12. Reconstructing prehistoric and historic settlement in County Cork

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"I paint objects as I think them, not as I see them"
—Pablo Picasso

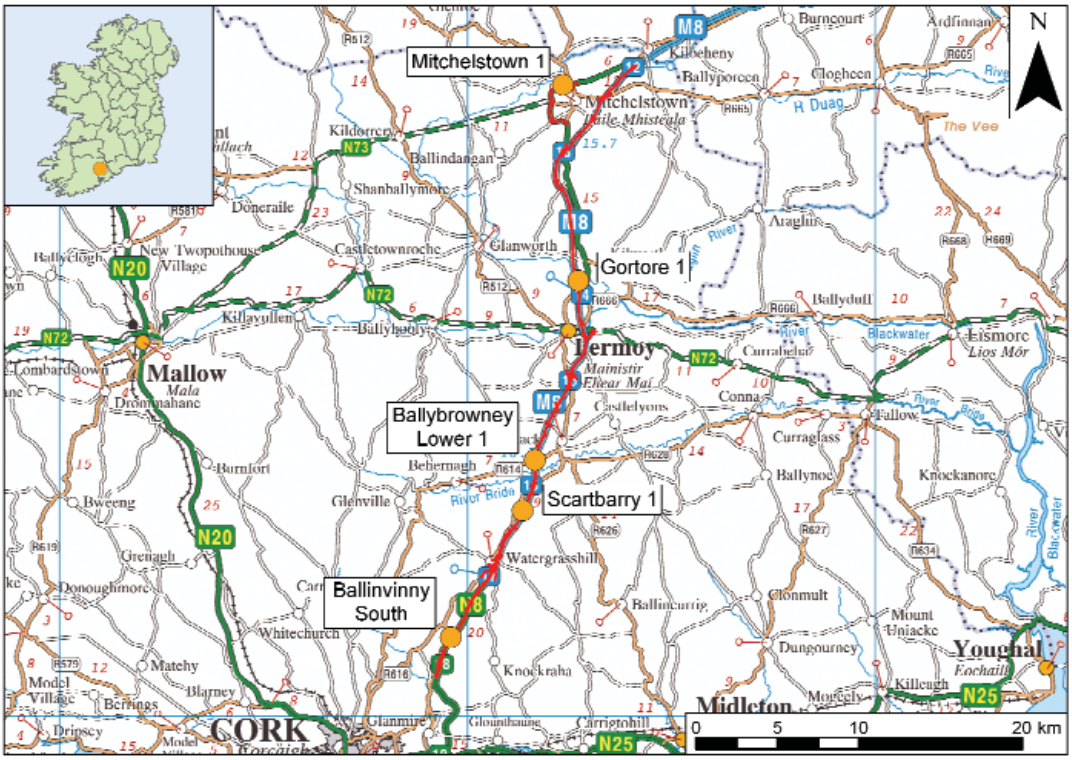
Archaeology is the study of past human life, society and culture through the investigation of surviving material remains. This is an evolving process of discovery, data retrieval, data analysis, the creation of hypotheses, and ultimately the development of theories or conceptual models from which we advance our understanding of how life once was. Critical to this process are the ways in which archaeologists project their understanding of how excavated sites may originally have looked and/or functioned. This paper will focus on how the NRA have supported attempts to visually reconstruct, using computer-generated 3D modelling, some of the prehistoric and historic settlements discovered on recent national road schemes in County Cork.

The stuff of archaeology

Archaeological remains are often ephemeral—surviving only as soil discolorations, pits, post-holes, broken pieces of artefacts or other fragmentary remains. This represents an incomplete picture of what may once have been a living and thriving settlement. This is the stuff of archaeology. Archaeological excavation involves four key components: a detailed record of the archaeological remains discovered, an interpretation of that record, dissemination of both record and interpretation, and the retention of the site archive.

Seeing archaeology

So, as archaeologists, how are we visually communicating our interpreted excavation results and associated research to the general public? One of the key outcomes from any archaeological excavation is the excavation team's final interpretation of how the site may have looked and/or functioned. Visually, this is best communicated by means of some form of artistic interpretation or technical reconstruction. There is an inherent dilemma, however, in that excavations record facts based on the surviving partial remains, whereas the interpretation of the excavated remains requires some degree of conjecture so that others can see meaning. This process of combining the certain with the uncertain is part of our daily trade. In order to form a visual model of how a site may have looked originally, we are often required to merge the certainty of the excavated remains with the uncertainty of what has since perished.



