The SAGES University Seminar Essay Awards

2012-2013

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The SAGES University Seminar Essay Awards highlight the best student writing produced in SAGES University Seminars each year.

The essays included in this booklet were selected from those nominated by SAGES faculty for this award in academic year 2012-2013.

December 6, 2013

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Students were asked to choose a concept from a reading and apply it to a recommended film from the syllabus.

Instructor's Nomination: Rarely as a film instructor do I read a student essay that is written at an impressive academic level. Reuben Sass's essay analyzing the style and subcultures reflected in the film *American Graffiti* is just such an essay. It is exceptionally well written, highly analytical, and very insightful.

The Trouble with Deep Time and How to Solve It
By Justin Bronstein

> "There are children playing in the street who could solve some of my top problems in physics, because they have modes of sensory perception that I lost long ago" (J. Robert Oppenheimer, *Pearls of Wisdom*).

Humans have been on the Earth for only a couple hundred thousand years, a rather short time compared to some of the Earth's longest-lived species. However, in this short period we have risen to the top of the food chain and have become the smartest organisms of which we know. We can attribute some of this to the size of our brains and our sociality, but the one thing that has allowed us to explode intellectually is our ability to record and pass down information. Knowledge was originally reserved only for those who could remember, but now it is recorded in written language, and passing from generation to generation is required, in the form of schooling. Without it, each generation would have to grapple with the seemingly simple concepts of multiplication, falling objects, and what to do with that thing in between your ears. But with it, we can learn rather quickly the accumulation of millennia of discoveries, such as calculus, history, and, as the focus of this paper, the notion of deep time. In order to keep advancing as a species, we need to know what we are advancing upon, and this starts in the classroom.

Deep time is one of the most, if not the most important discovery in science. Knowing that the Earth and the universe are older than any of us could possibly imagine allows us to postulate fact-based and logical theories for many of the things we observe as slow processes that simply cannot be observed during a human lifespan. Through this idea we have discovered such well-known and foundational theories as the Big Bang, evolution, and continental drift.

Even though it is a very important tenet of modern science, it is very difficult to teach deep time, and thus it is often given less weight in the classroom or omitted completely. This paper is going to talk about the importance of deep time in science education and the best ways to teach it, so that the youth of the world may feel comfortable with the scariest, most thought-provoking part of modern science. We will start with a brief discussion of what deep time is and why it is hard to teach. We will then discuss how it is currently taught, and why it is wrong. Next, we will look at research on different ways of teaching, both with deep time specifically as well as simply better methods of putting an idea in a student's head. Finally, we will go back and use the new methods to paint a much better picture of what it really means to talk about deep time. We will show what takes place through deep time, and finally summarize how important it is to know about deep time in order to function in modern science.

Deep time, as previously mentioned, is one of the tenets of modern science. It is the name given to the idea of time on the scale of tens of thousands to millions, billions, or even trillions of years. It is a way of putting a distinction between durations in which we can place events, and those which we can't. We can directly imagine events taking minutes, hours, days, or years. Our lives follow these time scales. Indirectly, we can look at the rate at which something is occurring, like the building of a cathedral, and extrapolate its construction over a few hundred years. However, once the scale of around a thousand years is reached, it is difficult to think of a single event which takes that amount of time. Once ten thousand years is reached, there is no event in human experience which can be used to quantify that event. That is where the scale of deep time starts. It includes, usually, the duration between two events very far back in time, often the duration from one event to the present. It is a useful mathematical tool for chronologically sorting events far in the past, although it does not have a physical meaning to anyone, scientist or otherwise.

Because deep time does not have a direct link to common human events, it can be a very difficult subject to teach. The teachers can themselves sometimes become more confused than the students. According to a study by Piaget, referenced in Dodick and Orion, "a young child's understanding of time is tightly bound to his concept of motion" (709). The events often associated with deep time either have no motion, as in geological studies of rock formations, or happen on such vast distances that the motion loses all relatable meaning, as in cosmology. Thus, the idea of deep time often becomes nothing more than a word or words, with no moving images attached.

