# GAME ART REVOLUTION

## We take a look at how Ubisoft has crafted one of the most visually stunning games of the generation in Assassin's Creed III

Words: **Chris McMahon**

**When we first booted up *Assassin's Creed* in 2007, we had little idea of what was in store.** Desmond Miles – bartender, slacker, unbeknownst assassin – awoke in the clinical confines of an Abstergo lab, held against his will by a mysterious cabal known as the Templars and forced to relive the memories of his ancestors through a nifty bit of sci-fi kit called the Animus.

That first adventure took us back to the Third Crusade, taking on the role of Levantine assassin Altaïr Ibn-La'ahad as he journeyed the wild plains of the 12th Century Holy Land and its surrounding cityscapes.

For Desmond's second outing we were transported to the cultural shift of the Italian Renaissance. Our travels as the charismatic Ezio Auditore da Firenze were greeted by 15th Century restorations of Monteriggioni, Venice and Rome.

Now, in this third ancestral exploration of memories past, we're in the deer-hide boots of half-Mohawk Ratonhnhaké:ton – or, going by his more comfortably pronounceable nickname, Connor. The action takes place right at the heart of the American Revolution amidst a sprawling frontier of forests and undulating mountain ranges.

From its stark beginnings in a cold, white lab to an adventure spanning almost six centuries, no one could label *Assassin's Creed* as lacking in ambition. Wider in scope and purpose than the majority of videogames out there, it's a serious achievement, growing larger and more impressive with each new release.

From the superlative animations to the richly detailed cities that are almost characters in and of themselves, the series' visuals have evolved in step with the breadth of its narrative. Each new title pushes the bar in terms of graphical fidelity and technical nous.

*Assassin's Creed III* (*ACIII*) is the culmination of developer Ubisoft Montreal's efforts so far. Along with the upgraded AnvilNext engine, a team of hundreds has produced one of the finest-looking, most graphically impressive titles at the back-end of the current generation of games.

We sat down with art director The Chinh Ngo, technical art director Danny Oros and animation art director Jonathan Cooper, to discuss the journey they've taken to get here – a feat in many ways as impressive as Desmond Miles'...

Concept art is a powerful tool used by developers during the conception of games – not only because it has the power to communicate a clear visual to the whole team, but also because it validates artistic references

UBISOFT

## A glance at one of the biggest videogame developers in the world

**Studio name** Ubisoft Montreal

**Location** Montreal, Canada

**Company history** Ubisoft Montreal was opened in 1997 as a subsidiary of Ubisoft, initially developing low-profile projects like *Tonic Trouble*. *Tom Clancy's Splinter Cell* put the studio on the map, however, followed by videogame classic *Prince of Persia: The Sands of Time*. Over the years, titles such as *Assassin's Creed* have seen the studio grow to become one of the largest in the world – currently housing over 2,100 employees.

**Portfolio Highlights:**

*Assassin's Creed: Revelations*, 2011
*James Cameron's Avatar: The Game*, 2009
*Prince of Persia*, 2008
*Far Cry 2*, 2008
*Assassin's Creed*, 2007
*Far Cry Instincts*, 2005
*Prince of Persia: Warrior Within*, 2004
*Prince of Persia: The Sands of Time*, 2003
*Tom Clancy's Splinter Cell*, 2002
*Tonic Trouble*, 1999

Connor's character-defining actions, such as walks, runs and idle animations, were tweaked throughout development as the team became more aware of who he was as a person

## GATHERING REFERENCE

**Ever since the release of the first Assassin's Creed in 2007, the series has been revered for its adherence to historical accuracy.** Each game features real characters and locations from the time period in which it takes place. *Assassin's Creed III* is no different, drawing upon a great deal of Revolution-era reference to ensure consistency in its vision for the world.

"*Assassin's Creed* as a brand has historical relevance and accuracy as a core value for our development parameters," explains The Chinh Ngo, who worked on both *Assassin's Creed II* and *III*. "Thankfully there are a lot of historical references for the American Revolution: original drawings, maps, and much of the authentic colonial architecture still exists. We also worked with a historian in our team; he helped us a lot with research so we developed a better understanding of 18th Century America."

