
rosco
VIDEO PAINT
CHROMA KEY GREEN
5711
One U.S. Gallon (3.785 Liters)

The title of this bulletin is lifted from half of a sentence in *Syntactic Structures* by Noam Chomsky, as found in a previously published bulletin, "Let's Eat Grammar" by Graham Meyer. "Colorless green ideas sleep furiously." is the classic (clichéd, even) example of a sentence that adheres to the rules of English syntax, yet means nothing. Furthermore, Meyer states, "although this sentence was just a prop in a larger argument about the nature of language, it also sounds like a challenge, so of course, linguist jokesters created contexts in which if you squint at it just the right way, it's sensible."

Thanks to Joel Svendsen at Rosco, Jon Erland at the Pickfair Institute, and Marta Braun.

Cover: Press image from Rosco Laboratories.

Back cover: Half of Lucas Benjamin and a canvas painted with Rosco's Video Paint. Photo by Sarah Demeuse.

A recent MTV Video Music Awards ad campaign featured former Disney icon, actress, and pop singer Miley Cyrus, alone, chewing the scenery against the featureless green monochrome background of a chroma-key film studio. In bright red lipstick and tightly controlled hair, she leapt, paddled, and flew through empty space — her body posture elastic, her facial expressions frozen or affected, signaling exaggerated impressions of worry, mischief, adventure, or faux-apology (oops!).

The posters and billboards included the program's air date and MTV's logo, but nothing else to explain the various images of Cyrus so affected by no detectable stimulus. Chroma-key's specific non-specificity initially appeared to be the campaign's entire conceit: Cyrus, of course, is famous for her conventionally outlandish behavior. It's easy to picture her performing these campy gestures anywhere, at any time. And there's a certain sport in imagining the majestic laziness of the executives who approved this campaign, as if the award show barely needed to advocate for itself. But in fact, these billboard images and their video clip counterparts were designed to be downloaded by fans, augmented, manipulated, and post-produced, then re-uploaded to the VMA website, where the best efforts of a few winning participants would be published. The chroma-key wasn't a trope after all, but a simple technical agent, enabling the young star's image to travel fluidly through digital circuits.

Many of the winning entries (a few of which were commissions from creative agencies) share the hallucinogenic aesthetics of early video games or stripped-down experiments with Photoshop software. One video features Cyrus clad in a bathing suit. In the untouched original, she spins in place, shaking her head sarcastically at nothing. In the final version, she spins under a pink sky in a tropical archipelago attended by three servile dolphins, while two other disembodied dolphin heads — now covering her chest — spew out a rain of pink fish. Another clip shows Cyrus exuberantly flying on the back of a giant white house cat. In others, she strides confidently across the plane of an early-generation Nintendo landscape, or eats cactus, vomits happily, hemorrhages candy from her eyes, or multiplies into triplicate clones of herself — all within the vacuum-void backdrops of interstellar space and op-art rainbows.

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These random, crowdsourced, typically non-sequitur images make a game of compositing—the character provides prompts for post-production, and post-production contextualizes the character. Cyrus gives us a wide grin; someone else makes that grin the product of flying on a cat. Of course, the real magic, as with all chroma-key compositing, isn't the tawdry illusion, but the money saved by the process. MTV successfully converted the raw enthusiasm, free creative labor, and distributed computing power of legions of fans and viewers into pure network ad revenue.

BLACK, BLUE, GREEN

Compositing is basic to moving images. Masking and rephotographing techniques originated in 19th-century photography, and by 1896, Georges Méliès was already translating them into cinema. In his *Un Homme de Têtes* (*Four Heads Are Better than One*) from 1898, Méliès appears to remove his own head, place it on an adjacent table while it continues to talk to him, and quickly re-grow a new head to replace the disembodied one. This whole procedure repeats four times within a minute, the table accruing each talking head.

