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An Overview of New Media Theory and Digital Gaming: History, Typology, Sequence, and Relationships to Socio-cognitive Theory and Affective Learning

This essay focuses on New Media Theory generally, and digital games specifically. To begin, an overview of the historical background of New Media Theory and games is provided, followed by a listing of major new media theorists and game scholars. Next, the ways in which New Media Theory and games accounts for phenomena in the social world is explored; that is, the basic principles of new media, the gaming experience, and ethical and aesthetic considerations. Based upon these considerations, the universal typology the theory establishes is discussed as well as insights gleaned from the typology, followed by how the theory postulates sequence and relationships to Socio-cognitive Theory and Affective Learning. And lastly, this essay looks at practical applications of games.

New Media and Digital Code

New media, including computer games, consists of digital code. All objects which are considered new media have digital code as their underlying basis; this includes such things as "graphics, moving images, sounds, shapes, spaces, and texts" (Manovich 20). In effect, all these are digital computer data, or soft media. From the point of view of the user or program, texts seen on the screen are virtual texts; that is, they are "not physically existing as such but made by software to appear to do so" until they are 'saved' to computer memory (Landow 35). Multilinearity is a key feature of new media whereby hypertext and hypermedia (electronic

links) create multiple reading paths through a text or other forms of visual data (Landow 1-4, 45). In addition, new media allows for the production of multiple copies of the same text without degradation (Landow 32), as well as timely sharing of texts via networks (Landow 38).

The History of New Media

New media is a recent convergence of media and computing which initially began about the same time, but on parallel courses. The history of media begins with the Jacquard loom invented around 1800. Jacquard's loom weaved intricate figurative images as controlled by punched paper cards. Then in 1839, Louis Daguerre created the first reproduction process, photography. Many improvements were implemented along the way until in the 1890s the still picture was put into motion laying the foundation for modern cinema.

The history of computing begins with Babbage who in 1833, inspired by Jacquard's loom, began design of his Analytic Engine. The Analytic Engine, although never developed, foreshadowed the digital computer. (According to an article in the New York Times, researchers in Britain are about to embark on building Babbage's computer (Markoff).) It used punched cards to enter data and instructions into the Engine's memory. A processing unit, the "mill," performed calculations in memory by following instructions and wrote the results to memory; the results could then be printed. Like media, the 1890s proved important for the development of computing. For the 1890 census, the Census Bureau employed electronic tabulating machines designed by Hollerith which collected census data on cards.

In the year 1936 the parallel paths of media and computing begin to converge with Turing's, "the Universal Turing Machine." His machine read numbers, performed calculations, and wrote the results on a continuously moving tape, similar in motion to a film projector. Also that year, Zuse built the first working digital computer using punched tape – discarded 35mm

movie film – to control its programs. Then in the 1940s programmable digital computers like the ENIAC were introduced as calculating engines mainly for military and scientific applications. Since then, each decade has seen a steady progression of the technology and the convergence of media and computing into new media. By the 1960s large corporations and governments had adopted the computer for their accounting processes; in addition, "a few pioneers saw …it as 'a new *writing* technology'" while the AI community saw it as a "symbol manipulator" (Landow 34). Word processing appears along with desk top computers in the 1970s. The first sign towards the shift to new media, according to Manovich, occurs in the 1980s as word processors improved the production of books and other text documents. Then in the 1990s digital technology comes into its own "with the rapid transformation of culture into e-culture, of computers into universal culture carriers, of media into new media" (Manovich 6). The 90s also saw the word processor evolve into "an *image capturer, presenter, and manipulator*" (Landow 35). Since then the internet has evolved to Web 2.0, marked by participatory culture and cloud computing.

According to Bolter, digital technology is a remediation of print technology; it is a "fundamental shift from tactile to digital, physical to code, and hard to soft media" (Landow 35). As such, the computer has newly defined the machine, for it shifts the processing of power to that of information; it is a technology of writing beyond the mechanization of the printing press (Bolter 15). And this shift to digital technology is, according to Bolter, one of the most dramatic of all remediations in the history of Western writing. (Bolter 189-190).

