The Info-Immersive Modalities of Film Documentarian and Inventor Roman Kroitor

by

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A thesis submitted in conformity with the requirements for the degree of Master of Information

Faculty of Information
University of Toronto

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Abstract
In this thesis, it is argued that Canadian film documentarian and inventor Roman Kroitor’s lifework is structured by simultaneous appeals to the realist and reflexive capacities of film and animation. It is shown that the diverse periods in Kroitor’s lifework (including documentary film production at the National Film Board of Canada; co-invention and development of the large-format film apparatus, IMAX; and software design for computer animation in stereoscopic 3D) are united by a general interest in facilitating immersive audience experiences with documentary information and evidentiary entertainment. Against those who have conceptualized cinema as functioning like a frame or a window, this thesis analyzes Kroitor’s diverse work in relation to Gene Youngblood’s conception of “expanded cinema” (1970). It is argued that Kroitor’s efforts in film and invention constitute modalities that actively eschew the architectonic limits that typically characterize the cinematic experience.
Acknowledgments

The realization of this thesis would not have been possible without the assistance I received from a number of people. First, I would like to thank my supervisor, Juris Dilevko, for his encouragement throughout the project. Second, I would like to thank my examining committee, David Harris Smith and Neil Narine, for their interest in the project and their insightful comments. Finally, I would like to thank Roman and Paul Kroitor, Greg Labute, and Emily Pelstring for their willingness to speak about their work.
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Introduction
The Info-Immersive Modalities of Roman Kroitor

Cinema’s first century involved significant advancements in the medium’s constituent technologies and the discourses used to theorize these technologies. While filmmakers and industry personnel strived to facilitate the many experiences that we associate with the cinema, there emerged a conterminous industry of thinkers and critics to account for these experiences and situate them in relation to society as a whole. As members of both groups know, the essential marvel of film is its twofold capacity to facilitate the immersive physical experiences we associate with such genres as melodrama, comedy, or horror, and the more intellectual, or, contemplative experiences we associate with such information-intensive forms of cinema as documentary. While experiences of the first sort are characterized by a sense of “being there”, experiences of the second sort are characterized by one’s sense of critical distance. What is interesting is that cinema facilitates both experiences with objectively similar images of our world.

The work of Canadian Filmmaker and inventor, Roman Kroitor, is noteworthy for how it exploits this twofold capacity of film. With work across a number of fields, Kroitor has dedicated his life to the development of modalities for immersive and intellectual audience experiences with documentary information and evidentiary entertainment. As a director, producer, and editor of films for the National Film Board of Canada’s Unit B, Kroitor helped to develop and extend the vocabulary of direct cinema and cinéma vérité. Through his involvement in the invention of the large-format cinema, IMAX, Kroitor helped to facilitate previously unimaginable sensory immersion with documentary sound and image. And with his current work developing stereoscopic 3D animation software, Kroitor is
refashioning the activity of animation in order to document and exploit the gestural activity of drawing in three-dimensional space. While Kroitor’s work in these areas constitutes a wide-ranging career, one could not say that this career has been marked by disruptions. This thesis will explore the connections between these periods of work, and, across them, Kroitor’s development of increasingly sophisticated strategies for intensifying documentary audiences’ experiences with audiovisual information.

Roman Kroitor was born on December 12, 1926 in Yorkton, Saskatchewan. While studying philosophy and psychology at the University of Manitoba, he became fascinated with the creative possibilities of cinema after a friend introduced him to the work of the avant-garde filmmaker, Maya Deren. Inspired by Deren’s work, Kroitor joined the university’s film society and made a short experimental film, Bridge. Through a professor who had previously worked in the institution’s distribution department, Kroitor secured work as a summer student at the National Film Board. After two summers, he was made a permanent staff member within Unit B, a documentary production department that was afforded a relative measure of creative freedom under the direction of Tom Daly. Along with such filmmakers as Wolf Koenig and Colin Low, Kroitor seized this freedom to pioneer a style of documentary that broke with the practices that had become standard under the supervision of the Board’s original director, John Grierson. Whereas the Griersonian documentaries that were produced during the war years were highly rhetorical affirmations of Canadian dominant ideology, Unit B’s documentaries from the late-1950s and early 1960s were more ambiguous and often critical of the relationship between documentary cinema and the reality it purports to represent. Enabled by the era’s revolutionary cameras and sound recording equipment, Unit B’s films were characterized by a heightened sense of presence
and the extent of their engagement with their subjects. As such, the Unit’s work is an early example of closely related documentary styles that would come to be known as direct cinema and cinéma vérité (cf. Issari & Paul 1979). And with such notable films as Paul Tomkowickz: Street-railway Switchman (1952), Festival in Puerto Rico (1960), Universe (1960), Lonely Boy (1961), and Stravinsky (1965), Kroitor helped to spearhead this pioneering period.

Towards the end of the Unit era at the Film Board, Kroitor became interested in the creative possibilities of large-format and multi-screen cinema. After an early experiment with the formats at the Canadian National Exhibition in Toronto, Kroitor secured a commission to produce a large-scale multi-screen project at Expo ’67 in Montréal, Québec. Produced in collaboration with Colin Low and Hugh O’Connor, Labyrinth was the most successful film project at the exposition according to noted film critic Judith Shatoff (1967). Inspired by the Greek myth of Theseus and the Minotaur, the project incorporated massive multi-screen set-ups, sophisticated surround sound, and unique architectural design to create an intensely immersive experience for visitors to the Exposition.

Following the success of the project, Kroitor and new collaborators, Graeme Ferguson and Robert Kerr, formed the Multiscreen Corporation to explore the possibility of making something like the experience Labyrinth facilitated available to wider audiences. Together they pioneered the large-format film stock, camera, and projector that would become the basis of IMAX, a special sort of cinema that intensifies audience experience with a gigantic screen and incredibly sophisticated sound technology. After rebranding their company, the team debuted their fledgling technology with Donald Brittain’s film, Tiger Child (1970) in another immersive pavilion at Expo ’70 in Osaka, Japan. In the following
years, the IMAX Corporation grew to become a major player in institutional documentary cinema production and technological innovation in large-format cinema. In 1973, the company introduced the OMNIMAX format and IMAX Dome theatre in San Diego, California. In the late-1980s it adapted the format to work in stereoscopic 3D. And in 1994, controlling interest in IMAX was sold to American investors and the company went public on the NASDAQ Exchange. It was at this point that Kroitor retired from IMAX, but his contribution to the format’s filmography remains considerable. In 1985 Kroitor produced and wrote the first IMAX 3D film, *We Are Born of Stars*. In 1991 he produced and co-directed the first full-length IMAX film, *Rolling Stones: At the Max*. All told, he has worked on 14 films in the format in collaboration with such notable IMAX filmmakers as Stephen Low and Toni Myers.

While working on *We Are Born of Stars*, Kroitor became frustrated with the technical complications of adapting computer animation to work in 3D in an IMAX Dome theatre. Accordingly, he began experimenting with various technologies to minimize the amount of mathematics and engineering necessary to realize an artist’s desire to animate in 3D. These experiments eventually led to the development of Kroitor’s Stereoscopic Animation Drawing Device, or, SANDDE—a software platform that allows one to draw and animate stereoscopic imagery in real space by means of a visual sensor that tracks the movements of an optical wand in three-dimensional space. Originally developed at the IMAX Corporation, the technology was further developed and commercialized by Kroitor’s private company, Janro Imaging Laboratory with assistance from the National Film Board. As the company notes in the SANDDE product description, “The resulting effect [of this development] is that the user creates content in an immersive environment where the artwork appears to float in the air,
taking shape as a real-time trace of their hand movements” (Janro Imaging Laboratory, Inc. 2011: 1). But beyond the technology’s remarkable facilitation of drawing in real space, it is additionally significant to computer animators for how it simplifies the mathematically complex business of tiling and inbetweening.

SANDDE is an innovative technology because it wrests the art of animation from the highly complex technologies that mediate between the artist and his or her work, and make it an artisanal practice once again. While the product has not been commercially available for long, numerous animators have made use of the technology during the period of its development. Among the more significant projects produced with SANDDE is a pair of films by the Montréal animator and son of Kroitor’s partner in the development of IMAX, Munro Ferguson. *Falling in Love Again* (2003) is a Genie Award-winning short about the romance that blossoms between a man and woman who fall from the sky after their cars collide on a narrow mountain road. *June* (2003) is an elegiac and abstract ode to Munro Ferguson’s early mentor, Joyce Weiland, which he produced after her death in 1998.

In spite of these major contributions to visual culture and technology, the full breadth of Kroitor’s work in film production and invention remains woefully under-examined in the critical literature of these subjects. It is true that scholars of Canadian film and its institutional practice have dedicated many studies to the documentary work of Unit B (cf. Elder 1977; Grant 2003; Hancox 2003; Harcourt 1977), but this literature tends to omit much of Kroitor’s work in order to focus on his two most revered films, *Paul Tomkowicz: Street-railway Switchman* and *Lonely Boy*, which he co-directed with Wolf Koenig. Beyond this, the authorial partialities of classical film studies have meant that scholars have largely overlooked Kroitor’s institutional contributions as a producer and technical advisor on an
impressive range of Film Board titles. Through study of a greater range of Kroitor’s work at the NFB than previously attempted, this thesis aims to address both shortcomings.

In addition to the aforementioned reasons, a survey of Kroitor’s lifework seems particularly relevant now given our culture’s current preoccupation with immersive information and entertainment environments and their accompanying technologies. As relatively recent analyses suggest, cultural studies is developing new discourses to account for the increasing popularity of technologies that facilitate more physical or affective audience engagement than cinema qua cinema (Grau 2004; Griffiths 2008; Lord and Marchessault 2007). Unfortunately, only a few of these studies address the role of Kroitor’s *Labyrinth* project and the IMAX technology that has been at the centre of this sea change (cf. Duncan 2006; Marchessault 2007; Nucci 2010; Recuber 2007; Whitney 1999 and 2005).

It goes without saying that this work could be extended to better illuminate its object in light of a more comprehensive survey of Kroitor’s previous and subsequent work. And because the SANDDE technology remains in development, this thesis will be most readers’ first opportunity to learn about Kroitor’s more recent innovations. Ultimately, this thesis aims to connect the observations of those who have chosen to focus on specific films or projects by Kroitor in order to situate these works in relation to an overarching career held together by a consistent motivation. In this thesis it will be argued that these disparate periods in Kroitor’s lifework are united by a preoccupation with the cinematic frame as a site of negotiation, and an interest in the facilitation of both immersive and intellectual audience experiences. That is, Kroitor’s work advances beyond the frame and its function to limit or contain representation in order to reveal and create new meaning.
Film Studies and the Frame

In the early days of film theory, thinking about the limits of the screen was structured by a more general desire to articulate the material specificity of the medium.¹ In order to be taken seriously in its early days, cinema needed a coherent ontology that could be used to situate the medium in relation to established arts like painting and theatre. But insofar as cinema represented a hybridization of other art forms, its legitimacy could not rest on simple comparison. Accordingly, the early thinkers of film sought its uniqueness in the medium’s dual capacity to capture and manipulate moving images of the world for a thinking audience. For such realists as Andre Bazin and Siegfried Kracauer, it was the medium’s documentary capacity that distinguished the motion picture from other arts. But for Rudolph Arnheim and the Soviet Formalists, film’s special significance was to be found in its usefulness for those who sought to create new meanings and associations from images of the world. Not surprisingly, efforts to conceptualize the screen during this period are based on two divergent metaphors: the window and the frame.

For Bazin (1967), Kracauer (1997), and their fellow realists, the screen was, or ought to be, a window that looked out onto a vast world. While the realists could not deny the bounded nature of the cinematographic image projected in a theatre, they tended to feel that the essential realism of the image captured by the camera invariably alluded to a world beyond the limits of the screen. In “Theater and Cinema”, Bazin argues that “the screen is not a frame like that of a picture but a mask which allows only part of the action to be seen” (105). So, while the spectator can only see the specific part of the action the filmmaker

¹ Parts of this analysis of the ways in which film studies has conceptualized its object are heavily revised and expanded versions of material that originally appeared in a paper produced for an essay assignment in INF1002 at the Faculty of Information, University of Toronto, Spring 2011 (Langdon 2011).
deems noteworthy, his or her experiential knowledge of similar masking devices forces him or her to acknowledge that the reality captured in the image continues in the space cut off by the limits of the screen. Thus, Bazin refers in his writing to the “window of the screen” (107), which overlays the world simply to facilitate a spectator’s access. And if this world is “prolonged indefinitely into the universe,” as Bazin suggests in “Painting and Film”, then the screen directs the spectator’s vision and thought in a wholly different manner than the painting’s frame. “A frame is centripetal”, notes the great exponent of film’s revelatory power, but the screen is “centrifugal” (166).

Against the interpretation that takes the screen for a transparent and value-free window, Rudolph Arnheim and such formalists as Sergei Eisenstein (cf. 1969) suggest that cinema is invariably enclosed by a frame that necessarily delimits any references to that which is not in the image. While the difference in theoretical perspective may seem slight, there is a great deal at stake in Arnheim’s observation that, “The pictured space is visible to a certain extent, but then comes to an edge which cuts off what lies beyond” (1957: 17). Indeed, this characteristic delimitation of the image is, in Arnheim’s estimation, one of the “restrictions which give film its right to be called an art” (17). It is the frame, writes Arnheim, which enables the director or cinematographer of a motion picture to alternately assign significance and insignificance to his or her images (73). In this respect, a filmmaker invested in the limits of the screen as a frame works to create meaning. Conversely, the realist filmmaker who views the screen as a window works to reveal meaning that is already present in the world.

Though the binaric opposition of the metaphors of the window and frame was broken by Jean Mitry’s mid-sixties’ observation that cinema might consist in the screen’s dialectical
oscillation between the two possible functions (1999), the supremacy of these specific metaphors was nullified by film studies’ appropriation of structural psychoanalysis and the field’s reconceptualization of the screen as a surface like the mirror in Jacques Lacan’s meta-narrative of the self (cf. Metz 1986). For Lacan, the mirror-stage is characterized by the infant’s simultaneous misrecognition of itself as a unified individual in its mirror-image and recognition of its essential incapacity to realize this ideal image (2002: 3-9). With the burgeoning field of film studies under the sway of this metaphor, the limits of the screen were still believed to function centripetally, though now the frame is seen as a precondition and sign of the essential lack or incompletion that informs cinema in its role as a “specific signifying practice” (Heath 1981: 7).

In Stephen Heath’s view, the manner in which the limits of the screen frame the space and time of a film is perfectly analogous to the manner in which the highly conventionalized content of a film functions to corroborate the framing function of ideology. Simultaneously excised by the limits of the screen and the narrative conventions that delimit a scene is an excess that Heath suggests is identical to that which is elided by the ideological constitution, or, unification “of the imaginary relations of individuals to the real relations under which they live” (5). In other words, the frame elides the contradictory desires, negativity, or otherness that invariably make a subject something more than the ideologized figure of his, her, or its representation. Thus, Heath concludes that the screen is essentially “imaginary” in Lacanian parlance. As an institution of “ideological systems in a capitalist mode of production”, writes Heath, cinema en folds the subject “in a perpetual retotalization of the imaginary” (8). And as the site of this return, the frame that surrounds the motion picture “is
the reconstitution of the scene of the signifier, of the symbolic, into that of the signified” (12).

In certain respects, the Lacanian critique of the repressive cinema of capitalist milieus is conterminous with Bertolt Brecht’s critique of realist theatre, which was taken up in film studies during the same period that psychoanalysis was gaining traction in the field. As Brecht famously argued, realist theatre functions to stupefy its audiences by a tactical negation of the processes by which it creates coherent illusions (1964). Thus, Brecht argued for a reflexive theatre that would cultivate an active and politically aware audience through a problematization of the apparatus and assumptions of traditional theatre (1964). Not surprisingly, the critique was easily adapted and applied to a cinema that was modeled on realist theatre and grounded in the same ideological presuppositions. In the work of such thinkers of film such as Heath (1975), Colin McCabe (1975), and Peter Wollen (1982) Brecht’s opposition came to inform a critique of realist cinema for how its invisible style effaced the signs of production that would expose film’s relationship to material conditions characterized by inequality and exclusion. Through these authors and others’ work, the Brechtian critique of realist cinema sought to foreground how any apparent realism was the product of a frame that functions centripetally to fuse the spectator to the highly ideological meanings present in a film’s images or narrative. In McCabe’s view, a Brechtian cinema would aim to cultivate knowledge in an audience by breaking this fusion through a host of reflexive strategies (1975: 48-9). But, just as Mitry has shown that cinema’s screen oscillates between its function as a frame and a window, we must concede that the medium’s realist

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2 Indeed, Stephen Heath is a key contributor to a significant special issue of the influential film journal, Screen, which sought to articulate the relevance of Brecht to film studies in 1975. In that issue Heath writes, “Art is a struggle in ideology by the distance it establishes in respect of the ideological homogenisation of reality” (1975: 34).
and reflexive impulses are not essentially incompatible. In any film, the two impulses are present in varying degrees, functioning simultaneously to preempt and over-code each other in order to constitute the filmic experience. Thus, Robert Stam suggests that it is “more accurate to speak of a ‘coefficient’ of reflexivity or realism, and to recognize that it is not a question of a fixed proportion” (2000: 152).