This fundamental matte process, whereby sections of the film are selectively masked off and repeatedly re-exposed, each time to either (a) different positions of the actor or (b) different sections of the background, developed over the early decades of cinema. Initially, following Méliès, actions were staged on black backdrops, often with actors in matching black costumes. These parts were then combined to produce startling effects of invisibility, disappearance, or superimposition within a single scene. More often, though, visual elements sourced from discrete locations were combined to produce the convincing illusion of action within a unified place and time. Elaborately painted backgrounds (eventually using panes of glass that could be selectively illuminated) allowed plots to unfold in exotic, imaginary, dramatically scaled, or financially burdened locations.

But these mattes were constrained by their need for static, unchanging scenery. The late 1920s brought a significant advance with the "traveling matte," in which a silhouette of an actor was produced frame-by-frame, following the actor's natural movements, making its recombination with other backgrounds significantly more realistic and precise. In the 1940s, under the standardized production system of 35 mm color film, theatrical background painting and the precision extraction of a filmed actor coalesced into a single process, the traveling matte composite, in which frame-by-frame traveling mattes were applied to actors who'd been shot against strong blue backgrounds. The primary studio footage was subjected to color filtering (to extract the blue), high-contrast masking (to make the foreground silhouette perfectly opaque), and re-photographing with an optical printer (to make the background perfectly clear), which prepared the image of the actor to be composited with footage from a substitute location.

In principle, any background color would work, but for a composite substitution to be precise, the color to be extracted must not mix, bleed, or blend with any others in the foreground subject, since this would cause parts of the foreground to be removed inadvertently and replaced. On the whole, movies favor the human subject, and since reds and yellows comprise the range of human skin tones, these colors are constituent parts of almost any foreground image. It is also the case that pure blue is found less frequently in the types of nondescript outdoor locations typically used as the substitute background. This paucity of natural blues meant the fewest traces in the masking process, therefore fewer problems when swapping out the blue screen background for a natural landscape.

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Different strategies for compositing images arose during the 1940s and 1950s with the development of video technologies for TV, when a foreground presenter and a background image suddenly needed to be combined from two separate electronic signals and broadcast simultaneously as a single output. Video permitted a few methods for layering these signals. The most basic was simply to overlay one on top of another, as in the now ubiquitous "lower-third" title bar graphic typical of TV news programs. Alternatively, a specifically-shaped hole could be cut into signal A, through which signal B could then be seen. This hole could be produced in a few different ways. Luminance values could be used to determine a selective opacity, so that a certain threshold of brightness would determine the transparent areas of a signal, thus revealing a secondary image behind. Or, this transparency could be defined by chroma value: a specific color at a specific brightness point (that is, a specific chromatic hue) within signal A could be made to vanish entirely, revealing signal B behind it.

Whatever the particular method employed, cutting the hole in the first signal became known as making the *key,* probably as in "lock-and-key," where the respective sizes of each were coded to each other. Very soon after its invention, the whole process had come to be known as "keying" or "keying out" a signal. The method of keying video by extracting a mass of identical color values — that is, *chroma-keying* — soon became the dominant mode in TV broadcasting, perhaps due to cinema's history with blue-screen compositing. However, green, rather than blue, was discovered to be the background color of choice for video since nearly half the photoreceptor pixels of analog video sensors were used to scan for green wavelengths, and so registered green far more precisely. Today, this is still true of digital video chips.

As it turned out, green was also easier on the talent: green has an innately higher luminance value (that is, it reflects brighter than blue under otherwise identical lighting conditions) and so requires less intense lighting, which significantly reduces the temperature on set. It also happens that green is found even more rarely in the natural complexion and clothing of foreground personalities than blue. Anyone who has

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ever watched a TV weather report with a news presenter gesticulating at the clouds and snow over a field of synthetic, neon cartography has seen chroma-keying at work. The illusion persists even if we all know by now that she's waving her hands across an empty green wall.