Currently in public schools, little attention is given to the subject of deep time. It "often fails to be included explicitly in… school curricula" (Trend 7). When it is taught, it is not given the proper amount of time for a student to truly understand what is being taught. The most common tool used is a timeline, in which durations in time are replaced by distances. This is a great way for all ages of students to picture time on large scales. However, there is inherently a problem with using physical timelines for such large time distances. The problem of understanding vast amounts of time is replaced with the problem of understanding very large distances (Parker 23). Because of the nature of deep time itself, it is very difficult to create a timeline on a scale with both ends within common human perception. Often, the "present" end will be on a microscopic scale, and/or the "past" end will be much too far away for a good conceptualization.

A tool that has both saved and destroyed the understanding of deep time is the logarithmic time scale. This is a scale in which one year of time is equidistant from a thousand years, which is equidistant from a million, a billion, and so on to infinity. In this way, events that happened far in the past are brought into focus on a relatively short distance. This is a godsend in chronology, as we can now visualize the order in which everything that we know happened occurred. However, it destroys the ideas of absolute time. On a scale

like this, it appears as if the distance between the birth of the Earth and the Cambrian explosion of life, which took place over four billion years apart, is the same distance apart as the Cambrian explosion and the extinction of the dinosaurs, which was a difference of only 400 million years. An order of magnitude is lost in one translation. Go forward a few more "even" events, and it will appear that yesterday's breakfast is as far away from today as the birth of the Earth and the appearance of life. A billion years taking up the same space as a day is not ideal for the conceptualization of absolute time.

Because of this inability to see the entire span of deep time properly, we reach an issue connecting the two main types of thinking for deep time, relative time and absolute time (Parker 23). Relative time concerns the placing of events in chronological order, starting with the very beginning and ending with the present day. Regardless of the duration between, most students do not have a problem with this task. Since it is a regular occurrence for any person to put events in the past in order, this comes almost as second nature, and only sometimes requires academic knowledge, but usually not that which pertains to time itself. Absolute time, on the other hand, is much less intuitive. It pertains to the duration between events in addition to the events themselves. Because the main issue with the teaching of deep time lies in the duration, absolute time is very difficult, and sometimes impossible, to grasp. This huge tear in the whole concept of deep time is what makes it hard to teach, and shows why something about the ways we do teach it have to change.

There are teachers and researchers who have dedicated their time finding a better way to teach deep time, although not nearly enough to come up with a well-known and working method (Dodick and Orion 709). Many of the methods are simply finding new ways of using the old methods. Larry Flammer, a retired high school teacher and science webmaster, is very much a fan of the old methods, but knows that "It's still a stretch to link familiar time (years) to deep time (millions of years)" (69). His approach is to take

the scale of the largest amount of time a human can witness one event, on the scale of ten years, and make that equivalent to the smallest familiar unit of length, the millimeter. From there it follows that a human lifespan is about eight centimeters. Getting into deep time, one million years is about the length of one football field. Flammer chooses not to extend this scale past 500 million years (approximately thirty miles), where the fossil record ends (or begins, depending on how you look at it). He also stops there because he does not believe that students will be able to visualize distances of much more than that. Thirty miles, he assumes, is the distance "they have probably traveled… to [see] some concert, relative, or friend (500 million years), so they have firsthand experiences with those extreme dimensions and points in between" (69). He also uses a map to plot the distances as times, which is a tool also used by Parker in his study. Even in going through all this work, he does not once mention the successes of his endeavors, only hints at them. This leads me to believe that his methods – while possibly more successful than the general teaching method – are still not ideal for the proper deep time education.