It is in terms of this coefficient that I would like to begin conceptualizing Kroitor’s work as a cinema that is both realist and reflexive, invested in the screen as both frame and window. Kroitor’s documentary filmmaking is reflexive in its acknowledgement of the apparatus of cinema and the practices of documentary filmmaking. Additionally, this reflexive tendency is embodied in the technologies he has invented. As many have noted, a large part of the IMAX experience involves a concerted foregrounding and celebration of the technology and the ways in which it distinguishes itself from traditional cinema (cf. Acland, 1998; Griffiths, 2008). In a similar manner, the SANDDE apparatus revives the pivotal role that hand-drawing previously played in animation against the digitization of the field. At the same time, Kroitor’s lifework has done a great deal to advance the realist project espoused by such thinkers as Bazin and Kracauer. Kroitor’s documentary filmmaking does this by penetrating through surface representations to access the contradictory or hidden truths that tell often tell us most about a subject. In a similar manner, the gigantic and incomparably crisp IMAX image facilitates an encounter with the photographed world unlike any other film format. And finally, SANDDE enables animators to draw and animate realistic movement in stereoscopic 3D in ways that trump other animation software packages. Together the realist and reflexive tendencies of Kroitor’s work combine to create a unique experience for the audience accustomed to more conventional cinema.
It is my belief that this coefficient of realist and reflexive tendencies is embodied by the term, “info-immersive”, which I use throughout this thesis to describe the ways in which Kroitor’s work exploits the twofold capacity of cinema described at the very beginning of this introduction. Kroitor’s work is informative or informational because it tends to engage with actuality as its object. Quite obviously, the man’s films are predominantly works of documentary, and the technologies he has helped to develop are easily adapted to non-fiction purposes as well. In this thesis, it is suggested that the reflexive critical strategies of this work function beyond traditional documentary to tease information from contexts and circumstances where it is not immediately available. And because Kroitor’s lifework is characterized by critique of this sort, it often encourages its audiences to maintain a degree of critical distance. At the same time, Kroitor’s work breaks with the dichotomy of the frame and window that structures the aforementioned efforts to articulate the ontology of cinema in order to facilitate cinematic experiences characterized by more embodied sensations of presence. In this respect, the work could be called immersive for how it cultivates what Allison Griffiths describes as “the sensation of entering a space that immediately identifies itself as somehow separate from the world and that eschews conventional modes of spectatorship in favor of a more bodily participation in the experience” (2). In Kroitor’s early documentaries, lightweight cameras duplicate the movement of a curious human subject and advance beyond what is immediately seen to gain access to private phenomena and behaviour. In IMAX theatres, spectators are literally enveloped by a screen that extends beyond the limits of their field of vision. And with SANDDE, there is a direct correspondence between the animator’s movement in space and time and the resultant image.
Kroitor’s filmmaking and invention is remarkable because it achieves an effective combination of informational and immersive qualities. And with this coefficient of qualities, the modalities that comprise his life work facilitate a bifold experience involving sensations that correspond to being in the action and being at a remove: the contemplative distance necessary for analytical thought. In this respect, Kroitor’s work functions to engender thought immanently, with the thinking audience situated amid the unfurling object of its thought.

To the extent that Kroitor’s work blends realism and reflexivity, information and immersion, I would like to propose conceptualizing this work in relation to Gene Youngblood’s analysis of expanded cinema (1970). In Youngblood’s view, the decentralization and individualization of communication channels that characterized the period in which he was writing had beget the “end of the era of cinema as we’ve known it, [and] the beginning of an era of image-exchange between man and man” (49). Whereas cinema was previously defined by the stable projection of a moving image on a clearly delineated surface that was separate from the audience, Youngblood perceived that the medium was redefining itself as an experience or event beyond the limits of the screen. Whereas traditional cinema sought merely to represent reality, Youngblood maintains that this “expanded cinema” attempts to manifest consciousness through the uninterrupted flow of information between image and audience (41-43).

The Expanded Cinema of Roman Kroitor

Like Youngblood’s conception of expanded cinema, Kroitor’s work involves a rejection of the logic that previously framed cinema as a stable mode of expression in order to facilitate
more immersive audience experiences. Indeed, the lightweight cameras and portable synchronized sound equipment that were used to produce Unit B’s documentaries, as well as the architectonics of Kroitor’s multi-screen experiments and the IMAX theatre, and the revolutionary SANDDE platform are all “image-making technologies that promise to extend man’s communicative capacities beyond his most extravagant visions” (Youngblood 41). As Youngblood writes, the direct cinema or cinéma vérité that Kroitor helped to pioneer represents a first step towards this variety of expanded cinema (107); and more, Youngblood suggests that the large-format multi-screen techniques that Kroitor developed in the late-1960s and 1970s achieve the sort of results that the thinker calls for on an environmental scale (352). If conventional film language has reached its limits, as Youngblood maintains, Kroitor’s innovations constitute a “technological extension” of the very sort that Youngblood advocates in his prophetic work (42).

In the first chapter of this thesis, the reader shall see how Kroitor’s career-long interest in expanded modes of cinema began with his documentary work for the National Film Board of Canada’s Unit B. In this capacity Kroitor helped to develop a mode of documentary filmmaking that eschews the rigidity of erstwhile documentary techniques in favour of a less bounded engagement with his subjects. Whereas the cinema produced under the supervision of the NFB’s first director, John Grierson, is characterized by its overtly rhetorical mode of presentation, Kroitor and Unit B’s cinema is markedly more ambiguous. As the reader will learn, Kroitor’s cinema represents an early articulation of the concerns that later came to inform the related direct cinema and cinéma vérité movements in documentary filmmaking around the globe. With its characteristic immediacy, Kroitor’s early documentary involves a rejection of the ways in which earlier documentary cinema tended to
frame its presentation of reality. And yet, we shall also see how Kroitor utilizes a number of additional strategies to call attention to the conventions of documentary and the myth of an unbiased representation of reality. In this way, Kroitor’s cinema facilitates encounters with its subjects that are at once realist and reflexive, immersive and informative.

In the second chapter, the reader shall see how Kroitor’s further pursuit of the concerns that characterize his early documentaries led to the experiments with multi-screen cinema that culminated in the man’s co-invention of the large-format cinema, IMAX. As the reader will learn, Kroitor’s work in multi-screen cinema belongs to a long tradition of similar efforts by film innovators to advance beyond the cinematic frame. But insofar as the IMAX screen is intended to fill the spectator’s total field of vision, it is also argued that the format represents an extension of the info-immersive strategies Kroitor helped to pioneer with his earlier documentary work at the NFB. The IMAX experience recalls Kroitor’s documentary work through its simultaneous investment in the medium’s capacities to realistically represent the world and encourage us to think about the relationship between representation and reality. In addition to this, the introduction of OMNIMAX 3D with Nelson Max and Kroitor’s We are Born of Stars (1985) will be shown to presage the recent boom in three-dimensional imaging technologies and Kroitor’s turn to modalities for stereoscopic animation.

In the third chapter, it will be suggested that Kroitor’s more recent involvement in stereoscopic 3D animation software design represents the culmination of his efforts to facilitate more absorbing experiences with visual information. As the reader will learn, Kroitor’s Stereoscopic Animation Drawing Device emancipates animators from many of the technical chores that have undermined animation’s relationship to its originary activities:
drawing and sculpture. In the third chapter, the reader will learn how the SANDDE technology breaks with existent animation techniques whilst remaining consistent with the spirit of Kroitor’s previous innovations. This is because SANDDE simultaneously facilitates a real-time immersive engagement with the work that one is animating and a reflexive engagement with the very act of animation. Through a detailed history of the software’s development and a brief analysis of the few existent SANDDE films, it will be argued that the transformation of image production facilitated by the technology is conceptually conterminous with Kroitor’s earlier work with direct cinema and immersive cinematic environments.

Ultimately, this thesis suggests that Kroitor has been a key figure in our culture’s embrace of the immersive and expanded modes of cinema prophetically theorized by Youngblood. Across a variety of cultural forms and activities, Kroitor’s career has been sustained by his unflagging desire to explore new possibilities for the form and content of the moving image. Through a careful coefficient of realist and reflexive elements, Kroitor has crafted a lifework that is both informative and immersive, or, as this thesis contends: info-immersive. With his documentary film work, his co-invention of IMAX, and now SANDDE, Kroitor has made a significant contribution to Canadian film and film culture. This thesis aims to give a preliminary sense of the simultaneous wholeness and diversity of the innovator’s career.
Chapter 1
The Info-Immersive Cinema of Roman Kroitor

In this first chapter, it will be argued that Kroitor’s documentary cinema is characterized by a simultaneous cultivation of both realist and reflexive tendencies. As the reader will learn, Kroitor developed an info-immersive cinema while working in the collective and collaborative environment of the National Film Board of Canada’s Unit B. The Unit B’s cinema is significant because it eschews the expository and rhetorical tendencies of the documentary cinema that had come to typify Film Board productions under its first Director, John Grierson. With this cinema, Unit B developed an original style and important precedent in the history of direct cinema and cinéma vérité, two closely related aesthetic movements that crystallized during the simultaneous advent of new technologies for the documentation of the real and popularization of certain discourses challenging realism for its role in the corroboration of dominant ideology. Direct cinema and vérité differed from earlier documentary because the films were more invested in exploring the tension between the real and its representation. While Kroitor and Unit B’s cinema possesses qualities of direct cinema and vérité, it is argued here that these labels may fail to represent the full significance of the films. This is because the direct and vérité qualities of Kroitor’s cinema are subordinated to more encompassing info-immersive strategies. Through a survey of a greater number of the filmmaker’s films than have ever before been considered in a single study, it will be shown how his lifelong eschewal of the frame begins with his earliest work.

Roman Kroitor became interested in cinema while studying philosophy at the University of Manitoba. It was Maya Deren’s Meshes of the Afternoon (1943) that first piqued his curiosity in the medium, but as Kroitor notes, this initial spark came not from
seeing the film (2011). In fact, Kroitor did not attend the university’s film society’s presentation of Deren’s work. It was one of Kroitor’s friends who attended the screening, and it was this friend’s description of Deren’s masterful superimpositions of her dancing body over a tangle of tree branches blowing in the wind that caused the future filmmaker to become intrigued by the artistic potential of the medium. As Kroitor notes, this superimposition—or, the thought of it—establishes a relationship between ostensibly distinct images in a manner similar to the concatenating arrays he would later pursue with his work in multi-screen cinema (2011).

This tale of Kroitor’s initial attraction to the medium is doubly relevant to any consideration of the career that would follow. First, it is telling that an experimentalist’s work would galvanize Kroitor to pursue his own path in cinema. For even though Kroitor has tended to work in or around documentary genres that rarely figure in discussions of experimentalism, this work has tended to break with the generic conventions that define documentary in order to facilitate more immersive engagement with the texts and their subjects. As such, it is natural Kroitor would be inspired by a filmmaker whose work is given special attention in P. Adams Sitney’s pivotal study, _Visionary Film_ (2010). Second, it is significant that Kroitor was so greatly inspired by a film he had yet to see because this originary moment of inspiration exemplifies a visionary capacity essential to art and invention that has animated his work in both fields. As we shall see, these aspects of Kroitor’s work cannot be thought in isolation: his work beyond the frame of documentary convention has enabled him to engender new modes of vision and documentary experience.
Kroitor, Unit B, and the Griersonian Tradition

Inspired as he was by his vision of Deren’s defiance of the conventions of cinema, Kroitor found a nurturing home in the National Film Board’s Unit B. One of a varying number of units responsible for production at the Film Board between 1950 and the abolishment of the unit system in 1964, Unit B was originally established to produce sponsored, scientific, cultural, and animated films in accordance with NFB standards. Like the other production units, Unit B had its own staff of writers, producers, and directors, but under executive producer Tom Daly this staff was granted an atypical fluidity in roles from production to production. “People did different things at different times”, notes Kroitor in a personal interview I conducted at his home in Arundel, Québec, and an individual’s involvement in a particular project in this or that capacity had a great deal to do with personal interest (2011). As Daly describes the system in D. B. Jones’ history of the Film Board, Movies and Memoranda, “Each person, confident of his ability in one or two areas, would recognize his lacks in other areas” (1981: 71). There was, as Kroitor notes, a culture of collaboration and idea-sharing within the Unit that resulted in him talking film “day and night” with such colleagues as Daly, Stanley Jackson, Wolf Koenig, and Colin Low (2011). As Daly maintains, “Each person had a sense that his own fulfillment could not be fully achieved on his own, but only in connection with a project to which he and others contributed where they could” (quoted in Jones 1981: 71). Not surprisingly, the Unit quickly became a hotbed of creative exploration in which the stolid and unremarkable professionalism typical of most other Units’ film production at the Board was subordinated, in Jones’ estimation, “to a different value, aesthetic quality” (61).
Of course, the organizational model of Unit B presents a problem for a work of analysis such as this, which seeks, to some extent, to situate an individual’s unique contribution to film culture. The paradox that any analyst of Unit B’s cinema must confront resides in how the number of personalities contributing to a project makes it all the more difficult to grasp the origins and intentions of that project. As Peter Harcourt notes in a very early profile of Daly, Kroitor, Koenig, and Low’s work, “these films are so thoroughly the product of a group that the names do not matter” (1977: 72). “Although”, Harcourt concedes, “as one grows closer to the films and comes to know them better, one can detect the personal contributions of the individual men” (72). This thesis does not intend to identify and celebrate what others might take for the triumph of individual initiative over established institutional practices. Nor does it seek to deny the existence of individual flourishes and styles within a more general regime of generic qualities. If anything, the collaborative environment within Unit B is what facilitated the flowering of any individualism or authorial expression that one might speak of. Kroitor is something of a special case within this culture because the apparently individual qualities of his cinema would later come to characterize the work of a long and immensely varied career. But if Kroitor’s lifework is motivated by consistent preoccupations, these preoccupations first emerged at a time when the Unit B was collectively articulating a coherent style of its own.

Both Kroitor’s style and the more general aesthetics of the Unit B’s work represented a major departure from the documentary model prescribed by the godfather of the genre,

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3 As, for example, John Grierson conceptualized the rise of the great animator Norman McLaren at the Film Board. As Knelman observes, McLaren was, for Grierson, an exception—the one “artist” that the director kept on staff (1977).
John Grierson, and normalized at the NFB during Grierson’s tenure as its first Director. While working as the founding Director of Britain’s Empire Marketing Board and General Post Office Film Units, Grierson infamously came to define the genre as “the creative treatment of actuality” (1933: 8). The emerging genre was, for Grierson in his “First Principles of Documentary”, of a higher order than such pedestrian forms of non-fiction as the newsreel and the lecture film. In the thinker’s lofty opinion, these other modes simply “do not dramatize, they do not even dramatize an episode: they describe, and even expose, but in any aesthetic sense, only rarely reveal” (1966: 146). But with documentary, writes Grierson, “we pass from the plain (or fancy) descriptions of natural material, to arrangements, rearrangements, and creative shapings of it” (146). Documentary proper does not, in Grierson’s view, simply describe the natural material that the filmmaker chooses to observe—it creatively shapes that natural material towards new ends. Accordingly, he had little time for the city symphony films that were en vogue when he was writing. In Grierson’s view, they failed to “apply ends to their observation and their movements” (151).

Essential to Grierson’s distinction between documentary and lower-order non-fiction is his belief that “creation indicates not the making of things but the making of virtues” (150). With his earlier training in the social science and psychology of propaganda, Grierson came to view documentary cinema as a preeminent means of mass enlightenment and engagement. While he firmly believed in the “art” of documentary, he conceived of this art as “the by-product of a job of work done” (151), the documentary’s facilitation of “alliance in spirit” (241), or, in the essay, “The Course of Realism”, “a revitalized citizenship” (1996: 

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4 Many historians maintain that it was Grierson who first used the term “documentary” in a 1926 review of Robert Flaherty’s *Moana*, though Carl Plantinga has shown that variations on the term were circulating in France as early as 1914 (1997: 26). Nevertheless, Grierson’s writings on the unique qualities of documentary cinema and its relation to the real world have had a profound effect on the history of the genre.
202). Above mere aesthetics, Grierson prioritized the “art of propaganda”, which for him lay in “the ultimate truth that truth will ultimately conquer” (1966: 244). Thus, he championed a realist mode of documentary grounded in coherent and authoritative argumentation.

While Grierson implemented many of his ideas with his 1929 film, *Drifters*, it was during his appointment as the Film Commissioner of Canada and first Director of the National Film Board that he was able to see his ideas actualized as an aesthetico-social movement. Between the war years of 1939 and 1944, Grierson led such filmmakers as Stuart Legg and Daly as they perfected such techniques as the authoritative off-screen narration, or, “voice of God” that typifies the Griersonian documentary in theorist of the genre, Bill Nichols’ estimation (1983:17). As R. Bruce Elder notes, the other characteristics of the NFB documentary that were perfected during this time included rapid cutting and “a close alliance of image and text” (1989: 95). It was during this period that the Film Board produced such exemplary works of wartime propaganda as Legg’s *Canada Carries On* and *The World in Action* series. But in addition to Canada’s pressing need for propaganda during the war, the sheer size and geographic and cultural diversity of the country made it the perfect locale for the Griersonian documentary with “alliance in spirit” as its objective. As Grierson noted at the time, “A medium which tries to explain the shape of events and create loyalties in relation to the developing scene is welcome [in Canada]” (1996: 248). Accordingly, the production of Griersonian work continued after his five-year stint as the Director of the NFB, and the style came to typify documentary production at the NFB until its spell was broken with Unit B’s more inventive pictures.

