

Sound effects as a genre-defining factor in submarine films

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Submarine films can be regarded as a genre with a specific semantic and syntactical structure that heavily depends on the acoustemological nature of submarine warfare. The sound design in submarine films therefore has decisive dramatic and emotive functions. The article presents the sound effects most specific to submarine films and discusses the creative potential they offer both as diegetic sounds bound to submarine existence and as emotive cues with an immediate effect on the audience.

The submarine world is a world of sound. Military submarines are “blind”; sound therefore serves to perceive and define their surroundings. Sound is vital for the submariners’ survival, it is essential for their mission and decisive for their success. The public perception of submarines is based on this premise: the famous “ping” of the sonar has become the acoustical icon of the submarine; it is accompanied by uncanny underwater sounds such as the muted drone of propulsion, the whales’ song, and man-made acoustical threats such as the propulsion sound of torpedoes or the dreadful roar of a sinking ship. This public perception, though, is not founded on “reality” or, at least, on documentaries presenting the professional world of the military submarine. Our (visual and acoustical) image of this world is entirely based on fictional film – and thus on the specific sound design of submarine films. No spectator will forget the U-boat-men’s agony in *Das Boot*: hours and hours of pursuit with depth charges and, again and again, the mortal threat of the ping, which signi-

fies their helpless exposure to the enemy. Equally, the uncanny creaking sound of the submarine hull strained under high water pressure has become an acoustical icon for deadly outward menace in submarine settings, whereas the propulsion sound of the torpedoes can be a sign either of the hunters' aggressiveness or of mortal danger to a boat (or ship) that is torpedoed.

Based on an examination of approximately 35 submarine fiction films and the submarine myth in documentaries, the Internet, and print-media, this article presents the submarine film as a very specific kind of genre, which strongly depends on sound design. After a short introduction on the submarine film as a genre in its own right, the soundscape of submarine films will be explored, with emphasis on some of the most characteristic "submarine sounds" and their dramatic potential as it has been used by filmmakers through several decades. Examples from films, such as *Das Boot* (D, 1981, Wolfgang Petersen), *The Hunt for Red October* (USA, 1990, John McTiernan), *Crimson Tide* (USA, 1995, Tony Scott), *Hostile Waters* (GB/D, 1997, David Drury), *K-19 – The Widowmaker* (USA, 2002, Kathryn Bigelow) as well as *Gray Lady Down* (USA, 1978, David Greene), will illustrate how sound is used not only as a structural element, but also as a dramatic and emotional factor.¹

I. The submarine film genre

Since 1910 up to today, around 150 fictional submarine films have been issued all over the world.² They focus on submarines in the First and Second World Wars, in the Cold War and in post-Cold War political and terrorist scenarios. Besides these "authentic" scenarios, there are science fiction and fantasy plots and – more rarely – horror stories with submarines. Finally, many of these settings have been parodied and thus been turned into submarine comedies.

These films are cinematic manifestations of the general submarine "myth" that has developed in the course of the 20th and 21st century.³ In fact, the central elements of this myth, first found in literature and images and subsequently applied to film and other media, constitute the perfect storyline for an enthralling and emotionally charged film setting: the fascination of the underwater setting; the aura of the secret weapon; the interaction of man and technology; the special qualities of the submariners' service – their youth and their heroic combat; and the father figure of the commander.⁴