There are other ways of teaching deep time that also use the common method of a physical timeline, but do so in a way that brings the old concept into the modern world. Joel D. Parker, a university lecturer, has taken the physical timeline and not only analyzed it for the best range of lengths, but uses Google Earth rather than a map to plot distances. The zoom feature of this software allows anyone to see all the distances outside of the lecture hall at once, so that they may get a complete picture of every event at once. He starts at the smallest distances for the most recent times. He uses the average age of a college freshman – eighteen years – as his starting point. This becomes analogous to the smallest length a person can see with the naked eye: about half of a millimeter, or about 1/50 of an inch. On this scale, the formation of the earth is about eighty miles away. Depending on where you live, this is approximately a 1.5-

hour drive by interstate, which can be a very common occurrence by college students, and thus it is much easier to use this analogy of deep time. Parker not only tells us of his method, but also has provided a scale of some important points in Earth history for the evolution of man. In addition to the Earth forming 78.4 miles away, it marks the first life at 61.4 miles (3.6 billion years ago), the Cambrian explosion, in which modern life forms first appeared, at a mere 9.2 miles (542 million years ago), and the earliest hominid, at the still-very-large age of 6 million years ago, at only 534 feet. This carefully analyzed scale truly shows the differences in magnitude of various events that are usually lumped together as "a long time ago." This method works so well because "humans are evolutionarily adapted to think in terms of geography" (Parker 26). We evolved as hunter-gatherers, and thus we had to have a deep knowledge of our surrounding territories so that we could hunt and gather most efficiently. Even with modern transportation taking us places faster than we could ever have hoped to run, this evolutionary advantage still helps us; our "territory" is now simply larger. An unexpected learning bonus was that, since the routes are commonly taken, students are subconsciously reviewing deep time every time they walk across campus or take a trip home. This method really is the lesson that keeps on giving!

As previously mentioned, deep time is a very important subject to understand in education on geology, cosmology, and evolution. It is so engrained in the teachings of these topics that once it is understood by the student, they will forever see these topics in a new light (Trend 8). This kind of pivotal idea is what is known as a "threshold concept." This is, of course, not to be confused with a "core concept." As Trend quotes from a 2008 paper by Meyer and Land, "a core concept is a conceptual 'building block' that progresses understanding of the subject; it has to be understood but it does not necessarily lead to a qualitatively different view of subject matter" (8-9). This shows that the way of thinking about geological processes changes

significantly when one learns the important tenets of deep time.

Roger Trend, a noted researcher in the Department of Education at Oxford, went much further into the study of teaching deep time to find out the basic core elements that those who have successfully learned the subject possess. Unsurprisingly, the students who learn deep time the best have the most motivation to learn it (Trend 11). This motivation is achieved through two different methods: interest and the four interest phases, developed by Hidi and Renninger in 2006; and the self-determination theory, proposed by Deci and Ryan in 1985. First and most importantly, is getting the student interested in the subject of deep time. The four phases of interest mentioned are, in order, "Phase 1: triggered situational interest, Phase 2: maintained situational interest, Phase 3: emerging individual interest, and Phase 4: well-developed individual interest" (Trend 10). This series of interest development can start with something as simple as showing an animation of the breakup of Pangaea to the continents in their present positions, as shown in Table 1 on page ten of his research. Little things like that were also what sparked my interest back in lower elementary school. To develop into phase two, we now engage the student in a subject that has already been researched, but is still of interest to many, such as the extinction of the dinosaurs. To move into phase three, where the interest becomes individual, the topic of research shifts from something common to something relevant yet requires the student to follow his or her own leads to the result, such as local geology. The fourth and final phase would be for students to be completely independent, as in a geology club. At this point, the students themselves would be choosing their own research topics, conducting said research, and presenting the data without the aid or direction of a teacher.

