonesia the shadow puppets represent ancestral spirits, gods, and demons, while the dalang, the puppeteer, still performs a semi-priestly function (Casati 2003: 21-24; Currell 2007: 7).

Empirically speaking indexical signs such as shadows (or mirror reflections) cannot exist without their referents, that is, the solid objects that produce them. But in physics-defying folk beliefs insubstantial ghosts may cast no shadows and are not reflected in mirrors, or else the opposite is the case: ghosts exist only as shadows or mirror reflections, without their bodily equivalents. This is why in Friedrich W. Murnau’s classic horror film Nosferatu (1922) the vampire steals upon his unsuspecting victim at night in the form of a disembodied shadow (Fig. 1).
The supernatural domain apart, the shadow in the physical world testifies unmistakably to the solidity of an object, for what casts a shadow must be real. The physical connection between index and its referent explains beliefs in shared properties between the two, as in the legend of the healing power of the shadow cast by Saint Peter (Stoichita 1997: 54-58). But a physical separation of a solid object from its ethereal shadow is likewise too compelling not to stimulate the imagination. The shadow as a person’s index will accordingly be considered a second, filmy self, an immaterial soul or a spiritual double, a ‘dark’ alter ego, a Doppelgänger, as in Carl Gustav Jung’s psychological theory of archetypes, in which the shadow denotes the dark aspect of personality formed by fears and unpleasant emotions rejected by the conscious self (Jung 1998). Beliefs in the shadow as a person’s spiritual extension are indeed common: in some cultures to step on one’s shadow is considered a serious offence, and a man can be ‘murdered’ by having his shadow pierced with a knife (Casati 2003: 22; Arnheim 1960: 258). The shadow as a familiar element of the visible world, easily ignored or simply taken for granted, has universally generated beliefs in ghosts and spectres, and has fascinated poets, writers, philosophers, dramatists, painters, photographers, and filmmakers.

Arguably the most famous example of philosophic speculation on the indexical properties of the shadow is Plato’s parable of the cave (Plato 2003: 514a-c; Ander-
What looks uncannily like a foreshadowing of a cinema experience from two and a half millennia later, Plato’s parable illustrates the limitations of human knowledge of the world as revealed by the senses. The philosopher compares humans to prisoners chained in a cave, unable to turn their heads: all they can see is the wall of the cave in front of them. Behind them, at the other end of the cave, burns a fire. Between the fire and the prisoners’ backs there is a parapet, along which puppeteers hold up puppets and other “figures of men and animals made of wood and stone” (Plato 2003: 514a), which cast shadows on the wall in front of the prisoners. The prisoners are unable to see these puppets; all they can see and hear are shadows and echoes produced by these objects.

In Plato’s rather pessimistic view of the extent of human understanding of the world people are not even seeing the shadows as indexes of real things – all they can see are the shadows of man-made puppets and figures which only refer to real things. In other words, for Plato our perception of the world is indexically twice removed from that world. This is not unlike the modern cinema experience, in which viewers see on the screen the shadows of the shadows of real objects, as the light of the projector passes through the transparent images on the celluloid film and casts them as magnified shadows onto the screen. The real objects, perceptually twice removed from the viewers, exist out there in the physical world captured by the film camera. This is what we see in documentary films, in which the camera captures spontaneous life, giving us shadowy images twice removed from that life. On the other hand drama films – in which the camera records iconic simulations of life performed by actors realizing fictional scenarios in artificial studio sets – reveal on the screen shadowy images perceptually thrice removed from real life.

Why should a common, perfectly natural optical side effect stimulate the imagination to such an extent? The shadow is a function of light, and responsiveness to light helps most living creatures, us included, to get around in the world. Our eyes have evolved over millions of years to help us find our way, to avoid enemies and physical obstacles in our path, to recognize our mates, to find food and shelter – in a word, to survive. The differences of light and shadow on the surface of objects tell us of their shape; the reflections on that surface indicate its texture, and the objects’ reactions to the various wavelengths of the light spectrum determine their
colour. Sight is the most effective and adaptively important sense in humans, and blindness is a serious, potentially life-threatening handicap. With our eyes we acquire crucial knowledge about the physical properties of objects in the environment, including shape, brightness, size, distance, movement and their spatial distribution (Sherwood 1997: 168).