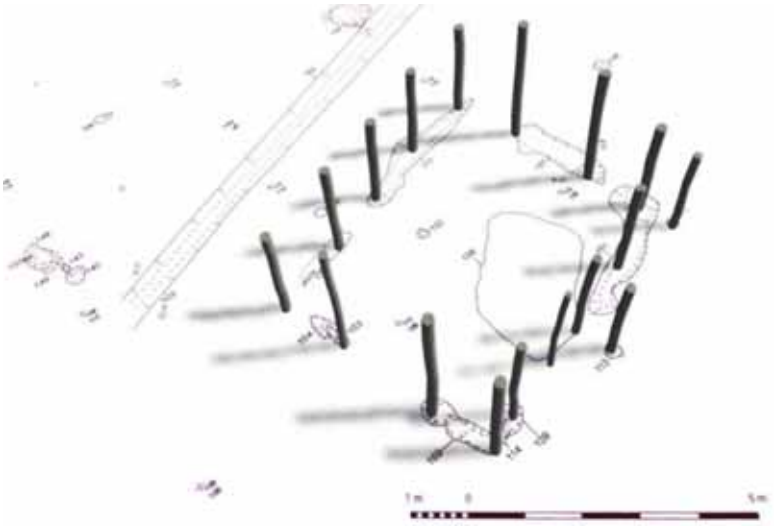
Illus. 1—Location of sites chosen for 3D-animated digital reconstruction modelling (based on the Ordnance Survey Ireland map).

Fresh attempts at digital reconstruction

Recent excavations on national road schemes in County Cork have revealed a considerable array of previously unknown archaeological sites. It was decided that several sites warranted 3D-animated digital reconstructions in order to offer the general public a chance to see how the sites may originally have looked. A German company, Digitale Archäologie, specialists in archaeological 3D visualisations, was commissioned to digitally reconstruct five sites from Cork: an Early Neolithic house at Gortore, a Middle Bronze Age settlement at Ballybrowney Lower, and a Middle Bronze Age sweathouse at Scartbarry (all on the M8 Rathcormac/Fermoy Bypass); two Middle Bronze Age houses at Mitchelstown on the N8/N73 Mitchelstown Relief Road; and a medieval moated settlement at Ballinvinny South on the N8 Glanmire–Watergrasshill road scheme (Illus. 1). These sites were excavated on behalf of Cork County Council and the NRA.

Early Neolithic house at Gortore

The site at Gortore 1 was located at the northern tip of the M8 Rathcormac/Fermoy Bypass scheme, approximately 3 km north of Fermoy town, and was on elevated ground directly overlooking the River Funshion. The site was excavated by Julianna O'Donoghue (Eachtra Archaeological Projects) in April 2005.[1] The excavation revealed the partial remains of a rectangular Neolithic house foundation, which has been radiocarbon-dated to 3928–3655 BC (UB-6769; see Appendix 1 for details). The internal dimensions of the house were 6.3 m by 5.1 m, thus occupying an area of approximately 33 m^2. The eastern



Illus. 2—Beginning the reconstruction of the Early Neolithic house at Gortore 1, based on the post-excavation plan (Digitale Archäologie).

wall of the structure was represented by a foundation trench and two post-holes. A total of 26 sherds of Early Neolithic Carinated Bowl pottery were found within stony clay packing material between the post-holes. The northern foundation was heavily truncated. The western wall was defined by a shallow trench with two post-holes and two irregular cut features. The south wall was the best-preserved section of the house, with the south-eastern and south-western corners clearly defined. A potential off-centre entrance was identified within this southern wall foundation. There was no evidence of internal subdivisions or of a hearth. A thin layer of redeposited clay (trampled floor surface?) survived north of the possible entrance. It contained fragments of charcoal, a hazelnut shell and a fragment of flint. Several external post-holes immediately outside the house suggested that the roof extended beyond the walls and was supported by external upright posts. Plant remains included emmer wheat and, unusually, fragments of charred apple.

Taking the evidence from these partial, visually unimpressive remains, the 3D digital reconstruction by Digitale Archäologie required a degree of conjecture to 'recreate' the site as it may once have looked. Once the geometrics, or basic 3D frame model, of the site was designed (Illus. 2), surfaces were then created to represent the physical walls, floors, timbers, ceilings, and so on. Textures were added to surfaces in order to represent the roughness and type of surface material. To give these textures a more realistic appearance, lighting and shadow effects were then applied. Animals, people and various household objects were then added, together with the background environment (trees, fields and sky), to create the overall visual scene. The same process was followed in reconstructing the four other sites.