The second of the ways to improve deep time education is through the Self-Determination Theory. It is based upon the idea that people have "three basic psychological needs of (i) autonomy, (ii) competence and (iii)

social relatedness" (Trend 9). This idea is not unique to the teaching of deep time. In fact, it is related to the motivation behind anything one does in his or her life. The first basic need of autonomy is very similar to interest. What it states is that a student learns much more quickly and thoroughly when he or she can transform the external motivation of a teacher or peers into his or her own internal motivation. The feeling of owning the task, timing, outcome, etc. has been shown to increase the level of motivation, as well as the learning, of the student. The second idea, competence, is rather self-explanatory. The student should feel able to tackle any assignment or idea thrown at them, while still feeling a challenge. Scientific research has been done which proves that, even though no proof is necessary, excessively easy assignments are boring, excessively hard assignments are stressful, and both hinder the learning experience. Positive feedback from the teacher can also improve both motivation and feelings of competence, while negative feedback will reduce both. The third and final psychological need, social relatedness, while having been deemed less influential than the previous two needs, still has a great influence on willingness to learn. Many times teachers, especially of the sciences, hear "why does this matter?" The questioning of a topic's social relevance is directly related to the autonomy of the student learning, and is part of the understanding that a well-rounded education helps prepare you for the real world, where your unrelated knowledge can be tested at any time.

Combining the ideas of interest and self-determination, Trend has come up with an ideal curriculum guide for teaching deep time to students of all ages. As interest develops, the level of autonomy increases. The teacher is always present, even when interest is in phase four, to make sure that the level of difficulty does not exceed what the students are capable of. In order to make all subjects relevant, student interaction is encouraged or required to increase peer support and general knowledge of the subject.

Deep time by itself is fascinating to think about, but has no significance unless applied to a subject which uses it. Most commonly it is used in geology, as a majority of geologic studies use processes that are only observable in deep time. Similarly, studying purely the understanding of deep time has no significance unless it is in a relevant context. Dodick and Orion noted that there have been few scientific studies into student understanding of geological time; far fewer than they think should be conducted on such an important tenet of the geologic sciences (709). They devised a way to measure the understanding of the students through geologic studies. The quiz was named GeoTAT, short for Geological Time Aptitude Test. There were two main goals to the test: the first was to observe whether or not those students studying geology prominently had a better understanding of geological time than those who didn't (Dodick and Orion 710). As is expected, the geology student held a significant advantage over non-geology students in diachronic thinking (708). (Diachronic thinking is a term meaning reconstructing and representing the transformation in time of geological structures.) The other part of the study was simply "Testing the general cognitive abilities of non-geology majors, both in junior and senior high schools, in understanding geological time" (710). This part of the test was much more relatable to the common grade school student who cannot choose an area of study.

Coming up with the GeoTAT test itself was a lengthy process, as this was supposed to be a test on understanding time, not geology. In the final product, there was some very basic knowledge in geology required, but many of the concepts were then re-applied in following questions so that students were given a fair chance to test solely their understanding of deep time (711). As seen on page 714, Table 1 of "Measuring Student Understanding of Geological Time," the final test looked at four important aspects of deep time in geology: *transformation* or simply change over time; *temporal organization,* or ordering events in time; *interstate linkage,* or cause-and-effect relationships; and *dynamic*

synthesis, or discovering a single process from various stages of change. These four ideas were believed to sum up the idea of deep time. Most importantly, the GeoTAT contained a control question which required no geological knowledge to answer, yet still tested aspects of diachronic thinking. This question was a safeguard against favoring geology majors simply because they know geology.

The results indicated that geology majors outperformed their non-specialized counterparts on every aspect of geological time except for *transformation* (719-724). *Transformation* happens to be an aspect of both common time and deep time, so it is possible that the GeoTAT question(s) which focused on the subject were based on logic and not understanding. The application of logic in geological studies could have given an advantage to the geology students that was not in the original intent of the test. Regardless, these tests showed that the common teaching of deep time does not prepare students with an adequate knowledge of deep time.

Now that we have explored all the ways to teach and test deep time, we can go back to our original description of it. It is still time on a scale with which we can no longer place common events. However, we now have the tools to convert deep time into a physical timeline we can visualize. We will use a scale very similar to Parker's, in which half a millimeter is 18 years. A human lifespan is about 2 millimeters. Going back to the birth of Christ is only 2.1 inches, and the biblical age of the Earth is about 6.4 inches (keep this in mind, and we will quickly see why 6000 years is an utterly ridiculous age for the Earth). The earliest hominids appear 534 feet away. If we started in the Sears Library Building, that is about the distance to the Physics offices. Going back to the extinction of the dinosaurs puts us right around the Village. To the origin of the dinosaurs, 250 million years ago, puts us at Tower City. And if we decided to go vacationing to Cedar Point, that would put us at around four billion years ago. As we can see, the history of the Earth is so much longer than anything we can imagine. We understand how unimaginably

slow, and yet how unimaginably effective geological processes can be, and why we need billions of years of time if we are to explain our origins with something more than "and God said let it be so."