The History of Digital Gaming

New media games encompass "[a]rcade games, home video games, and desktop computer games [;] each operate within their own social space" (Bolter, *Remediation* 102) taking on "various forms, including story worlds (*Myst*), simulations (*Sims*), first-person shooter

(*Quake*), multiplayer (*Lineage*), and god-games" (Landow 250). Computer games originated in 1962 when Steve Russell (then a graduate student at MIT) designed the first video game, *Space War*, on the main frame. Although at the time, Russell didn't think his game had commercial value, the game's popularity spread (amongst graduate students) and sparked the gaming industry. Games first appeared as arcade games, like *Pong* (a table-tennis game), on mainframes and minicomputers. The second venue for games, home video games, was introduced in the early 1970s with the home video game console. The first video game, *Odyssey*, developed in 1972 by Ralph Baer was, in Baer's words, "a way of doing something else with the television set rather than turning it on or off" (Flynn 553). The early home video games were re-purposed arcade games; for example, *Pong*, originally released in 1972, was released as a home version in 1975. Throughout the 1970s and 1980s, video games became more complex with the introduction of video game consoles by companies like Atari and Nintendo. Today home video games are played on console machines such as the Sony Playstation 3, Nintendo DS, and Xbox 360. The third venue for games, PC games, came into being with the development of the desktop computer. Soon games for the PC proliferated; and both, games and PCs, became increasingly graphically sophisticated – "[s]ometimes the desktop computer would run ahead of the games…sometimes the visual presence and interactive strategies of the games would suggest new paths for the desktop interface" (Bolter, *Remediation* 90). Today, desktop or PC computer games are played solo or in concert with others on the internet. Since their inception, games have been increasing in popularity and "are poised to become a major entertainment form for the twenty-first century" (Postigo 593).

According to Manovich, of all computer interfaces, that of computer games is being transformed most aggressively into a cinematic interface. The transformation had begun by the

1990s as game designers moved from two to three dimensions and began to increasingly incorporate cinematic language. In addition, "games began to feature lavish opening cinematic sequences (called 'cinematics' in the game business) that set the mood, established the setting, and introduced the narrative." In the beginning of the 1990s many games were based on a branching-type structure and digital video; for example, they used digital video of actors superimposed over 2-D or 3-D backgrounds. As a result, all possible scenes of a game had to be videotaped beforehand. But by the end of the decade, characters became fully synthetic and rendered in real time; these 3-D animated characters moved "arbitrarily around the space, and the space itself can change during the game. (For instance, when a player returns to an already visited area, she will find any objects that she left there earlier.) This switch also made virtual words [sic] more cinematic, as characters could be better visually integrated with their environments" (Manovich 83-84).

Increasingly game designers borrowed cinematography techniques from traditional cinema, creating more complex interactive virtual worlds. A particularly important example is the implementation of a dynamic point of view whereby the user can adjust the position of the camera; for example, the user can switch his point of view from that of the hero to a top-down bird's-eye view. In essence, directing the virtual camera becomes as important as controlling the character's actions (Manovich 84).

This steady progression in the automation in computer games is consistent with the overall progression in the automation of new media as it moved from basic to more complex operations. For example, with regard to automation of images, since the early 1960s, "element by element, cinema is being poured into a computer: first, one-point linear perspective; next, the mobile camera and rectangular window; next, cinematography and editing conventions; and, of

course, digital personas based on acting conventions borrowed from cinema, to be followed by make-up, set design, and the narrative structures themselves" (Manovich 85-86).

New Media Theorists and Game Scholars

The major new media theorists working in the area of hypertext are Jay David Bolter who wrote on the remediation of print by new media in his books, *Remediation: Understanding New Media* and *Writing Space: Computers, Hypertext, and the Remediation of Print*, and George P. Landow who wrote on the relationship between literary theory and computer technology in his book, *Hypertext 3.0: Critical Theory and New Media in an Era of Globalization.* Lev Manovich, who wrote *The Language of New Media* is a new media theorist of visual culture who centers on its relationship to cinema. Rob Cover is a new media theorist whose research interests include digital, participatory/interactive media and communication theory (Cover, *Dr. Rob*).