In contrast to the Griersonian documentary ideal, Unit B’s work in the genre repeatedly achieves an effect that is markedly less authoritative in tone. In fact, Unit B
documentaries do a number of things to undercut the rhetorical heft of their predecessors. Whereas the Griersonian documentary presented facts in Lorne Greene’s “voice of God”, Unit B documentaries are typically structured around the “unassuming commentary” of Stanley Jackson (Leach 2011: 35), which one can hear in the films of the Candid Eye series produced for broadcast by the CBC between 1958 and 1961. Whereas the Griersonian documentary sought to communicate the broad relevance and significance of big stories, Unit B films are characterized by an “emphasis on marginal groups and unusual practices seen with an ironic or detached but not sensationalistic eye” (Nichols 1991: 22), such as one sees in Kroitor’s Paul Tomkowicz: Street-railway Switchman (1952). Whereas the Griersonian documentary’s use of tight scripting, archival footage, and inter-titles allowed it to address its subject from a controlled distance, many have noted how the Unit B’s eschewal of rigorous scripting and their utilization of newly developed light-weight cameras enabled a more engaging closeness to their subjects. And finally, whereas the Griersonian documentary aimed for a seamless presentation of an idea or ideal, Unit B pictures like The Living Machine (1958) and Lonely Boy (1961) are shaped by a proclivity for disruptively acknowledging the cinematic technology and practices that make an image possible (Harcourt 1977).

One might conceptualize this transition from the Griersonian documentary to the sort of work produced by Unit B as representing a passage from what documentary theorist Bill Nichols has labeled the expository mode of address to a peculiar mixture of modes he terms observational, participatory, and reflexive (2010). As Nichols notes in an earlier effort to explain this group of concepts, “Modes are something like genres, but instead of coexisting as different types of imaginary worlds […], modes represent different concepts of historical
representation” (1991: 23). They are, in a sense, the means by which a documentary presents its message, its manner of addressing itself to the thinking spectator. In Nichols’ view, the expository mode that emerged from the direct-address of the Griersonian tradition “was the first thoroughly worked-out mode of documentary” (1991: 17). Its principle quality, as the theorist notes, is that it pursues rhetorical ends above any and all aesthetic concerns (2010: 167). Its goal is to convince its audience of something, so it is assembled with cogency in mind. In contrast, the modes one finds combined in Unit B’s documentary work need not have argument in mind. In its efforts to minimize the signs of the documentarian’s overt intervention in the action that unfurls in front of the camera, the observational mode dispenses with the typical authority of the expository mode (2010: 172-179). By directly engaging with its subject, the participatory mode subordinates objectivity to the emerging relationship between the filmmaker and subject (2010: 179-194). And by calling attention to the technologies and techniques that make or unmake the documentary, films made in the reflexive mode demonstrate the constructed nature of the documentary as a representation (2010: 194-199). In the cinema of the Unit B, these modes of address are combined to facilitate wholly original perspectives on a variety of subjects.

There are various reasons why the Unit B documentary, with its observational, interactive, and reflexive qualities, would supplant the more Griersonian fare of the NFB at the time that it did. As Jones notes in his thorough history of the Film Board, there was a considerable recalibration of production standards and practices at the Board after a period of instability following Grierson’s departure in 1944 and the end of the Second World War (1981: 45-58). As a result of Conservative Member of Parliament, G. K. Fraser’s recriminations, the Board was subjected to three governmental investigations addressing
waste, purpose, and loyalty to the government of Canada (52). “And yet,” notes Jones, “as dire a future as these three investigations seemed to forbode, they turned out to be the Film Board’s salvation” (53). As it turns out, the three investigations led to legislation constituting a new film Act that improved working conditions and permitted a degree of creative freedom at the board (57). Before the publication of the 1950 Act, writes Jones, the Film Board’s commitment to Grierson’s propagandistic requirements tended to result in work that failed to live up to Grierson’s definition of documentary as “the creative treatment of actuality” (59). On the one hand, writes Jones, it “did not probe deeply into its subject” (59). On the other, “The ‘creative’ side was not highly developed, either” (59). With their emancipation from the erstwhile standards of a Film Board established under Grierson, filmmakers at the institution had some opportunity to begin cultivating their craft.

More generally, one might infer that the Unit B documentary capitalized on and exemplifies anxieties that were circulating during the era around realism and the extent to which the style functioned to legitimize a reality that was actually quite unpleasant for many people. As Jim Leach notes, film culture’s earlier faith in realism was so rocked in the 1950s by French critics’ embrace and popularization of Bertolt Brecht and Louis Althusser’s critiques of the style’s “function as a vehicle for the dominant ideology”, that there was nothing to do but turn the realist conventions of pre-war and wartime cinema on their head (2011: 33). At the forefront of a global blossoming of similarly over-determined documentary movements, the Unit B filmmakers “not only rejected the authoritarian structures of the Griersonian tradition”, in Leach’s view, “but also responded to the emerging concerns about the ideological implications of realism” (34). Their work is a “creative treatment of actuality” that refuses to accept the a priori coherency of that actuality.
Unit B, Direct Cinema, and Vérité

With its characteristic self-awareness, unscripted feeling, and fascination with the everyday, Unit B’s work represents a pioneering first step in two closely related documentary movements that would crystallize in the following years. With obvious connections to Dziga Vertov, Elizaveta Svilova, and Mikhail Kaufman’s work with the Kino-Pravda newsreels in 1920s, direct cinema and cinéma vérité emerged during the late 1950s and early 1960s alongside the abovementioned critiques of realist ideology. As Elder notes, the aesthetics of these movements rested “upon the tensions that could be developed in the dialectic between artifice and nature and, more particularly, between fiction and reality” (103). While typically viewed from the present as something of a coherent and cohesive movement, the movement actually consisted of a number of divergent factions with many names and differences in opinion at the time of its inception. Nevertheless, these works are united by an important philosophy that distinguished their work from the rhetorical documentary of the Griersonian tradition: if there is a truth, it is not pregiven. “To the exponents of [these movements]”, writes M. Ali Issari and Doris A. Paul, “‘truth’ is interpreted as meaning that part of reality which is captured by the film-maker [sic] at the time he or she is making the film” (1979: 6).

As nearly every commentator on the direct cinema and vérité movements notes, the enactment of this belief was made possible by new camera and synchronous sound technology, which emancipated filmmakers from the bulky 35mm cameras of old. In fact, Bill Nichols notes that the availability of portable synchronous sound recording is what allowed observational and participatory documentaries to supplant the dominance of the

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5 As Issari and Paul note, the styles of documentary being discussed have been alternately labeled, “cinema-vérité”, “living camera”, “direct cinema”, “mobile camera”, “realistic camera”, “film inquiry”, “synchronous cinema”, “cinema of common sense”, “cinema of behaviour”, “personal documentary”, “tele-verite”, “film journalism”, “truth film”, “direct shooting”, “candid-eye”, and “free cinema” (1979: 6-7)
expository mode. But as Michael Rabiger notes, supposedly realist documentarians’ use of the earlier equipment paradoxically required that many events be staged (2004: 27).

Working with lightweight 16mm cameras such as the Auricon and more affordable 16mm film stock meant that a filmmaker did not need to rigorously prescript, plan, or stage the profilmic events of his or her productions. By facilitating greater mobility, the lightweight cameras enabled a correlative increase in the filmmaker’s physical access to his or her subject. Because it allowed the filmmaker to shoot more footage, the inexpensive stock enabled a correlative increase in the potential that the total footage would reveal something noteworthy. The documentary filmmaker was finally free to film the world unencumbered by the technologies of the craft, but it is how a filmmaker chose to utilize this freedom that determines the resultant work’s status as direct cinema or cinéma vérité.

The extent to which the filmmaker acknowledges his or her place in an image of reality is the principal criterion that distinguishes direct cinema from vérité. With the former, the freedom that comes with the use of lightweight equipment is mobilized to minimize the filmmakers’ presence while shooting so that he or she might obtain a surfeit of unselfconscious footage. With the latter, this freedom is mobilized in the opposite direction: to enable the filmmaker’s intervention in the events being documented. As Erik Barnouw humorously notes in his paradigmatic history of documentary filmmaking, “The direct cinema documentarist took his camera to a situation of tension and waited hopefully for a crisis; […] cinéma vérité tried to precipitate one” (1983: 245-255). That said, Elder is quick to point out that the Unit B documentary differs from the otherwise similar documentary work of American directors in that it does not adopt a crisis structure in the name of dramatic form (104-109). As Elder argues, the considerable influence of Henri-Cartier Bresson’s
photojournalism led the Unit B filmmakers to pursue structures that evolved organically from one patiently selecting the “decisive moments” from quotidian events (113). What matters in Barnouw’s distinction between direct cinema and vérité is where and how each purports to access its subject. While “Direct cinema found its truth in events available to the camera”, writes Barnouw, “Cinéma vérité was committed to a paradox: that artificial circumstances could bring hidden truth to the surface” (255). In essence, the distinction rests on the respective movements’ different investments in realism and reflexivity.

As Michael Rabiger maintains, the difference in direct and vérité styles developed as the documentary evolved on both sides of the Atlantic Ocean (29). In North America, he writes, such filmmakers as the Maysles brothers and Fred Wiseman cultivated a style that “kept their intrusion on participants down to a minimum” (29). In France, he notes, the opposite impulse was inspired by the work of the interventionist ethnographer Jean Rouch (29). “As the story goes,” writes Charlie Michael,

the American “direct cinema” […] strives to capture events without allowing the presence of the camera or the filmmakers to “distort the situation”… of real events on-screen. Conversely, the French cinema-vérité of Jean Rouch and Edgar Morin, first exemplified by Chronique d’un été, confronts the invasive nature of the new equipment by actively signaling its presence on-screen with the filmmakers and their subjects (2004: 32-33).

But at the National Film Board of Canada, where both English and French filmmakers were hard at work, the two styles developed concurrently. Ultimately, it is this concurrence that characterizes Kroitor’s cinema.

As David Clandfield has argued, the practical differences between direct cinema and vérité correspond perfectly with the difference in styles between the more radical French Unit at the Film Board and Unit B (1978). While the Candid Eye films are characterized by a “dispassionate empiricism” in Clandfield’s view, the French Unit’s films—which he labels
“cinéma-direct”—are characterized by the tension between such empiricism and the
“impassioned’ involvement of the filmmaker in his pro-filmic material” (50). “For the
Candid-Eye filmmakers,” writes the critic, “the subject of the film was its subject-matter
rooted in objective reality” (52). “For the cinéma-direct filmmaker,” he notes, “the point of
departure is the filmmaking process in which the filmmaker is deeply implicated as a
consciousness, individual or collective” (52). Thus, Clandfield’s is a distinction between
what others would have labeled an English direct cinema and a Quebecois vérité.

While I do not mean to infer that films of Unit B enact or embody a commitment to
social justice on par with the more radical documentaries made around the same time by the
French Unit or later with the Challenge for Change series, their strategies do represent an
early blow to the ethos expressed in Grierson’s paternalistic belief that the “truth will
ultimately conquer” and his films’ easy realism. In fact, a sense of ambiguity or
unresolvedness pervades many of Unit B’s finest works. “There is in all these films a quality
of suspended judgment”, suggests Harcourt, “of something left open at the end, of something
undecided” (72). And, as Leach notes, the failure of these films “to uncover an underlying
and unifying reality […] raised questions about the national-realist project” that had
previously guided the Film Board under Grierson’s influence (35).

Beyond this, Clandfield seems to overlook the ways in which Unit B’s cinema does
engage with its subject. In his view, the participatory documentary of the French Unit is
wholly dissimilar from the observational documentary of the Unit B. But in many of
Kroitor’s films, the filmmaker is heard asking questions or issuing directions to his subjects.
In fact, reflexive disruptions of the film are a key feature of the Unit B documentary during
the years of innovation being discussed. In this respect, Unit B’s documentary represents a
commingling of the impulses that would come to characterize the American direct cinema we associate with such filmmakers as D. A. Pennebaker on the one hand and the French vérité we associate with such filmmakers as Jean Rouch on the other.

The difference between intervention of this sort seen in Unit B’s cinema and the more immediately social intervention that characterizes the French Unit’s cinema is that it takes place at the level of the medium itself. The Unit B documentary’s engagement with the world proceeds through the very means of documentation at their disposal by a self-conscious negation of the authoritative character of the Griersonian documentary and the dramatic form that would come to characterize American direct cinema. In his role as a key contributor to Unit B productions, it was Kroitor who helped to develop this influential style with films that sought to cultivate a tension between the real and its representation. His cinema is simultaneously realist and reflexive.

The Info-Immersive Cinema of Roman Kroitor

In Kroitor’s documentaries there is a characteristic fascination with the quotidian activities of the films’ subjects. In Farm Calendar (1955) and Paul Tomkowicz (1952) the filmmaker represents the everyday labour of an Ontario family farm and a man who keeps Winnipeg’s streetcar rails clean at night. With the Glenn Gould pictures (1959), Festival in Puerto Rico (1961), Lonely Boy (1961), and Stravinsky (1965) Kroitor captures iconic public performers enjoying periods of rest and relaxation or rehearsing backstage. In each of these films, there is great focus on the business of travelling to, or preparing for performances. In Glenn Gould: On the Record, the great pianist jokes with a cab driver en route to a recording session. In Festival in Puerto Rico, the contralto, Maureen Forrester, travels with her family
to the Casals Music Festival. As she prepares for her performance, the film crew perambulates the island territory in a tiny car. In their respective profiles, Paul Anka, and Stravinsky are both shown in humble states of transit. Even when Gould, Forrester, or Anka are seen on stage, Kroitor typically diverts his focus to the audience and the comparatively less noteworthy activity of spectatorship.

When Kroitor interviews the subjects of his films, the conversations often unfurl naturally—as if they were taking place without the presence of cameras. In those cases where interviews are with an authority or expert, the individual is often posed quite casually or situated in notably nonprofessional or avocational contexts, such as when the M.I.T. mathematician Warren McCulloch is interviewed in *The Living Machine* (1961) at his summer cottage without a shirt on, or when Stravinsky is interviewed on an ocean liner with his wife. These examples reveal a fascination with the everyday that is felt throughout the films that comprise Kroitor’s lifework.

Many of Kroitor’s films are notable for their rejection of dramatic form and expectation. Films like *Paul Tomkowicz* and *Lonely Boy* offer little in the way of the revelation or conflict that characterizes most mainstream cinema. The first reel of *The Living Machine* is noteworthy because it comes the closest of any of Kroitor’s films to representing conflict of the sort that characterizes other fare. In the film, a checkers master named Arthur Gladstone squares off against an IBM computer that has been programmed to play the game. The film intercuts moments in this match with more expository sequences about the growing presence of computers in our everyday life. As the match heats up and Gladstone begins to fret about the possibility that the computer will win, Kroitor cuts to a science-fiction aficionado who speaks of certain works in the genre that cast artificial intelligence as
something to fear. In the end, Gladstone is able to beat the computer by resorting to more unconventional moves, but the viewer is denied the satisfactions that tend to follow victory in representations of sport or combat scenarios such as this. In place of these satisfactions is a “post-mortem” during which Gladstone and the computer’s programmer discuss the match. The visibly embarrassed programmer contends that a computer programmed to take longer would surely beat Gladstone, but the checkers master finds this improbable. The programmer insists that that the computer would at least play Gladstone to a draw, but Gladstone doesn’t acknowledge the remark, and the programmer is forced to repeat it. With the inclusion of this dreadfully awkward loss of face, the combat narrative of the checkers match is folded back on itself as if to punish those who seek pleasure in the representation of combat narratives.

When Kroitor’s films do follow something like a narrative arc, it is typically in the form of a journey or outing, such as the abovementioned musicians’ travels to and from concerts, or the animated voyage to the stars and back in *Universe* (1960). But Kroitor and his travelers rarely return from these journeys with conclusive documentary evidence of a notable discovery. What, for example, is the viewer to make of *Lonely Boy*’s ending, in which a despondent Anka is seen dozing off in the passenger seat en route to his next gig so that he can begin again the rigmarole depicted earlier? In a similar move, the weather film Kroitor co-directed with Hugh O’Connor, *Above the Horizon* (1964), concludes a final sequence about scientific attempts to control the weather with a long shot through the rain-soaked windshield of a car racing down the highway. In both cases, a sense of pointlessness—the “quality of suspended judgment” that constitutes the special significance of Unit B’s cinema for Peter Harcourt—is perhaps the only point available to grasp.
Finally, Kroitor’s films represent the abovementioned content in a manner that is often self-reflexive and deeply ironic. In many of the documentarian’s films, frequent reference is made to the business of observation and the ways in which it is inflected by the cinematic apparatus. In *Paul Tomkowicz*, for example, the titular railway switchman is shot doing his work through a department store window flanked by two mannequins. Insofar as the mannequins “observe” Tomkowicz, they function in the shot as representations of the spectators watching the film. Accompanying these analogues, a third mannequin—or, its disembodied head—sits on a plinth in the centre of the shot. Like the other mannequins, it faces the street, but the shot is composed such that this third mannequin’s reflected face, clearly visible in the shop window, appears to be looking into the camera. So, in addition to the representations of the observing spectator, the shot contains a more abstracted analogue of the observing spectator observing itself. In almost countless other films by Kroitor there are images of people looking or attempting to document that which they observe with cameras. The fans and members of the press hoping to capture images of Anka and Forrester are obvious examples, but the astronomers at the Dunlop Observatory in *Universe* must also peer through a lens to view the cosmos. In the next chapter the reader will learn how the act of observation and its technologies are reflexively acknowledged by the IMAX apparatus.