Cinema's traveling matte process rephotographed an actor over a false background; video's chroma-key switching wired multiple live signals into a single stream. Today, what we call, almost interchangeably, "chroma-key" or "green-screen" is a messy and imprecise composite of these two forms. Digital recording of an actor against a green screen permits the easy extraction of that background (as with film) and also its seamless, live replacement (as with video). This integrated process can be achieved with a single piece of software. It hardly matters where the foreground subject moves within the frame: the solid green background is just another set of identical pixel values, easy for both the camera and the computer to capture.

The proliferation of consumer chroma-key technologies — from roll-up backgrounds to YouTube tutorials to smartphone apps to cheap (or cracked) editing software — has boosted the cultural profile of the blank green color field. Its use has trickled down to low-budget commercial advertising, while it has become an icon of self-reflexivity in the finer arts. We now read a green screen as *virtually anything*: not only as a placeholder for a particular image, but also the very notion that an image could be plausibly inserted later. Image production increasingly presupposes post-production, and a green screen both technically enables, and stands in for "pending treatment." Actors on chroma-key backgrounds make only elliptical, partial sense: they're punchlines without jokes.

A *NOTIONAL* COLOR

There have been many shades of chroma-key green. It's more of an idea than a particular color. Different studios have used different greens, and Hollywood sound stages use slightly different shades than your local TV news network, because they each use different kinds of cameras, work at vast differentials of scale, and distribute through channels with differently specified color standards. In any instance, chroma-key green is a highly synthesized color, finely calibrated across all the lights, cameras, and editing software modules in use throughout the studio. As with the early decades of cinema — where, unbeknownst to each other, various people were experimenting with different processes — it's not easy to pinpoint exact origins. From the late 1950s to the mid-1980s, the BBC, the CBC, and NBC, along with a number of technical institutions in Germany, were each experimenting with chroma-key switching, and tested various background colors and lighting rigs to find the best practices for a TV studio.

The first green paint specifically formulated for chroma-key video applications was developed in 1982 by an American company called Rosco Laboratories which still specializes in scenographic, chemical, and lighting products for the movie industry. Rosco was commissioned to develop its green by a CBC news director in Montreal after he saw some of their paints with low-reflectivity surface treatments — exactly what he wanted, just not yet the right shade. In principle, the color development was straightforward: the *purest* green wavelength the camera could see would be the ideal chroma value for keying, since it could be removed with the most precision. Rosco's research team aimed to find that wavelength, and to formulate a color pigment that would match — a paint that, when applied and lit correctly, would bounce back only this shade to the camera. To achieve this, they connected the standard commercial video camera in use at the time, an Ikegami 79E, to a vectorscope — a specialized type of oscilloscope, which is a device used for assessing electrical voltage or current oscillations. The vectorscope was designed to calibrate color video signals and check their intensity before broadcast.

A vectorscope parses two aspects of color data: hue (a color's particular tone relative to its brightness), and saturation (a color's intensity, relative to itself). It displays these two sets of data as clusters of brightness around a central point and uses a transparent, circular grid called a graticule to decode them. Each degree around the graticule's circle represents a differently colored wavelength of

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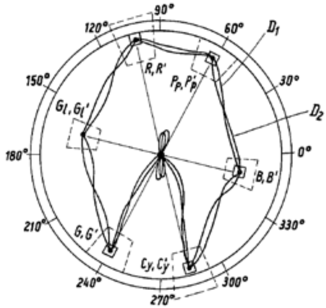

light. A cluster's hue is determined by its angular position in degrees, and its saturation is determined by its distance from the center. For example: the red end of a video signal will appear as a fuzzy cluster of light along the 104 axis, positioned closer or farther from the center, depending on how intensely saturated that red is; and dispersed widely or tightly around the axis, depending on how many different shades of red are in that signal. To help adjust the signal, the graticule circle has standardized guides for the primaries red, green, and blue; and for the cyan, magenta, and yellow that fall between them. Point a camera at a picnicker in a meadow on a sunny day: the vectorscope will show the subject as six pre-defined color zones, connected in a zig-zag pattern. This is the trace registration of standard daylight.