Game scholars have been in debate over the study of games; on the one side, the 'narratologists' who assert that 'everything's a story' and on the other side, the 'ludologists' who posit that 'everything's a game' (Patrickson). Among the ludologists are Markku Eskelinen, Espen Asrseth, Raine Koskimaa, and Celia Pearce who have written on ludology in gaming. Acting the part of a referee, narratologist Janet Murray has proposed that "It is time to reframe the conversation... games are not a subset of stories; objects exist that have qualities of both games and stories" (Murray). And, Bronwin Patrickson stands somewhere in between with his call for a new word, Plai, to describe the "staged encounters in computer-mediated environments" (Patrickson).

New Media Theory, Games and their Relation in the Social World

Basic Principles of New Media

All new media objects, including computer games, have digital code as their underlying basis. Manovich details five principles of new media with the caution that not all new media follow all of the principles. The principles are numerical representation, modularity, automation, variability, and transcoding. Of the five principles, three (numerical representation, modularity, and transcoding) are related to the object as digital code. The other two, automation and variability, are combinations of numerical representation and modularity; they describe a typology more so than an ontology. The principle of numerical representation posits that since all new media are composed of digital code, they can be described mathematically; and thus, are subject to algorithmic manipulation. For example, graphics can be manipulated to improve contrast, or change proportions. "In short, media becomes programmable" (Manovich 27). The next principle, modularity "can be called the 'fractal structure of new media'" (Manovich 30). Analogous to how fractal structures retain their structure on different scales, new media objects retain their identities when combined with other objects. For example, an HTML document might contain images, and flash movies; but each of these objects remains independent. "In short, a new media object consists of independent parts, each of which consists of smaller independent parts, and so on, down to the level of the smallest 'atoms' – pixels, 3-D points, or text characters." (Manovich 31). And lastly, transcoding, means that new media takes on two views – new media objects are displayed such that they make sense to the human, for example, as graphics or text sentences; and since new media objects are computer code, they are represented as computer organization structures, for example, records, arrays, variables, and so on.

Numerical representation and modularity are two basic "material" principles of new media and form the building blocks on which more complex new media structures are

constructed. These two principles allow for the third principle, automation of many operations involved in new media creation, manipulation and access (Manovich 32). Finally, the computer layer and cultural layer influence each other, and are composited together to create a "blend of human and computer meanings" (Manovich 45-46).

The Gaming Experience

New media presents the meaning of its digital code in terms the human can understand through the computer interface. Manovich explains the human-computer interface (HCI) as a cultural interface. He writes, "[i]n short, we are no longer interfacing to a computer but to culture encoded in digital form" (70). As applied to gaming, epistemology consists of the virtual environment and play as narration, interactivity and immersion. In the gaming environment, stories are not simply told, but created and experienced interactively. Patrickson notes that computer programs use metaphors; "metaphors by their nature are inexact…they merely need to make sense to clarify meaning and, ideally, evoke resonance" (Patrickson). Metaphors lead to immersion. Dede writes, "immersion is the subjective impression that one is participating in a comprehensive, realistic experience… [i]nvoking digital versions of archetypical situations from one's culture deepens the immersive experience by drawing on the participants's beliefs, emotions, and values about the real world" (66). Patrickson, in reference to Brenda Laural's paper, *Computers As Theater*, reinforces Dede; he writes, "In Laurel's model the drama twists and turns between the computer and the user. In effect, users collaborate with programs to create enactments. In other words, players will engage with on screen representations (and simulations) from the perspective of their own cultural and personal framework and if a user experiences catharsis, for example, in terms of affirmation than these experiences are part of the event too.

Interactivity is as much an exchange of information and interpretation (meaning) as it is a form of play" (Patrickson).

New Media and Gaming Ethics In terms of new media ethics, there is "an emerging set of values, practices, and expectations regarding the way people (should) act and interact within the contemporary network society." These emergent properties have roots from both offline and online venues and are influenced by "an increasingly individualized society in a globalized world" (Deuze 63). For new media in general, this participatory culture has bred the proliferation of user-generated content, much with questionable credibility, bringing to the forefront issues of intellectual property and copyright. In addition, participatory culture has produced "many services and intellectual goods on the Internet" as unwaged labor. This trend is seen in the games sector of new media in the form of, 'modders', "hobbyist groups that develop modifications to commercial games" called 'mods.' According to Postigo, "[t]here are hundreds of mod groups on the Internet producing thousands of mods for the scores of PC game titles" (Postigo 596). He explains that "as hobbyists' leisure work is converted from gift to commodity, what results is the circumvention of the initial investment risk for the commercial developers as the development work is transferred to the fan base where costs are negligible. Paradoxically, the hobbyist status of modern modders works against them as it situates their work outside the programming profession, since commercial video-game companies are able to circumvent initial investments and maintenance costs for hired programmers and can simply choose from the most successful of the already-developed mods…Ultimately, this process manages to harness a skilled labour force for little or no initial cost and represents an emerging form of labour exploitation on the Internet" (Postigo 596-597).