Although historical accuracy is a necessity, the team must still allow for some degree of artistic license when it comes to actual game design. "We grant ourselves space for artistic freedom and fictional elements," says Ngo. "Our challenge is always to find the delicate balance between this historical accuracy and creative freedom, so as artists we do not restrain ourselves too much."

There was plenty of reference material left over from the 18th Century that Ubisoft Montreal could use to build *ACIII*'s game world – a benefit it could not rely on for the first game's Holy Land setting

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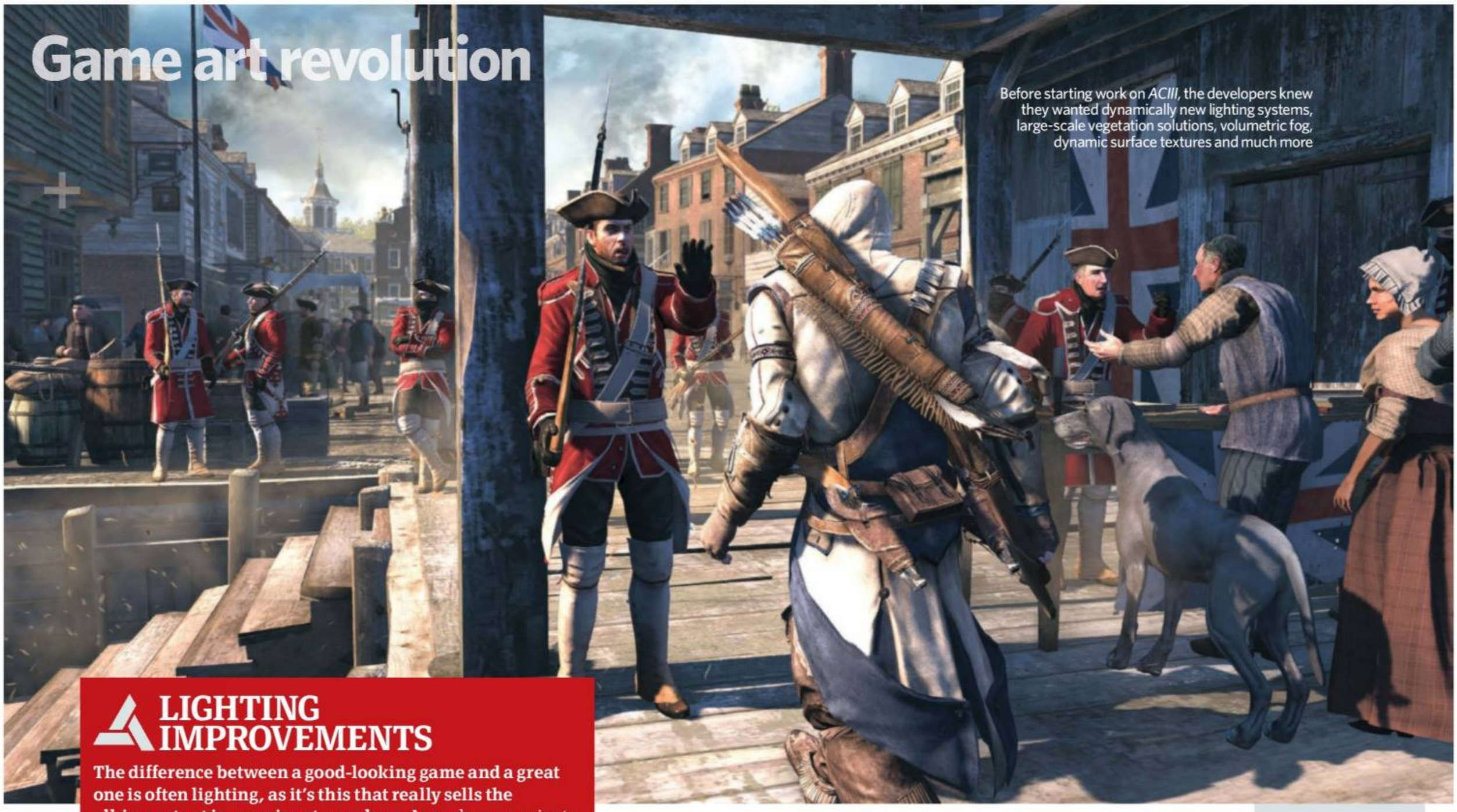

Before starting work on *ACIII*, the developers knew they wanted dynamically new lighting systems, large-scale vegetation solutions, volumetric fog, dynamic surface textures and much more

