In his work, *The Perception of the Environment*, the anthropologist Ingold postulates, “if perception is a mode of action, then what we perceive must be a direct function of how we act. Depending on the kind of activity in which we are engaged, we will be attuned to picking up particular kinds of information”. Based on the phenomenology of Merleau-Ponty and supplemented by Gibson’s insights on visual and tactile perception, Ingold mounts a convincing argument regarding the emergent nature of perception in relation to the environment. Research by contemporary psychologists, such as Toth or Schwartz, supports this position: that the brain is structured by virtue of interaction from any early age to be disposed to certain patterns of information. Though principally associated with early childhood development, similar evolution can occur later in life and thus, according to Schwartz: “the power of wilful activity to shape the brain remains the working principle”.

Ingold’s argument, that people and the environment are mutually shaped by one another, underpins his hypothesis that the manipulation of material into form is not achieved through the imposition of an intellectual representation onto material but rather the mutual interaction between the maker, the process of making and the material, all of which play a role in the resulting artefact. Ingold also acknowledges the existence of bias in this process, suggesting that; “if people from different backgrounds orient themselves in different ways, this is not because they are interpreting the same sensory experience in terms of alternative cultural models or cognitive schemata, but because, due to their previous bodily training, their senses are differentially attuned to the environment”. Ingold’s thesis, in tandem with the work of Schwartz and Toth, suggests that the types of information attended to in the process of design are therefore related to one’s prior experience. Given the complexity of the design process these patterns in attention, which serve to privilege certain types of information over others, will inevitably influence the form of the artefact.

There is an interesting case in the history of dock building along the River Liffey that exemplifies this very process, being illustrative of the relevance of one’s background in shaping one’s perceptual horizon and thus the manner in which the environment is attended to and the design process is undertaken. History documents that the acclaimed Scottish engineer John Rennie (1761-

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3 Ibid., Schwartz and Begley (2003):130
4 Op. cit., Ingold, 372
5 Op. cit., Ingold, 162
was author of the three docks built eastward of the Custom House in Dublin. This trio consists of the original dock, or Revenue Dock, completed 1796 (now in-filled), as well as George’s Dock and the Inner Basin, both built by 1824. Yet the first dock was actually designed and constructed in tandem with the Custom House by James Gandon (1743-1823). Though this fact is clearly recorded by Mulvany in his biographical work on Gandon, and tentatively acknowledged much later by McParland, the record of citation evidence has slowly mutated across nearly two centuries to accommodate an altered perception of the increasingly specialized roles of engineer and architect. What is clear, from Rennie’s well kept business records, is that once awarded the contract to build the two additional docks and associated warehouses by the Commissioners of Custom and Excise in 1814, Rennie was in a position to assess the condition of the original Revenue Dock in late October of 1820 in an attempt to estimate the cause for its failure. Based on this assessment, three sides of this original dock in addition to its entrance channel were to be largely rebuilt, following Rennie’s untimely death in 1821, by resident engineer John Aird (1760-1832) under the supervision of Thomas Telford (1757-1834) by 1822. Presumably the subsequent rebuilding of substantial portions of the Revenue Dock are responsible for the muddied record of authorship. Regardless, there remains substantial documentation that attests to both Gandon’s role in the design of this first dock, as well as the significant differences between Rennie’s and Gandon’s approach to the design of these structures.

The Revenue Dock

On the 28th of March 1794 the Ballast Office, understanding that a new dock was being considered adjacent to the Custom House, ordered a memorial to be put forward to the Lord Lieutenant to request that “the new Dock at the Custom House may be constructed with Gates to keep in a sufficient Quantity of Water, so that Vessels may be constantly afloat therein instead of letting the Water flow in and out every Tide as the Corporation understand is at present intended”. The author to these works becomes apparent in the return letter enclosing a report from a Mr James

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6 This is reflected in the biographical database kept by the IAA, and reiterated in published works such as Gilligan’s A History of the Port of Dublin (1988), Meredith’s Around and About the Custom House (1997), Rynne’s Industrial Ireland 1750 – 1930 (2006), Casey’s Dublin: The City within the Grand and Royal Canals and the Circular Road with the Phoenix Park (2005) and Cox’s article of 2009 “Telford in Ireland: Work, Opinions and Influence” in the Proceedings of the Institution of Civil Engineers. Vol. 162. (2009). Notably this opinion is not supported in the work of McParland in James Gandon: Vitruvius Hibernicus (1985) or De Courcey’s The River Liffey in Dublin (1996).