New Media and Gaming Aesthetics

"'Aesthetic' has come to be used to designate, among other things … a kind of experience" (Shelley). Applied to new media, aesthetics pertains to the kind of experience one derives from the computer interface. Applied to games, aesthetics focuses on the experience as it relates to the cinema and the imagination where "the window into a fictional world of a cinematic narrative has become a window into a datascape" (Manovich 86). "Vivid imagination is what is involved in aesthetic participation, engaged pretense, or absorbing games of make-believe... what we imagine is often (particularly in the context of … games of make-believe) what we take to be fictional" (Gendler).

New Media and Gaming Typology

New media typology is characterized by the concepts of hypermedia and hypertext, transparency, interactivity, and hybridity. Citing Bob Cotton and Richard Oliver, Bolter defines the first concept, hypermedia as a media experience that brings together in any combination, images, sound, text, animation and video, that can be accessed randomly with "no physical beginning, middle, or end" (Bolter, *Remediation* 31). Variability, Manovich's fourth principle includes hypermedia; it is a combination of the principles of numerical representation and modularity whereby new media objects may be modified in potentially infinite versions by a human author or by a computer. Hypertext, is hypermedia, but limited to text (Manovich 36-38). The next concept, transparency, has as its goal the ability "to function as a window through which the viewer can see the objects represented" (Bolter 25). Bolter explains that the concepts of hypermediacy and transparency are divergent. He writes, "[t]he same medium can strive for transparency in one case and hyper-mediacy in another, and in general today we swing back and forth between a desire for transparent contact with the ostensibly real (unmediated) world and a fascination with the possibilities that media offer us" (Bolter). The concept of interactivity or

automation (Manovich's third principle), like variability, is a combination of numerical representation and modularity. Manovich explains automation as the creation, manipulation and access to new media objects. To explain the next concept of hybridity, Bolter references Latour, "the phenomena of contemporary technoscience consist of intersections or 'hybrids' of the human subject, language, and the external world of things, and these hybrids are as real as their constituents – in fact, in some sense they are more real because no constituent (subject, language, object) ever appears in its pure form, segregated from the other constituents. The events of our mediated culture are constituted by combinations of subject, media, and objects, which do not exist in their segregated forms…[summarizing Latour, Bolter writes,] media are hybrids in Latour's sense and are therefore real for the cultures that create and use them" (Bolter, *Remediation* 57-58).

The typology of new media in reference to games includes the concepts of hypermedia, transparency, and interactivity. In addition, games are goal-oriented and rule-based. Goal orientation of games is defined by the "vast set of permutations for a game narrative, allowed by the random number generators of a computer and by the responsive inputs of a game player, are not without limitation… [and as such] enforce a certain compliance with choices offered" (Cover 186). Automation (Manovich's term for interactivity) in games is carried out by the Artificial Intelligence (AI) engines (or computer code) that control character's actions where characters are programmed (according to rules) to perform a limited number of actions. "In short, computer characters can display intelligence and skills only because programs place severe limits on our possible interactions with them" (Manovich 34).

In contrast to print, digital technology not only changes the 'look and feel' of writing and reading, but also increases the emphasis on visual communication with graphics, animation,

video, and audio (Bolter xi, 24). In print, the author exerts overall control over the text; readers interact with the text in terms of sounds, images, or ideas in their own minds. Whereas, electronic writing replaces the fixity of print with the flexibility of hypertext; although authors have written the words and selected the images, it is the reader who chooses how the text will be read and which links will be followed (Bolter 165).

Similarly, in games, it is the player who chooses how the game will be played. As players engage with the game's narrative, their actions, such as clicking a mouse or manipulating a joystick, determines what the player encounters next. As well, games are meant to be performed; they are meant to be performed multiple times. In addition, the player's actions appear to be linear since they make their way through a series of game choices in linear time (Landow 250).