## LIGHTING IMPROVEMENTS

**The difference between a good-looking game and a great one is often lighting, as it's this that really sells the all-important immersive atmosphere.** As such, even prior to working on *ACIII*, Ubisoft Montreal knew that lighting was an area they were determined to improve. "There were certain risks and costs we couldn't afford to take on the shorter development cycles of the *Assassin's Creed II* games, but we knew there were a few things that needed improvement going forward – character detail, global image fidelity, atmospherics and lighting," says technical art director Danny Oros. "Specifically lighting-wise there were limitations and issues we wanted to get around in terms of surfaces, global illumination simulation quality, popping and so on.

"For *ACIII* we adopted a deferred lighting architecture, which unified shading and specular on all surfaces for a fixed performance cost, enabling cost-effective surface weathering for snow and rain," explains Oros. "This change also significantly improved fillrate for scenes of massive overdraw, such as our forests, which ended up being a big plus for us.

"Other smaller but significant lighting improvements include a new global volumetric ambient occlusion and static lighting system (with specular), screen space ambient occlusion, shaders and so on. All of this together improves the game environment's global lighting solutions in all its time, weather and seasonal conditions."

*ACIII*'s lighting is most impressive in confined indoor spaces, such as in the fast-travel tunnels that weave beneath the game world and the caverns that Desmond Miles occupies when outside the Animus

> "THERE WAS NO QUESTION OF INCORPORATING THE NATURAL SPACES – IT WAS AN ESSENTIAL PREREQUISITE OF THE SETTING OF ACIII"
>
> **The Chinh Ngo,** art director

## A LIVING, BREATHING WORLD

*Assassin's Creed*'s environments have always been astonishingly impressive spaces, whether they're the golden hues of Jerusalem or the rich Renaissance architecture of Rome. However, Ubisoft knew players would demand more than just an aesthetic change for this third entry into the series. These game worlds aren't just environments after all, but playgrounds too. It was this line of thinking that led to a new kind of setting for *ACIII*.

"As a brand, *Assassin's Creed* constantly strives to reinvent itself," says art director Ngo. "With that attitude in mind, we set ourselves the ambitious goal to explore entirely new areas within *ACIII* that, in the past, we had never thought could work for the series. We took the leap of moving beyond the city limits to the organic environments of the forest and frontier."

These large woodland environments, where a huge amount of the game takes place, truly are a sight to behold. The terrain naturally flows from mountainous canyons, through towering pine forests and across swaying planes of lush grass. All of this manages to feel organic, believable and entirely natural. "There was no question of incorporating the natural spaces – it was an essential prerequisite of the setting of *ACIII*," continues Ngo. "The cities of Boston and New York at the time were very young and didn't have a strong enough visual 'wow' factor on their own, when compared with the sprawling European Renaissance cities, so we added the wilderness and the frontier."

Although the *Assassin's Creed* games have featured natural spaces in the past, they have never before been achieved on such a large scale – and certainly not with this much attention to detail per square foot. Unsurprisingly, the technical challenge this presented the team was no small undertaking. "There were many challenging things to consider – most of all rendering performance," explains technical art director Danny Oros. "Thick foliage and vegetation scenes cost a lot to render due to the sheer amount of layering on display, with hundreds of levels of overdraw. Performing this seamlessly in a free-roaming... open-world context over four square kilometres is additionally challenging, all the while keeping a good level of visual and artistic quality.

"This particular challenge was partially resolved by the use of deferred lighting – that is, lighting only the final pixels, as opposed to lighting each one as they are layered atop one another as in previous tech," he continues. "However, it also required significant optimisations and content control, including replacing our previous vegetation tech, rewriting optimal shaders like lighting, shadowing, wind