Green, in the original vectorscope graticule, showed up on the circle's bottom left, hovering around the 241 mark. Rosco employees reported finding the Ikegami chip's natural green point closer to 242. By continuously coordinating the painted wall color with the vectorscope's numerical rendering of the wavelength the wall bounced back to the camera, Rosco formulated a pigment that clung as tightly as possible to the line at 242. Surface treatments were added to maintain even saturation and reflectivity. This resulted in Rosco's "Video Green" paint, which had a flat, non-glare surface texture and comprised only a single green pigment. Though it has since been superseded by products specifically formulated for digital sensors and high-definition formats, the essential method remains the same. Several other manufacturers also make chroma-key green products; of course, they can't all be the exact same shade, but (especially under a digital production framework) this doesn't matter. Chroma-key green — whichever version — is only a notional color, and any will work to greater or lesser degrees, provided the cameras and lights are calibrated accordingly. Of course, due to the variances of lighting and material surfaces, no green screen background ever actually reflects back precisely and exclusively the hue that registers pure, unmixed green, which means the color (technically speaking) is an impossibility. Chroma-key relies on a mathematical idea of green-ness, one only asymptotically approached by industrial manufacturing. But special effects don't traffic in the precise. Like hand grenades or folk music, chroma-key green comes close enough.

SLOW REVEAL

Traveling-matte compositing grew popular because it saved money. Industry movies are in the business of going to far-off places with lots of staff and equipment to stage incredible or dramatic events. This is expensive. Blue-screen work allowed dangerous, difficult, and financially unfeasible actions to be performed (or visually conjured) safely and cheaply, without risking damage to actors, crew, or technical machinery. Dramatically reducing travel expenses helped free up more exotic script and plot locations: films could now easily be set on other planets, in Peruvian jungles, the Swiss Alps, the interior of a fiber-optic cable, or the workshop of a medieval plumber. But, as with any value, lower costs are relative; and as with any commodity, the quantity of human labor embedded in a classically composited image is difficult, if not impossible, for an outsider to detect. While the work of any film crew is designed to self-elide, an audience can typically see the results of all the bother: an actor's makeup and wardrobe, the sets and props, the lighting that makes it all visible. In a composited image, most of the production labor is quite literally extracted from the frame, more necessarily absent than willfully obscured. By parsing the steps involved, we can more fully understand what we're actually seeing.

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Initially, someone at the apex of the command chain has an idea for an image, one that is either too expensive or too difficult to simply stage and film. Their hazy, amorphous visualization is then conveyed into written language, source images, and storyboards, and entrusted to managerial hands. If this is a commercial production, a director of photography will be hired. (Though, given the strict instructions regarding angle, focal length, lighting, distance ratios, and framing, cinematography on a chroma-key set is more like copy-stand photography, where the plane of the lens is flush to that of the background, and the process flattens the depth between background, actor, and camera.) Production assistants will be found, and materials purchased or pulled from storage. Sound stages with prefabricated chroma-key walls will be rented for shoot days. Most of these have 40-foot ceilings, and square footage in the tens of thousands. If this is an independent production, smaller scale backgrounds can be fabricated easily. One only needs a blank surface and a sufficient quantity of video green paint with which to cover it. Note that the size of this painted area will determine the possible spatial distance between camera and actor, and actor and background: it must be large enough to allow for all required camera positions. The designated areas or objects are prepped and painted. Ample and even coverage in height, width, depth, and surface flatness is the goal—any variance or texture could produce shadows and uneven lighting, which would create hurdles for the compositor. The sets are then assembled and the stage lit to specifications. Technicians ensure that the middle ground (between the actor and the wall behind) disappears under even lighting, and that the actress casts no shadows: this, too, would tether the action to the actual studio space, complicating post-production. At last, actors and camera operators take their respective positions, all sufficiently imagining an actual picture. The blank background surfaces and objects on a chroma-key set are typically generic, nondescript things: a wall, stretched canvas, or even common multi-plane sculptures, like a table or a staircase. A uniform monochrome skin makes them blank a second time. A third coat of synthetic images finally converts such unremarkable, low-resolution background matter into emplotted, hi-resolution objects.