The majority of submarine films are linked to war settings, since the sort of underwater vehicle best suited for fictional film is the military submarine. However, submarine films are by no means just a sub genre of the war film: an examination of the semantic as well as the metastructural aspects of these films reveals recurring motivic and structural elements that justify the definition of the submarine film as a genre in its own right (Koldau, 2010a). While the typical semantic elements – war/military plot with corresponding setting and motifs, narrative and iconographic conventions, genre-specific role types, lighting and soundscape – constitute a broad spectrum from which a film producer can choose to construct the indi-

vidual storyline of a submarine film, the essence of the submarine genre can be reduced to a very simple and fundamental syntactical pattern that is genre-specific: the basic contrast between inside and outside. "Outside" stands for the enemy, be it natural (water pressure, underwater canyons, maritime monsters) or human. "Inside" is survival and homeliness: the solidarity of the crew, the mutual trust (culminating in the figure of the commander), the common interest and common destiny. Outside is bad, inside is good. This basic structure can again be varied in manifold ways: the precarious balance between outside and inside is disturbed by the intrusion of foreign, inimical objects upon the boat (water, missiles, terrorists, contagious diseases), and the general safety of the inside can be endangered by conflicts within the crew (especially between commander and executive officer), mutiny or treason, but also by fire and dangerous accidents, such as a reactor defect. It is these factors of imbalance that create the plot: the aim of the storyline is to re-establish the balance between inside and outside, between good and bad.

Due to its specific structure – and, not least, the considerable number of films that evince this very structure and the corresponding elements – the submarine film assumes the status of a film genre. It is a characteristic of this genre, though, that in most cases it occurs in combination with another genre, such as war, action, comedy or fantasy. Unlike these genres, however, the submarine film is imbued with one specific trait that is decisively auditory: sound and sound design are an indispensable part of the submarine setting, since it is sound that defines the submarine's surroundings and guarantees its survival.

II. Sound in submarine films

Submarine films offer enormous potential for cinematic sound design. On the one hand, the sense of hearing is the vital sense in a submarine, in which a person perceives his/her surroundings almost exclusively acoustically. On the other hand, underwater sound has particular characteristics that are not only used for special effects, but also in other fields of sound design and musical composition.⁵ A submarine setting therefore offers the perfect experimental ground for the manifold dramatic and expressive uses of sound in film.

Life on a submarine is mainly acoustemological: the surroundings and daily routine on a submarine open up an enormous scope of various sounds. Especially the submarines of the First and Second World Wars, with their rudimentary sonar technology, had to be highly sensitive to all kinds of sound, since it was mainly by human capacity alone that sounds from the outside were registered and classified. Due to Lothar-Günther Buchheim's famous novel *Das Boot* (1973), the manifold world of sounds on a German VIIC submarine in the Second World War has been preserved in literary description. Buchheim depicts around 40 different forms of sound characteristics of daily life on a Second World War U-boat, covering various sounds of propulsion, the daily routine, the natural surroundings, military communication, and warfare (the latter with distinctive sonic differences between attack and pursuit). Many of these sounds offer the necessary information about the invisible sur-

roundings. However, they also exert a strong influence on the crews' mental states. Sound is much more than a simple sensory perception – sound is immediately linked to emotion.⁶ Basically, Buchheim offers with literary means what sound designers would do in film: he creates a soundscape that is necessary to define the setting, but which also reflects the perception and emotions of those who are dependent on this soundscape in order to survive.

The “acoustemology of submarine life” makes it obvious that sound offers ideal opportunities to filmmakers to create a gripping, emotionally enthralling film with a submarine subject. Recent film research, beginning with Michel Chion, has shown that sound is by no means a subordinate parameter in film, but it is to be regarded as of equal importance to the cinematic entity (Chion, 1990, 1994; Langkjær, 1997, 2000; Flückiger, 2001). The basic notion of sound as pledge for the “realism” of the fictitious universe has by now been differentiated into a more complex and dynamic understanding of sound as an expressive process that directly involves the spectator.⁷ Sound as an immediate physical experience forces the spectator to direct his attention to the auditory level, which is imbued with complex expressive and emotive qualities. Birger Langkjær's notion of the “listening spectator” (*den lyttende tilskuer*) exposes both the decisive role of sound as an expressive element in film production and the spectator's active role, whose listening animates the fictional visual universe of film and turns it into the experience of a “true” reality.