In addition to the many steps it takes to call attention to the apparatus of cinema, Kroitor’s film work is replete with ironic disruptions that undermine the typical verisimilitude of the realist documentary. Most famous in this respect is the kiss between Paul Anka and the owner of the Copacabana in *Lonely Boy*. After the exchange of a gift, Anka and the club owner share a kiss. But the camera is jostled in the filming of the interaction, so Kroitor – who remains off screen – asks if they could repeat it. Both Anka
and the club owner burst out laughing before obliging with a second kiss. It is a remarkable break in the fabric of the film, but it is not the only instance like this in the film. Earlier, the Copa’s owner interrupts an interview to ask the filmmakers if they would prefer if waiters were walking around giving the impression of a bustling nightclub. In Stravinsky, the subject’s desire for verisimilitude is given a sardonic edge when the composer and his friend, Nicholas Nabakov, acknowledge a sound recorder and note that they should remain on their best behaviour (in fact, they end up consuming a great deal of drink in the scene that follows). In The Living Machine a second interview with McCulloch at his summer cottage is interrupted when the mathematician responds angrily to an intrusive sound that Kroitor is producing off camera. “Don’t squeak the table,” he snaps while glaring into the camera, which holds on a frown that slowly twists into a malevolently confident smirk. In Harcourt’s opinion, “This is a moment of great embarrassment in the cinema, as if the filmmakers were no longer in control and no longer knew what to do” (69). But Harcourt also proclaims that this interaction is “a moment of greatness in the cinema” (69). For with this shot, which follows an unresolved debate between the two men, the filmmaker “has been faced with an ultimate – the relativity of the values of his own existence – and, confronted by the explanations, can find nothing more to say” (69). In this respect, the moment represents an affront to the supposed authority of the Griersonian documentary, the filmmaker’s supposed capacity to effectively represent the world seen through the camera’s lens. In a similar fashion, the aforementioned scene in Stravinsky ends with the imbibed composer insisting that the filmmakers are “too diligent!” By keeping moments like this in the films, indeed, by building films around these moments, Kroitor calls attention to documentarians’ often-invisible contributions to the articulation of their cinema. In his view of the practice,
The filmmaker is perfectly honest about being there, being part of what is going on, and feeling that the audience is going to feel that the whole thing is of interest, is of more interest than just say, “here’s Anka kissing so-and-so.” But the moment somebody is there, saying, “We’re filming this and we want you to do this again, etc. etc.”, it breaks boundaries (2011).

It is an attitude that recalls Barnouw’s suggestion that the emergence of cinéma vérité was characterized by a belief that “artificial circumstances could bring hidden truth to the surface” (255), though one can see that Kroitor does not use the word truth. In his opinion, what is interesting about interventions of the sort described above is how they help to communicate the filmmaker’s “relationship to the situation” (2011).

It is also important to note Kroitor’s concern for the audience’s interest, which he expresses in the block quotation above. The problem with analyses that focus on the abovementioned ways in which Unit B and Kroitor’s documentary work represents an explicit challenge to the expository realism of the Griersonian documentary is precisely the extent to which they cast the achievements of this cinema in negative terms as a reaction to something else. The argument and its manifestation in mild, medium, and more piquant forms should be familiar to any analyst of Unit B’s cinema. As Clandfield argues, Kroitor and Unit B’s cinema “registers surface impressions of a myth-laden aspect of Canadian life, in order to de-mythicize and de-dramatize it” (1978: 26). As Barry Keith Grant suggests, “a close reading of Lonely Boy reveals that the film expresses a more cynical view of Anka’s cultural meaning” (2003: 49). And finally, consider the American practitioner of direct cinema, Richard Leacock’s rejection of Lonely Boy for how “it ridicules Anka at his own expense” (quoted in Brightman 1964: 12). While I do not necessarily mean to refute these conclusions, analyses that posit such ends fail to acknowledge how the moments of negation in Kroitor’s work as part of a larger project resulting in an info-immersive documentary
cinema that anticipates the filmmaker’s later work in IMAX and software design for stereoscopic animation. That is to say, Kroitor’s filmmaking results not or not merely in a disembodily reflexive intellectual cinema, but rather in a cinema that is equally engaging for how it encourages its spectators to become immersed in what is seen and heard. In this respect, it exploits the more engaging capacities of the observational documentary mode, which in Nichols’ estimation, “calls on the viewer to take a more active role in determining the significance of what is said and done” (2010: 174). But with its participatory and reflexive elements, Kroitor’s cinema more closely approximates a phenomenon that Gene Youngblood has labeled “synaesthetic cinema” (1970). As Youngblood argues, synaesthet cinema is a product of the aesthetic assault on conventional film language that accompanied a decentralization of technology and individualization of communication channels in the years before he wrote his prophetic tome (42).

It is not fiction [he writes,] because, with a few exceptions, it is based wholly on unstylized reality. It is not documentary because the reality is not organized into an explanation of itself. And it is not cinéma-vérité because the artist shoots and manipulates his unstylized reality in such a way that the result has style (107).

Synaesthetic cinema differs from these erstwhile modalities in its purpose, which Youngblood writes of in terms of evocation and the creation of an experience as opposed to exposition, which tells one something (92-93). While Kroitor’s cinema retains an unmistakable documentary investment in the information of the world as such, its immersive strategies locate it on a threshold between cinéma vérité and synaesthetic cinema. In what follows, the above-analyzed qualities of Kroitor’s documentary work with Unit B will be reconsidered for the ways in which these qualities function to actively involve the spectator in the films’ elucidation of their subjects.
In Kroitor’s cinema the representation of his subjects’ engagement in quotidian and commonplace activities makes it easy for the audience to identify with these subjects. Enabled by the lightweight cameras and sound equipment of the era, Kroitor’s documentaries maneuver themselves into vehicles and crowds to achieve a hitherto impossible proximity with their subjects. But even before the advent of this technology, during the shooting of *Paul Tomkowicz*, the filmmaker achieves this effect quite masterfully. After an opening shot of a streetcar travelling towards the camera, Kroitor cuts to a position amongst the eponymous railway switchman and the other passengers inside the streetcar. While the cumbersome camera on its tripod cannot supply a steady image inside the moving streetcar, the shaky image captures something of the physical experience of the ride and puts the spectator in the place of the passengers on-screen.

In the crowded environment of the streetcar, the shots of Tomkowicz and the cutaways to the streetcar driver and other passengers mimic the perspective of an inquisitive passenger. As Laura Mulvey has shown, shots that assume a character’s point of view play a key role in facilitating the spectator’s identification with the character, narrative, or ideology of a text (1989: 25). In this case, the camera’s function as a member of nameless crowd allows the spectator to enter the text without assuming the attitudes or identity of a particular character. Throughout Kroitor’s work one finds similar sequences and shots—in which a nonaligned camera captures glimpses of people around the action to simply establish that this action takes place within a social context full of things to look at. In this way, his cinema presents an imagery that caters perfectly to a mode of “reception in a state of distraction” that Walter Benjamin maintains is normalized by the popularization of technologies like cinema, which facilitate a proliferation of images as never before (1968: 240). And as Youngblood
notes, “Synaesthetic cinema is the only aesthetic language suited to the post-industrial, post-literate, man-made environment with its multidimensional simulsensory network of information sources” (77).

With its characteristic rejection of dramatic form, Kroitor’s cinema mirrors the meandering and unencumbered tendencies of its camera work. In more pedagogical films such as *Universe*, *The Living Machine*, and his weather picture, *Above the Horizon* (1964), documentary focus jumps from subject to subject with little respect for cohesion, and yet the films do not seem erratic in the slightest. This is the organic structure that Elder suggests comes from the influence of Cartier-Bresson, but it is equally a feature of Youngblood’s synaesthetic cinema. As Youngblood argues, synaesthetic cinema “models itself after the patterns of nature rather than attempting to ‘explain’ or conform nature in terms of its own structure” (76). Thus, I would argue that the trips and journeys that loosely structure many of Kroitor’s films might be theorized apropos of the act of migration. For like an animal’s regular relocation, the journeys undertaken by the working musicians in Kroitor’s films are little more than the consequence of these people’s identity as musicians—individuals committed to a particular “species” of profession. By allowing the structure of his films to be shaped by the banality of the musician’s workaday world, Kroitor gets near to the nature of creative work in a way that few others have.

Finally, even the reflexive tendencies of Kroitor’s cinema sometimes function to engage or immerse the spectator. In contrast to the disruptive function of the reflexivity that one finds in the work of a filmmaker such as Jean-Luc Godard, one is rarely disturbed when individuals are shown engaged in the business of looking in Kroitor’s films, or when the operation of film technology analogizes the activity that resulted in the representation one
sees. In fact, images of this sort in Kroitor’s work perform the double function of the mise en abyme—at once deconstructing the image’s function as a representation of reality and paradoxically enticing the viewer into the image and film with a sequence of embeddings that allude to deeper meanings (even if one of these meanings is the film’s awareness of itself as representation). In this respect, Kroitor’s work on Colin Low’s City of Gold (1957) is especially instructive. In addition to co-writing the film with Pierre Berton, Kroitor was essential to the development of the tracking system that enabled the elegiac camera movements across the stunning archival images of the Yukon gold rush. While the cinematographic images of the photographs do not feature the reflexive embeddings or framings that one sees in Lonely Boy or Festival in Puerto Rico, they simultaneously analogize and enact the activity of reminiscence that motivates this historical portrait of Berton’s hometown. The images in the old glass prints are made alluring by the movement of the camera in a way that was not possible before Kroitor invented the technology necessary to produce this effect. As the reader will learn, this early innovation anticipates the budding inventor’s innovative work in the development of IMAX’s large-format cinema and a software platform for stereoscopic 3D animation in real space.

Ultimately, I conclude this chapter with the suggestion that the documentary cinema that Roman Kroitor produced in the National Film Board’s Unit B is noteworthy for how it subordinates the observational, participatory, and reflexive tendencies associated with Unit B’s work to a larger interest in the possibilities of spectatorial immersion in an informational cinema. If the extent of this latter quality does not seem readily apparent to those readers without immediate access to many of these films, I hope to make this clear through analysis of the subsequent phases in the man’s career in the subsequent chapters of this thesis. For if
one can say that Kroitor rails with his early documentary work against the authoritative framing of the Griersonian documentary, this rejection of the frame is self-evident in his work developing and producing for IMAX. And if one can say that Kroitor’s documentary functions to entice the viewer into its film worlds, this is obvious in the films that have resulted from his work developing the stereoscopic animation software platform, SANDDE. In the next two chapters this work is considered in terms of its relation to the first phase in Kroitor’s career when he worked principally as a film documentarian. As the reader will learn, an interest in the creative possibilities of the info-immersive or synaesthetic structures the whole of his long and varied career.
Chapter 2

*Labyrinth* and IMAX

In this chapter, I show that Roman Kroitor’s involvement in the development of multi-screen cinema and the influential IMAX format follows logically from his documentary work at the National Film Board’s Unit B. With its mobile camera, synchronized live sound, and cavalier disregard for rhetoric, the documentary cinema Kroitor produced for the Board facilitates an immersive engagement with its subjects in a way that distinguishes it from earlier documentary cinema. As we saw in the previous chapter, Kroitor’s early filmmaking involved a disavowal of the conventions that previously framed the genre that John Grierson famously labeled “the creative treatment of actuality.” Kroitor’s documentaries from this period conjoined realist and reflexive qualities in order to facilitate informational and immersive encounters for their subjects. And yet, this work remains invariably bounded by the architectonic conditions of cinema as such—with the spectator seated squarely in front of a silver screen with discernible limits. With his experiments in multi-screen and his co-development of the massive IMAX format, Kroitor emancipated his spectators from cinema as it was previously defined. In so doing, he helped to pioneer an info-immersive modality that is truly unbounded by the cinematic frame.

Through reference to Allison Whitney’s earlier work on the subject (1999 & 2005), this chapter offers a history and theory of IMAX’s early development and its major innovations. In the following pages, the reader will learn that the increasingly popular IMAX format did not emerge out of thin air as a fully articulated innovation. Rather, the format will be situated in relation to a long history of experiments in multi-screen cinema from Abel Gance to *Labyrinth*, a project produced for Expo ’67 in Montreal by Kroitor and other Unit
B filmmakers. Through an explication of the innovations that characterize the OMNIMAX and IMAX 3D formats, the reader will learn how IMAX’s developers have continued to experiment with the technology in order to produce increasingly immersive experiences. It will be argued that the qualities and aesthetics of the IMAX format are closely related to the aesthetics and concerns expressed in Kroitor’s earlier work in documentary filmmaking at the NFB’s Unit B. Ultimately, the connection between these two periods in Kroitor’s lifework will help us to understand the innovator’s more recent work in the development of stereoscopic 3D animation and drawing software.

**Before *Labyrinthe***

The variously ironic and immersive techniques that characterized Kroitor’s earlier assault on the realist and rhetorical documentary of Grierson’s day were first developed in the context of a multi-screen project at the Canadian National Exhibition in Toronto in 1963. As Kroitor explains, the project came to be when the CNE offered an empty pavilion to the Film Board in advance of that year’s summer (2011). Having just come off the success of *Universe*, *Festival in Puerto Rico*, and *Lonely Boy*, Kroitor leapt at the opportunity, which would require him to compile a filmic survey of the Film Board’s prior work apropos of its relevance to the nation that the cultural institution exists to serve (2011). To meet this need, Kroitor conceived of a semi-circle of thirteen screens grouped into four clusters of three (with the last screen at the centre of the arc) displaying material culled from the Film Board’s archives. While the footage was arranged thematically, Kroitor maintains that each and every sequence was chosen for its capacity to stand on its own without the sort of energetic or metaphorical connections one typically finds between shots in single-screen cinema.
In this respect, the apparatus enabled the sort of wandering eye that characterizes Kroitor’s single-screen documentary. A spectator could alternately look at a single screen, the relationships between images in a cluster of three screens, and the “image of the country in all its varied aspects” represented by the panoply of all thirteen screens (Kroitor 2011). Because the thirteen projectors were rigged to loop asynchronously with material of different durations, the project represented something of an affront to the various expectations that structure our encounters with narrative cinema. As Allison Whitney suggests, “The fact that a visitor might see an entirely different show every time he or she entered the pavilion underlined the potential power of multiscreen cinema to create complex and variable connections between diverse images” (1999: 24).

While Kroitor’s CNE project was an important step towards his fuller development of the immersive potential of multi-screen cinema with *Labyrinthe*, it was not the first experiment with technology and techniques of this sort. In fact, the French filmmaker, Abel Gance’s 1927 epic, *Napoléon*, was originally presented with a panoramic climax sequence that was shot with three synchronized cameras and projected in a similar tripartite manner. As Nelly Kaplan recalls, Gance believed that the resulting effect, which he dubbed “Polyvision” for the multiple-image it facilitated, would “prompt a revolution in our way of seeing” (1994: 42). What Gance had in mind was an enlivening cinema, one that would enable more participatory viewing practices. Thus, Whitney quotes a letter in which Gance writes of a cinema that would put spectators in the position of actors (1999: 41). It was, for the filmmaker, a question of immersion. With *Napoléon*, that affect was achieved with the

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6 It is common for film innovators to speak of advancements in the medium contributing to revolutionary advancements in human perception or intellect. Speaking of his work in multi-screen cinema, Kroitor himself suggests that “New kinds of storytelling and new audience tastes will result from this technology […] A new language is going to develop” (quoted in Youngblood: 352).
massive motion picture triptych depicting Bonaparte’s 1797 victory in Italy at the end of the film. As Émile Vuillermoz writes of the effect, “Reality and dreams no longer appear through a tiny casement; a whole wall grows transparent like crystal and opens up another universe” (quoted in Brownlow 1983: 153).

As both Janine Marchessault (2007) and Whitney have demonstrated, multi-screen and large-format presentations were a popular attraction at World Expositions long before Labyrinthe and other projects stunned audiences at Expo ‘67. As Whitney argues, World Fairs are ideal contexts for the presentation of such works because they “offer filmmakers a large and receptive audience primed to consume unusual and innovative forms of technological entertainment” (2005: 17). In Whitney’s estimation the sudden popularity of multi-screen cinema experiments at the World Fairs of the 1960s can be traced to the success of Czech artist Josef Svoboda’s multi-screen presentations at the 1958 World’s Fair in Brussels (1999: 26). In the following year, the influential designers, Ray and Charles Eames presented their seven-screen documentary, Glimpses of the USA (1959) to considerable acclaim at the American National Exhibition in Moscow. And, as Marchessault demonstrates, the project was so well received that it was presented again at the 1964 World’s Fair in New York with an additional seven screens for a total of fourteen (31). Another significant project presented in New York that year was Francis Thompson and Alexander Hammid’s three-screen documentary about the human condition, To Be Alive! (1964), which was produced for the Johnson Wax pavilion at the Fair. As Whitney indicates, the film made such an impression on the NFB filmmakers involved with Labyrinthe, that they consulted with Thompson before beginning work on that project (1999: 27). After the
great success of *To Be Alive!*, Thompson and Hammid returned to the multi-screen format with the six-screen, *We Are Young*, which they produced for the CPR Cominco Pavilion at Expo ‘67. Along with *Labyrinth*, it was one of 40 film projects in Montreal that year, including IMAX co-founder, Graeme Ferguson’s *Polar Life*, which featured eleven screens arranged in an inward-facing circle with the audience on a rotating platform in the centre of the theatre. Clearly, it was an era characterized by a broad fascination with the possibilities of doing cinema differently, of thinking the medium beyond its frame.