I have mentioned many times the importance of deep time in science education. Now it is time to show how it actually fits into nearly all of modern science. We will start with the biggest focus on deep time: geology. Deep time is used in the theory of plate tectonics and the sedimentation and morphing of rocks. It was, in fact, the ways in which sediments were laid down, compacted, thrust upward, rotated, truncated, re-covered, re-compacted, and re-exposed which was the biggest indication that processes had occurred in deep time. You can even see from the explanation how complicated even a basic two-plane rock formation is. They must have taken many millions of years to make. Using this knowledge, we can take the movements of the continents not as random fluctuations due to volcanic activity, but rather understand that the continents do move. We can use current data and leftover traces to extrapolate the movements back until the very beginning of plate tectonics itself.

Deep time isn't only useful for describing the inanimate. Deep time is the arena in which evolution plays out. Many hundreds of thousands of generations of animals under various evolutionary pressures will slowly have the genes which benefit the population selected for. Eventually, enough genes are selected that the population splits into two completely different species. The trouble many people have in understanding evolution is the sheer amount of time it takes. They cannot fathom the hundreds of thousands or millions of years it takes, and thus cannot believe that eventually species evolve into other species.

Finally, deep time rules in cosmology. Even with many objects approaching the speed of light – an unimaginably high velocity – it takes millions of years for events to occur. The distances in the visible universe are so mind-bogglingly large that even light itself rarely has two events which occur on a humanly visible timescale. The only

events which take place on scales we can perceive are rotations and orbits. But the general movement of galaxies, the deaths of stars, and even the Big Bang itself, are all but unnoticeable to humans. Hell, the Big Bang is STILL happening after 14 billion years! It is the epitome of a deep-time event: one which has occurred for all of time's existence, and is still going strong.

Deep time is a fundamental idea in the sciences of geology, cosmology, and evolutionary biology. Accordingly, a student wishing to pursue a career in one (or many) of these subjects must be able to understand deep time. We have shown why teaching of deep time today is flawed, how it can be solved, what its effects are on students of all ages, and finally we showed how easy deep time can be to understand and how important it is to modern science. Without its important contributions, these core scientific subjects would remain in their infancy, and we would still be in the dark ages, staring up at the sky, wondering how it all got there, without any way to ever pursue it. Deep time has opened the door to science for us, and we should all follow it in, in eager anticipation of the discoveries that await.

Appendix A: Table 1 from "Using Google Earth to Teach the Magnitude of Deep Time"

TABLE 1

An example ideal scaled timeline.

Date	Event	Distance from line at presentation	
4.6 BYA	Earth formation	78.4 mi.	126 km
3.6 BYA	First life	61.4 mi.	98.7 km
2.7 BYA	Oxygen atmosphere	46 mi.	74 km
1.5 BYA	Eukaryotes arise	25.6 mi.	41.1 km
670 MYA	First Metazoan	11.4 mi.	18.4 km
542 MYA	Begin Cambrian	9.2 mi.	14.9 km
488 MYA	End Cambrian	8.3 mi.	13.4 km
375 MYA	First tetrapod	6.4 mi.	10.3 km
140 MYA	Angiosperms	2.4 mi.	3.8 km
25 MYA	First apes	2,223 ft.	678 m
10 MYA	India connects to Asia	890 ft.	271 m
6 MYA	Earliest Hominid	534 ft.	162 m
4.5 MYA	Ardipithecus	400 ft.	122 m
3 MYA	Lucy	267 ft.	81.3 m
1 MYA	Migration from Africa	89 ft.	27.1 m
200,000 yrs	Homo sapiens arise	17.8 ft.	5.4 m
34,000 yrs	Neanderthals go extinct	3 ft.	92 cm
6,000 yrs	Biblical age of Earth	6.4 in.	16.3 cm
2,000 yrs	Christ	2.1 in.	5.4 cm
18 yrs	Student age	1/50th of an inch	0.5 mm

Note: BYA = billion years ago; MYA = million years ago; yrs = years.