7 Correspondence kept by Rennie on his projects includes a letter from 1820 addressed to the Commissioners on the question of the authorship of the first Revenue Dock, under the reference REN/RB/11/303. These record books are kept in the archive of the Institution of Civil Engineers in London, UK.

8 Following Rennie’s death in the autumn of 1821 the completion of the construction administration for the Custom House Docks project was awarded to Thomas Telford, who retained John Aird as Resident Engineer on the works. The correspondence regarding the completion of the project can be found in the Telford Papers, filed under the Edinburgh & Glasgow Canal, kept in the archive of the Institution of Civil Engineers in London, UK.

Gandon concerning the depth of water considered appropriate for the new basin now that it has acquired gates. Though the report is not extant the Board responds that they are “inclined to hope and believe that the Depth of the Water proposed by Mr Gandon to be kept in the Dock at all times, Viz Ten foot, will be sufficient to keep most Vessels … Water borne”\textsuperscript{10}. It is clear that prior to the Board’s intervention Gandon’s intention was to build the new Revenue Dock as a tidal basin rather than a wet dock. Though tidal basins are, even today, still common, the difference between these two constructions would have been immense on a tidal watercourse of such insignificant depth as the River Liffey, upon which merchant ships of substantial draught could not remain afloat at all states of the tide. By the close of the eighteenth century dock systems on rivers had evolved significantly beyond these simple tidal basins, as is clear from the nearly contemporary works for the Grand Canal Company on the south side of the Liffey under the direction of the British engineer William Jessop (1745-1815), which accommodated an entrance to a wet dock through no less than three locks.

Gandon’s strategy was likely influenced in large measure by the Liverpool docks, having been advised by John Beresford at the start of the Custom House project in 1781 to “come by Liverpool by all means, as you will then see their docks, and procure every information about them”\textsuperscript{11}. Liverpool had a glowing reputation for its sophistication in dock technology at that time, yet their system was rather idiosyncratic, having evolved quite separately from other major engineering works, and did not represent the contemporary advances made in the field of engineering by the late eighteenth century.\textsuperscript{12} The single most eccentric aspect of Liverpool’s dock system, until the mid-nineteenth century, was that only a single pair of gates were used on the dock entrances in tandem with a dry basin between the dock and the river.\textsuperscript{13} The obvious tidal nature of the dry dock adjacent to the River Mersey may well have been the source of Gandon’s first instinct to provide a dock with no gates, to which the Ballast Office was to take such exception. Once chastised regarding this lack, Gandon still draws on recent experience and proposes a dock with a single pair of gates, emulating the Old Dock in Liverpool designed by Thomas Steers (? -1750) earlier that century, rather than a pair of gates to provide a lock as used in the Grand Canal Dock. The difference between these strategies is significant, as gates could only be opened for an hour or two at either side of high tide to allow ships in or out, in order to preserve the water level in the dock, while a lock system allows for entry or exit at any state of the tide.

\textsuperscript{10} Ibid. p 336.
The figure of Liverpool's Old Dock is also telling, as it bears an uncanny resemblance to that which Gandon was to finally build in Dublin, both in terms of scale and configuration (Fig. 1). The shape of this Old Dock is something of a mystery, for though earlier harbour structures might adopt the local form of the surrounding landscape, by the eighteenth century docks of any scale were far more likely to be built as rectangular basins. Though the Old Dock in Liverpool has long since been buried under landfill, buildings and road works, recent archaeological excavations undertaken by Oxford Archaeology North confirmed that the dock walls were principally constructed of handmade brick, with two courses of large yellow sandstone copings, to a dimensional width of approximately 4 feet at the top and 5 foot, 10 inches at the base with a wall height on average of 12 feet.14 This last dimension varies considerably across the dock, however, as the walls are founded directly on the bedrock of the former Pool and sloped precipitously.

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downward toward the south edge, near the indentation in the otherwise rectangular form, where the walls were more than 3 feet deeper than the north side. It is conceivable that the particularities of the bedrock in Liverpool precluded building a fully rectangular basin, a condition which was not present in Dublin despite the similarity of the figure. The only remaining explanation for this feature is provided by Vernon-Harcourt, who notes that in early dock design “It used to be considered advisable to have sufficient width for vessels to turn round in the dock, and this is sometimes effected by making the dock wider near its entrance . . . By this means a vessel can turn, and start with its bow foremost, without a greater width than necessary being adopted in the rest of the dock.”

