richard lemarchand

FROM SMART TO FINISH

JAK X: COMBAT RACING AND THE NAUGHTY DOG PRODUCTION METHOD

IN THE FALL OF 2004, WE AT NAUGHTY DOG INC. (CRASH BANDICOOT and JAK series of games) set out to create a game in a genre that was relatively new to us. And we had only 10 months—the shortest product cycle in the history of the JAK games—between the beginning of full production and gold master to do it.

This is the story of how we pulled it off, how Naughty Dog worked swiftly without compromising quality or resorting to human sacrifice.

INVITATION TO RACE

In order to be able to work as quickly as possible, we always start a project with a clear and simple summary of what we want to achieve. Collaborating with our producers at Sony, game director and Naughty Dog co-president Evan Wells defined three basic goals for the game.

First, we wanted to make a combat racing game using the physics-based vehicle gameplay from JAK 3, since it received a lot of positive feedback. Second, the game would be Naughty Dog's first online multiplayer game, a change we were all very excited about and had been anticipating for a long time. Finally, the game would have a strong single-player story mode with around 40 minutes of the movie-quality animation that the JAK games are known for.

Having a good plan and sticking to it is the best way to make a game efficiently, and working without wasting time or resources is the key to working fast.

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JAK X: COMBAT RACING character sketches drawn by Bob Rafei.

SHIFTING GEARS

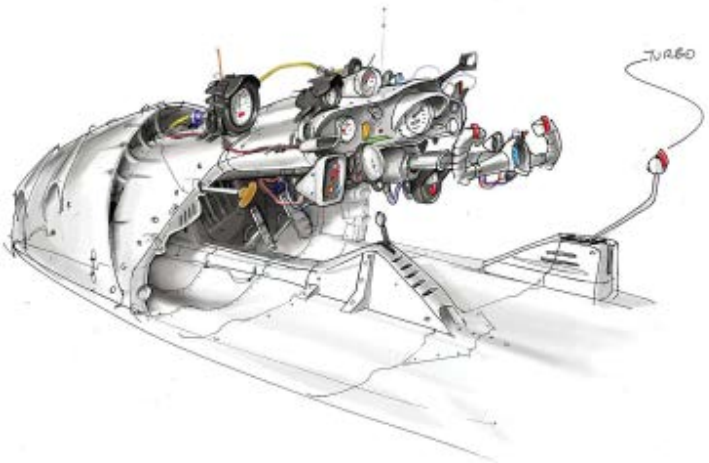
A new type of game demanded some new design and production techniques, but many of our methods stayed the same as those we used on JAK 3. Our development approaches are very technology-driven, and without deliberately following any particular dogma, many of our best practices run parallel to the software development philosophy known as agile development.

For example, on any project we always keep the game code running healthily and close to being turned into a finished package that a player could navigate and enjoy. We never leave the game broken or misbehaving for longer than an afternoon. Our frequent demo and focus test deadlines keep us focused on this goal and let us stay relatively stress-free in the face of what are sometimes weekly milestones to produce a new disc for E3 or a press event.

We develop concentrically—that is to say, we implement the fundamental mechanics of the game first, working to a good level of polish. Then we work outward through the secondary and tertiary mechanics, pushing upstream sensibly to implement more gameplay systems when there's a dependency. This lets us get a well-playing basic game together quickly and immediately provides a context in which we can evaluate new mechanics. If something isn't as much fun as we thought it would be (as was the case with some of the weapons we prototyped), it can easily be ditched without undermining other gameplay systems that might have depended on it.

This emphasis on working code rather than lengthy specifications, and treating change as an opportunity instead of a crisis, is characteristic of agile development. We consider agile development to be more of an attitude than a set methodology, and it's great for getting the very best out of smart, hard-working people. It also helps to keep the potentially stressful development process enjoyable and engaging, and if it's fun to make, then it's much more likely to be fun to play.

Another development method we used on both COMBAT RACING and our previous two projects was to adapt the engine of the previous game, giving us a big, time-saving leg-up in terms of functions and features.