The benefit of such digital modelling is that camera angles and flight paths can then be added before rendering the scene to produce a complete 3D-animated reconstruction. Another benefit is that still images can be captured for every frame of the animation sequence. So, whereas a traditional two-dimensional hand-drawing would provide a single image of the site, digitally animated 3D models allow for the production of a near-unlimited number of views (Illus. 3).

Middle Bronze Age village at Ballybrowney Lower

The site at Ballybrowney Lower 1 was located approximately 2 km south-west of Rathcormac village and 0.4 km north-west of the River Bride. The site was excavated in

the summer of 2003 by Eamonn Cotter on behalf of Archaeological Consultancy Services Ltd (ACS Ltd).[2] The Middle Bronze Age phase of the site consisted of three large subcircular enclosures (enclosures 1–3), one of which contained an oval house, and three unenclosed houses, dating broadly from 1700–1500 BC (O'Sullivan & Stanley 2005, 149). Late Bronze Age, Iron Age and medieval features were also excavated on the site (Cotter 2005).

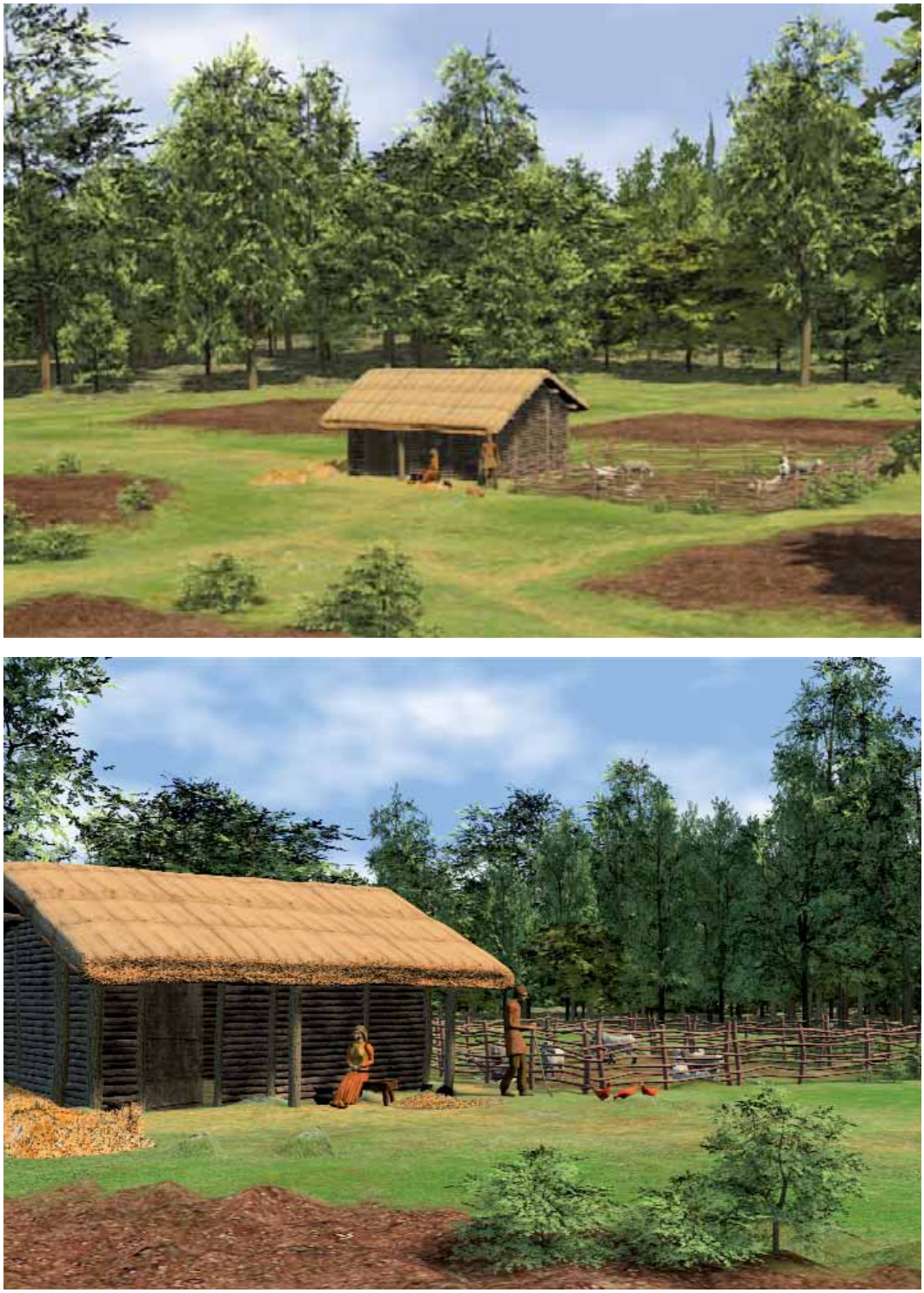
Enclosure 1 was subcircular, measuring approximately 20 m in diameter. It was fully exposed within the southern end of the excavation area. The enclosing fencing/walls were formed by split oak timbers (c. 0.1 m thick), set upright in a narrow slot-trench and supported by large packing stones. The enclosure was entered from two points and both entrances were formed by stout posts, set approximately 1 m apart. One of the entrances was at the northern end, but angled north-east. The other was at the south-eastern end. Several sherds of Middle Bronze Age pottery were found in the slot-trench for enclosure 1. At the centre of the enclosure there was a suboval structure, possibly a house, with an internal floor space of c. 24 m^2 and two substantial post-holes located near the centre. These would have held posts that provided the main support for the roof. The entrance faced south-east and was clearly evident as substantial post-holes, one of which contained a fragment of a saddle quern (used for grinding grain). The apparently intentional placement of quern-stones within the structural foundations of Bronze Age houses is believed to have been intended to bring good luck to a settlement (perhaps as a votive deposit to ensure bountiful harvests).