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American Graffiti and the Limits of Subcultural Defiance
by Reuben Sass

American Graffiti is a colorful, doo-wop-infused spectacle which portrays a very historically evocative subculture—that of early sixties, Mid-Cal high schoolers, whose obsession with cruising around in beautiful, big-finned gas guzzlers represents a quintessentially American individualism. While the work of theorists such as Dick Hebdige (1979) might raise doubts about whether these Mid-Cal high schoolers are too generically American to constitute a subculture, my essay argues otherwise. To Hebdige, subcultural style represents refusal—an aesthetic of defiance, embracing lifestyles and art forms which express an unwillingness to assimilate mainstream values (2). The scope of subculture, however, should not be limited to avowedly anarchist punks, with their safety pins and torn shirts and combat boots. Thus I rely on a broader definition of subculture: as a group of people who, at a well-defined historical locus, share certain rituals, styles of clothing, and musical tastes, reflecting their individual aspirations in domestic and social life, and constituting altogether a collective yet mutable identity which influences its members' ideological and behavioral relationship to mainstream society. As Toad cruises around in Steve's white-and-red '58 Chevy Impala, with its almost archetypal hot-rod body, and as he picks up Debbie in her platinum bouffant hairdo to the tunes of early rock's golden oldies, he is as much a member of a subculture as Sid Vicious. The relationships of the high schoolers (especially Steve and Laurie) in *American Graffiti*, as well as Curt's brief amicable interaction with the Pharaohs, convey a concept of subculture which need not encompass "transformations [which] go against nature, interrupting the process of 'naturalization'…challeng[ing] the principle of unity and cohesion, which contradicts the myth of consensus" (Hebdige 18). Indeed, to the high schoolers of

American Graffiti, subcultural affiliation offers a means of liberating yet limited self-expression which does not explicitly reject integration into mainstream society. Instead of encouraging secession from the mainstream, their subculture regards it simply as a little too sanctimonious, too disapproving of sexuality and risk-taking.

Consider the high school hop dance scene, a ritual[1] which in this case showcases an early '60s Mid-Cal youth subculture, and which under various permutations could do so for many other American youth subcultures. The scene is shot in a high school gymnasium whose shiny tan floors, colored streamers, sports banners, and elevated stage—complete with a tie-wearing band—might still be familiar to many Americans at student dances today, despite differences in music and outfits. The subculture with which Steve, Laurie, Toad, and Curt identify is to some extent conformist, then, because it reflects some aspects of a common American culture whose influences in turn pervade other youth subcultures across space and time. After Steve and Laurie are introduced as class president and head cheerleader (again in much the same way as they might be today), the camera turns circularly to show a crowd of students, the guys in flannels and colored sweaters and the girls in short windowpane skirts. Everybody looks young, clean-cut, and respectable enough not to draw the ire of any passing teacher. The choice of opening song for the dance is highly significant—it is not even a rock song. A classic '30s romantic tune (here in its 1958 cover by The Platters), "Smoke Gets In Your Eyes" sets the scene by anchoring the characters to the wholesomeness and safety of the mainstream American culture which they seek to transcend but not to abandon entirely. Indeed, one could hardly think of a venue less

[1] Lucas himself seems to have viewed the film as a piece of popular anthropology, noting, "I was always fascinated by the cultural phenomenon of cruising, that whole teenage mating ritual. It's really more interesting than primitive Africa or ancient New Guinea—and much, much weirder" (Denisoff and Romanowski 178).

offensive to the mainstream: the school is public, and the hop dance is an American tradition.