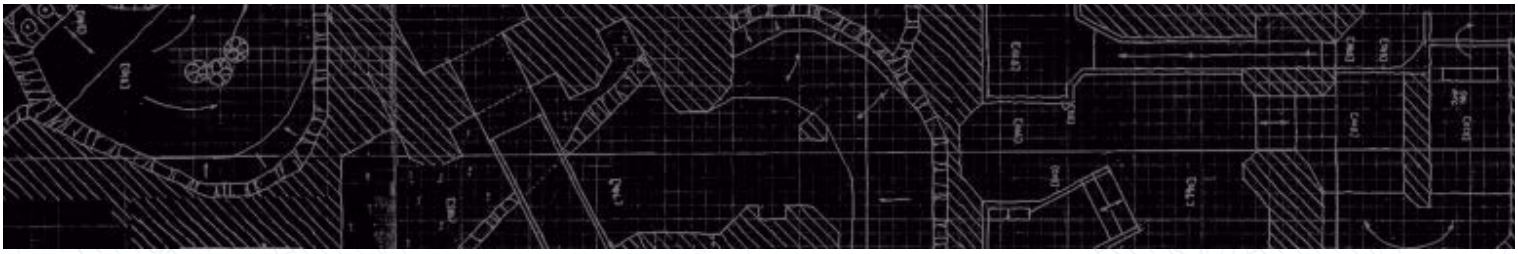
JAK X is Naughty Dog's first game to offer online play.

This being our first online game, we developed the core of the online multiplayer game first—a new approach for us. Usually, we start with a mission partway through the single-player game. Getting a working version of the game up quickly allowed us to make discoveries that helped us plan better. Almost before we knew it, we were holding deathmatches across the network, which allowed us to see that our core concept was indeed a lot of fun, but that we'd need some HUD iconography to help players locate each other in the arenas.

Another new method that helped keep things moving quickly was to make a weekly build of the game from almost the beginning of development. Weekly builds could be seen as a new manifestation of our "always keep the game running" philosophy, and it paid dividends. Just a couple of months into development, we were able to play together online every Friday night from home, and that inevitably spurred in-depth conversations over the USB headsets about what (and who) ruled and sucked in the game.

Even though we had a game engine already, we needed to make considerable modifications to accommodate the new game style. Naughty Dog's programming director Christophe Balestra led the coding team as they tackled the new challenges of making objects networkable, meeting the changed spooling demands of the new style of game and handling the more developed vehicle physics and play features of JAK X.

Finally, to enable everyone to play the game as it grew, we immediately set up an interface shell that gave the developers easy access to the game's events.



TURBO BOOST FROM THE STARTING LINE

We knew that with such a short development cycle we had to hit the ground running, technologically speaking—and so we did. Around five months before the official November 2004 start date of the project, one of the lead programmers Ben Stragnell, an industry veteran and networking expert, began writing network code that would integrate into the JAK 3 code base.

We also prepared ourselves on the design front. We started thinking and talking about the game design of JAK X even before JAK 3 had gone gold in the late summer of 2004. We made sure to keep an exhaustive record of our initial ideas, since we've found that our first notions about a given gameplay subject are often some of our best.

Our preparations were completed when we duplicated the JAK 3 code and content base, quickly built some simple test tracks and arenas, and started driving around them immediately. This gave us a concrete mock-up of the game we were going to build, and we began to experiment, iterate, and most importantly play.

DESIGNING MAPS TO DRIVE BY

Naughty Dog's small group of game designers met almost every day for the first three weeks of the project, brainstorming for rarely more than two or three hours at a time, and then breaking to document and reflect on what was discussed. The product of this period was a concise 30-page design document.

The design discussed three things: top-level objectives for the project, the basis of the story, and key play features of the game. These included notes about the customizable cars and a macro-level spec of the resource economies we expected the game to have. We also kept several lists of ideas for locations, event types, and weapons, which ultimately provided nearly all the ideas we ended up using, as well as some extras. We planned from the start to build the Adventure Mode macro from a subset of the location/event matrix, depending on which combinations we thought were the most fun.