Throughout this process, the production assistants, painting technicians, and technical crew are bound to rules instituted by the director's original idea for the composite; strict, inherent parameters must be followed, and individual artistic tendencies must be suppressed. And, yes, this is true of almost any industrial scale image-making procedure, in which a single creative vision is serviced by numerous employees and attendants. But the relatively modest scale of a single composite image makes it a useful thought experiment, a maquette-caricature of a sprawling Hollywood production, albeit with droopier eyes and a longer nose. Any composite image internalizes a complex montage: not just the fictionalized combination of character and location, but the very real conjunction of different times and sites of image-making, along with the involvement of dozens of writers, producers, technicians, editors, and after-the-fact computer operators. Chroma-keyed images show us — by virtue of their absence — the labor that studios conceal. It's easy to imagine a movie consisting entirely of surfaces being painted with chroma-key green. If run through the proper post-production, it would be a record of bodies brushing objects out of existence, or into some kind of elsewhere — a slow, tedious, and all too human wipe transition.

242 DEGREES AND CLOUDY

Close your eyes. Picture a classic televised weather report. The animations keyed into the green screen move within the rectangular frame of the backdrop. You see rolling clouds, precipitation patches color-coded to their intensity, temperature numbers, flashing lighting bolts, and maps that slide from region to region. While the weatherman in this scenario walks across the green screen — that is, in front of the image of the weather map — the studio camera itself needs to remain stationary, as nothing ties the size, perspective, or angle of movement in the animation to the camera's lens. If the camera changes its relationship to the chroma-key wall, the animation will become unevenly mottled by shadows. Until the late 1990s, this inability to link the planar orientation of the background animation to the camera was considered a formal limitation of TV news. Weather animations made

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for informative, engaging graphics, but couldn't work anywhere else in the studio.

In 1994, a German company called RT-Set (that is, Real Time Synthesized Entertainment Technology) converted flight-simulator software designed for the Israeli Air Force into a mechanism for live, on-air TV graphics. Clumsy at first, these evolved into the hyperactive charts, graphs, and diagnostics that we now recognize from practically all major news outlets. These graphics are connected to the feeds and data streams of market pools, trade algorithms, and government data sets. They automatically self-update throughout the duration of a broadcast.

But the real innovation of RT-Set wasn't the new visual language of the graphics packages, it was the construction of entirely virtual sets: CAD-rendered digital architecture of intricate, often hyperbolic newsroom sets that only exist as a graphic overlay within the final signal. The visual language of TV news now so relies on these that the physical studio architecture has evolved to accommodate them. Anchors deliver their nightly scripts from angular, oblique furniture, perspectivally attenuated at the edges so that entire environments can be easily keyed in around them. A precision three-dimensional grid system of radio transmitters and signal receivers tracks and coordinates each camera on the chroma-key field, tying each perspective to potential angles embedded in the final architectural file. Whenever the producer switches between angles, the corresponding point of view is automatically updated. On screen, it appears that we "move" through "space."