The next shot of Steve and Laurie at the dance shows how their subculture aims to liberalize but not overthrow mainstream attitudes towards sexuality and relationships. The song has changed to "Louie Louie," and its cover by Flash Cadillac and the Continental Kids is very danceable, much livelier than "Smoke Gets In Your Eyes." Its simple, memorable rhythm is bubbly and upbeat rather than angry in the sense of latter-day hard rock. The song strikes a balance between the restraint of "Smoke Gets in Your Eyes," the traditional sweetheart romance, and that aggressive, unmasked sexuality which dispenses entirely with romantic tropes. At the very outset of the scene, the camera is pointing towards the floor, emphasizing the centrality of movement—loose, full-bodied, and unrestrained in comparison with ballroom dance—as a reaction to the song and an expression of the high schoolers' desire for emotional and sexual release. This movement style differentiates the subculture from the mainstream: the high schoolers' parents would not have danced this way. Again a circularly rotating camera shows the high schoolers, intermingling in a crowded though not mobbed tangle of limbs, with the cheerful lack of orderliness enhanced by a camera line pointing from a floor-level observer as opposed to a top-down one. Though moving slower than the other couples, Steve and Laurie are hugging each and making full-body contact. When a gray-suited, balding, middle-aged teacher (Kroot) comes up and attempts to tell them off in irritated, humorless tones, Steve responds by telling him, "Go kiss a duck, marblehead." Kroot then turns back and points a finger into Steve's face, which is now wearing an almost blissfully unconcerned smirk. "Kroot, Kroot, I graduated last year," Steve says, and Kroot shakes his head in disgusted resignation. In seeking to enforce the prevailing values and behavioral expectations of responsible adult professionals, Kroot represents the mainstream, and Steve and Laurie's qualified defiance of him reflects the attitudes of their subculture. Right on cue the song's tone

shifts from doo-wop to a classic rock riff. The rhythm intensifies and becomes faster, expressing the exuberance unleashed by Steve's defiance. United by their shared contempt for Kroot's stupid, unfeeling rigidity, Steve and Laurie twirl rapidly in each other's arms, and the scene ends.

So while the young cruisers congregate in this mainstream venue instead of shunning it, they seek at the same time to appropriate it, imprinting it with their own cultural and social identity. They do not aim, in a Hebdigean sense, to "transform" the hop dance into a platform for subverting every mainstream convention of appearance and social and sexual conduct. Nobody swears or chants anarchic slogans, and nobody appears disheveled or sexually androgynous. Yet there is a subtler form of subversion occurring, one which pushes the mainstream to extend its own behavioral and sexual limits rather than simply creating a self-contained cultural space, like punk in its ideal form, in which the subculture's members do whatever they please while interacting minimally with the mainstream. The very incompleteness of the challenge which the high schoolers' cruising culture issues to the mainstream at least allows for *the possibility* of an integrationist dialectic, in which culture and subculture influence each other dynamically, to the point where the subculture eventually becomes subsumed into a mainstream culture which has itself changed by acquiring an admixture of the subculture's ideals. Thus, even after Steve marries Laurie and (as the ending credits inform us) becomes an insurance agent—an archetypally mainstream occupation—the couple's previous identification with the early '60s Mid-Cal youth subculture is likely to affect the way they view their own children's behavior and relationships.

In the same way, Curt's affinity for the Pharaohs, the local gang, shows how his subculture balances a dissatisfaction with the mainstream's social repressiveness against an aversion to heedless defiance of the existing authorities and their rules. Indeed, though the Pharaohs embody the most classically Hebdigean subculture, they readily accept Curt the honors student into their ranks (if