The design document was handed around to the team, and was updated a few times near the beginning of development; for the rest of the project we used a wiki to create living project documentation driven by need, linking it to schedules, asset lists, and other documents on the network that the team would find useful but might not find on their own.

Early on, we discussed the pros and cons of physics-based gameplay, and foresaw the tuning and balancing challenges we would have to meet. This let us approach a difficult job with our eyes open, which allowed us to dedicate the proper amount of tuning time to it.

Thanks to Naughty Dog's creative director and scriptwriter Dan Arey, our story planning saw a shift from a linear branching plot to a notion-based story arc with components that were fairly freely interchangeable. This approach to story became extremely useful as we constructed and reconstructed the Adventure Mode macro. Our phenomenal team of animators worked very hard to create the movies on a tight schedule and, as ever, achieved great results, including the most complex intro sequence that Naughty Dog has ever attempted.

Some other important design work that we tackled early on was to design the game flow and interface. Game flow in previous JAK games had been fairly simple. However, with an online multiplayer game, we knew we'd have to accommodate players getting online, creating games and browsing those of others, and personalizing and upgrading multiple vehicles, while having freedom of movement between all these actions and others. We knew we had to have a solid plan before we began to implement the game flow in earnest.

After careful analysis of some competitors' games, we created a huge flowchart that seemed to let players do everything they could want. Needless to say, we didn't get it exactly right the first time, but had to refine the design as we implemented it.

We also put a lot of effort into the design of the interface and spent part of November making simple screen mock-ups focused on functionality that we continually critiqued and improved, eventually building a prototype in Macromedia Flash. We decided to leverage our 3D strengths, and instead of the 2D interface we had initially planned, built a stylish and animated polygonal one. It took a lot of iteration and polish time, but we were happy with the results.

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Finally, art director Bob Rafei (the man to whom JAK and CRASH BANDICOOT owe their stylish lines) and our awesome concept artists began creating the images that would lead the art direction for the game assets. Working art ideas out on paper can save a huge amount of time and effort (hence, money), and can inspire new thoughts about the game design. We made sure that we got off on the right foot with great concept designs for the vehicles (courtesy of a talented young transport design major named Hugo Martin) as well as game "furniture," such as power-ups and race banners.

As you can tell from the amount of work we applied to it, we value planning very highly as a key way to keep the project moving along at top speed.

WHERE THE RUBBER HITS THE ROAD

Naughty Dog has an in-house level layout guru, Hirokazu Yasuhara, one of three core members of the original SONIC THE HEDGEHOG team. Yasuhara first draws cartoons that illustrate the play mechanics for a level, and then simply uses a pencil, squared paper, and his visual imagination to draw a level map. A background artist then quickly makes a block mesh version of the level, which Yasuhara and the other designers can play test and fine-tune, while the artist simultaneously moves on to producing the finished background art.

Over the course of the last few JAK projects, this level layout process proved to be predictable and reliable in terms of the time it takes and the quality of the levels it produces. Nevertheless, we immediately performed a level layout test for JAK X, and by the end of the first month of development, we had our first level up and running.

At the same time, we created simple spreadsheet schedules for layout and art that kept the level design ahead of the artists implementing them. Since there was a wide variety of level sizes, we used a combination of experience and gut feeling to schedule the artists, based on an initial educated guess and working in collaboration with each background artist. Our artists are mostly very senior and are given a lot of responsibility for hitting their deadlines. Slipping is not an option, except in very special circumstances, which makes the team largely self-producing and keeps the bar of quality, organization, and professional conduct very high.

We entered full production at the beginning of November. By the winter break, we had completed three of the game's seven arenas and had built many of the levels comprising the various circuit tracks. We continued working on background art steadily through mid-July and were all but done by alpha.