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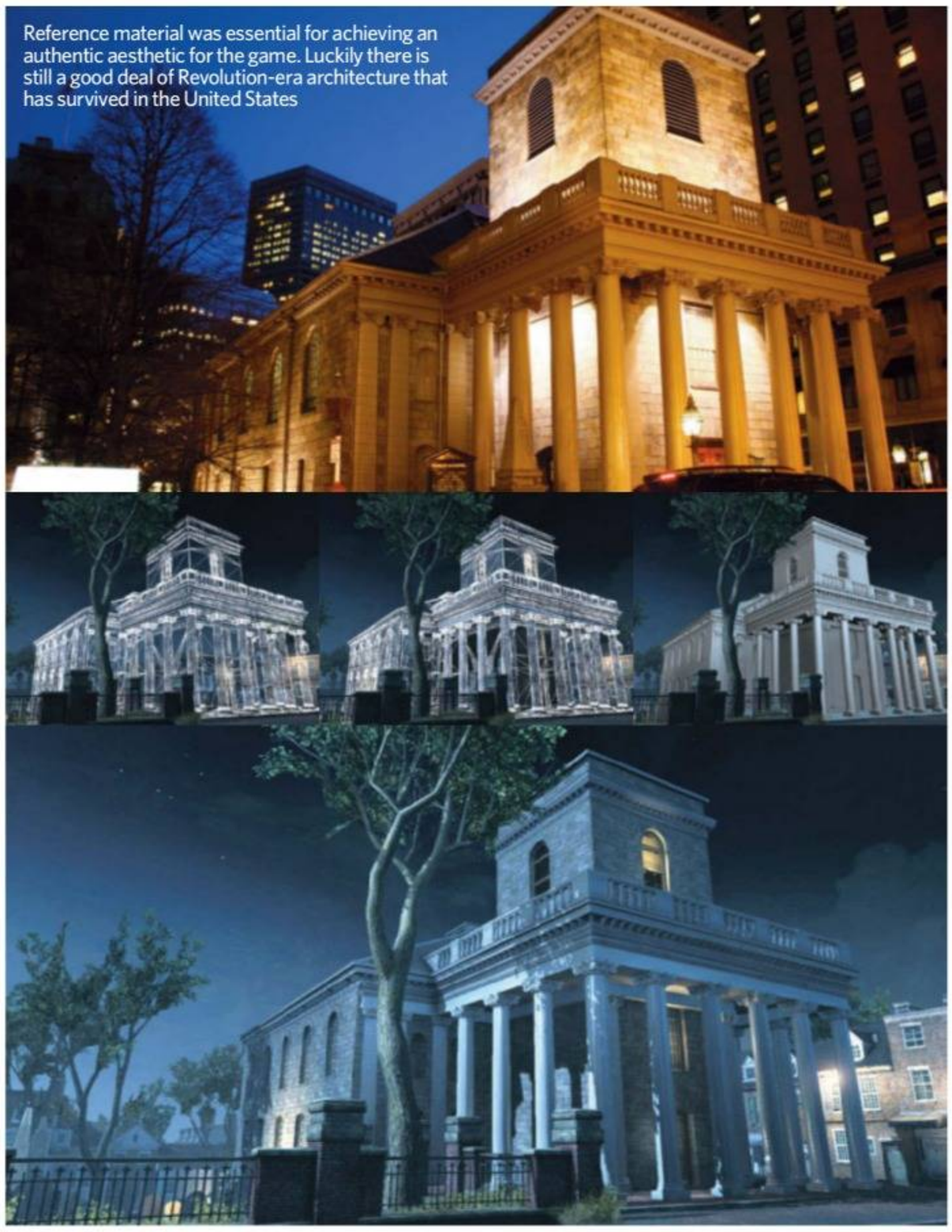
The golden hues of the first Assassin's Creed's cities and the ornamental flourishes of *ACII* have been replaced by the darker greys and browns of Boston and New York's 18th-Century architecture

Rendering performance was a big challenge facing the team, particularly because of the rich, sprawling, open-world environment of the American frontier being re-created



Reference material was essential for achieving an authentic aesthetic for the game. Luckily there is still a good deal of Revolution-era architecture that has survived in the United States

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> **Danny Oros,** technical art director

reactions and so on, while strictly budgeting for content and placement."

The expansive, natural landscapes of revolutionary America comprised of great variety in terms of their topographical nature and terrain, ranging from plains and cornfields to waterfronts, rivers and cliffs. In order to replicate the diversity of these locations without repeating themselves, the team at Ubisoft had to create a selection of visual recipes, which the artists could then use to iterate and define the visual fidelity of each location. "These recipes, once optimised and approved, were used as templates to propagate throughout the game world," states Oros.