**Labyrinth**

Commissioned by the federal government for Canada’s centennial celebrations and Expo ‘67, *Labyrinth* was a three-chamber multi-media experience that made extensive use of multi-screen cinema and large-format film. Inspired by Expo ‘67’s theme of “Man and His World,” the project came to be in a manner similar to Kroitor’s CNE project, when the filmmaker leapt on an external offer to further experiment with the medium (Kroitor 2011). With the CNE project, Kroitor had proven to himself that the stationary spectator could assimilate visual information from as many as thirteen screens. With *Labyrinth*, he combined the spectatorial excitement of multi-screen with an architecture designed by Colin Low that required the visitor to move through the theatre space. As visitors moved from chamber to chamber, they were treated to enigmatic multi-screen presentations of footage that was shot around the world. As Judith Shatoff suggests in her survey of noteworthy works of cinema at Montreal’s Expo ‘67, it was “the most ambitious film project to date” (6).

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7 Thompson and Hammid’s film won an Academy Award for best Documentary Short Subject in 1966.
To address the theme of “Man and His World,” Kroitor and his collaborators, Low and Hugh O’Connor, conceived of a three-chambered pavilion based on the myth of Theseus and the Minotaur, but abstracted as per Northrop Frye’s suggestion in order to foreground the psychological significance of the tale. As Whitney explains, “The creators of Labyrinthe used this story as a metaphor for man’s confrontation of the beast within himself, through which he might be reborn” (1999: 10). In the myth, Theseus descends into the labyrinth to slay the Cretan Minotaur and put an end to its yearly sacrifice of young Athenians. With Labyrinthe, visitors travelled to farthest tip of Montreal’s Old Port, entered a large building built next to Moshe Safdie’s Habitat 67, and progressed through three cinematic chambers via darkened corridors. According to Shatoff, these chambers symbolized childhood and confident youth; conflict, death, and metamorphosis; and rebirth and celebration (6-11). Thus, Labyrinthe enacted or analogized the content of the myth of Theseus and the Minotaur with its architecture and play of light on screen: ingress and enlightenment. And because Labyrinthe’s psychological journey drew on footage that was gathered around the world, the project perfectly embodied the global concern of the Exposition concerned with “Man and His World.” As Kroitor asserts in a National Film Board Technical Bulletin from 1967, the labyrinthine pavilion symbolized “the world” and visitors’ progression through Labyrinthe analogized the “thread of a person’s life” (“Labyrinthe” 3).

The first chamber of Labyrinthe was a horseshoe or teardrop-shaped theatre in which audiences viewed two massive screens from balconies on each side of the chamber’s four floors. Arranged into the shape of an “L,” with one screen on the floor and the other perpendicular to it at the top of the elliptical room, the multi-screen functioned to divide viewers’ attention between images. On these screens, visitors to the pavilion were treated to
70mm footage allegorizing the individual’s passage from birth to adulthood. At the start of the 18-minute program, a child is born. Then children play and young adults engage in sport. Eventually, the audience is confronted with images that cast the confidence of youth in doubt. For example, Shatoff recalls that the Chamber’s final act consisted of images of derelicts, drunkards, gamblers, and riots (9). In each case, the geometrics of the multi-screen arrangements were used by the project’s creators to facilitate or emphasize relationships between images.

As Whitney notes, the distribution of Chamber One’s footage across the right-angled diptych produced effects that functioned both diegetically and physiologically (1999: 13). In the first case, actions that began on the vertical screen were completed on the horizontal screen at the bottom of the chamber or vice versa. In the second case, soaring aerial shots on the horizontal screen functioned to induce a sense of vertigo in individuals viewing from higher up in the chamber. In fact, Marchessault explains that Film Board officials were concerned that the physiological effects of such shots might be enough to “induce anxiety, depression, or even suicide in spectators” (43). Ultimately, the fragmentation of images and actions in a manner consistent with their realization in the real world functioned, in Shatoff’s estimation, to simulate “literal space” (8). In other words, this strategy functioned to locate the spectator in the locale of the action seen on screen. A complex sound system consisting of several hundred speakers enabled an imposing surround sound and directional audio effects that surely furthered the effect.

After departing the first Chamber’s theatre, visitors wound their way through an interstitial hall that Marchessault describes as “a zigzagging passageway of mirrored glass that both reflected and transmitted a multiplicity of different flashing lights that were
triggered by an experimental soundtrack combining electronic and animal sounds” (44-45). Dubbed “The Maze,” Labyrinthe’s second chamber was the most labyrinthine of its three rooms, though visitors followed a set path and were not mean to get lost en route to the final Chamber. In actuality, visitors were only meant to get lost in self-reflection in The Maze, which Whitney claims “was designed in a way that elicited feelings of confusion, weightlessness, and even disembodiment” (1999: 14). According to Whitney, these effects were achieved by means of the intermittent lights, which produced alternating illusions of endless accompaniment and isolation (15). When the flashing lights were on, a visitor would find his or her image reflected infinitely in the mirrored walls. In this way, the chamber recalled the reflexive embeddings of images and imaging technologies throughout Kroitor’s early documentaries. When the flashing lights were disengaged, the visitor found him or herself alone in the dark. Thus, the chamber functioned to usher Labyrinthe’s visitors into immediate contact with the material conditions of cinema itself. In the first case, the visitor negotiating his or her way through the narrow passageway functioned cinematically as the source of an endlessly repeated image. In the second case, the visitor confronts the alternation of light and shadow that is the very essence of cinema.

In Labyrinthe’s third and final chamber, a seated audience observes a five-screen cruciform of imagery captured around the world with a specially rigged assemblage of five Arriflex cameras. Shot in locales as diverse as Montreal, Greece, and Japan, the footage in Chamber Three juxtaposed cultural rituals and everyday activities in a manner that suggested

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8 As Whitney notes, it was Frye who recommended the use of mirrors, glass, and blinking lights to approximate the ways in which the modern city recalls the desert or wasteland, and it was the consultant Fernand Cadieux’s suggestion that darkness could be used to foster introspection (2005: 25). Kroitor, Low, and O’Connor’s contribution was combining these suggestions to facilitate the immersive experience that was Labyrinth.

9 The multi-screen presentation of the Third Chamber survives in a somewhat different form with In the Labyrinth (1979), a composited single-channel version of the multi-screen film.
their ultimate similarity. As Whitney demonstrates, there were three principal strategies for the presentation of this material: a shot could unfurl across all five screens with the edge of the cruciform functioning to frame the image; a single shot could be multiplied and appear simultaneously in each screen; or, each of the five screens could display a different image (1999: 16). As a result of these strategies, cinema’s standard shot was subjected to a number of distortions that served to bring its content closer to the audience. In the first case, the image was enlarged to the point of almost filling the spectator’s field of vision in a manner that anticipates the innovations of IMAX. In the second case, the multiplication of a single image made it more accessible to individuals seated in the more distant corners of the theatre. In the third case, the variety of images allowed the viewer to observe and appreciate any one image’s relation to the total network of images constituted by the five screens. In this way, the multi-screen film of Chamber Three functioned prismatically to present the full significance of its evolving subject.

As a result of former Unit B head Tom Daly’s sophisticated editing strategies, the film’s barrage of disparate images remains compelling throughout the twenty minutes that constitute its original runtime. Principal among these strategies is the way in which montage paradoxically functions to enthrall by calling attention to itself. With five screens, there was a clear risk of the viewer missing key information on one screen while scrutinizing another. But as Shatoff indicates, Daly “found he could direct attention from screen to screen by the order in which material appeared” (9). It seems obvious enough, but with images held on four screens, a simple cut on the fifth screen could provoke a recalibration of attention in a way that a simple cut rarely can in single-screen cinema. But beyond simple cutting, Labyrinthe’s Third Chamber is notable for how it uses its footage to reflexively analogize the
way in which montage is used to orchestrate viewers’ attention and entice them deeper into the film. In one sequence, for example, a police officer is seen directing traffic on the rightmost screen of the cruciform. As the officer points in one direction, he disappears from his screen and re-appears on another that corresponds to where the officer was pointing. “As the policeman points Go that way,” writes Shatoff, “the audience looks that way, and there he re-appears, looking the same” (10). Thus, the audience is put in the place of the commuter who shares the officer’s literal space; and he or she responds to the officer’s instruction by looking in the new direction exactly as the commuter would. It is a technique that perfectly recalls the way in which Kroitor’s documentary cinema worked to align the viewer with on-screen analogues engaged in the act of observation.

The brilliance of the five-screen cruciform is that a cut on one screen—a close-up or different perspective—needn’t sacrifice or necessitate the abandonment of the visual information on the other screens. In this way, the multi-image presentation of Chamber Three recalls the proliferation of perspectives that results from the self-awareness of Kroitor’s cinema. In Kroitor’s documentary work on the Candid Eye series, for example, the viewer is presented with both the subject and the subject affected by the filmmakers’ presence. In Chamber Three, the viewer is presented with multiple images, and the myriad relationships (spatial, aesthetic, conceptual, energetic) that exist between them. In Jones’ view, “The intent was to suggest the unity not only of all peoples but also of all experiences, including death” (1996: 136), but there is a more general significance to the material form of the presentation. As Marchessault argues, the Third Chamber’s simultaneous presentation of multiple images allows one to conceive of the project “as an important precursor to the multiplication and interconnectedness of screens that characterize twenty-first-century digital
architectures” (29). The Chamber anticipates the ways in which windows have come to inform our engagement with the computer screen as a series of embedded screens within screens.

The Labyrinth project is significant for how it builds on the documentary strategies pioneered by the Unit B by assembling them into an architecture of visual information. As Marchessault argues, the two projects are closely connected: in the documentary work of Unit B, she finds that “the camera and sound apparatus are set free to document the outside world because they are no longer tied to studio shooting” (39). Similarly, she maintains that with Labyrinthe, “the spectator is set free in a new cinema architecture to create individualized views through screens that exceed any one person’s perception” (39). And yet, Whitney asserts that multi-screen and large-format cinema have long been celebrated for their facilitation of more participatory and immersive viewing experiences (2005: 29). This was the case with Gance’s foray into the format, the invention of Cinerama, and the many multi-screen experiments that debuted at earlier Expositions. Labyrinthe is especially significant because it realized this experience on a truly environmental scale with visitors convinced that they were actually “in the movie” (Whitney 2005: 29). In this respect, the project facilitated an immersive and affective experience that Kroitor would perfect with his subsequent project.

IMAX

Following the success of Labyrinthe, Kroitor became interested in the possibility of making the experience it facilitated more broadly available (Kroitor 2011). Unfortunately, the multiple projector system developed for Expo ’67 was far too complicated to be reproduced
consistently. With Graeme Ferguson, Kroitor conceived of a 70mm film format that moves horizontally through the projector by means of 15 perforations or sprocket holes along the top and bottom of each frame. With such a system, the frame is large enough to enable the composition of multiple images, but it only needs a single (albeit specially designed) projector to produce imagery as grandiose as that which was achieved with multiple projectors at *Labyrinthe.* With Robert Kerr, Kroitor and Ferguson founded the Multiscreen Corporation to develop the idea into a sustainable business. Shortly thereafter, the three renamed the company “IMAX Corporation” after the unique film format they had developed. As of September 30, 2011, the company had 583 IMAX theatres operating in 48 countries (“Corporate Overview” 2011).

The principal challenge that Kroitor, Kerr, and Ferguson faced in the development of the revolutionary format was the inadequacy of existent projection technology. In order to achieve a smooth moving image from the projection of the oversized and horizontal IMAX stock, the film would need to pass through the projector much faster than it does with other stock sizes. But simply speeding up the projector was untenable because it would put far too much stress on the perforations by which the film was pulled through the projector’s gate. To address this problem, the team acquired the patent for a wholly different means of film movement developed by an Australian technician named Ron Jones. Jones’ system was different from conventional film projection because the film advanced through the projector by means of a rolling loop that ensured enough slack to prevent it from ripping. After acquiring this system, Kroitor, Kerr, and Ferguson brought on the chief engineer at CCM Bicycles, William Shaw, to further develop the technology. In Ferguson’s opinion, Shaw’s

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10 In fact, the projection of IMAX’s 70mm format results in an image that is ten times larger than the image that results from the normal projection of 35mm film stock.
lack of familiarity with the apparatus of cinema was an advantage “because he had no preconceived notions of how a projector should work” (1997: 3-4). Sure enough, it was in the absence of such preconceptions that Shaw developed the IMAX projector that debuted at Expo ’70 in Osaka, Japan and later settled at the site of the first permanent IMAX theatre at Ontario Place in the Toronto harbour.

Accompanying Shaw’s projector to Osaka was Tiger Child (1970), the first film made in the IMAX format—though camera troubles resulted in the majority of the film being shot on 35 mm and regular 70 mm film (Kroitor 2001: 31). Written and produced by Kroitor and directed by Donald Brittain for the Fuji pavilion, the film recalls the mosaic multi-screen cinema of Labyrinth’s final chamber. And as with Labyrinth, Tiger Child’s footage was shot around the world (this time by Brittain), and edited together to produce interesting juxtapositions (though Whitney argues that the film’s imagery is much darker in tone than the imagery in Labyrinth (2005: 45-47)). Indeed, the film is replete with references to the forms of exploitation that result from or are antagonized by our late-modern faith in technology. A slaughterhouse, a prison, and a child born with a Thalidomide-induced birth defect all grace the screen over the course of Tiger Child’s seventeen-minute running time. As Whitney remarks, images like these positioned the film in an ironic relationship to the Osaka Exposition’s theme of “Progress and Harmony for Mankind” (2005: 45).

Like the films shown in Labyrinth’s first and third chambers and Kroitor’s earlier work at the Canadian National Exhibition in Toronto, Tiger Child was but one part of a more extensive multi-media experience. The film was viewed from a rotating platform inside a pneumatically inflated pavilion designed by the architect Yutaka Murata. In addition, the film was projected in concert with a mandala of images designed by Maya Deren’s second
husband, Teiji Ito, and projected by twenty-seven looping slide projectors (Whitney 2005: 43). Because the presentation’s slides looped asynchronously with the film, which also looped without interruption, each visitor to the pavilion was guaranteed a wholly unique experience unbounded by a beginning or end. In this way, the project incorporated the aleatory qualities of Kroitor’s first multi-screen project from 1963: one could enter and exit the pavilion at any point in *Tiger Child* without negatively affecting one’s experience.

The use of the 70mm IMAX format for intricate compositions of multiple images fell out of favour after Expo ‘70, though Kroitor himself does not know why and laments the loss (Kroitor 2011). What is known is that it was after Expo ’70 that the inventors of IMAX became aware of the format’s incredible capacity to facilitate immersive and affective spectatorial experiences through gigantic single images of the world. This revelation came after the IMAX team returned from Japan and sold their projector to Ontario Place for use in the newly established attraction’s large-screen cinema, Cinesphere. As part of the deal, Ferguson was commissioned to produce the first complete IMAX film for an omnibus film series about the geography of Ontario. The result of this commission, *North of Superior* (1971), was hugely popular according to Ferguson (Wise 1997). “The reason,” he explains, “was that for the first time the audience felt immersed in the film” (quoted in Wise 1997). He continues:

Wherever the camera was, the audience felt “in” it. And to this day that remains one of the dominant characteristics of Imax, to be able to put the audience in the picture. The use we primarily conceived for Imax, for multi-images, didn't put the audience in the picture. Instead, what it did was to present cinema in a metaphorical way. You could see two or more images and your mind would combine those two images to create, in a poetic sense, a new whole out of the two parts. Intellectually, what we were trying to do was more interesting, and certainly was interesting if you go back and look at those Expo films. They worked dramatically and intellectually. They were very stimulating. What we did with *North of Superior* was to go back to a less
intellectual, more gut reaction, to go back to what had been done in the days of Cinerama (quoted in Wise 1997).

Thus, IMAX became a cinema predicated on its promise of an immersive experience, and IMAX films began to be structured around the physical affect of a single large image as opposed to the complex intellectual stimulation of multi-screen.

North of Superior’s most notable appeal to the gut is a shot in which a camera attached to a glider swoops over a cliff and drops quite suddenly. With the gigantic image filling one’s field of vision, the shot functions to overwhelm the body’s exteroceptive capacities and make the spectator feel as if he or she is personally experiencing the frightening plummet represented in the shot. As Ferguson recalls, he became convinced he could produce the affect when he learned that the filmmaker Robert Gaffney had made people airsick by strapping a camera to the nose of an airplane for his 1967 film Sky Over Holland (5), but this is hardly different from the way in which Kroitor and his team induced a sense of vertigo with Chamber One of Labyrinthe. As Whitney asserts, the use of such shots would become a hallmark of IMAX cinema (2005: 50). Whether a film takes one to outer space or deep sea, a physically moving experience has become part of the promise of IMAX cinema. But what is interesting about IMAX’s cultivation of a physically exciting and immersive cinema is how the company did this within the context of documentary and educational filmmaking. For much of the format’s history it is utilized to make the absorption of knowledge physically exciting or immersive: info-immersive.