Enclosure 2 was located to the north-west of enclosure 1. It differed from enclosure 1 in that it was enclosed by a shallow ditch rather than a fence of upright oak timbers. Only half of enclosure 2 was excavated as the other half extended beyond the road corridor, but it would appear to have been around 38 m in diameter. A causewayed entranceway was noted at the northern end. The ditch contained some sherds of Middle Bronze Age pottery. While the enclosure contained some internal features, not enough were exposed to determine its function within the overall settlement.

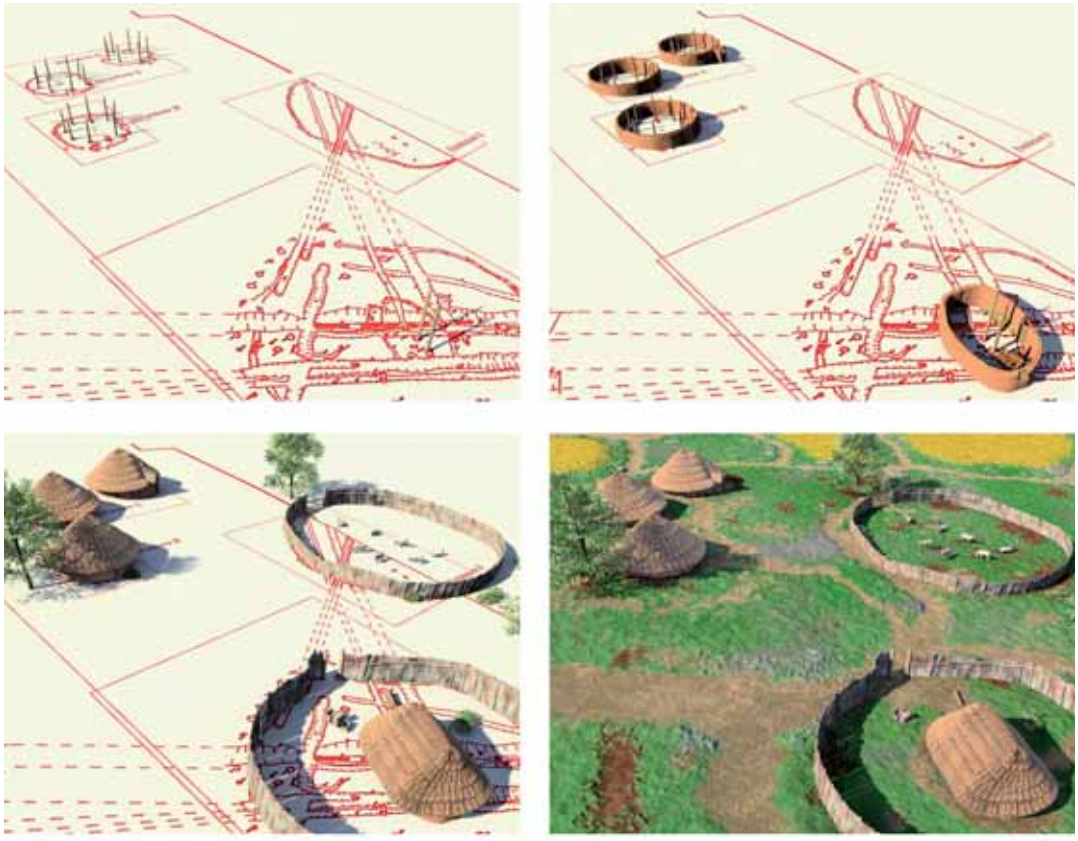
Enclosure 3 was located on the eastern edge of the site and only half of it was excavated. It had a diameter of approximately 22 m and was similar in construction to enclosure 1, being enclosed by a split oak timber fence. A number of small post-holes and stake-holes were excavated within the enclosure but these did not form any coherent pattern. A single sherd of Middle Bronze Age pottery was recovered from the fill of the enclosing slot-trench.