Though there is no original plan of the Revenue Dock in Dublin still extant, there are rather telling drawings by Gandon held by the National Library of Ireland detailing the dock entrance as well as the intended gate and drawbridge, which also provides information on the form of cill. When viewed in relation to the Liverpool Old Dock and the later comments made by Rennie, Aird and Telford on examination of Gandon’s work in Dublin, a great deal can be discerned as to how this first dock was constructed. The entrance to the Revenue Dock, as planned, had a single pair of gates constructed of timber, with two sluice gates built into each leaf, closing on a timber cill and floor construction, similar to what is known of Steers’ work. Steers’ construction methods were known to leak, a flaw also apparent in the Revenue Dock when assessed by Rennie in 1820.

Gandon also used the standard mitre gate, in common use throughout Europe at the time, yet dock gates of the period had already evolved into a curvilinear form, which allowed for the more equitable distribution of forces across their surface and achieving a more efficient use of material. Also at odds with contemporary developments was the position of the sluices, used to adjust the height of the water inside the lock, or in this case dock, to the adjacent body of water. What is striking about their placement is their location at the top of the gate, as sluices served a secondary role in scouring the base of the entrance clear of mud and were thus more effectively located near the base of the gate or wall. In comparison, a gate used by Rennie at the Grimsby dock, a project contemporary with Gandon’s Revenue Dock, includes both a curvature as well as sluices at the

15 Ibid.
21 REN/RB/11/303. Institution of Civil Engineers. London. UK.
23 Ibid. p 272. See also; Vernon-Harcourt, 440.
bottom of the gate structure.\textsuperscript{24}

\textit{George's Dock}

Rennie’s reputation for building prodigiously, with little regard for budgetary constraints, is well known but he was equally admired for “never enter[ing] upon an undertaking without making himself fully acquainted with the local surroundings”.\textsuperscript{25} Though Rennie was only to inspect Gandon’s Revenue Dock in 1820, he had been invited to Dublin in 1801 to give his opinion on the state of Dublin Harbour during which he undertook just such a comprehensive study.\textsuperscript{26} Rennie spent at least three weeks in Dublin, much of it in the company of Captain Huddart, a respected navigator who was often called upon to consult on harbour projects in Britain.\textsuperscript{27} The pair spent time in the Bay studying tidal movements, taking soundings and, when on land, speaking to all and sundry from Howth to Dun Laoghaire regarding the pattern of shipping and types of ships in Dublin. The information from local sources, in conjunction to insights gleaned from Captain Huddart early in the following year, indicate that the average size of ship frequenting Dublin ranged from 175 – 250 tons, though some as large as 500 tons would on occasion arrive.\textsuperscript{28} The lower class of West Indiamen belonging to Dublin, as well as the smaller colliers, could enter Gandon’s Revenue Dock at the highest neap tide when there was on average 13 feet, 8 inches of water over the cill. But the average class of vessel frequenting the port of Dublin, which drew between 14 and 15 feet of water, could not enter save on the highest of spring tides.

As early as 1790, when Jessop was building the locks at the Grand Canal Dock, dock entrances had advanced from timber-bottomed structures, used by Steers and Gandon, to a form of inverted arch constructed entirely of masonry, or brick faced with masonry, such as Rennie was to construct at the entrance to East India Docks and the London Docks at a similar period. It is by means of this inverted arch structure that the upward pressure of water under the floor and walls of the lock when empty is evenly distributed across its surface and thus reduced.\textsuperscript{29} That the entrance lock to George’s Dock, designed by Rennie, is built in this manner was described by Aird in a letter sent to Rennie in September 1818 reporting that “[a] considerable part of the Inverted Arch of the Lock is in, and [is] a good job”.\textsuperscript{30} As to the side walls of the entrance lock, though at the East India Docks there appears to be a curvature radiating up the side walls, by the time George’s Dock in Dublin was constructed side walls of lock entrances were vertical, to ensure a

\textsuperscript{24} See “Lock Gate for Grimsby Harbour Dock” drawn by Rennie in 1797, located in Rennie MSS 83-84 at the National Library of Scotland.
\textsuperscript{25} Prosser, R.B. “Rennie, John (1761–1821).” Civil Engineer. Dictionary of National Biography. (1896)
\textsuperscript{26} Rennie MSS 19793F. National Library of Scotland. Edinburgh. UK.
\textsuperscript{27} Ibid.
\textsuperscript{28} Rennie MSS 19874. National Library of Scotland. Edinburgh. UK.
stable width of water regardless of level.\textsuperscript{31} Further advances at George’s Dock involved the laying of masonry flat at the gate floor, above the curvature of the substructure, to facilitate the gate mechanisms at the cill, an objective fulfilled at the early London Docks in timber.