Shadows as indexes of light falling on opaque objects also play a role in our visual negotiation of the physical environment. A sense of depth is first of all created by our stereoscopic vision, which fuses two slightly different images produced by our eyes into a mental impression of three-dimensional space. But cues of depth can also be conveyed by shadows: cast shadows indicate the direction of light falling on objects, but also the fact that something is obstructing the light. Texture of objects is revealed by small shadows, and both the texture of the surface and the direction of illumination are indicated by the form and direction of shadows. This is particularly important in drawing or painting, in which shading, or modelling, can create on a two-dimensional surface a compelling illusion of volume and space, producing something surprisingly close to binocular vision (Gregory 1998: 189).

Cast shadows inform us about the solid objects that produce them, even if we do not see those objects, as when the presence of a person hiding behind a tree or the corner of a house is betrayed by a shadow cast on the ground. In this way shadows testify to the existence of spatially displaced but temporarily co-present objects. Some indexical signs are more removed from their referents than others. For example, footprints, death masks, or photographs testify to the existence of objects that are displaced both in space and time. A fossilized footprint is an index of an animal whose species has been extinct for millions of years, while an old photograph shows an image of a person who died decades ago. One of the most poignant iconic indexes on record is a human shadow etched in stone, whose photograph is displayed in the Hiroshima Peace Memorial Museum. This photograph of a ‘photograph’ shows a dark spot on the bright steps of the Sumitomo Bank, about 260 metres from the hypocentre over which the atomic bomb went off on August 6th 1945. The fixed shadow is what has remained of a person who sat on the steps that fateful day waiting for the bank to open. The victim was exposed to the flash from the atomic explosion and must have vaporized on the spot. The surface of
the surrounding stone steps was turned whitish by the intense heat rays, while the
dark patch, a permanent shadow, corresponds with the outline of the victim’s body
that reduced the heat’s exposure in that spot, making it darker.

The important thing about the way we interpret indexical signs such as shadows
is that we are making inferences about objects implied by their indexes, especially
when we do not perceive the objects themselves. We infer someone’s presence in
the dark by their voice; we smell a person’s odour and realize that the person is
near us even with our eyes closed; we know that there is no smoke without fire;
and we are making a reasonable deduction that a cracking sound of a broken twig
in the forest may be a sign of an approaching large animal or a human. Indexical
signs tend indeed to stimulate the imagination more when they appear on their
own than when they are accompanied by their referents. In the latter case what we
see is what we get, so there is little else left to the imagination. The uniformly lit
paintings of the Renaissance provide us with full visual information of the scene
to contemplate and interpret. On the other hand the chiaroscuro of a Caravaggio
painting or Rembrandt’s tenebroso hide more than they reveal, provoking the viewer
to infer the invisible but implied elements of the scene from suggestive patches of
darkness. A figure casting a shadow forms a perceptual whole in which the indexical
shadow is for the most part ignored, our attention being concentrated on the
figure as the main subject. This is probably why cast shadows are relatively rare in
painting (Gombrich 1995:19); just as in photography or film they are often only
accidental and dramatically irrelevant. But if we are not missing a shadow of a
painted or photographed figure, we are certainly missing a figure if all we see is the
shadow. The eeriness of the Surrealist painting Melancholy and Mystery of a Street
(1914) by Giorgio de Chirico is in no small measure due to a threatening human
shadow emerging from behind a building, opposite a dark silhouette of a girl rolling
the hoop and obliviously heading towards possible danger (Fig. 2).
The effectiveness of shadow images in painting and the photographic media thus builds on unconscious fears provoked by indexical signs. An index on its own implies a missing original and ultimately it is the original that matters, because it can be a person whose intentions towards us we are not sure of, or an animal stalking to attack us. For evolutionary reasons, therefore, our senses are instantly alerted to the sight of detached shadows whose mystery, as in de Chirico’s painting, is precisely about the yet unknown and potentially dangerous identity and intentions of their bearers. The mixture of uncertainty, curiosity and fear that is provoked in us by indexes like detached shadows, appears to be instinctive and automatic: in our history as a species it probably paid in survival terms to be keenly attentive, rather than indifferent, to signs of movement of large objects such as fellow human beings or animals in one’s proximity. Our brains appear to be hard-wired for clues of near presence of potential friends or foes, especially when these clues are, as is the case with indexes, literally “indicative” of real rather than just imagined objects (Plotkin 1994: 103).
While natural indexical signs appeal to our senses, primal emotions and imagination because of their direct, physical connection with their referents, human communication in a cultural context also appears to be based to a large extent on iconic signs, that is, signs that are not physically caused by their referents but only resemble them to some extent (Sadowski 2009: 36-38; Jappy 2013: 79-84). A person’s shadow is caused by and remains physically inseparable from that person, but a painted portrait only resembles the person it is referring to. The sitter has not inadvertently caused his or her image to be imprinted on a painting, the way one automatically creates one’s shadow or produces one’s reflection in the mirror, but has allowed the imagination and skill of the painter to create the visual resemblance on the canvas. Apart from the similarity between the painted portrait and the sitter, which is formed in the minds of those contemplating the picture, there exists no physical connection between the two: icons not so much indicate near-present real objects as suggest distant imagined ones. For this reason our responses to iconic signs are usually not as emotive and instinctive as our reactions to indexes: the silhouettes of Pleistocene lions painted with red ochre on the walls of the Chauvet cave, for all their admirable realism, are not terrifying to behold, whereas a shadow of a real lion lurking nearby certainly is.