Although much of the developer's focus was placed squarely on carving out these natural landscapes, the cities – albeit less ornate than in the decorative Italian settings of *Assassin's Creed II* – had great effort poured into them to get the details right. "There is a huge difference between the architecture and buildings of the old cities in which previous *Assassin's Creed* games took place, and the younger cities of *ACIII*," says Ngo. "On its own the architecture of New York and Boston of the time might seem less interesting, so our real artistic challenge was bringing charisma to a fairly simple aesthetic. We dedicated our energy to bringing the streets to life, focusing on the living and breathing aspect of these cities by having a rich variety of crowds, animals, behaviours and unique animations. You see a big variety in scale between all living things – from large horses sharing the street with pigs and rats, to a big crowd of people with kids running around. The cities have truly become organic, living and breathing in their own right."

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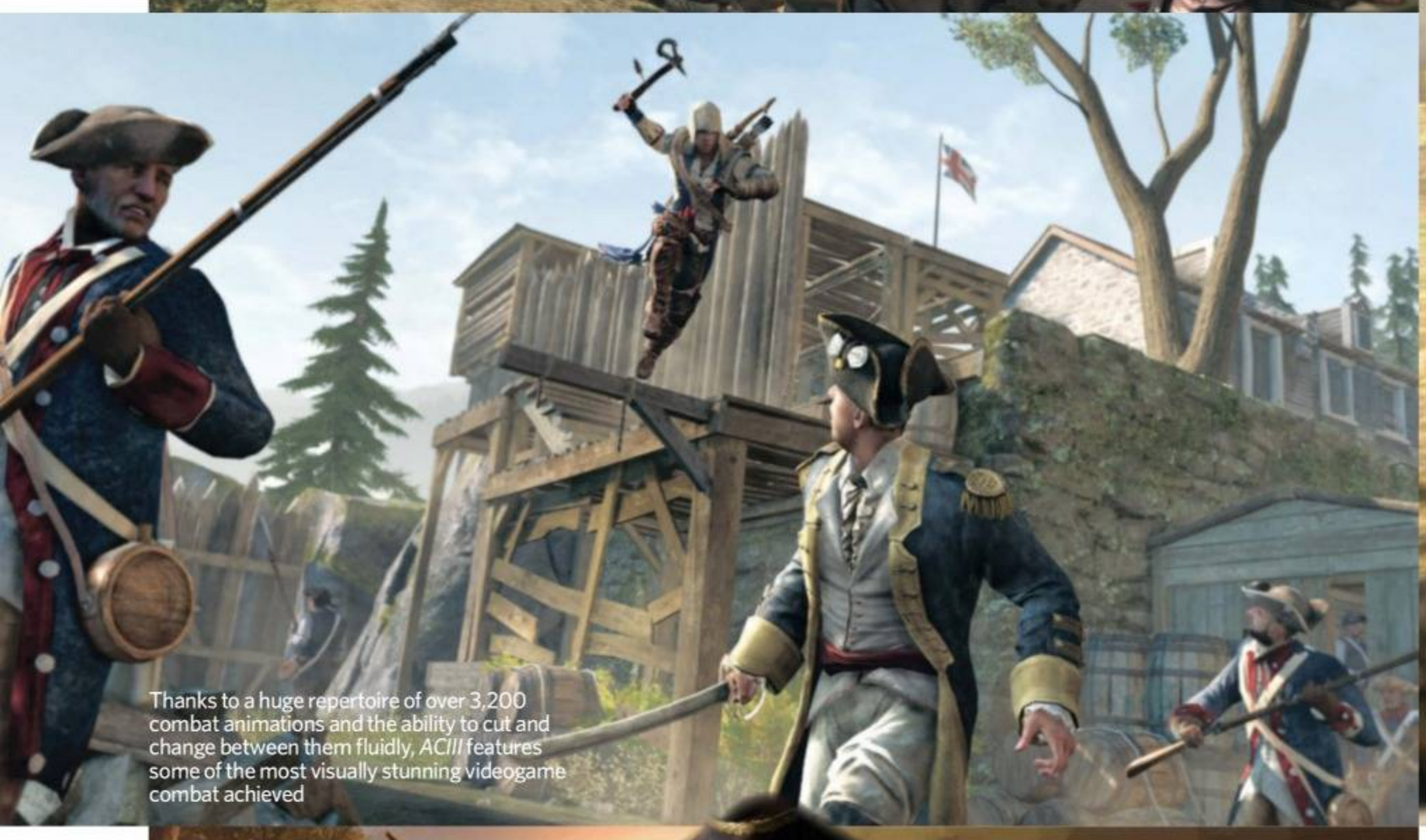
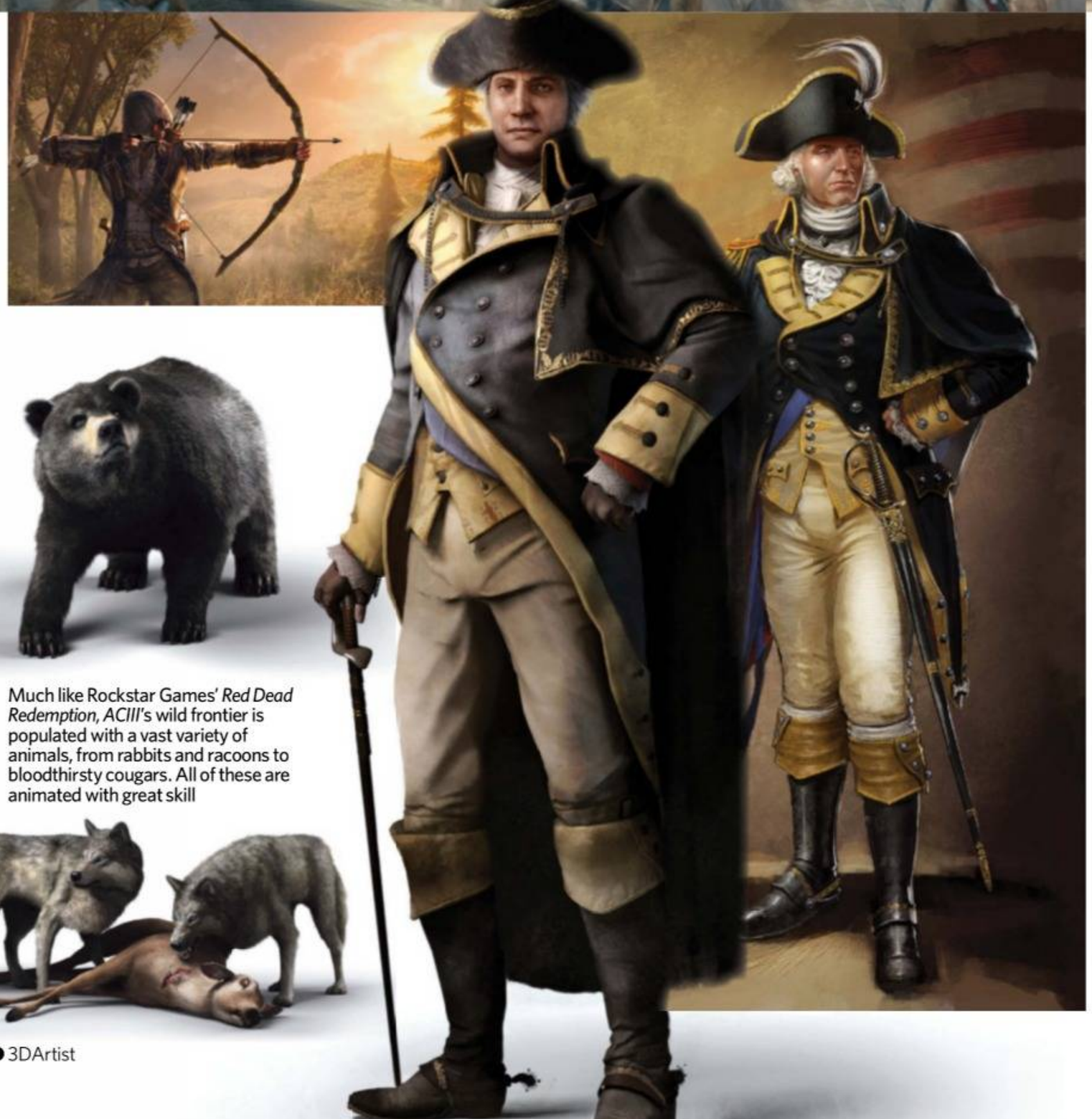
The context-sensitive simulations during combat are stunning to see in action. For example, Connor can halt a move mid-swing, grab his enemy and use him as a human shield against incoming musket fire