only for a night), showing that their two subcultures are far from being mutually exclusive. Curt's role in the slightly slapstick robbery at the miniature golf park encapsulates the nature of their interaction. The scene opens with a shot of the Pharaohs[2] driving into the parking lot in a red '51 Mercury coupe to the tune of the Silhouettes' "Get a Job," a not-so-subtle dig at the Pharaohs' complete lack of interest in cultivating anything resembling a work ethic. From the standpoint of a ground-level observer several feet away, we see the Pharaohs piling out of the car, the camera angled so we see as much of the parked Merc as possible while Curt talks with the leader, Joe Young. "We're also out of money," Joe tells Curt, by way of explanation. As with the more academically inclined youth in town, the Pharaohs are fans of the car cruising lifestyle, and that shared connection makes the Pharaohs' subculture less alien and threatening to Curt. Thus Curt doesn't balk as he accompanies the Pharaohs into the golf course's vending room, filled on each wall with '50s-style pinball machines decorated with colored embellishments and prominent metal coin plates. The doo-wop scat-singing of the song lends a carefree tone to the Pharaohs' casual attempt to shake down the machines. Looking down the short, narrow passage, Curt appears nervous and shifty but not precisely panicked; though the star student does not want to get into any serious trouble, he does not want to alienate the gang either. Despite the Pharaohs' tough-guy appearance and curt, masculine talk, they shy away from conflict, quickly hiding a screwdriver when the middle-aged, clean-cut, tie-wearing owner walks up. Recognizing Curt as the recipient of the local Moose Lodge scholarship, the owner asks Curt what he's doing with "those punks." Instead of turning the Pharaohs in, however,

[2] The Pharaohs are a gang of local miscreants. Their "uniform" consists of a dark-gray cotton-duck work coat with the gang name stitched on the back. Though they may try to look like working-class hoods, none of them are ever shown carrying weapons, nor do they ever use any physical violence.

Curt refers to them as his "friends." Angled so that the back of Curt's head is visible, we see a close-up of the owner's face, complete with a paternal smile conveying all the pride and approval that such an upstanding community member would be likely to feel for a promising young man like Curt. Briefly and in a limited way, Curt supports the Pharaohs' subculture over the mainstream, so long as he does not have to change his societal identity. He sympathizes with the Pharaohs' unapologetic rejection of a respectability which he finds socially and emotionally unfulfilling, yet he does not wish to face any consequences for doing so. So while in the back room receiving the best wishes of the owner and his Moose Lodge friend (Hank Anderson), Curt does not offer a warning that the Pharaohs are simultaneously pilfering the machines outside. Having become an accessory to the crime, he does not seem particularly distressed; his desire for shared adventure and identification with people near his age outweighs a punctilious respect for the law and the financial condition of his elders. But Curt has not adopted an antisocial lifestyle—the next day he will head off to a big school in the East, and (according to the closing credits), he will eventually become a writer in Canada. (Of course we do not know whether he joins SDS in the interim). He seems to find a certain stimulating irony in the situation, in breaking out of the mold of conformity to which a dedicated middle-class white student would be culturally expected to adhere. The limits, however, are clear—no one gets so much as a scratch. Far from courting fights with the police, the Pharaohs show no interest in gratuitously destroying property as an outlet for unsatisfied aggression and generalized frustration.

American Graffiti thus challenges the notion of a subculture as a fixed set of behaviors and beliefs characterized, at least at its inception, by a rebelliousness which predominates over all other tendencies. The film conceives of subculture as the product of an *internal* tension between conformity and opposition, a conflict inherent in a subculture's very identity. Whereas Hebdige contends that subcultures only become palatable to the mainstream as a

last-ditch effort at preserving their identity (99), Curt, Steve, and Laurie do not join a subculture in order to reject the mainstream, but rather to *discover* how they wish to relate to it. Instead of providing easy answers, a subcultural affiliation thus becomes a tool for its members to continually negotiate and re-negotiate their personal and societal identities vis-à-vis the mainstream. And mainstream society's role in defining the subculture is not only limited to the resistance which it provokes among the subculture's members. Indeed, the mainstream need not represent only the threat of external tyranny— it may also be a *viable alternative* exerting an appeal of fluctuating strength on the subculture. So if *American Graffiti* has any critical insight to offer, it is that an analysis of subculture cannot assume a stereotypical dichotomy between society and outcast.

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