X, Y … Z

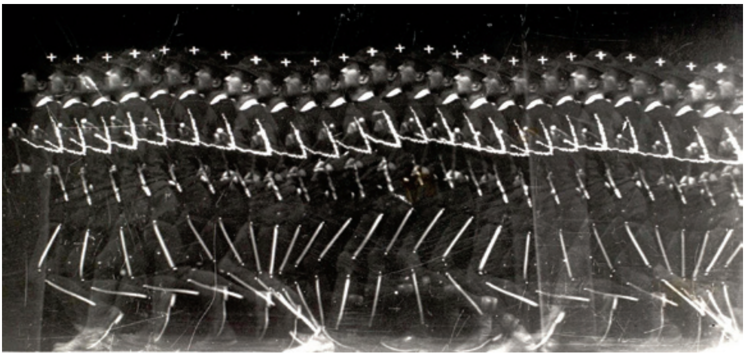
From most distances, the surface of a chroma-key background appears featureless; only a very close inspection would reveal it to be textured and concrete, producing extremely small shadows. Such visible matter is so minute that setting the focus on a chroma-key stage requires the mathematics of the lens, whose various depths of focus and changing scale ratios imply the metrics of an invisible grid overlaid in real space. In fact, all chroma-key technologies (including historical antecedents) fundamentally rely on the gridded imaging logic found in the work of two of photography's pioneering experimenters, Eadweard Muybridge and Étienne-Jules Marey, fellow travelers who both lived, notably, from 1830 to 1904—they were born and died within weeks of each other.

Muybridge, working in Philadelphia in the 1880s, used banks of multiple cameras to make frame-by-frame movement diagnostics of people performing physical tasks. His images relied on X-Y spatial coordinates, which were rendered against schematic, high-contrast backgrounds. Marey, meanwhile, made multiple exposures on single pieces of film; his models wore black bodysuits painted with articulated joint-and-bone patterns in order to reveal motion at the physiological level. This technique is still used in an almost identical fashion by 3D motion-capture suits, typically in conjunction with chroma-key backgrounds. Where Muybridge's measuring pictures were captured in a gridded environment, Marey effectively gridded the models themselves.

Beyond the two-dimensional grid long synthesized within a film plane or sensor chip, chroma-key procedures imply a third, Z-dimension, moving infinitely deeper into the image, away from the camera, standing in for the virtual spaces to arrive in post-production. This anchors the images to come, whether traditionally recorded landscapes or digitally fabricated animations. Thus, in some sense, a chroma-key wall is actually a highly realistic and representational depiction. It's a picture of the composing space presumed by software: a computer's version of a blank sheet of paper.

The technical artistry of using color films in the traveling-matte process went unnoticed for its first 20 years, since the major studio releases were all in black-and-white. The first major color film widely celebrated for its blue-screen special effects was *The Thief of Baghdad* (1940), a loose re-telling of *One Thousand and One Nights*. The film used shots of Arizona's painted desert and the Cornwall coast to suggest Persian rooftops, Bedouin caravans, and Mediterranean beaches—though it also required two Los Angeles sound stages, one on Santa Monica Boulevard and another on Las Palmas Avenue. Despite its many production woes, signaled by its crediting of three directors, the film won

Eadweard Muybridge; plate 298 from *Animal Locomotion* (1887): “Lawn Tennis,” collotype, 1884–86



Étienne-Jules Marey; “Run with Baton,” geometric chronophotograph, 1890 an Academy Award for special effects. The novel blue screen conjuring methods coupled with the plot's fantastic narrative produced befittingly exaggerated shots: a genie emerges from his bottle and towers over his antagonist on an empty coastline; the protagonist later rides on the genie's shoulders as they fly over mountain ranges; magic carpets disappear into a brightly lit (blue!) sky. The foreground characters are edged with a faint blue halo—an artifact of a process still in its infancy. Despite the visible seams, the images maintain a fundamental "magic," evincing a correlation between the protagonist's euphoria at carpet flight and the exhilarating new technology that made it occur on screen. Since this original success, composited images have become increasingly normal in Hollywood films, finding themselves accommodating effects budgets and expectant audiences. Over time, the technology began to direct the directors, implying or even demanding the repeated conception of particular kinds of shots: super-heroes catching falling skyscrapers; lovers escaping along dangerous highways; aliens arriving in remarkable spacecraft. Chroma-key technology became a script—a production whose product is both the director and her spectators.