Sound in a submarine film combines and concentrates all facets of sound in film as well as its decisive, activating influence on the audience. Any sound in a submarine setting can have multiple layers of significance, ranging from the sonic background setting to acoustic events that are of central importance to the plot – and any of these sounds is emotionally charged, not only for the audience, but first and foremost for the protagonists themselves, since their lives depend on the perception and classification of these sounds.

The spectrum of sound in submarine films, however, is far narrower than in the detailed description of submarine life offered by Lothar-Günther Buchheim. In films, hearing and listening are relatively seldom emphasised as the very centre of submarine life and survival. This is partly due to the fact that the basic isolation and dependence on the sense of hearing is thwarted by the cinematic convention of showing “the other side” or, at least, the outside of the boat. The submariners' utter dependence on the sense of hearing is therefore not shared by the audience, who can see what the men in the boat only can hear (if at all). Above all, though, the artistic genre of the film entails a massive reduction of the universe of sound as described in Buchheim's novel. It is simply not possible for a filmmaker to translate literally Buchheim's “sensual” written descriptions of sound into film: the result would be an expressionist film, a study of the acoustical phenomenon “submarine” – but not a fictional film with a storyline focussing on the interaction and fate of the protagonists. Finally, the drastic reduction of conspicuous acoustical phenomena is due to general cinematic convention and the audience's customisation to it. The background noise of daily life on a submarine, described in so many facets by Buchheim, is not consciously perceived (unless it is very loud, like the diesel motors) – and this is exactly what an acoustic background setting

should be like in film. This sonic fundament is emotionally neutral – unless it is disturbed by a malfunction (a technical defect, conflicts in the crew) that turns the audience's attention to it. Sounds of warfare represent aggression, menace, and fear. However, characteristic acoustical emanations of warfare – the detonation of explosives, artillery, the splintering of glass and dishes – do not appear idiosyncratic in terms of *submarine* warfare: they are common sounds of war or strife and quite generally imbue a feeling of danger and unease. These acoustical representations of violent conflict are therefore far less disturbing than the typical submarine sounds denoting menace and peril – a general audience will pay less attention to them than they would if they shared the submariners' fate and had learned to listen for the finest nuance of any sound that can be perceived.⁸

If a sound therefore is to be exposed as significant in a submarine setting, it has to be specifically emphasised. There are several techniques to direct the audience's attention to a certain sound as a dramatic element in the plot. First of all, there is, of course, the selection of sound events, which is natural to any fictional film.⁹ This filtering is supplemented by techniques highlighting particular sounds. In order to enhance the expressivity and dramatic function of sound, the volume is often exaggerated or modified to a degree that makes it "unrealistic". Due to cinematic convention and life-long film experience, the audience does not recognize it as such, but takes it as "authentic". A current technique is the isolation of sound events that have a special dramaturgical significance (such as a pistol shot in a room filled with people – in film, the shot will usually be heard much more distinctly than it would in reality). Another technique, frequently found in submarine films, is the addition of sounds that do not correspond to the authentic soundscape of a boat. Thus, there is an irregular electrical buzz heard in the reactor department of K-219 in *Hostile Waters*, implying an irregular voltage and the danger of blackout. This is a dramaturgical addition, which is part of the overall foreboding of disaster in the first sequences of the film. A reactor does not emanate such a sound; in *Hostile Waters*, however, the aggressive buzz, in combination with the visual cue of a flickering light in the reactor department, represents the precarious technical condition of the out-dated submarine and at the same time conveys a presentiment of the subsequent reactor defect.