In analyzing the communicative function of cast shadows the iconic dimension is important, because shadows are not only indexical extensions of their objects but they can also resemble them in varying degrees. However, the iconicity of indexes such as cast shadows is not of the same kind as the iconicity of figurative arts. In the case of natural indexes their occasional iconic character is still a function of the sign’s indexical origin, whereas the iconicity of figurative arts has entirely to do with the artists’ intention and skill. Insofar as an index, natural or man-made, resembles its object in a perceptual (mostly visual) sense it is called, as said earlier, an iconic index. Iconic indexicality covers a fascinating area of visual culture, including some of the most perceptually and cognitively powerful media and art forms such as the shadow theatre, magic lantern shows, shadow portraits, the camera obscura, photography, film, and television (Sadowski 2011: 355-368).

The reliance on a physical extension of the represented object makes iconic indexical media so much more efficacious in reflecting the outside world, and con-
sequently so much more powerful in their emotive effect on viewers than purely iconic media, with their imagined rather than real connection with the world. Shadows and photographs directly depend on the visible properties of the objects they represent, whereas paintings depend not so much on the objects themselves as on the painters’ beliefs about these objects. The painted scene is always an interpretation, whereas a cast shadow or a photograph captures an object “as it is”, in a way not affected by the artist’s beliefs. It is thus the combined emotive power of indexicality and iconicity that accounts for a truly ‘magical’, compelling effect of immediacy and reality produced by the fleeting cast shadows or the fixed images of photography. One might even argue that the contiguous nature of shadows accounts for their comparatively stronger effect of instant curiosity, urgency and anxiety than is normally the case with the contemplation of displaced, and therefore non-threatening, photographic images. Still, as Susan Sontag has argued, even old photographs exert an uncanny effect of being co-substantial with their subjects, allowing the viewer to establish an illusory if psychologically compelling impression of a surrogate possession of a cherished person or thing, a possession based on an implicit assumption of identity, on an inseparable sympathy between a photograph and what it represents (Sontag 1978: 57). This sympathy results from an indexical, real connection between image and subject, which in the case of photographs offers a compelling illusion of preserving someone’s existence and appearance forever, in defiance of time, and in the case of shadows of concealed objects creates an immediate sense of urgency, curiosity, and fear.

As visual phenomena shadows and photographs are of course in many respects different: as said earlier, the former is primarily a natural effect, the latter an advanced technology. They are, however, historically connected, in that photography as we know it has been emerging over the centuries as a result of optical experiments and forms of popular entertainment involving shadow projections. The belief in a fleeting shadow as a person’s spiritual extension is responsible for the fascination with eerie and spectral effects produced by cast shadows in dramatic spectacles. Shadow theatres belong to the traditions of China, India, Java, the Middle East, and Turkey, among other countries. Chinese shadow plays for example were like modern films, serial in form, embracing themes and stories born
in religious myth, local legend, history, domestic life, and they were often satirical or melodramatic in tone (Casati 2009: 18-19; Ceram 1965: 17, 27).

The traditional shadow-player, like the modern filmmaker, created moving pictures on a bright surface by means of light projection, but unlike a filmmaker he did not create displaced fixed images to be contemplated after they were taken, but arranged moving projections as part of a live performance simultaneously with the audience contemplating it (Fig. 3).