Houses B, C and D were located close together, to the north of enclosures 1 and 3. House B was subcircular with an internal floor space of approximately 49 m^2. It contained a concentric inner ring of six post-holes and a central post-hole that are likely to have held roof supports. Two large post-holes on the eastern side are thought to have formed part of the entrance. One of these contained a fragment of a saddle quern. House C was located c. 6 m north of house B and was almost identical in construction, with a similar floor space and internal roof supports. It appears to have been entered from the south-west. House D was 6 m east of house C. While it also contained an internal concentric ring of support posts, it differed from houses B and C in that it was oval in plan, it did not have a central support post and, more significantly, it had a distinctive porch-like structure at the entrance, which faced roughly south.

The 3D digital modelling for this site attempted to capture the sense of 'village', in terms



Illus. 3—Two stills from the completed reconstruction of the Gortore 1 house, showing how multiple views can be generated from the 3D-animated reconstructions (Digitale Archäologie).



Illus. 4—Stills from the 3D-animated reconstruction of the Middle Bronze Age complex at Ballybrowney Lower 1, showing how the two-dimensional site plan is gradually brought to life (Digitale Archäologie).

of its scale, organisation and community (Illus. 4). The animated model provides a 'fly-through' that allows the viewer to visually fly around the settlement, then fly through the northern entrance to enclosure 1 and enter the enclosed central house. Once inside, the viewer is shown a scene of domestic activity (Illus. 5).

Middle Bronze Age sweathouse at Scartbarry

Scartbarry 1 was located 3.6 km north-east of the village of Watergrasshill, in a marshy area just 0.4 km south-east of the River Flesk. The site was excavated in August 2003 by Tara O'Neill (ACS Ltd).[3] What was assumed to be a classic *fulacht fiadh*, or burnt mound, proved to be the remains of a substantial and (at the time) unique sweathouse of Middle Bronze Age date. In essence, it consisted of a structure/house built over a 5-m-long stone-lined trough, with a large stone-built hearth attached to the eastern side of the trough (Illus. 6). The hearth was partly surrounded by the remains of a windbreak shelter. The entire complex appeared to be surrounded by a partially surviving shallow enclosing feature that appeared to have an entrance towards its southern edge. Charcoal from the base of the trough was radiocarbon-dated to 1650–1190 BC (Beta-201083).

The hearth measured roughly 2.3 m by 1.6 m and was composed of three thin slabs of stone laid flat. These were surrounded to the north, south and east with vertical stones forming a semicircular border to a height of approximately 0.25 m. The western edge of

Illus. 5—Interpreted scene of domestic activity inside the suboval structure within enclosure 1 at Ballybrowney Lower 1 (Digitale Archäologie).

the hearth culminated at the long stone-lined trough, which was approximately 0.5 m deep. Two large post-holes flanked the junction between the hearth and the trough. Aligned east–west, the subrectangular stone-lined trough was encircled perfectly by what would have been a timber-built and roofed oval structure/house. The sweathouse survived as an oval slot-trench with abundant packing stones. The slot-trench would originally have contained plank-built walls, encompassing a floor space of approximately 4.5 m^2 on either side of the trough (the total internal spatial area would have been around 16 m^2). It is likely that the roof would have been covered with thatch. Overall, it was clear from the excavation that this represented a relatively permanent sweathouse, its core purpose being to trap the steam/heat derived from heated stones rolled into the trough from the connected hearth.