As Whitney demonstrates, IMAX’s long association with museums, science centres, and theme parks has had a significant impact on the sort of films produced in the format (2005: 58-63). This is because these institutions are able to influence the content of films through exhibition guarantees, which can make or break a project (Whitney 2005: 60). Thus,
Whitney shows that IMAX films tend to satisfy three criteria: relevance to the institution or institutions presenting the film; conformity to these institutions’ ethics and research standards; and general appeal (2005: 59-63). The educational and commercial mandates of these institutions have, in Whitney’s view, resulted in a cinema that necessarily strives to be both informative and enthralling (2005: 58). In other words, IMAX is a modality that simultaneously strives to satisfy the information needs of the institutions that house its theatres and the entertainment needs of those institutions’ patrons. These concerns have been central to the development of the format since it was first installed at Ontario Place.

The first major innovation in IMAX technology was the invention of the IMAX Dome theatres, or, the OMNIMAX format. First installed at the Reuben H. Fleet Science Centre in San Diego, California in 1973, OMNIMAX theatres enable projection onto a curved screen surface that fills the spectator’s field of vision via a fish-eye lens. Seeing as the curved screen is somewhat reminiscent of a planetarium’s dome, it is little wonder that the unusual theatres were first marketed to natural history museums and science centres as a modern update of their planetarium facilities (Whitney 2005: 72). As Whitney writes, the IMAX theatre is like a planetarium because it “fills the viewer’s field of vision and thus renders the frame invisible” (2005: 50). As the director of the first OMNIMAX film explains, in those cases where a planetarium’s dome has a diameter larger than 45 feet it becomes impossible for the audience below to perceive it as curved screen (Tilton 1973: 1026). This is precisely how the classic planetarium star show can achieve such illusions of celestial depth. But as OMNIMAX designers William Shaw and Creighton Douglas retort, the position of planetarium seating below the planetarium dome inevitably contributes to a

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11 IMAX’s relevance to a particular exhibition site is not simply a matter of content. As Ferguson notes, the typically shorter length of an IMAX picture when compared to mainstream commercial cinema is a result of the rate at which exhibition sites’ such as planetariums tend to turnover visitors (6).
sense of being “earthbound” (1983: 285). In their view, OMNIMAX breaks this sense of being earthbound because it replaces the concentric and inwardly orientated seating of the classic planetarium with theatre style seating and a screen that is tilted at a 25-degree angle (285). The result is a feeling that one is being suspended in the infinite space of the hemispheric screen. Not surprisingly, Whitney notes that the theatre format is more commonly used for space travel and underwater films than works representing “a strong horizon line or emphatic vertical forms” (2005: 77). As Whitney maintains, “The weightlessness of outer space and the buoyancy of underwater correspond to the sensorial experience [of OMNIMAX]” (77). That is, the form of the presentation facilitates something that very closely approximates one’s immersion in the represented locale.

While Kroitor remained on the board at IMAX during this period of development, he returned to the NFB in order to lighten the financial burden that his salary placed on the fledgling corporation (2001:32). Between the early 1970s and his return to IMAX in 1981, the filmmaker worked at the Film Board developing and overseeing a new drama program for Jim Domville.12 While at the institution, Kroitor worked on many films, including multiple award-winners. Most notable from this period was his work as executive producer on two highly regarded films: Giles Walker’s Bravery in the Field (1979) and John N. Smith’s First Winter (1981). The first is an enigmatic short about the unlikely understanding that develops between a veteran of the Second World War and the young man who mugs him one night in the street. By incorporating archival footage from World War II, the film recalls

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12 Kroitor did work on two IMAX films during his second period of employment at the National Film Board. Man Belongs to Earth (1974) was a treatise on the value of American ecology that was produced by Ferguson and Kroitor and directed by Ferguson for Expo ’74 in Spokane, Washington. Circus World (1974) was produced and directed by Kroitor for a new IMAX theatre established for the Ringling Brothers Circus World Showcase in Florida. The commission came about when Kroitor contacted Paul Anka’s former manager after the man acquired Ringling Bros. Barnum & Bailey Circus (Ferguson 1997: 5).
and subverts the original purpose of such footage when it was utilized in the Film Board’s more propagandistic wartime documentaries. Smith’s film is a chilling dramatization of a particularly hard winter for an Irish immigrant family struggling to survive in the Ottawa River Valley in the 1830s. When the father must leave to pursue work and the mother suddenly dies from poor health, the children are left to fend for themselves. Shot in sumptuous black and white by David De Volpi, the film recalls Unit B’s more critical work by illuminating the dark side of our tidy conceptions of Canadian settlement. Like the work of Unit B, the film challenges the mythic aspects of Canadian identity that so many take for granted. Ultimately, Kroitor’s executive production helped to insure that both Walker and Smith’s films were honoured with Academy Awards nominations.

Following Kroitor’s second stint at the NFB, the second major innovation in the IMAX format was its adaptation for the exhibition of 3D cinema in the mid-1980s. 3D cinema is a form that exploits the normal human capacity to perceive in three dimensions by tricking the mind into fusing two slightly displaced 2D images. Under ordinary viewing conditions, the mind fuses the infinitesimally different imagery that comes from each eye in order to produce an impression of depth. With 3D imagery, the difference in images is amplified to exaggerate or misrepresent an object’s location in space. Effectively, the spectator is forced to view an image with eyes more widely or narrowly spaced than his or her own. As a result, the projected image of an object will appear to be closer to or farther from the audience than the actual screen. The effect can work because of the special glasses associated with the format, which ensure that the each eye sees only the image it is supposed to.
When IMAX 3D was developed, this effect could be achieved with anaglyph and polarized devices. In the first case, glasses with different coloured lenses (generally red and blue) function to filter out simultaneously projected images in corresponding colours. In the second case, the effect is achieved with lenses that are polarized to filter out correspondingly polarized images. At the time of writing, there are a number of additional technologies that enable a spectator to perceive 3D images.

The first IMAX 3D film was *We Are Born of Stars*, which debuted in an IMAX Dome theatre at the Tsukuba World’s Fair in 1985. Written, directed, and produced by Kroitor in anaglyph 3D, the film uses computer-generated animation to tell the story of the evolution of human life from the earliest molecular level to the ontological complexity of the present-day. It is a striking film with remarkable imagery that was designed by a specialist in computer imagery at Livermore Labs in California named Nelson Max. As Kroitor suggests, Max’s earlier experience modeling atomic reactions for Hydrogen bombs was a major asset on the production (2011). For, while Whitney writes that “The use of 3D in a Dome theatre is particularly effective because it enhances the feeling of being surrounded by the image,” the historian concedes that “3D filmmaking for a Dome screen is exceedingly complicated, as accounting for the curvature of the screen adds a high level of intricacy to the film’s geometry” (2005: 86). As Kroitor recalls, the dome’s presence in almost every direction that a spectator can look required the calculation of myriad complex stereoscopic relationships in order to achieve good 3D effects (2011). Thus, Max’s specialty in the mathematics of computer imaging was invaluable to the production. Nevertheless, Kroitor perceived the work of adapting computer animation to the OMNIMAX Dome as an

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13 Besides his work on *We Are Born of Stars*, Nelson Max also collaborated on a number of IMAX projects (cf. *Echoes of the Sun* (1990)).
inconvenience for the artist who must wait to see if his or her work will even function in 3D. And ultimately, it was the difficulty Kroitor encountered working on *We Are Born of Stars* that led him to begin the experiments that anticipated his development of the stereoscopic 3D animation technology discussed in the next chapter (2011).

The first live-action IMAX 3D film, *Transitions*, debuted the next year at Expo ’86 in Vancouver. Sponsored by the Canadian National Railway and directed by Colin Low and Tony Ianzelo, the film depicts the evolution of transportation in Canada from earliest settlement to the era of space exploration and satellites. While Low and Ianzelo’s film was received enthusiastically, the IMAX Corporation’s gamble on live action 3D did not take off until Low’s son, Stephen’s film, *The Last Buffalo* debuted at Expo ’90 in Osaka, Japan. Produced by Kroitor and Sally Dundas, the film is a stunning meditation on the artist, William Lishman’s efforts to immortalize the animals and ecosystem of Alberta’s badlands. As Kroitor maintains, “It’s one of the best 3-D films ever made by Imax” (2001:32). And, as Ferguson recalls, it was the popular success of the film at Expo ’90 that effectively inspired most theatres to convert to 3D (7). In fact, IMAX 3D was adopted so enthusiastically after the debut of the film that the technology is now present in most of the corporation’s 538 theatres. In addition to this, the corporation maintains a profitable side business converting popular 2D movies such as titles from the *Harry Potter* series into 3D. As Whitney argues, the success of IMAX 3D is attributable to the ways in which size of the gigantic IMAX screen facilitates a better 3D effect than traditional cinema because its edges are not visible (2005: 113).

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14 As David Harris Smith has shown, Low spent many years prior to the production of *Transitions* experimenting with 3D cinema at the National Film Board of Canada (2011).
IMAX and the Info-Immersive

In spite of the format’s remarkable uniqueness, IMAX shares certain qualities with the info-immersive documentary of Unit B and the cine-architectural eccentricity of *Labyrinth*. Like Kroitor’s multi-screen projects and his documentary work at the National Film Board, IMAX cinema tends to achieve an adroit balance between representation of an event or subject and self-reflexive acknowledgement of the activities and apparatuses of cinema. In such documentaries as *Paul Tomkowicz: Street-railway Switchman* and *Lonely Boy* this reflexivity is achieved by the representation of individuals looking at the films’ subjects or attempting to capture images of these subjects with various types of film technology. In *Labyrinth* and *Tiger Child*, visitors were “constantly positioned in a way that kept other audience members in their field of vision” (Whitney 2005: 75). With IMAX, these two strategies are combined through the content of the films and the architecture of the theatre. For an example of how the content of IMAX films functions self-reflexively, consider these works’ reliance on frequent cutaways to individuals observing and impressed by the splendor of the spectacle before them and represented on screen. One need only think of the spectators observing the Cape Canaveral launch of the titular shuttle in *Hail Columbia!* (1982), the NASA technicians observing a shuttle’s landing in *The Dream is Alive* (1985), or the ecstatic audience in *Rolling Stones: At the Max* (1991). Much like the almost identical shots in *Universe* and *Lonely Boy*, these shots function to cue the IMAX audience to respond in an appropriate manner to such encounters with splendor.

The architecture of IMAX theatres also functions reflexively to remind the spectator that he or she is engaged in an act of observation. As Whitney maintains, audiences in traditional IMAX theatres are encouraged by marketing discourses and pre-textual prompts
to notice the audience around them (2005: 75). In her view, the visual reminder functions to create a sense of scale that reinforces or amplifies the grandeur of the gigantic large-format image (75). In addition to this, Whitney notes that the seating in IMAX Dome theatres is designed so that the heads of those in lower rows will obscure the bottom of the screen for those in higher rows (75-76). While this may seem to contradict the paramount drive to fill the spectator’s field of vision, it performs another important function relevant to the format’s facilitation of info-immersive experiences. As Whitney verifies, the presence of other viewers’ heads at the bottom of one’s field of vision functions remind the spectator that he or she shares this experience of immersion with others (2005: 75). In these ways, the spectator’s awareness of the act of observation is a significant part of the IMAX experience.

Beyond its fascination with the act of observation, IMAX cinema is also characterized by a self-reflexive fascination with its own technology. In *Rolling Stones: At the Max*, the technologies of film production are repeatedly captured on-screen and revealed to the audience. As part of the concert performance, the Stone’s front man, Mick Jagger, regularly ventures out on to passageways that project from the left and right sides of stage. As Jagger saunters out and back, he is captured with long smooth dolly shots that make no effort to exclude the dolly tracks that make the shot possible. In fact, they often become the principal focus of the shots after Jagger passes out of the frame. At other moments in the film, additional camera units are seen on screen securing close-ups of the performers. When the film cuts from the long shot to a close-up, it is tacitly understood that the new vantage point comes from the place of the camera crew previously seen in the long shot. In this way, immersion in the event is facilitated and mediated by the camera, which appears in the spectacular representation of the event because it is part of the spectacular event. What’s
more, this awareness of the apparatus is reinforced by the total experience that is a journey to the IMAX theatre. As Whitney points out, IMAX Dome theatres typically include windows in their lobbies that enable patrons to view the projection system before a screening (2005: 71-72). And as Charles Acland notes, screenings at the Grand Canyon Tourist Center’s IMAX theatre invariably end with the audience shepherded “backstage” to view the revolutionary projector and the staff that operates it (1998: 438). In this respect, the technology is as much a part of the spectacle and experience as the gigantic images it furnishes.

The fascination with people’s journeys and peregrinations that structures many of Kroitor’s Unit B documentary’s about musicians is also a key feature in many IMAX pictures. In the early documentaries Festival in Puerto Rico and Stravinsky, Kroitor accompanies his subjects to new or different locales in order to better understand them and their work. In many IMAX films, the spectator is regularly transported to otherwise unreachable locales like outer space, the depths of the oceans, and various other geographical marvels around the world. According to Ferguson, the business of taking the IMAX camera to previously undocumented locales is an essential aspect of the format (1997). “It’s just about exploring what the medium can do”, asserts the co-founder of the medium (6). “If you look at Roman’s films and my films,” he explains, “you’ll see that it’s a common thread to try and do different things with the medium” (6). And with IMAX, this novelty is closely related to the documentation of otherwise undocumented phenomena and

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15 Through a series of films concerned with human exploration of outer space (Hail Columbia!, The Dream is Alive, Blue Planet (1990) and Destiny in Space (1994)), IMAX has effectively continued a documentary project initiated with Kroitor and Low’s Universe. When Universe was produced, the cosmos could only be represented by complex animation, but concurrent advances in motion picture and astronautical technologies have allowed IMAX to literally represent the cosmos with images captured in the very expanses of outer space. In this way, IMAX takes its audiences into outer space.
locales. Thus, Paul Virilio suggests that the Géode OMNIMAX theatre in Poitiers, France be thought of as a “‘cineport’ for a trip minus the travelling, a journey on the spot” (1990: 1064).

As Charles Acland writes, IMAX represents a significant contemporary manifestation of what John Urry labels, “the tourist gaze” (1998). In Acland’s view, the large-format cinema of IMAX constitutes itself as both a means of tourism and a tourist attraction itself. In the first case, the medium functions as a “cinema of ‘transportation’ [that] promises a form of virtual tourism, and invites an understanding of distant locations” (Acland: 437). “By combining the giant IMAX screen, the incredible IMAX digital sound system and state-of-the-art IMAX projector,” proclaims the pre-show announcement at the Paramount IMAX theatre in Montreal, “Famous Players IMAX will transport you places you thought you’d never go” (quoted in Whitney 2005: 100). In the second case, “IMAX remains an extraordinary form associated with a special trip” (Acland: 437). It is not everyday that one travels to his or her city’s science centre or museum to enjoy an IMAX film; but when one does, he or she can expect an experience that amounts to something more than conventional cinema.

The IMAX film most closely recalls Kroitor’s earlier work through its creation of remarkably immersive representations of unique situations and locales. In Kroitor’s documentary work, the roving lightweight camera enabled ingress and intimate access to situations in ways that would not have been possible with earlier film technology. With its special interest in the backstage dealings of public performers, Kroitor’s early documentary cinema allegorizes this access that is its central feature. In the typical IMAX film, the size and scope of the screen coupled with shots designed to exploit the chain of command that
proceeds from eyes to brain to body engender the physical experience of actually being there. “Wherever the camera was,” remarks Ferguson of his pioneering IMAX film, *North of Superior*, “the audience felt ‘in’ it.” By soaring camera movements that mimic the movement of a plane of diving glider, the format is often able to produce sensations of flight. Thus, Acland proclaims that “The stunning films of IMAX and the special viewing situation reignite the early experience of filmic realism – the shock of movement and the sensation of ‘being there’” (430). And Griffiths repeats, “Being immersed in the image is the defining feature of the IMAX brand, whether in flatscreen theatres, 3-D, or Dome screens” (94).

Given IMAX’s remarkable capacity to produce such sensations with its massive and incomparably crisp moving images, it is no wonder that so many have equated the format with Andre Bazin’s conception of “total cinema.” In the 1967 essay, “The Myth of Total Cinema,” Bazin casts cinema as a still-fledgling articulation of humankind’s longstanding effort to produce “a total and complete representation of reality”, or, “a perfect illusion of the outside world in sound, color, and relief” (20). In Bazin’s view, the medium ought to aspire to “an image unburdened by the freedom of interpretation of the artist” (21). Not surprisingly, the critic spent his career championing a realist mode of filmmaking that was grounded in techniques that Nucci (2010: 51) suggests have come to characterize large-format cinema such as IMAX: deep focus (with all images in the frame in focus) and prolonged shot length between cuts. By reproducing human sensorial experience, these techniques furnish images that “become rather than represent the real” in Heidi Wasson’s estimation (2007: 85). Thus, Acland proclaims, “IMAX is unambiguously a film technology and form designed to create the experience of being there, or getting there, for spectators” (431). It is a format that “takes the world out there,” in Allison Griffiths view, “and enlarges
it to gigantic proportions, heightening the sensation of virtual presence and haptic immersion” (2008: 95).