A short way into production, we shifted toward spooling tracks that would dynamically load ahead of the player's progress through them. As a result (and as usual with the JAK games), we had to put a lot of serious thought and consideration into planning each level loading scheme, but in the end we got longer tracks with improved graphical variety, and hybrid tracks that would mix up different locations. The loading scheme also helped us get into and out of the menus with almost no loading times.

LAP TIMES AND POWER-UPS

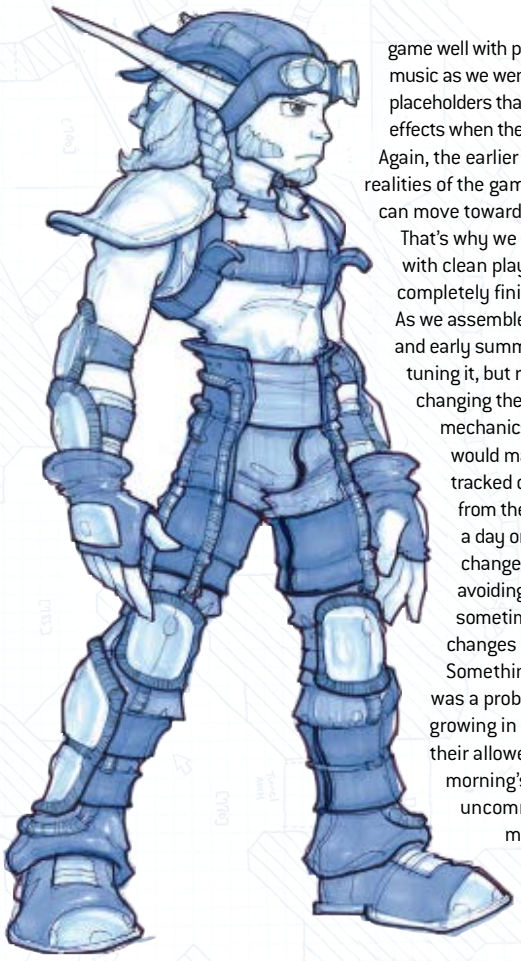
Working intensively with the programmers, artists, and audio crew, we began to implement the game promptly and rapidly, starting with the core mechanics and events and working out toward the more experimental types of gameplay. Game designers at Naughty Dog also act as producers, facilitating communication, clearing dependencies, iterating to raise the quality bar, and generally making a nuisance of ourselves. We like this method because it keeps the team lean, mean, and focused on the concrete goal of making the game, rather than getting bogged down by bureaucracy and deferred responsibility.

We always performed level implementation tasks (like placing power-ups and setting up signal planes) as soon as the levels became available in block mesh form to grow the game's footprint very rapidly and keep a good handle on performance issues. We would constantly play the game and try to provide timely and consistent feedback to the artists and programmers, who typically implemented any changes we asked for immediately. That way, we could keep our focus as we iterated quickly to a finished level of quality.

Whenever something wasn't quite coming together, a designer would sit down with the appropriate team member and hammer out a solution until we got it just right—Naughty Dog's version of extreme programming! GOAL (the proprietary LISP-like language that we write the JAK games in), along with our in-game editing tools, facilitates real-time changes and experimentation so we can reach optimally fun implementations of mechanics quickly and easily.

We put a small number of very experienced in-house playtesters on the project early, only about two months into production, which let us get some great feedback about the gameplay right out of the gate and smoothed the bug-fixing process as the first strands of the game were drawn together in early 2005. We worked continuously with our visual effects and audio staff to cover the

Level designs by Hirokazu Yasuhara are first done on paper, then mocked up by a background artist.



The JAK series' unique character design is part of what sets it apart from other games.

game well with particles, glows, sound effects, and music as we went along, occasionally using placeholders that could easily be switched out for final effects when there was a good reason for doing so. Again, the earlier we can make discoveries about the realities of the game we're making, the more quickly we can move toward a finished, great-playing game.

That's why we always value ASAP implementation with clean play and clear, if not necessarily completely finished, visuals.