Thanks to a huge repertoire of over 3,200 combat animations and the ability to cut and change between them fluidly, *ACIII* features some of the most visually stunning videogame combat achieved



Much like Rockstar Games' *Red Dead Redemption*, *ACIII*'s wild frontier is populated with a vast variety of animals, from rabbits and racoons to bloodthirsty cougars. All of these are animated with great skill

## ANIMATED PERFORMANCE

*Assassin's Creed*'s immersive open worlds may have set a new standard for the action-adventure genre, but perhaps not quite as much as the series' dynamic and believable approach to animation.

From the first time Altaïr dynamically scrambled up a fortress battlement or pirouetted around enemies in a balletic display of combat flourish, the expert animation of *Assassin's Creed* has entrenched itself in the minds of gamers. In *ACIII* this has been revisited afresh, with Connor's ability to free-run through the forest canopy, opening up new challenges for the team at Ubisoft.

"One of the primary mandates when I began on the project was to completely refresh the assassin's animation, which was quite a daunting task considering the pedigree set before," says animation art director Jonathan Cooper. "I don't believe in fixing something if it isn't broken, so we were initially careful never to simply replace an animation just for the sake of it. Every element of the movement, combat and interactions – including the crowd and animal life – has been added or replaced with the specific aims of making the gameplay more fluid and responsive."

> FOR THE FIRST TIME IN THE SERIES WE'RE DELIVERING THE HOLY TRINITY OF SIMULTANEOUS BODY, FACE AND VOICE CAPTURE FOR ALL OF OUR KEY SCENES AND CHARACTERS
>
> **Jonathan Cooper,** animation art director

In order to achieve this, Cooper and his team invested heavily in integrating a physics model and inverse kinematics rig on Connor's every footstep – an approach similar to one previously used exclusively for the climbing animations. "This allows Connor to turn on a dime or change direction mid-stride in a natural or believable manner, while importantly remaining grounded in a world that now contains many slopes in the frontier and high-vaulted roofs in the cities."

Not only was navigational animation overhauled, but also the combat. Connor swirls and dances around his foes as much as he hacks and bludgeons at them. His combat is a whirlwind of cinematic violence that, animation-wise, only *Batman: Arkham City* has come close to matching. "Whereas all previous games in the series involved the animators themselves getting into the suits, *ACIII* is the first game in the series where we worked closely with stuntmen and choreographers for the combat system mocap," says Cooper. "As such, we were really able to push the boat out in terms of the imagination and physicality brought to the numerous fighting moves and assassination flourishes."

It's not just the actions themselves that impress, but also the seamlessness by which they're woven together, with the repeated attacks from enemies often forcing Connor to switch stances mid-move or adopt new on-the-fly tactics. "We maintain that fluidity by ensuring that we create lots of coverage for most actions, such as blocks from every direction. [This ensures] they can play smoothly regardless of the initial footing of the assassin, or which direction and distance the enemy is attacking from," explains Cooper. "All our animations are cut up on export, allowing them to be smoothly branched to whatever input the player could require at any moment. There are over 3,200 animations for combat alone!"

The team has consistently used 3ds Max for every project so far in the series, and stuck with it for *ACIII* to ensure consistency and speed in their work. Still, some tweaks were made to the cinematic-end of the pipeline. "We moved over to MotionBuilder in the early stages with the dual goals of maintaining a high frame-rate with multiple high-resolution characters interacting and ensuring as quick a turnaround between exporting and reviewing in-game as possible. I believe that, especially in the final stages of a project, such quick iteration makes the difference between a polished and an unpolished game."

## FACIAL ANIMATION

**Although facial animation started out as a passable but hardly noteworthy feature in 2007's Assassin's Creed, the importance of character and narrative in the series has seen the discipline grow into an increasingly integral part of each new game's development.**

In *ACIII* a great many expressions and emotions are readable on the characters' faces during cut scenes, thanks to Ubisoft's proprietary performance-capture technology. "For the first time in the series we're delivering the holy trinity of simultaneous body, face and voice capture for all of our key scenes and characters," says Cooper. "This essentially involves cameras and high-quality microphones mounted to headsets, with software that can later translate this video back into information used to drive the various facial shapes on our characters.