The 3D digital model for Scartbarry 1 aimed to visually highlight the permanent nature of the structure and the human aspects of how the site was used. The fly-through first encircled the site as a whole, then flew past the front of the sweathouse, revealing the burning hearth being tended by one individual, while several others gathered unclothed within the sweathouse itself—and all the while hot (perhaps herb-scented) steam circulates vividly within (Illus. 7).

Two Middle Bronze Age houses at Mitchelstown

Mitchelstown 1 was located 0.6 km north-west of Mitchelstown, overlooking the Gradoge River, some 0.3 km to the south. The excavation by Eamonn Cotter (Eachtra Archaeological Projects) in 2004 revealed three Middle Bronze Age houses (Tierney & Johnston, this volume), two of which were digitally remodelled (Illus. 8).[4] Based on the

Illus. 6—Elevated view of the surviving remains of the sweathouse at Scartbarry 1 (Cork County Council).

excavated evidence, these two houses had been built over an earlier house. The two contemporary houses (A & B) were similar in construction.

House A was a roughly D-shaped structure enclosing an area of about 90 m^2. It was entered from the east via a 1-m-wide doorway in a slightly flattened façade. The house walls survived as a curving slot-trench, believed to have supported post-and-wattle walling. The slot-trench faded out towards the west but was likely to have formed a complete arc originally. Internally, there was a semicircular arrangement of roof support posts. The house was divided internally by a partition wall running north–south. A possible hearth was noted near the centre of the house, opposite the entrance but sheltered from it by the partition.

House B was slightly larger, with a floor area of about 120 m^2. It was located 1.8 m south of house A and had a similar D-shaped plan and eastern entrance. The slot-trench was found only around the northern half of the house and it was unclear to the excavator whether it ever existed around the remainder of the house, although it may have. Like house A, it also had a semicircular arrangement of internal post-holes that acted as main roof supports, but, unlike house A, there was no evidence of an internal dividing wall nor of a recognisable hearth.

The 3D digital model for Mitchelstown 1 focused on the 'rural farmstead' nature of the site (see Tierney & Johnston, Chapter 10, Illus. 7). The viewer first 'flies' around the site, then approaches and enters house A. Inside, the partition hints at a dual purpose of private and more public access—the hearth indicating the private section.

Illus. 7—Still from the reconstruction of the sweathouse at Scartbarry 1 (Digitale Archäologie).

Illus. 8—3D digital reconstruction of two of the Middle Bronze Age houses at Mitchelstown 1 under way (Digitale Archäologie)

Medieval moated site at Ballinvinny South

The site at Ballinvinny South was located near the crest of a moderately steep west-facing slope, overlooking an unnamed tributary of the Butlerstown River, c. 7 km north of Cork Harbour. The site, which was excavated in 2001 by Eamonn Cotter on behalf of Sheila Lane & Associates, consisted of a subrectangular moated enclosure with two internal rectangular houses.[5]

The moat ditch was generally steep-sided with a flat-bottomed profile. It varied from 2.8 m to 1.7 m in width and from 1.15 m to 0.58 m in depth. A linear ditch appears to have fed spring water into the moat ditch from higher ground to the east. According to the excavator, it seemed likely that the moat would have filled only partially (and perhaps seasonally). A 5.5-m-wide entrance was located at the south side of the enclosure. Here, three surviving post-holes may have been the remnants of an entrance gate. Immediately east of the entrance was an 8 m section of drystone wall against the inner (north) side of the moat cut. This revetment was interpreted as a support for an earthen entrance embankment that may have served as a platform, guarding the entranceway.

Two rectangular structures (structures A and B) were excavated within the enclosure. Structure A measured 11 m by 4 m and was aligned north–south. Foundation trenches partly survived for the north, south and east walls of the structure, while pairs of post-holes formed the north-western and south-western corners. Little evidence for the western wall survived. Clay-bonded stone foundations were uncovered within the interior north-eastern corner of structure A. These appeared to have been the remains of a stone chimney.