As we assembled the game throughout the spring and early summer of 2005, we were continually tuning it, but rather than constantly and broadly changing the parameters underlying the game mechanics, we worked in a controlled way. We would make a small number of carefully tracked changes, gather feedback about them from the testers and team over the course of a day or two, and then make another batch of changes. We moved toward our goals while avoiding the churn and tail-chasing that can sometimes result from making too many changes in an uncontrolled way.

Something that occasionally slowed us down was a problem with the levels inexplicably growing in memory size overnight, exceeding their allowed maximums and spoiling that morning's disc with crashes. The problem isn't uncommon when a lot of people are making minor changes to the game, but because we didn't use version control software for the content, it was hard to track down and roll back the changes that had caused the growth.

Occasionally, we paused to remind ourselves of our initial goals, to make sure that the design hadn't drifted off course. Our game was designed to be interoperable with Ready at Dawn's DAXTER PSP (each game unlocking features in the other when connected together by a USB cable), and so we started cross-development with the other team early to avoid any unexpected problems.

Throughout development, we maintained lists of the secrets and bonus content we were planning, so that when the time came to add them, we moved very quickly. We also localized the game in real time using specially created tools and a lot of elbow grease, and shipped the game with all the languages on one disc.

By mid-March we had enough events, locations, and gameplay features to unveil JAK X: COMBAT RACING at a special press event. Even though the gameplay would continue to evolve and grow in the following months, our methods supported the making of a complete demo that played well enough to wow the assembled journalists and editors.

FINAL LAP

Well in advance of our alpha date in early July, we had expanded our in-house Q/A department to around 12 people who were technically savvy enough that we could teach them how to build and burn daily discs, taking considerable pressure off our midnight-oil-burning programmers.

The naturally scalable type of game that we were making let us evolve our best events through natural selection. We maxed out at about 15 events and whittled them down to the best 11 by beta in August. We were also able to cut a level fairly close to the end of development when the schedule demanded it, a great luxury for people used to working on character action games, whose crystalline, self-dependent structure usually creates headaches for people looking to prune levels.

To everyone's delight, JAK X ran very smoothly overall, but one unexpected snag we hit was that the full footprint of the game was much larger than we had anticipated, which led to some difficulties in getting everything tested thoroughly. Looking back, we should have developed a more explicit test plan and tracked its progress to avoid the scramble we had at the end to give every level and event the polish it deserved.

Starting as early as April 2005, we had begun to collect game metric data—the single best method for tuning a game. We held focus tests at Sony Computer Entertainment of America in Foster City and recorded information to the PlayStation 2 memory card about the unfolding game state of each test player, which we then compiled in spreadsheets and analyzed to see how players had progressed and to locate difficulty spikes.

We had a great online public beta in June that harnessed the power of PlayStation.com's message boards to generate invaluable player feedback, and we could always count on our extremely candid Q/A crew to tell us exactly what was fun and what was not. The metric capture sessions continued right up until the last weekend before beta, as we scoured our networks of friends for rookie players who could bring a fresh eye to the game.

Finally, the close relationship between the Naughty Dog team, our amazing Sony production team, and our Q/A departments was critical to the smooth running of the project in the final stages of development, as the programmers and artists worked around the clock to polish the content and hunt down the last bugs. Good organization, clear and open communication, and lots of all-hands-on-deck, can-do attitude helped us drive smoothly through the switchbacks of Format Q/A; we completed the game at the start of September, hitting our scheduled gold date perfectly.

THE CHECKERED FLAG

We hope that this overview of JAK X: COMBAT RACING's development will prove as useful to you as looking back over it has been to us, in helping develop best practices that let us all maximize the potential of our games—and the teams that make them—by working swiftly and efficiently. We do what we do at the Dog because we love games and the gamers who play them. We are very lucky to have such an amazing team, who worked with great dedication to make JAK X a success—thanks, guys! We can't wait to see what's coming next, as we move into the 2006 consoles and beyond.