A systematic examination of submarine films has shown that the enormous variety of "submarine acoustemology" is reduced to a few memorable sound effects in films of this genre. Their nature, use and effect on the audience will be described individually below in reference to films from the late 1970s onward, in which sound design plays a more prominent role than in earlier submarine films. Except for the "ping", which, as an acoustical symbol of submarine warfare, is described first, the order of the various sound effects does not imply a ranking according to their appearance and dramatic significance in submarine films: the dramatic function of a typical submarine sound effect is dependent on the storyline. Thus, some of the sounds described below do not even figure in various submarine films, while others are given a decisive weight according to the dramatic intentions of the script and the director.

a) *The ping of the sonar*

First and foremost, there is the ping of the sonar. This rounded sound event with its sharp attack, reverberating aftermath and ensuing, suspenseful silence, has become the very icon of submarine life since Wolfgang Petersen's famous film *Das Boot*. The ping in the film *Das Boot* is a highly artificial sound effect: it took the sound designers great pains to create this effect by combining nine different soundtracks that were partly accelerated or decelerated.¹⁰ Klaus Doldinger, the composer of the film music for *Das Boot*, was so impressed by this matchless sound effect that he integrated it into his famous score.¹¹ The alien, intrinsically menacing sound is one reason why this score gained so much popularity worldwide; in turn, the score, distributed in several versions as a CD soundtrack and played on the radio all over the world, contributed much to the general fascination with the sound of the ping.

In the film, the ping is almost exclusively used diegetically, i.e., as a "real" sound of pursuit inducing mortal fear in the U-boat men. However, it is additionally used as an expressive effect in the opening sequence of the film. Like many other war films, *Das Boot* opens with a claim of historical authenticity: on a black screen the wartime situation is sketched in white letters. This sober opening, though, is underlaid by sound, and it is this sound that leads the audience directly into the U-boat world. There is a dimmed background sound which eventually turns out to be the propulsion sound of the boat under water (as it is conceived in the film). This sonic layer is so inconspicuous that an untrained audience would not notice it – but then comes the ping. The irregular sonar sound accompanies the verbal historical setting of the film, and it acoustically stresses the final message: of 40,000 U-boat men 30,000 did not return.¹² This sound illustrates the "valeur ajoutée" Michel Chion identified as characteristic of sound in film (Chion, 1990, p. 8): taken by themselves, the screens with information about the historical setting would be relatively neutral, and so would the sound effect of the ping (which can also occur in "harmless" underwater settings, most famously in the opening sequence of the later film *Titanic*, where a research sub dives down to the wreck). It is the combination of this very sound effect (plus the background propulsion noise) with the description of a submarine war situation that turns the ping into a highly expressive device: the sonar sound stands for the hunt, for fear, and for death.

As a sonar sound generated by the enemy, the sound effect indicates that the boat has been located. The decisive advantage of the submarine, its invisibility and stealth, has been nullified. Sonar detection is a submarine's mortal enemy, since it eliminates the ocean's cover and all additional attempts at stealth. The boat and its crew are helplessly exposed to the sound waves hitting the steel hull and disclosing their position. The sonar sound is the worst that can happen to a submarine: the rounded, echoing ping is a herald of death. Any spectator who has a little submarine (film) experience will immediately recognise this association at the beginning of the film *Das Boot*.

Not always, though, does the ping stand for death alone. In rescue plots, the ping turns into a vital means of communication (as it also does in the most famous scene of *The Hunt*

for *Red October*, in which the Soviet commander Ramius [Sean Connery] communicates with the American submarine commander by means of visual Morse code and a ping to express consent). Thus, the ping as a acoustic sign of communication is dominant in *Gray Lady Down* (1978), where a submarine is lost after a surface collision and its crew must be rescued from the ocean floor with the help of a surface ship and a DSRV (deep submergence rescue vehicle). Here, the ping denotes contact and, with it, hope: it indicates that the lost sub is found and that there is at least a chance to rescue the crew.