Insights Derived from the Typology of Games

Applying the building blocks of new media, hypermedia and transparency, Manovich identifies a cultural tradition of cultural interfaces as cinema. He defines cinema as "the mobile camera, representations of space, editing techniques, narrative conventions, spectator activity – in short, different elements of cinematic perception, language, and reception" (Manovich 71). Using the movie theater metaphor, cinema provides strategies to organize "audio-visual narrative taking place in a 3-D space" (Manovich 72) on the cultural interface. Games employ cinema in an effort to "seek the real"; they either encourage the player to "dwell on the surface of the screen with its multiplicity of mediated objects" (as in hypermedia) or encourage "the player to look through the surface of the screen" (as in transparency) (Bolter, *Remediation* 94). For example, some games incorporate three-dimensional transparency, they strive to produce in the user a feeling of immersion through linear perspective and a first-person point of view (Bolter, *Remediation* 91). Interactivity in games "allows the user to manipulate, control, alter or

transform the text as *registrational*, meaning that the medium works to record access patterns and accumulates imputed or responsive information." In this sense, the player has control over the narrative; the computer keeps track of the player's inputs and alters the narrative accordingly (Cover, 178).

Game genres use the building blocks of the typology of new media. Games fall into many genres and subgenres; and within each genre-subgenre category game designs and goals vary. Genres include "'Action Adventure', 'Driving or Simulation', 'Strategy' and 'Role Playing' (RPG)." A subgenre of 'Action Adventure' is 'First Person Shooter.' Game designs in this genre "are immersive and allow the player to experience the virtual environment from the perspective of the lead character." The goal is to complete short tasks while navigating an environment. Subgenres of 'Strategy' include 'Real Time Strategy' (RTS) and 'Turn-Based Strategy.' RTS game designs "give the player a third person point of view of the virtual environment on a larger scale…[and] tend to be more open-ended and give the player more time to fulfil [sic] a given task" (Postigo 595).

Landow explains that even theorists who believe that games are narrative recognize that games and stories have major differences. He quotes three theorists on this point: "'A story,' Janet Murray explains, 'has greater emphasis on plot; a game has greater emphasis on the actions of the player.' Furthermore, as Eskelinen points out, 'information is distributed and regulated very differently in games than in narratives.' Pearce points to a third difference, namely, that 'games tend to favor abstracted personas over 'developed' characters with clear personalities and motivations.'" Landow writes that despite the many disagreements between narratologists and ludologists, "they all accept two of Murray's major points – that agency is crucial to computer games and narrative has at least *something* to do with them" (Landow 252).

Sequence and Learning in Games

Sequence is demonstrated through narration and the game experience; learning is acquired through player's actions and strategies. Brenda Laurel, in her '90s paper *Computers As Theatre*, "applied Aristotle's foundational *Poetics* of performance to digital media" (Patrickson). To her it was obvious that computer interaction and drama resembled each other. In effect, she "fired the imagination of interface designers" to create games that incorporated drama along with play (Patrickson).

Patrickson tells how Janet Murray surveyed the state of digital storytelling at the end of the twentieth century. She found that "much work had already been done to incorporate narrative into game-play" (Patrickson). Drawing from Aristotle's *Poetics,* she made the observation that gaming and narrative share two basic structures – those of the contest and puzzle. Moreover, she writes, "stories and games are like one another in their insularity from the real world, the world of verifiable events and survival-related consequences" (Landow 250). For games, Patrickson writes that "in the realm of emergent narrative what is encountered is less about story and more about storified experience." Games are rule-based and generally, those rules, otherwise known as restrictions, shape the player's experience. "Narrative is a form of restriction. It defines a set environment or history out of a limitless range of possibility" (Patrickson). Patrickson writes, "Interactive 'stories'… change and develop according to the user experience. In reference to interactive storytelling he cites Crawford, 'plot is replaced with a web of possibilities that communicate the same message' – or not, depending on the player's choices."

Landow quotes a crucial point that Markku Eskelinen makes in "Towards Computer Game Studies," "a story, a backstory or a plot is not enough. A sequence of events enacted constitutes a drama, a sequence of events taking place a performance, a sequence of events

recounted a narrative, and perhaps a sequence of events produced by manipulating equipment and following formal rules constitutes a game." And, distinguishing between games and narratives, "in games, the dominant temporal relation is the one between user time and event time and not the narrative one between story time and discourse time" (Landow 252).