"The acting really takes a big jump in believability when you can see the facial expressions match perfectly with the tilt of a head and the voice intonation," continues Cooper. "If you can remove as many of the various production stages as possible between the actor and what the player sees, the natural performance really shines through."

*Assassin's Creed* is now up there with the best of the best – such as *Uncharted, Heavenly Sword* and *Half-Life 2* – when it comes to convincing facial animation

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Given that it's difficult to imagine a North American forest *without* snow, work on the feature began almost immediately, with a group of programmers dedicated to achieving convincing results

## WATER FX

*ACIII* features water, but it's hardly the smooth-running canals of Venice or the aqueducts of Rome – it's the tumultuous, dangerous and crashing waves of the Eastern seaboard. Encountered during the game's naval warfare missions, the water here is a surging mass of salty spray, foam and surf that both looks and feels dangerous.

"The water in the *ACIII* naval missions is considered by most as the pièce de résistance," beams Oros. "Big props go to the Ubisoft Singapore team for this, who spent many months defining and refining the water system and rendering. Visual and physical simulations of waves were key both visually and gameplay-wise, and they did an incredible job with it, including reactions to weather and wind driven by the Beaufort scale.

"The water shading itself includes dynamic scene reflections, refraction, dynamic lighting from cannon fire, apex and reef foam formations – it's fully fleshed out," concludes Oros.

The water not only looks fantastic, but also drives physics simulations for floating ships and debris that provide both visual feedback and numerous gameplay challenges

Ubisoft Singapore is credited with helping achieve the incredible realism in the naval missions. A litany of factors impacting on the environmental physics – not least the weather and time of day – had to be carefully considered

The water in *Assassin's Creed III* contains a great many features that truly make it stand out, such as crashing white foam on waves or the surf that bubbles up to the surface

## WEATHERING THE STORM

Effects in the first two *Assassin's Creed* games were clearly light on the ground, relegated to the odd explosion or spurt of blood. But even those were less noticeable than in most contemporary adventure titles.

*ACIII* stands out, then, for being the first title in the series to introduce seasonal changes and weather effects, with rain and snow having an impact not just on how the game looks, but also the way it plays.

"In defining *ACIII*, we knew that having a game set in the then-undiscovered North-American territory required multiple improvements to adequately portray the rich settings and believably wrap the player into them," says Oros. "Atmospherics such as volumetric fog, wind, precipitation, fully dynamic dry, rain and snow effects on all surfaces and assets were key elements we needed to develop to do them any justice."

Snow in particular played a large part in development. "We wanted to portray the harshness and difficulties of navigating the territory in the wild, before the existence of snow ploughs, shovels and global warming!" smirks Oros. "This was identified early on as a gameplay ingredient we wanted for both the player and non-player characters (NPCs), with the snow slowing down the navigation pacing and pushing the players up to the trees if they want to move faster."

Another element introduced by the snow is deformable trails – something the player can use to track enemy NPCs around the game world (or vice versa). In order to get this feature just right R&D had to commence at a very early development stage. "The ambition was to have dynamically displaced trails over the entire four square kilometres of world, where NPCs could be tracked and NPCs could track *you* with a high level of persistence," states Oros. "The displacement snow tech uses the objects', characters' and animals' collision data to stamp down into the snow surfaces and collects this displacement data in the world – so basically every object can physically deform the snow. Earlier prototypes used up all the available memory of the consoles and ran extremely poorly, but over months of cross-platform optimisations and improvements to systems, we got the tech to work in mere megabytes of memory at low performance hits."

The Ubisoft development team has managed to get not only this believably deformative snow working on the current generation of consoles, but also the rest of the completely polished *ACIII* package – an extremely impressive accomplishment. The finished product looks less like one of the final games of this generation and more like the first of the next. Luxuriously textured, smoothly animated and lavishly detailed, *ACIII* very much stands as a first nod towards the cinematic graphical revolution coming to videogames over the next few years. We can't wait to see what follows.

> "ACIII STANDS OUT... FOR BEING THE FIRST TITLE IN THE SERIES TO INTRODUCE SEASONAL CHANGES AND WEATHER EFFECTS, WITH RAIN AND SNOW HAVING AN IMPACT NOT JUST ON HOW THE GAME LOOKS, BUT ALSO THE WAY IT PLAYS"