Insofar as IMAX facilitates a physically affective experience of presence, the format completes a project that its co-inventor initiated with his similarly innovative documentary work at the National Film Board. Just as Kroitor’s direct cinema documentaries’ use of lightweight cameras and synch-sound technology enables unrivalled access to their subjects, IMAX is an info-immersive modality that facilitates an intimate connection between its audiences and its subjects. In this respect, the format recalls various earlier attempts to enhance the cinematic experience by increasing the size of the screen. From Abel Gance’s *Napoléon* to Kroitor’s multi-screen work at the Canadian National Exhibition and *Labyrinthe*, this chapter has sought to demonstrate how filmmakers have worked to circumvent the frame’s function to delimit or contain the spectator’s vision. To the extent that IMAX fills the spectator’s field of vision with an incomparably crisp image of the world, the format approximates Bazin’s conception of total cinema more than any previous effort. And as previously noted, Bazin envisioned a cinema that would ultimately be indistinguishable from reality. In the next chapter, we shall see how Kroitor approximates this notion with his work in software design and development for 3D animation in real space. With SANDDE, Kroitor is rethinking the business of animation in a manner consistent with his earlier challenges to cinema’s established orthodoxies.
Chapter 3
The Stereoscopic Animation Drawing Device

In this chapter Roman Kroitor’s pursuit of the info-immersive capacities of representation are followed into a distinct third period in his lifework in which he became interested in software design for stereoscopic 3D animation in real-space. Kroitor’s experiments in this field began in the mid-80s after the release of his anaglyph 3D computer animated IMAX short, *We are Born of Stars*. During this period Kroitor taught himself to program in the computer language Basic in hopes of developing software that would make computer animation less complicated for artists and animators with more traditional skills. Kroitor’s many years of work in collaboration with his son, Paul, Greg Labute, and various other animators and programmers have resulted in the Stereoscopic Animation and Drawing Device, or, SANDDE. A recently commercialized product that belongs to IMAX and Kroitor’s Janro Imaging Laboratory, SANDDE is a stereoscopic 3D animation software platform that allows a user to draw and animate in mid-air through the use of a highly responsive motion-tracking device. The technology is remarkable for how it improves upon the ways that existent animation software facilitates such animation activities as inbetweening and the creation of volumetric surfaces, but the software’s most significant aspect is how it establishes a more immersive and physically engaged means of computer animation. In this way, the outcomes of Kroitor’s work on the technology recall his earlier documentary work at the National Film Board of Canada and his development of IMAX with Graeme Ferguson and William Shaw. That is, SANDDE distinguishes itself from other animation software at the same time that it represents a continuation of the concerns that motivated Kroitor through the earlier periods in his varied career.
SANDDE is a stereoscopic 3D animation program that allows the user to draw and animate movement in real space through the use of a hand-held motion-tracking device, or, “wand” (SANDDE Promotional Material 2011). As one moves and manipulates this device, the software interprets the device’s coordinates to create and display 3D stereoscopic lines and brush strokes that correspond to the user’s movements with the device in real-space. Used in concert with a 3D display and 3D glasses, the software enables animators to see their work in 3D as they freely draw it. In this respect, SANDDE distinguishes itself from other 3D modeling programs, which require the user to define the coordinates of his or her artwork using a keyboard and mouse. In contrast to the users of such standard 3D modeling programs as Maya and After Effects, SANDDE users draw in real-space as their artwork is rendered in the air in front of them in the form of a real-time trace of their movement with and manipulation of the wand. As such, the software allows an animator to create content in an immersive environment defined by the substance of his or her art much like a sculptor or painter, though SANDDE facilitates a different relationship to time than that which characterizes these prototypical practices. As Kroitor suggests in an interview with Christopher Miller in Popular Science, “It’s halfway between sculpture and painting, except it’s instantaneous” (1998: 42).

SANDDE is a 3D animation program that fuses the freehand compositional possibilities of 2D animation programs with an illusion of 3D modeling programs’ capacity for volumetric surfaces by means of what those involved in the development of the software refer to as the “strawberry effect” (Labute 2011 & Pelstring 2011). One can draw freehand in typical 2D animation programs such as Flash and Toon Boom, but only with a mouse or tablet—not in real-space. It is true that some 2D animation programs can be used to create
stereoscopic imagery, but only after complex work in After Effects. What’s more, this adapted 2D will invariably lack volume, with essentially flat characters and objects staggered as if they were sets on a stage. In typical volumetric 3D modeling programs such as Maya and 3D Studio Max, one creates volumetric surfaces by defining the coordinates of tiles, but this tedious technical work has little to do with the art of drawing.

Kroitor’s innovation with SANDDE was to use a drastically reduced number of 3D elements to trick the brain into thinking that an otherwise flat object constitutes a complex three-dimensional surface. As such, the system involves substituting the normal human capacity to process images stereoscopically for the complex technical business of designing volumetric surfaces. This is a patented feature of SANDDE that Kroitor and his employees refer to as “the strawberry effect” for how an animator might use a few seed-shaped specks placed at varying depths to create the illusion that a flat red disc placed behind the specks is actually a three-dimensional strawberry (cf. R. Kroitor 2011, Labute 2011, Pelstring 2011). This feature was originally advantageous because it produces an effect very close to the more complex modeling programs without taxing the central processing unit of the computer running the program, but computers have since caught up to most animators’ needs in this respect. The feature remains advantageous because it relieves the user from involving him or herself with the tedious and technical work of modeling volumetric surfaces. More simply, the software achieves the illusion of three-dimensionality with two-dimensional techniques. And because they are produced through a combination of 2D drawing software and 3D modeling, SANDDE animations look like a novel combination of the aesthetics of both.

Besides functioning as a 3D drawing device, SANDDE allows one to use the motion-tracking wand as a selection tool and, more significantly, a means of controlling the
animation of one’s drawings in various ways. When animating with SANDDE one can use the movement of the wand to stretch, warp, and move objects as if one is a puppeteer working with real objects. One can also use the wand to set the parameters of traditional frame-by-frame animation and control a related process that animators refer to as “inbetweening” for how it involves the generation of intermediate frames between key frames or poses to complete full movements. Most revolutionary is how the wand allows the user to produce complex real-time interpolations between multiple key-poses in a manner that combines the processes of traditional inbetweening and motion capture.

In works of traditional cel animation, a character or object’s movement is comprised of key frames and inbetweens. The first are the poses that define the broad strokes of a movement and are typically drawn by the studio’s most senior animators. The second represent the movement between these poses and are typically produced by more junior animators because they require less skill to make but need to exist in greater numbers. Not surprisingly, this division of labour has carried through into the age of computer animation with the animator defining the key frames and a computer program filling in the inbetweens. There are many animation software packages that can produce inbetweens of the sort described above, but they are extremely limited. As Labute notes, “it takes an understanding of the movement as a whole to know how to space your inbetweens” (2011). Given that this involves intelligence not currently possessed by machines, it is little wonder that software-generated animation often seems very mechanical and unnatural.

While traditional inbetweening is produced between two key frames, SANDDE is a significant technology because it allows one to intuitively generate the inbetween poses or intermediate images of animated movement from a plurality of key frames or source poses.
through a feature called “Polypose.” The user does this by defining a polyhedron in which the vertices correspond to source poses so that the wand’s position at any point within the polyhedron corresponds to a weighted average of the source poses. Accordingly, a character or object’s movement between poses is generated by the animator’s movement of an optical wand within the predefined three-dimensional space. “With the wand moving through the space,” explains Labute, “I can choose what proportion to give the different drawings and effectively give a blend of all of my poses simultaneously, and with that, define nice curved lines through your pose-space, which would be very difficult to do if you only have two poses” (2011). Additionally, the rate of transformation between this plurality of predefined poses is controlled by the rate of movement of the motion-tracking wand. In this way, there is an unmediated connection between the animator’s real-time definition of the movement and the movement of the image. As the software’s product manager, Emily Pelstring maintains, “It’s a very sophisticated way of interpolating between poses in real time and getting an almost infinite number of poses out of a few drawings” (2011).

In addition to one’s movement of the wand determining cursor position, the software also enables the user to map various controls to buttons or responsive surfaces on the wand or additional input devices such as a midi-controller so that the animator can generate effects more simply. For example, one can tilt the wand to produce variations in the thickness of lines one draws. As such, the computer animator is enlivened by a more physically involving activity without complex technical software mediating or framing his or her engagement in the creative process of drawing and animation. In this way, SANDDE facilitates the computer animator’s reconnection with the more tactile skills at the heart of his or her field: drawing, sculpting, and puppetry.
The Development of SANDDE

As noted in the second chapter of this thesis, Kroitor first began to wonder about a technology like SANDDE while working on the first OMNIMAX 3D film, *We Are Born of Stars*. The difficulties involved in adapting the film’s computer imagery to anaglyph 3D for the OMNIMAX Dome theatre were so great that Kroitor came to feel that the work was incommensurate with the rewards. As Paul Kroitor recalls, the lack of general-purpose animation software at the time required the team to generate each shot with a uniquely designed Fortran program (P. Kroitor 2011). To power such a complicated program, the team used an array of more than a thousand Zilog Z80 microprocessors running together in such a fashion that they filled an entire room (P. Kroitor 2011). Even though they were working with some of the most modern equipment available, Paul Kroitor recalls that it took hours to simply generate a single frame for use in the finished film (2011).

Paul Kroitor maintains that his father found the experience of talking with mathematicians and programmers frustrating because he was used to talking with animators such as Colin Low, who he collaborated with on the award-winning documentary, *Universe* (P. Kroitor 2011). While the programmers working on *We are Born of Stars* and its follow-up, *Echoes of the Sun*, were doing extremely complex things with computer graphics, Paul Kroitor recalls that his father was disappointed by the fact they couldn’t capture the ineffable qualities of movement the way a gifted animator could (2011). “You tell an animator what an interesting movement is and they know exactly what you mean,” he asserts; “You tell a programmer that you want an interesting movement and they don’t have the slightest idea what you mean” (2011). Not surprisingly, this is exactly what happened during the production of *We are Born of Stars*. At some point in the project, Roman Kroitor approached
Nelson Max, the Livermore Labs specialist in computer imaging who was working on the project, to inquire as to the possibility of producing 3D computer graphics a different way. According to Roman Kroitor, Max became quite insulted by the thought of an artist circumventing his more technical contribution; but that is precisely what Kroitor was interested in: a technology that would allow the animator who works with computer graphics to “just draw the damn thing” (R. Kroitor 2011). Kroitor was looking for a technology that would make 3D animation less technically complex in the same way that the gigantic IMAX format made multi-image projection easier (remember that it was the coordination of multiple projectors that made multi-screen cinema such a hassle and necessitated the invention of a IMAX).

Kroitor’s work in 3D computer graphics began with a small experiment with a primitive Computer Animated Drawing (CAD) program in the late-1980s. Kroitor was working at IMAX’s Toronto headquarters at the time, but construction had begun on the home that he now shares with his wife in Arundel, Quebec. During one visit to the construction site, Kroitor and his son used the CAD program he had installed on an early IBM PC to model an image of the kitchen they intended to build. Once the two had drawn and adequate model, they used the program’s camera function to produce two images of the planned kitchen spaced in a manner that corresponded to the inter-ocular distance necessary to achieve a stereoscopic effect when the images were fused. Kroitor then had his son write the code for a simple program that would facilitate the alternation of the two images. When they looked at the alternating images with synchronized alternate-eye glasses that Sharp had developed for Echoes of the Sun they saw the kitchen they intended to build in perfect stereoscopic 3D. As Paul Kroitor recalls, “What wound up getting built was very close to
those pictures” (2011). It was not an especially sophisticated example of 3D graphics, but
the fact that it was produced with a fraction of the work necessary to produce one of the
images seen in We are Born of Stars was impressive. So, while the experiment bears little
relation to the development of SANDDE proper, it represents the beginning of Kroitor’s
interest in the development of technologies for the relatively uncomplicated creation of
stereoscopic 3D graphics.

Over the following six months, Kroitor took the first steps to develop a new
technology based on what he had learned from the CAD experiment. Kroitor was in his mid-
60s at the time, and when time would allow he taught himself the early programming
language, Basic. In Basic, he wrote a simple program for the animation of a cursor in three-
dimensional space that was viewable in anaglyph 3D. As his son Paul recalls, one could
facilitate the cursor’s movement on the x, y, and z-axes with assigned keys on the computer’s
keyboard (2011). In Paul Kroitor’s view, the system wasn’t technically remarkable, but it
was proof of a concept that his father was hoping to realize (2011).

At the same time that he was developing this software, Roman Kroitor had purchased
a Polhemus motion_tracker in hopes that it would enable him to draw the cursor position in
real space. The device is essentially a wand with a magnetic sensor at one end that sends
position information to a magnetic receiver. The elder Kroitor was personally unable to
adapt his program to acknowledge the signal from the motion_tracker, but he had sagely
anticipated his son’s capacity to produce the necessary code. During a visit to his father’s
home, Paul Kroitor completed the interface and installed a draw button on the wand that
would allow the user to regulate the signal it sent to the computer. Paul Kroitor also advised
his father to switch to the more expedient programming language, Quick Basic, and adapted
the system so that the 3D functioned in alternate-eye 3D instead of anaglyph. With these improvements in place, Roman Kroitor had a crude system for drawing stereoscopic 3D images in real space.

Kroitor’s next step was the development of a system for recording and transposing the spatial information of movements executed in real space. At first, the use of the motion tracker to define movement in three-dimensional space was quite simple. Among the first varieties of animation developed involved using the wand to drag an object while recording its movement, but Kroitor developed many other types of movement as well. As Paul Kroitor recalls, this was a period of experimentation and many of the movements were subsumed by more complex processes with the development of subsequent versions of the technology (2011). What would prove to be quite innovative was a feature that Roman Kroitor called “Tweening” for how it facilitated a novel way of producing the inbetweens that represent the majority of frames in animated movement. Eventually renamed “Polypose”, the process is described at the beginning of this chapter.

Roman Kroitor brought the results of his early experiments to IMAX. From the corporation he received $25,000 in funding to pay his son to program a simple, professional drawing program to use as a demonstration for customers and clients of IMAX. With this funding, Paul Kroitor began programming what was technically SANDDE version one, though Paul notes that they originally called it version four because they were counting Roman Kroitor’s early experiments as versions one, two, and three (2011). Additionally, Paul Kroitor’s demonstration software worked only as a drawing and frame-by-frame animation platform because Roman Kroitor’s revolutionary system for movement creation had not yet been refined and integrated as a central feature of the software.
Besides the financial support necessary to complete this work, IMAX provided the time and expertise of their Sheraton Park engineers who developed a stereoscopic viewing system for use by the animator working with SANDDE. The system these engineers developed involved a perisopic headset and functioned by means of a system of mirrors that deflected each eye to different display monitors. The system produced the illusion of 3D because the images on each monitor corresponded to the left and right images of a stereoscopic image. And because the periscope goggles functioned to fill the user’s field of vision with the stereoscopic image, the system approximated the immersive nature of the massive IMAX image. As Paul Kroitor states, the team’s goal at the time was to make the animator feel like he or she was working in an IMAX theatre (2011). In his words, they “wanted to expand the frame” (2011).

In hopes of finally putting the technology to work, Roman and Paul Kroitor persuaded IMAX to fund a movie and invest in the technology as a viable production tool. In order to develop the technology, the Kroitors hired Greg Labute to reprogram SANDDE in a professional manner. Labute was an ideal choice for this position because he had been trained as an animator and a computer programmer. As such, he possessed both the right-brain and left-brain capacities relevant to the development of a novel system like SANDDE. The Kroitors were aware of Labute because he was living next door to Graeme Ferguson’s son, the animation director, Munro Ferguson. Labute had heard rumblings about the evolving SANDDE technology because Munro Ferguson was often asked to test the various articulations of the device. According to Paul Kroitor, the focus of Labute’s work when he joined the team was assembling a movement component system out of Roman’s Tweening program and fusing it with the demonstration drawing program that Paul had developed.
(2011). As Paul Kroitor recalls, “I had put various plugs in and defined the overall structure for this movement system to operate but I still hadn’t looked at how we were going to make it work” (2011). In fact, Labute’s contribution to the software was to reprogram Roman Kroitor’s Tweening system from scratch in the more sophisticated programming language, C++. For while Labute remains impressed that Roman Kroitor was able to teach himself Basic and develop a wholly original approach to animation in the language in his advanced age, he maintains that his services were necessary in order to “develop [the software] in such a manner that it could be expanded because, like most novice programmers, Roman had managed to program himself into a corner” (2011).

While Labute and the Kroitors were developing this more professional version of SANDDE, they were also trouble-shooting the existent version six, which was being used to animate the first SANDDE films, *Paint Misbehavin’* (1996) and *Cyberworld* (2000).¹⁶ To complete these films, the Kroitors hired the producer Steve Hoban and a small staff of animators and other industry professionals. Among these individuals was the animator, Peter Stephenson, who had studied animation with Labute at Montreal’s Concordia University, and who currently heads the SANDDE beta-testing site at the Nova Scotia College of Art and Design. *Paint Misbehavin’* is a two-minute short co-directed by Stephenson and Kroitor that was originally shown before the holiday film, *The IMAX Nutcracker* (1996). In the whimsical short, a young child attempts to paint a sign that hangs above a theatre screen, but he falls from his ladder and the paint spills in every direction. While it was Stephenson who wrote the film, it is interesting to note that the action in *Paint Misbehavin’* takes place

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¹⁶ SANDDE was, in fact, used on a single production between *Paint Misbehavin’* and *Cyberworld*, though the limited extent of this use makes this instance negligible. The 1998 IMAX film, *Mark Twain’s America*, includes a few seconds of SANDDE footage.
backstage and calls attention to the apparatus of cinema. In this respect it clearly recalls the
documentary cinema Kroitor produced with Unit B at the Film Board. Regardless of whether
this connection was intentional or even obvious, the film resonated deeply with its viewers.
As Paul Kroitor notes, “it was very successful in terms of audience response” (2011).