Similarly, rather than the straight batter used on the earlier Revenue Dock, walls were by this time more commonly built with a continuous curvature from top to bottom, the object being “to increase the stability of the wall by bringing the centre of gravity nearer the back and somewhat lower”.\textsuperscript{32} Though who first developed this is unrecorded, it is certain that Jessop used this curved form of wall structure, in combination with the regular placement of counterforts, as early as 1793 in the Cumberland Basin in Bristol\textsuperscript{33} and Rennie used this profile on the London Docks, the East India Docks, and at Humber Dock in Hull.\textsuperscript{34} From records documenting the work being undertaken at Sheerness, a project on which Rennie was working concurrently to building the docks in Dublin, it was clear that Rennie had made improvements on Jessop’s designs, adding a heel to the back footing of the wall to increase its resistance to movement at the toe of the construction.\textsuperscript{35} In addition to the upward hydraulic pressure under the entrance to the dock, the walls of the structure faced similar horizontal thrust from the soils, and the presence of any water in them, often leading to sudden collapses during construction or when a dock was laid dry for repairs.\textsuperscript{36} Rennie accounted for this problem by constructing sewers around the perimeter of both George’s Dock and the larger Inner Basin, to which it led, draining the surrounding soils of excess water into the River Liffey through flap-gates.\textsuperscript{37} Once this information is amalgamated with the specifications outlined by Rennie for the dock construction dated 1815,\textsuperscript{38} in tandem with later evidence regarding the sewer derived from the Arup survey undertaken during demolition works in 1988, the construction of the two dock walls and their relationship to the sewers and adjoining stores becomes clear (Fig. 2). That Rennie built the entire structure of stone, rather than brick, or a combination of brick and stone, which he used throughout his dock works in London, is a matter of what material was locally available, rather than of structural consequence.\textsuperscript{39}
Conclusion

The relative difference between the work of Gandon and Rennie on the Custom House Docks could be attributed quite simply to the disparity between the works of a novice versus the well-seasoned practitioner. Docks were not, after all, Gandon’s field of interest, while Rennie had made a considerable career of such work. As a newcomer to the arena of dock engineering Gandon had played his hand well: he had learned a good deal from his brief exposure to the Liverpool docks and applied the lessons in a cogent manner to a much different site, all the while being responsive to adjudication by the members of the Ballast Office as they strove to educate him in this quickly evolving field. There was little reason for Gandon to doubt the worthiness of the model he had been encouraged to study. Even Rennie, on his grand tour of Britain had visited the very same set of docks in Liverpool in the spring of 1784 and commented, “the docks at this place are certainly the finest in Europe”. But Rennie of course had laid out a very different career path from that of Gandon, and on continuing his travels to London had made extensive drawings and notes on mills, machinery, windmills and bridges in addition to the description of the Liverpool docks and Bridgewater Canal. Though to work initially for Boulton & Watt, Rennie’s attentive study bore fruit in the commencement of his own practice seven years later and it is not long after this that the docks at Liverpool no longer garnered the initial praise he had laid on them, but a rather more critical report.

But there is more to this than the simple difference between the skills of the novice and the expert. There is also the question of awareness of the forces at play that must be attended in such an endeavour. Rennie is a man who very willingly acknowledges his lack of expertise and, when faced with a novel challenge, actively questions the nature of the thing to be built and seeks out the guidance of those more knowledgeable. This is clear from his extensive study on the ships, shipping, tides and winds of Dublin harbour in the company of Captain Huddart. On that same trip

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he was known to have contacted Jessop as well, to query him regarding the nature of soils in the area, knowing he had recently completed the Grand Canal Dock.\textsuperscript{41} Likewise, in stark contrast to Gandon’s first foray into dock engineering, is Rennie’s initial work in the field at Grimsby Harbour in 1798: a project which saw the invention of the hollow dock wall in response to seemingly unbuildable soil conditions. This was not a newly acquired tendency but one that underpinned Rennie’s engagement with the world around him: an interest in how things worked, and what worked upon them. Even within that first early journal there exists a careful study of the Bridgewater Canal system and its workings: its sluices, gates and basins for water supply as well as its construction. So detailed are Rennie’s notes that it becomes clear that he must have spoken with some one in order to understand the subterranean works on site, implying an understanding that there was more to the works than was simply visible above ground.