Thus, even the apparently unequivocal significance of this sound effect can vary according to the situation. Nevertheless, in the overriding majority of submarine films, the ping is a sound of deadly menace, and it is used as such by filmmakers and sound designers.

b) Silence

The terror of the sonar sound has an acoustical correlate that usually does not receive much attention in auditive film analysis: silence. Silence has a vital psychological significance, not only in film, but also in daily communication. In submarine life, silence stands for shelter and security – but it can equally signify lurking danger. The terror of silence in a submarine hunt is the uncertainty of how long it will last – and what it will be that breaks it. Silence thus turns into psychological tension: in his description of a pursuit with depth charges lasting for hours, Buchheim names “eine schwirrende, wie eine Violsaite gespannte Stille” [“a silence imbued with the thrilling tension of a highly strained violin string”] (Buchheim, 1973, p. 213). It is a silence of expectation; the “thrill” of its tension heralds the next deafening detonation of a depth charge – and with it possible death.

c) High pressure: The creaking of the hull

A natural enemy for a submarine and its crew are the natural surroundings – and, concomitantly, the enormous water pressure imposed on the boat. In itself, this pressure must be seen as “both “realistic” and metaphorical” – an image for the pressure of warfare, fear and responsibility weighing on the young soldiers in their tiny refuge from a vast, inimical environment. In film, this pressure is occasionally rendered by the creaking, echoing sounds of the wood inside the submarine that are a reaction to the increased pressure at (relatively) great depth. Due to the laws of underwater acoustics, these sounds are enlarged and distorted, and thus turned into an acoustic manifestation of the horror of the unknown, of the constant pressure menacing the boat and its crew.

The cracking sound itself, though, represents first and foremost the basic fear of intrusion – it seems to shatter the precarious balance between safe inside and menacing outside. Thus, this sound effect is at the centre of the basic structure of the submarine film, appearing as an acoustic omen that the vital balance will be disturbed. The audience cannot ward off the sudden shock of the irregular sounds, the lacerating creaking and snapping that seem to announce the imminent break-up of the hull. It is this auditory shock that serves personally to involve the audience in the submarine myth in its purest form. The fear of

the unknown is at the core of this myth. This fear manifests itself in two ways. For the hunted (mainly surface ships in a First and Second World War settings), this is the submarine emerging suddenly from the depths, striking with its mortal weapon, and disappearing again. For the submariners, in contrast, the fear of the unknown is the fear of the ultimate, mortal depth. The water pressure is ubiquitous in submarine life; the creaking sound represents the omnipresent threat of the vast ocean environment to the little, vulnerable boat. Here, the ultimate question of every submariner inevitably forces itself on the audience: what happens when the boat reaches crush depth – and surpasses it? What happens when the creaking turns into a ripping noise, when the boat – including its contents – is crushed like a tin can? This question is the central query in submarine life – and there is no answer.¹³ The open, unanswered question turns into an omnipresent, gnawing fear – nobody knows how his life will end once crush depth is surpassed.

d) The aggressiveness of the hunter: Torpedoes

While the explosive sounds of detonating torpedoes or depth charges, as well as the noise of artillery, cannot be regarded as “submarine-specific”, torpedoes do have a unique sound in their movement through the water that is often put to expressive use in submarine films. In the drama of cinematic submarine combat, torpedoes are visually distinguished by their “aggressive” form (streamlined and pointed like a bullet) and their high speed under water. The acoustical correlate is an ominous buzzing sound connoting the iron “will” of this self-propelled weapon, which seeks its target itself and can therefore only be eluded by excellent manoeuvring. Its relative “intelligence” makes the torpedo superior to a depth charge. Although depth charges and mines proved deadly to many a submarine, they were mainly thrown overboard by guess, whereas the torpedo as an “intelligent” weapon has a far greater chance of hitting its target.¹⁴ Although a torpedo can also endanger the boat itself due to defects in its complicated technology, torpedoes in submarine films generally appear as the perfect mortal weapon. This characteristic is acoustically enhanced by the quiet, regular, but deadly, buzz of its mini-propeller.