During the play a sketchy shadow puppet would be transformed and fleshed out by the imagination of the spectator. Such suggestiveness remains the main visual appeal of all shadows, natural or intentional, where the bare outline of a figure and lack of texture stimulate the mind often more effectively than a three-dimensional puppet or a detailed photograph. Like all indexical representations, theatrical shadows only imply the essence of the characters or concepts they represent, inviting the audiences to supply dimensions that the dark silhouettes on the screen can only hint at, such as volume, depth, costume, bodily details and facial expressions (Currell 2007: 9, 12).

While the Oriental shadow play exploited the mysterious quality of moving shadows in the context of live performance, the shadow portraits popular in eighteenth-century Europe came a step closer towards the fixed indexical images
of photography invented a century later. Unlike the fleeting shadow projected on the screen, the silhouette portrait exists in its own right as a material object, a sort of fixed shadow, like the photograph, usually executed in solid black and set against a light background. The chief proponent of the silhouette cut-outs was the Swiss scientist cum physiognomist Johann Kaspar Lavater (c. 1741-1801), who believed that one could deduce the character of a person from the features of the face or the shape of the body. For his character reading Lavater used silhouette profiles obtained by tracing the shadow of a person’s head onto paper, and then filling the image in by hand and using it as a template to cut a silhouette from black paper (Fig. 4).

In profile projection the nose and the chin are maximally visible, and only the image thus created can be unambiguously interpreted as the shadow of a solid head to be used in character reading (Marien 2006: 1, 5). The silhouette portraits of the eighteenth century were executed with the utmost care so as to obtain a true and unquestionable likeness of the sitter. As in photo studios a century later, the sub-
ject was seated on a specially constructed chair, with a support for her head. Incorporated in this chair was a frame with a glass plate in a fixed position. The frame was covered with oiled paper and a candle was employed to project a shadow on the screen without distortion. The outline of the head was then carefully drawn on the paper, the inner space subsequently filled in with black ink to create a negative image of the actual head (Willats 1990: 235). In this way an ethereal and immaterial shadow was converted into a solid (if flat) object, which as such could cast its own shadow.

It is a remarkable fact that although shadow silhouettes were not as detailed and colourful as traditional painted portraits, they were considered to be more truthful of a person’s appearance (and personality) than the latter. The reasons for this intuitive assessment must lie in the indexical nature of a person’s shadow captured by a silhouette portrait, which is subsequently perceived as retaining the original direct link with the sitter, whose head has been ‘imprinted’ on the shadow image by natural light, as in a photograph, rather than by the skill of an artist’s hand. As an index a silhouette portrait was thus accepted as a record of a person’s appearance with a fidelity never attained by a mere iconic drawing, in which the accuracy of representation depends more on the artist’s imagination than on the objectivity of mechanical reproduction.

Interestingly, the appeal of silhouette portraits continued long into the age of photography and film. For all the visual realism of the photographic media a suggestive plain dark shadow portrait continued to hold its fascination. Apart from the menacing cast shadow, so beloved by horror filmmakers (Fig. 1), the so-called attached, or self-shadow has often been used with great effect to create suggestive mood and psychological understatement. The attached shadow is created by single-source side or back lighting which fails to illuminate parts of an object on the opposite side of the light source, with no fill-light to mitigate the sharp chiaroscuro effect. A self-shadow shows a figure as a dark silhouette, without texture or surface detail, a living shadow that can be menacing and mysterious.
In Orson Welles’ classic film *Citizen Kane* (1941) for example, a frequent use of self-shadows conveys a range of (usually negative) psychological connotations: self-effacement, ignorance, insignificance, humiliation, self-delusion, or powerlessness, depending on the dramatic content of a scene. When Kane (Orson Welles) reads his ‘Declaration of Principles’ to his associates in the newspaper office his face remains in the dark compared with the other, dramatically less important characters (Fig. 5). Depending on one’s interpretation Kane’s self-shadow can be seen as hiding the character’s possible insincerity or signalling his self-delusion in announcing idealistic principles which he will later betray. As always, by virtue of their semiotic indefiniteness and understatement, cast or self-shadows effectively provoke the viewers’ apprehension and curiosity, eliciting instinctive interpretive responses that complement missing visual information with imagined but contextually probable meanings.

_Dublin Business School_

References
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