Rennie was sensitized to the primacy of material forces, having a background, which in terms of classical theories on cognitive processes, had predisposed him to being aware of such forces. Rennie was first been trained to use his hands as a millwright and, interestingly, the much more famous Thomas Telford, began his career as a stonemason. Likewise John Smeaton (1724-1792), mentor of William Jessop, who, though the very definition of detachment when it came to dealing with his engineering projects, was first a maker of scientific instruments. Though of a different scale, even in the construction of these devices Smeaton would have developed an attitude toward the relationship between material, form, and the process of making which would inform his later endeavours in civil engineering.

Gandon’s background and his apparent approach to a project, stands in contrast to these men. That Gandon was spatially gifted there can be little doubt, and his mastery of the arts and the aesthetics of architecture have been well documented. Gandon’s academic early training was at the hands of a drawing master at Shipley’s Academy, followed by an apprenticeship with the well-regarded architect William Chambers and from thence to studies at the Royal Academy. This training certainly influenced Gandon’s attitude toward architecture and the art of building, as Craig was to observe, “Gandon was a little too ready to take at its face value the assertion of his friend Lord Carlow (then more or less an absentee) that there were no architects worth the name in Ireland. This links up well with his contempt for builder architects; but this attitude, though we may disagree with it, is just what we would expect of a man with his academic training”.\textsuperscript{42} Though his aesthetic judgement, and gifts in drawing and the manipulation of form, were well honed, at no point were these sensibilities to be modulated by any activity which could make the young Gandon sensitive to the more primal forces which would come to bear on his work at the Custom House, nor perhaps would he have wished it so. While it is true that Gandon’s work on the original

\textsuperscript{41} Rennie MSS 19874. National Library of Scotland. Edinburgh. UK.
Revenue Dock was undermined by the rapid transformation of technologies underway concurrent to his work, which had relied heavily on Steers’ outmoded construction in Liverpool, the level of curiosity manifested by Rennie is seemingly absent in Gandon’s approach to this original dock. No mention is made of testing tides or surveying the bulk of ships, neither are experts consulted, though on occasion they appear unbidded. Yet, the form appears remarkably like the Steers’ dock, despite the dissimilarity in physical context. Ingold argues that the process of copying a work, such as Steers’ dock, is a form of learning through action which helps to tune the novice’s sensibilities and perceptions to the environment around him, which he describes as “the education of attention”. Even in this first copy exercise though, Gandon’s attention was focused on the form, rather than the rational behind it, manifested by his failure to learn of the timber baulks embedded into the brickwork of the Liverpool dock walls, which reached back into the surrounding terrain to act as lateral ties, stabilizing the slender walls from the horizontal thrust of the water laden soil which surrounded it, knowledge that may well have aided in the building of the Revenue Dock in Dublin. A detail, one imagines, that Rennie would have ferretted out in some manner given the same task, due to his attentiveness to the material context, as is suggested by his careful mining of information on the Bridgewater Canal.

Ingold has argued that “if the knowledge of the expert is superior to that of the novice, it is not because he has acquired mental representations that enable him to construct a more elaborate picture of the world from the same corpus of data, but because his perceptual system is attuned to ‘picking up’ critical features of the environment that the novice simply fails to notice”. This is an apt description of the difference between Rennie’s actions and Gandon’s, but would it then stand to reason that Gandon would be more attentive to “critical features of the environment” in his later works? Aird’s dealings with Gandon nearly thirty years after the Revenue Dock was complete suggest not, since his preoccupations remained attuned to formal aesthetic concerns over the more pragmatic considerations of security, or the required water level to successfully float a ship. That after such a lengthy career Gandon still resists attending to such imperatives is not an indictment against Ingold’s thesis regarding the reciprocity between the environment and the development of neurologically grounded structures of perception, but rather a proof. Gandon’s detachment from the actual work of building in preference to his preoccupation with aesthetic concerns, coupled with his continued socialization with the likes of Paul Sandby, John Beresford and Lord Carlow, or as Ingold would describe “the history of [his] relations with his environment”, is what developed his perceptual abilities as well as its limitations, which were never to be challenged by a different

manner of engagement. Gandon's perceptual system was undoubtedly fine-tuned across his career to pick up "critical features in the environment", they were simply not the features to which Rennie had been attuned to perceive, and these differing patterns in attention, which privileged certain types of information over others, profoundly influenced the form of the trio of docks east of the Custom House.

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