Landow writes that Aarseth also makes a crucial point that computer games characteristically involve simulation where players learn the game through their actions and strategies:

> *The computer game is the art of simulation*. A subgenre of simulation, in other words. Strategy games are sometimes misleadingly called "simulation games," but all computer games include simulation. Indeed, it is the dynamic aspect of the game that creates a consistent gameworld. Simulation is the hermeneutic Other of narratives; the alternative mode of discourse, bottom up and emergent where stories are top-down and preplanned. In simulations, knowledge and experience is created by the player's actions and strategies, rather than recreated by a writer or moviemaker." (Landow 252).

Socio-cognitive Theory and Affective Learning as Related to Games

A relationship between games and socio-cognitive theory exists. The potential for learning by playing games is recognized; a multitude of games exist for a wide variety of contexts where "educational objectives are in the foreground, and learning is the explicit goal of the game." Cognitively, players of more complex games, "learn to assimilate information and make decisions quickly. They discover strategies for overcoming obstacles, and construct understanding of complex systems through experimentation in natural and unobtrusive ways... in addition, games can provide higher levels of continuing motivation, improve practical reasoning

skills, and complex problem solving or cognitive development in scientific/technical aspects" (Dormann 41). According to Socio-cognitive theory, these players are exhibiting what Bandura terms Self-Reflective Capability, that is, "[p]eople are not only agents of action but self-examiners of their functioning. Effective cognitive functioning requires reliable ways of distinguishing between accurate and faulty thinking. In verifying thought by self-reflective means, people generate ideas, act on them, or predict occurrences from them. They then judge from the results the adequacy of their thoughts and change them accordingly" (Bandura 269).

Game players become immersed in the game; they derive pleasure from mastering the game, from attaining goals. Bandura's discussion about motivation is relevant to games. He writes, "The anticipated self satisfaction gained from fulfilling valued standards and discontent with substandard performances serve as incentive motivators for action. The motivational effects do not stem from the standards themselves, but from the evaluative self-investment in activities and positive and negative reactions to one's performances" (267). When interacting with the progressively more advanced levels in games, player's become motivated to attain the next level. Bandura explains this phenomena, "People motivate and guide their actions through proactive control by setting themselves challenging goals and then mobilizing their resources, skills, and effort to fulfill them. After people attain the goal they have been pursuing, those with a strong sense of efficacy set higher goals for themselves" (268).

Three of the six dimensions for affective learning (identified by Martin and Reigeluth) can be applied as variables that impact the construct of narration in games: emotional, social, and moral (Dormann).

Emotional development consists of understanding one's own feelings and those of others, learning to manage those feelings and wanting to do so;

Social development includes the development of pro-social attitudes, often in relation to caring, justice and equality;

Moral development is described as self-awareness, self-management, social awareness, relationship skills, and responsible decision making.

As players interact with a game, an observer can assess how well the player displays learning in these dimensions, combinations of them, or a subset of them.

Practical Applications of Games

Many researchers have studied games from the perspective of cognitive learning and development. These studies have shown that playing games can enhance visual processing skills, including visual attention, and the ability to manipulate objects or mental images through space." They have also shown that more complex games based upon problem solving improve player's ability to analyze information from many sources and make decisions quickly. In addition, it has been documented "how games can provide higher levels of continuing motivation, improve practical reasoning skills, and complex problem solving or cognitive development in scientific/technical aspects" (Dormann 41).

Dormann writes that there is a growing trend of educational games with affective objectives; they aim to change behavior and or attitudes by addressing emotional, social, and cultural issues. Such games may take the form of role-playing simulations (Dormann 41).

Kim writes that computer games enhance learning because they are a form of play that motivates students through entertainment; they also have competitive activities that include rules, goals, feedback, interactions, and outcomes. He paraphrases Dickey, "interactive learning environments allow learners to construct understandings by interacting with information, tools, and materials as well as by collaborating with other learners within the game. Games are

seductive, deploying rich visual and spatial aesthetics that draw players into fantasy worlds that seem very real in their own terms, exciting awe and pleasure" (Kim 800).

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