All special effects rely on a progressive threshold of believability: once the strategies have been repeated and perfected, and the limits made apparent, what seems dynamic and convincing today will appear clichéd and hackneyed tomorrow. But the converse is also true. *Cinematic visual effects represent the traveling threshold of what's imaginable.* They reveal the limit contexts in which a human character can be imagined to exist—the extremes of (sometimes) survivable situations. They define, or at least stretch, plausibility. Animation, by contrast, nods to the mechanics of the real world, but has never been bound by them. Whenever Wile E. Coyote runs off a cliff in *Looney Tunes*, we know he will fall downwards, even if he gets an extended mid-air suspension to realize it. Yet we don't question how he repeatedly survives such catastrophic bad luck. This is the pleasure—and grounding assumption—of a cartoon.

Today, most background images used in compositing include (or are fabricated exclusively by) computer generated imagery. As such, composites represent a contemporary state of mid-dissolve between

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the long history of recorded images and a future of algorithmically drawn ones. With this in mind, one could even imagine chroma-key compositing as a final, fraying connection between imaging technologies and images of humans: the end stage of the era when moving images were made with lenses, physical locations, and people. (Though, let's avoid pat nostalgia: watching movies in a theater has long privileged sight-and-sound over touch-and-taste, already pressuring what it means to be fully embodied and sensorially alive.) Some might eventually mourn the passing of our now half-digitized state. If all cinematic forms do become, finally, entirely computer-generated, compositing might one day be looked upon as a handicraft. Quaint, almost.

HUMAN CLIP ART

The models in Eadweard Muybridge's photographs performed a variety of common daily actions meant to represent the standard physical movements of late 19th-century Americans as construed through upper-class mores. People walked, ran, used tools, embraced, held children, served tea, and climbed stairs. These were common, intuitive, and empirically observable actions. The models performed for the camera, of course, but they performed these ordinary activities just as they actually lived them. Muybridge's models didn't imitate another image form; they simply acted as themselves. Eerily, they presage an actor on a chroma-key set: a person, alone, against an invisible background of data points and spatial metrics, animates her own body in response to imagined environmental stimuli. Perhaps all acting responds to elusive, invisible prompts, but the chroma-key actor is animated by provocations she must fabricate alone. She must imagine the other person (or creature, structure, or situation), while also imagining herself in an unimaginable (almost by definition!) location. Her performance must be solid enough to be taken as intentional and yet soft enough to bend to the unknowns of the final, digitized context.

In the VMA ad campaign, Cyrus gives us a masterclass: her gestures and postures are distilled versions of popular gestures and postures, both generically specific and specifically general. Her motion is rubbery

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and malleable, unbound by gravity; her face and hands signal particular feelings — it's just not clear which ones. She is, in effect, human clip art. Braced for impact in the virtual world, she is ready to be extracted, re-combined, (re-)compressed, re-posted, printed out, emailed, uploaded, and deployed towards ends that aren't hers alone.

DEEP END

If "the future is already here; it's just not very evenly distributed," as novelist William Gibson said in a 1993 interview, then the past must operate similarly: it, too, is unequally available, and indicative of different claims for different readers at different times. What should we make of the current explosion of interest in chroma-key green across the fine arts, and as a trope of commercial design? What strange theory of monochromy would chroma-key soundstage ruins prompt for a future archaeologist? Chroma-key green is only a temporary color: it won't remain in the visual vocabulary of the future, but will vanish along with its parent technology. And since unmixed shades don't tend to occur naturally, it's unlikely that it would manifest under any other circumstances. So our archaeologist might find scant reference to diagnose her discovery. She might, too, be flummoxed by the seemingly unmotivated body language of a model on an empty green billboard, if she found one. Such a figure would apparently be caught between different kinds of nowhere, using swimming motions and alternating facial gestures to escape a green void.