The second SANDDE film for IMAX, *Cyberworld*, is a feature length film that
combines repurposed 2D computer animation converted to IMAX3D and original 3D
SANDDE content. Directed by Colin Davies and Elaine Despins and co-produced by Roman
Kroitor, Hoban, Sally Dundas, and Hugh Murray, the film is essentially an omnibus work
that highlights a variety of notable work in computer graphics for popular entertainment
including segments from the Dreamworks film, *Ants* (1998), and Matt Groening’s television
series, *The Simpsons*. As such, the film is something like a *Fantasia* for the computer
graphics era, but in *Cyberworld*, these segments are presented by a character named Phig,
who functions as something like a tour guide in the eponymous SANDDE-animated diegetic
world while also fighting off a trio of bug-like creatures whose presence is jeopardizing the
world’s computer code infrastructure. Through this alternation of SANDDE-animated
narrative elements and widely acknowledged achievements in computer animation, the film
functions to situate the new technology alongside the established computer graphics
programs that made the excerpted segments. And because the framing narrative involves a
SANDDE-animated character engaging with the excerpted material as something like a
marshal, the film also function to distinguish the technology from the competition.

In many ways, *Cyberworld* anticipates the ways in which our relationships with
screens have changed since the release of the film. As Susan Lord and Janine Marchessault
observe, the mass mediation of the present era has entailed a proliferation of screens and the
connections between them (2007). To the extent that the film represents and facilitates an immersive experience with this networked world of screens, the film recalls the *Labyrinth* project that led to the invention of IMAX. And insofar as Phig engages physically with the screens and images that surround her, this early SANDDE film functions as a metaphor for the fledgling SANDDE technology itself. As the technology’s current product manager suggests,

> People now a days are growing accustomed to interacting with screens through their gestures. This is the direction that technology is heading in. So, SANDDE is an interesting next step for content creation because it emphasizes this immediate, real-time connection between the body in real space and the virtual screen space. In SANDDE there are tools that allow you to map the physical space you are moving around in to any amount of virtual space you can define (Pelstring 2011).

In Phig’s role as guide who spirits the audience around a virtual world of screens, the character anticipates something of the activity of the SANDDE animator who uses his or her gestures to define and work in an immersive space.

After the release of *Cyberworld*, the team invested a fair amount of time and energy in hopes of launching additional productions, but these efforts were derailed when IMAX cut all research and development and most in-house production after its stock value plummeted in 2000. At first, IMAX kept Paul Kroitor and Labute on staff to perform useful updates on the code in the hopes that the technology might eventually attract investors or outside productions, but ultimately the corporation was forced to shut the subsidiary down. Because of the goodwill that existed between IMAX and the National Film Board, much of the SANDDE equipment was delivered to the institution where Roman Kroitor got his start along with a previously established free license to use it on any projects that did not compete.

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17 While IMAX did cut all other production, the company did continue to produce its highly regarded series of space films in collaboration with NASA and a few of its underwater exploration films.
with IMAX productions. With this technology, Paul Kroitor helped to establish the stereoscopic lab at the Film Board with David Verrall, and Munro Ferguson. At its new home, the stereoscopic animation technology was used on four films between 2003 and 2008. These include Munro Ferguson’s *June* (2003) and *Falling in Love Again* (2004), Paul Morstad’s *Moon Man* (2004), and a short SANDDE sequence in François Pouliot’s *Facing Champlain* (2008) for Québec’s Musée de la civilisation. Unfortunately, there was very little development of the software during this period beyond bug fixes. Labute had left to program for various companies in the computer software industry, and SANDDE languished.

While IMAX put a stop to SANDDE’s development when the corporation’s stock plummeted in 2000, Kroitor became interested in the project when the sudden prevalence of 3D televisions and the renewed popularity of 3D films in the mid-2000s reaffirmed his belief in the software’s commercial potential. In 2006 he approached IMAX to ask that his invention be repatriated to him at Janro Imaging Laboratory (JIL), the company he and Paul Kroitor established to oversee the use of SANDDE in Stephen Low’s 2010 film, *Legends of Flight* (P. Kroitor 2011). Between 2006 and 2010, the agreement between JIL and IMAX was modified to grant the former full licensing rights and the authority to commercialize the software as a standalone package (Pelstring 2011). In exchange for this, IMAX receives a small percentage of every license that JIL manages to sell (Pelstring 2011).

In order to realize these new commercial objectives, Labute was rehired in 2008 and the development of the SANDDE software was revived at JIL. While the core system remained the same, a number of new features were developed that Labute feels make the software more versatile and easier to use than ever before (2011). In 2010, the company hired Emily Pelstring to serve as the product manager of the technology, and she later
became the vice president of product development and marketing. In this role, Pelstring has established a product development cycle that involves close interaction with beta sites and research partners in academia and the animation industry (Pelstring 2011).

The Art of SANDDE

As SANDDE’s developers repeatedly stress, the software’s key feature and the principal factor influencing the aesthetics of works produced with the technology is how it allows the animator to eschew complex technical tasks so that he or she can create in real-time (cf. R. Kroitor 2011, P. Kroitor, Labute 2011, Pelstring 2011). In this respect, it is a far more immersive platform than other computer animation software packages, which require complex mathematical work to produce art. As I have suggested, the technology facilitates an artist-animator’s immediate engagement with freehand work that comes to life before his or her eyes. According to Pelstring,

The professional process of making animation is so detached from how artists are trained – like drawing or sculpting – and digital animation tools are very numeric, very based on mathematical precision. You’re often working with a library of assets that you plug into different positions. You’re almost a programmer. You’re not even really making art at this point in the history of digital animation. So, Roman’s vision, as early as the mid-80s when computer animation first started to become a thing, was to make something that would return computer animation to artists, something that would make sense for people who like to paint and draw, which is what draws most people into animation to begin with (2011).

As a result of the software’s unique features, animation produced with SANDDE tends to have painterly or artisanal qualities that distinguish it from other computer animation. In the Film Board animator Claire Blanchet’s The Wobble Incident (2009), for example, one finds very elegant use of simple lines to represent two characters stranded on a seesaw. In this case, the hand-drawn nature of the film contributes to a pictorial innocence that makes the
film a success. As Amid Amidi suggests, “the films created with this process don't have the sterilized look of modern computer animation, but rather the appearance and feel of ‘traditional’ cel-animation, resulting in both a process and result that is vastly different from anything else out there” (1998).

Besides its capacity for approximating traditional painterly animation, SANDDE is also well suited to abstract or experimental work because it makes it so easy to create and modify animation on the fly. This aspect of the software was adeptly exploited by Pelstring in her recent collaboration with the noise band AIDS Wolf for the 2011 Québec Triennial at Montreal’s Musée d’art contemporain. As the band performed, spectators were invited to enjoy the anaglyph 3D projection of undulating SANDDE compositions layered over stereoscopic stills of geometric landscapes produced with traditional photographic film. In essence, non-figurative applications such as Pelstring’s work and more painterly applications such as Blanchet’s work represent the two directions available to the SANDDE animator. Because he has spent so much time with the SANDDE software, Munro Ferguson has had the opportunity to explore both possibilities.

In his evolving role as an animation director at the National Film Board, Munro Ferguson has produced two films that represent the contrasting possibilities of the apparatus. Ferguson’s first major work with the software was his elegy to his early mentor, Joyce Wieland after she succumbed to Alzheimer’s in 1998. In two parts, the film analogizes Wieland’s battle with the disease and her healthier creative period before she fell ill. In the first half of the film, “Alzheimer’s”, Ferguson uses overlapping shapes and geometric masks to conjure the disease’s obfuscating function. In the second half of the film, “Memory”, Ferguson attempts to approximate what it was like to know Wieland when she was alive and
well, producing at the height of her creative powers. This period in Wieland’s life is represented with organic undulating lines that flow towards the audience from an elliptical aperture that recalls the mouths that showed up in so much of Wieland’s work. As an NFB press release suggests, the film is essentially a moving abstract painting (Marginson 2005). The film was first screened at the Art Gallery of Ontario, but it has travelled to many festivals since.

Ferguson’s second major project with SANDDE was the Genie Award-winning short, *Falling in Love Again*. In the whimsical work of animation, a man and a woman are sent soaring into the stratosphere after their cars collide on the hairpin turn of a narrow mountain road. After locking eyes on their upward trajectory, the two spend their fall to earth scrambling to attain each other’s embrace. When they do lock hands and lips, their burgeoning affection materializes as floating hearts, which slow their fall and allow them to touch down safely. Unfortunately, the two land back at the hairpin turn where they first collided and where they now stand in the path of two on-coming trucks—one carrying fireworks, the other carrying matches. Fortunately, the new couple is spared when the two trucks collide. In fact, a heart-shaped explosion enwreathes the two as fireworks blast towards the screen and the trucks’ drivers (two portly blue-collar types) are similarly launched into the stratosphere.

Set to Marlene Dietrich’s performance of “Falling in Love Again”, the work is a lighthearted take on the ups and downs of romantic love that makes skillful use of the technology. In many ways, the warble, crackle, and overall age of the Dietrich performance alludes to the primitive style of the hand-drawn work. Because it facilitates freehand drawing in real-space, SANDDE tends to result in work that, unsurprisingly, looks hand-
drawn. In this way, SANDDE films tend to recall works of earlier cel animation and
cartooning in which certain features are emphasized in order to better characterize narrative
agents, except that SANDDE films are in 3D. In fact, SANDDE is the only way to achieve
certain aspects of this look in stereoscopic 3D while remaining directly involved in the real-
time creation of an image or sequence of images.

Insofar as SANDDE facilitates this immersive connection between the creator and his
or her content, the software amounts to an extension of the project Roman Kroitor began with
his documentary work at the National Film Board of Canada and continued with his
development of large-format cinema with IMAX. In the same way that Kroitor’s
documentaries and IMAX functioned to eliminate the frame that previously bounded
audiences’ encounters with cinema, SANDDE eschews the technological preconditions that
prevent the computer animator from engaging more directly with his or her work. SANDDE
is notable for how it retrieves computer animation from the complex technologies and
processes that frame and constrain an activity that was once characterized by its appeal to the
left side of the brain. And because SANDDE enables the user to simply render an idea in
mid-air, the technology enables an immediacy that was hitherto impossible in the field of
animation. In this way, it is the most recent achievement in a career marked by similar
triumps across filmmaking, animation, and invention.
Conclusion

Since its earliest days more than one hundred years ago, cinema has remained a preeminent mode of expression by ceaselessly updating itself for its increasingly sophisticated audiences. Through various technical and artistic innovations, those invested in the medium have sought to advance its capacity to impress these audiences and secure their continued support. From Cinerama to digital video, from talkies to THX, the success of an innovation in the field has depended on its capacity to supplement a form that functions alternately to document the world as it is and imagine the world as it could be. Insignificant efforts are quickly forgotten in contexts as mediatized as North America, but important innovations will exert a considerable influence on the culture of such contexts.

Over a long and diverse career, the Canadian film documentarian and inventor Roman Kroitor has done a great deal to advance the practices and technologies of film and film culture. As a documentarian, the man helped to pioneer a style that continues to influence noteworthy works in the genre. In his role as an inventor, the man has revolutionized the theatrical presentation of the motion picture and the practices of computer animation. In both capacities, his work is noteworthy for how it exploits the dualistic potential of film in order to facilitate new cinematic experiences. As I assert throughout this thesis, Kroitor’s numerous innovations have done much to invigorate the medium for its evolving audiences.

Kroitor began his first period of innovation with the National Film Board of Canada’s Unit B. With Colin Low, Wolf Koenig, and others, Kroitor helped to pioneer an approach to documentary filmmaking that would come to influence direct cinema and cinéma vérité. With films such as Paul Tomkowickz: Street-railway Switchman and City of Gold, Kroitor
and his colleagues eschewed the aesthetics and rhetoric of erstwhile Film Board documentary for a mode that engages with its subject and audiences in ways that the Board’s war-era documentaries do not. In place of the Griersonian documentary’s assertiveness, Kroitor and his colleagues cultivated an aesthetics of ambiguity that undercut the very idea of documentary authority. Through their documentation of private moments and quotidian activities, Kroitor’s films achieve a naturalness that is rarely seen in cinema before Paul Tomkowickz. And yet, Kroitor’s films also subvert this effect through authorial disruptions of the sort produced when the director asks Anka to repeat the kiss he shares with the owner of The Copa. In this respect, Kroitor’s films strike an original balance between the attitudes and practices that characterize both realism and reflexivity. On the one hand, the documentaries that Kroitor produced for the Film Board are realist because they present their subjects without pretense. On the other hand, these documentaries are reflexive because they take relatively unconventional steps to guarantee this lack of pretense. And in such films as Lonely Boy, Stravinsky, and Festival in Puerto Rico, this coefficient of realist and reflexive qualities, which characterizes Kroitor’s lifework, functions as an info-immersive appeal to the films’ audiences. Spectators are invited into the films, but encouraged to remain critical of what they see.

In his second innovative period, Kroitor advanced from important experiments in multi-screen cinema to pioneering work towards the invention and development of the large-format IMAX apparatus. While considerably different in scope from the man’s early documentaries, this work follows logically from that first period in Kroitor’s career because it was similarly invested in the info-immersive potentialities of realism and reflexivity. Just as Kroitor’s documentaries exploit certain strategies to thrust their audiences into contact
with their subjects, *Labyrinthe* and the IMAX theatre make use of scale to facilitate a previously unimaginable sense of closeness to the documentary image. In the highly celebrated Expo ’67 project, architecture and multi-screen cinema combined in a manner that encouraged a fully embodied spectator to think of him or herself as the subject of the expanded film’s narrative. With IMAX, this spectator is treated to an image so large and crisp that it is capable of confounding the spectator’s physical awareness of his or her position in a movie theatre. Nevertheless, these modalities are also characterized by reflexive elements that recall Kroitor’s documentaries and encourage the spectator to remain mindful that he or she is part of an audience that is enjoying an experience made possible by remarkable film technology. From IMAX to OMNIMAX and IMAX 3D, the experience has always involved some extra-textual effort to foreground the innovative technology that facilitates the experience. But as with Kroitor’s earlier work and the work that follows, this aspect of the IMAX experience functions to encourage the audience to think about the technology’s role in the evolving relationship between representation and reality.

Following his work with IMAX, Kroitor initiated a third period of innovation in hopes of melding the impressive effects of stereoscopic computer animation with the tactility of more elemental modes of creation like drawing and sculpture. After a long period of experimentation and development, he produced the Stereoscopic Animation and Drawing Device, or, SANDDE to enable animators to draw and animate in immersive real space by means of a motion sensor and optical wand. In addition to the ways in which the technology expands the activity of animation, SANDDE improves upon existent animation software in two ways. First of all, the software is significant for how it exploits the human capacity to perceive in stereoscopic 3D in order to simplify the complex business of 3D modeling.
Second, the software is noteworthy for how it facilitates incomparably detailed inbetweening with multiple key-poses in polyhedral spaces defined by the animator. While it would be a grievous leap to suggest that a content creation tool such as SANDDE is essentially adapted to certain aesthetic approaches or attitudes, the technology is suited to simultaneously realist and reflexive projects such as those that characterized the previous stages in Kroitor’s career. SANDDE enables realist work because it allows one to physically generate assets and their movement in real space and time with an optical wand and motion tracker (to create a realistic movement, the animator need only move his or her wand in a realistic manner). The technology enables reflexive work because the painterly or abstract animation that it facilitates is not what one would expect from such a sophisticated device. To learn the physical activity of animating with the device is to relearn the relationship that once existed between drawing, sculpture, and animation.

Ultimately, this thesis has sought to suggest that the diverse periods in Kroitor’s lifework are united by a relatively stable interest in developing new ways for audiences and creators to relate to reality through cinema. Whether in filmmaking or invention, Kroitor’s contributions to film and film culture have helped to redefine the experiential nature of spectatorship and animation by breaking with the stagnant conventions that previously delimited these activities. Kroitor’s work conjoins the realist and reflexive strategies detailed in this thesis in order to facilitate audience experiences that are simultaneously characterized by immersion and a sense of critical distance. Insofar as this work anticipates our culture’s growing fascination with immersive apparatuses for the creation and relay of information and entertainment, Kroitor is an innovator of considerable importance. By elucidation of the
connections between the various periods in Kroitor’s lifework, this thesis aims to encourage future work on the man and his work.
Works Cited


Janro Imaging Laboratory, Inc. “SANDDE Studio – Product Description.” (2011)


- - - The Best Butler in the Business: Tom Daly and the National Film Board of Canada. Toronto, ON: University of Toronto Press, 1996.


Knelman, Martin. This is Where We Came In: The Career and Character of Canadian Film. Toronto, ON: McClelland & Stewart, 1977.


Langdon, Graeme. “Interrogating the Cinematographic Frame.” INF1002 Course Paper. Faculty of Information, University of Toronto, 12 Apr. 2011.