Illus. 9—Stills from the 3D-animated reconstruction of the medieval moated site at Ballinvinny South, showing how the two-dimensional site plan is gradually brought to life (Digitale Archäologie).

Structure B lay immediately east of, and was equal in size to, structure A. It was aligned east–west. A section of the east foundation wall survived as a few courses of clay-bonded stone. A sherd of late 13th/early 14th-century Saintonge pottery was found within material backfilled into the foundation trench. While some evidence for the northern and southern foundation trenches survived, more recent ground disturbance appears to have largely obliterated the interior of the structure and the western wall foundations.

The 3D digital model for Ballinvinny South tried to capture the overall look of the site based on the excavated evidence (Illus. 9). Again, the viewer first 'flies' around the site, then enters through the entranceway before encircling the internal structures, at least one of which (structure A) is likely to have been domestic (Illus. 10).

Illus. 10—Still from the 'fly-through' of the reconstruction of the Ballinvinny South moated site, approaching entrance (Digitale Archäologie).

Challenges and opportunities

In this exercise in 3D-animated modelling of archaeological sites, the excavation directors were faced with several challenges, most notably the need to make conjectures based on only partial remains. The initial unease expressed by site directors was based on professional integrity: there was some reluctance to stand over unproven conjecture. This is a widespread challenge; all too often archaeologists tend, by habit, to think almost exclusively in two dimensions. Often the only third dimension discussed is the depth of surviving cut features. If we consider that perhaps less than 5% of the material remains that once occupied a settlement site might survive to the time of excavation, a 3D digital model of the site would therefore require 95% of the site to be remodelled from the surviving 5% of remains. This is done by comparison, experience, consultation, intuition and a degree of artistic licence.

Another source of unease for many site directors stems from the particular circumstances of Irish archaeology, whereby, given the commercial nature of development-led contracts,

individual directors may be charged with excavating a Neolithic house one month and a 17th-century kiln the next month. This reality, of a mobile work market and development-dominated contracts, has meant that a director excavating one or more Bronze Age houses is not necessarily an expert on all matters relating to the Bronze Age. There is therefore a natural uncertainty concerning issues such as what appropriate Bronze Age house furnishings, styles of dress or contemporary farming practices should be depicted.

In Ireland there is relatively little shared experience in formulating detailed models of how sites may have looked. It is for this reason that many choose to shy away from anything other than perhaps safe and stylised artistic impressions. Detailed 3D digital animations force us away from our traditional comfort zones owing to the sheer precision offered by digital media. With current and future 3D (and indeed 4D) modelling, the ball is firmly in our court and we now have the opportunity to flex our creative and intellectual muscles in terms of testing our hypotheses of how ancient structures may have looked in precise technical/architectural detail and how sites may have looked in terms of their social/cultural/landscape 'scene'. Equally, the interpolation of disparate datasets across software platforms allows for more integrated manipulation of information. What is required is a degree of coordination, so that virtual landscapes can be developed that creatively incorporate collections of digital data. If our aim as archaeologists is to study the past, then we need to address the imbalance between the archaeological record, which involves vast data banks, and archaeological interpretation, which involves the clear presentation of our evolving ideas with the gaps filled in.

Acknowledgements

I would like to clearly acknowledge the primary work of the featured excavation directors, namely Eamonn Cotter (Ballybrowney Lower 1, Mitchelstown 1 and Ballinvinny South), Tara O'Neill (Scartbarry 1) and Julianna O'Donoghue (Gortore 1), and of Matthias Link and his team at Digitale Archäologie, Germany. All modelling was carried out by Digitale Archäologie using Autodesk 3D Max Version 9.

Notes

1. Gortore 1: NGR 181815, 101661; height 39 m OD; ministerial direction no. A014; excavation director Julianna O'Donoghue.
2. Ballybrowney Lower 1: NGR 179146, 90645; height 71 m OD; excavation licence no. 03E1058; excavation director Eamonn Cotter.
3. Scartbarry 1: NGR 178392, 87553; height 112 m OD; excavation licence no. 03E1438; excavation director Tara O'Neill.
4. Mitchelstown 1: NGR 180869, 113639; height 106 m OD; excavation licence no. 04E1072; excavation director Eamonn Cotter.
5. Ballinvinny South: NGR 173989, 079790; height 94 m OD; excavation licence no. 01E 0111; excavation director Eamonn Cotter.