Something is *off* about these ads, even now. For empty chroma-key backgrounds to work as a trope of corporate advertising without people necessarily knowing they were images prepped for post-production, chroma-key green and its attendant processes must have achieved sufficient legibility in the popular imagination. This is true, of course: keying tools are now packaged in the most basic video editing applications, and comprise an entire stylistic subgenre of the YouTube video archive. But chroma-key's dilution from professional studio system to mass-market consumer tool also signals that it has already been replaced — at the high end, at least — with more advanced compositing methods. Visual effects are increasingly functions of CGI graphics, which combine 3D-modeling and spatial renderings with time-based animations. It's no surprise that the original developers of Computer Automated Drafting, used by architects, now sell the most popular high-end suite of visual effects software. And while Hollywood-style productions still use large-scale chroma-key environments to manufacture the basic image, the process has been eclipsed as a fine-grained technique.

The recent development of "deep" pixels (where each individual pixel includes data indicating its distance from the presumed recording camera, alongside color and transparency information), and the capacity to precisely bound the edges of a moving object, frame-by-frame, using contoured spline curves or density differentials, means that you no longer need a vivid lime green background in order to distinguish and extract different pieces of a recorded image. This kind of hardware is still prohibitively expensive, and so typically unknown, but the technological cutting edge, by definition, can't be known to everyone. Besides, its purely computational nature doesn't map easily onto an accessible, monochromatic iconography. In fact, only because compositing technology is now sophisticated enough to operate invisibly, to vanish itself, to make compelling digital worlds with no giveaway glitches, do the clunky aesthetics of a pop star jumping through an 8-bit rainbow make any meaningful sense. Just try imagining a billboard that used deep-pixel algorithms as an advertising joke.

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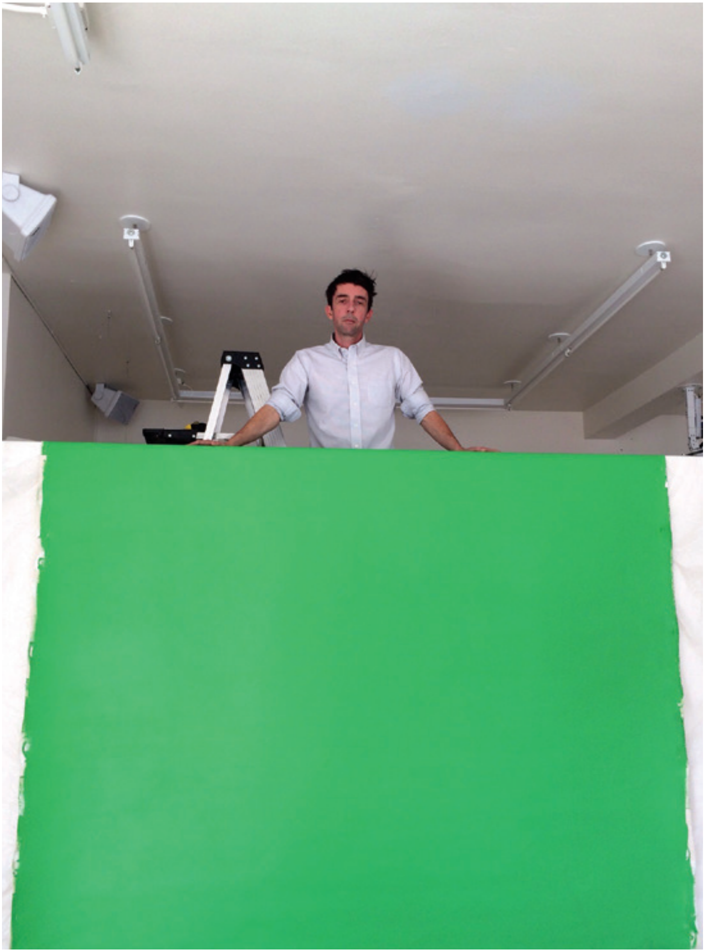

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