e) Becoming the hunted: The alarm

One of the most prominent sounds in submarine settings is the alarm, which has a strong emotional impact on the audience. There is a great variety of alarm sounds in submarine settings; they also cover civil underwater operations, since there can be technical defects or leakages at any time. The alarm is a signal which arrests the attention of the audience, as is also seen in everyday life.¹⁵ Acoustically, it is constituted by a penetrating sound frequency in a high volume and the incessant reiteration of the sound event or, with alarm signals with a held sound, its continuity. Both the frequency and the high volume engender a spontaneous reaction: the urge to shut the alarm off by detecting its cause and eliminating the danger it denotes. Sociologically, alarm signals are an important acoustical part of life in urban civilization. They occur everywhere throughout the day, from the alarm clock in the

morning to kitchen alarms (the microwave, the toaster) to the omnipresent ringing of the telephone or the mobile phone. Alarm is ubiquitous on the street with car horns and fire engines or ambulances; it is met in public buildings and places, at gates and entries. And, of course, alarms are omnipresent in fictional film, especially in crime or war settings.

An alarm in a submarine immediately attracts our attention, since it denotes an imminent, mortal danger for the crew (and implicitly, depending on the plot, to their country or the entire world). Transferred to the syntactical structure of the submarine genre, alarm again denotes the intrusion of an inimical outside into the safety of the inside.¹⁶ Submarine alarms have their own acoustical traditions: nobody having seen *Das Boot* will forget the enervating rattle of the alarm on the German submarine, while in American films, the squawking double hoot accompanied by the order “Dive! Dive!” has become an acoustical icon for American submarine warfare.¹⁷ The acoustical icon of the alarm has by no means been abolished in submarine films featuring more modern technology: the enervating reactor alarm in *K-19 – The Widowmaker* is just as upsetting as the nasal sonar alarm in *Crimson Tide* or the alarm sounds of the multiple disasters on the Soviet nuclear submarine K-219 in *Hostile Waters*.

e) The menace from above: The noise of ship propellers

Another sound that exposes the submarine as the hunted (and not the hunter) is the propeller sound of surface ships. Destroyers are the most dangerous enemies of submarines under water.¹⁸ The amplitude (i.e., volume) of their propellers determines the sort of menace this sound denotes. If it is very loud, it represents the mortal danger of an imminent collision with the submarine on the surface or close to it (cf. the impressive scene in *Das Boot* – or the parodistic instance of a submarine diving between the propellers of a super tanker in *Down Periscope* [1996]). In this case, the mechanical cyclicity of the propeller sound assumes the character of merciless advance and cold indifference. A weaker destroyer noise requires the skill of listening: on German submarines, the “Horcher” would not only be able to identify the source of sound, but also the position, the direction, and the speed of the object producing it. In this case, the menace is not as palpable as the imminent danger of being rammed – but it is just as frightening, since it denotes the danger of being detected (with the ping) and pursued with depth charges.

Basically, any noise of ship propellers from above means an immediate danger to a submarine, since it indicates that the submarine is not alone and that there is the palpable danger of detection. The sound of ship propellers therefore reduces or even nullifies the submarine’s single great advantage, its invisibility and stealth.

f) Aquatic soundscapes

Finally, there is the broad spectrum of “aquatic” sound that is used in submarine settings. “Aquatic” here stands for any sound or, in particular, soundscape that uses techniques of sound reflection, scattering, and distortion resembling the effects water has on the propa-

gation of sound waves. Since these effects offer fascinating sonic results, they are frequently used in films with an underwater setting, whether they are “realistic” or not.

There is, in fact, no submarine-specific soundscape that is used in the majority of submarine films. Nevertheless, films starting with *Das Boot* evince a greater concern for a sound design that acoustically conveys the concept of an alien underwater world. As mentioned above, the opening of *Das Boot* begins with an indistinct reverberating sound that represents the propulsion of the submarine underwater. This sound always returns when the boat is shown from the outside; it thus contributes to the uncanny perception of water as being an alien, inimical element against which the submarine offers only very fragile protection. A corresponding beginning (including the black screens with white writing) is portrayed in *Hostile Waters*, which uses a Cold War setting to highlight a dangerous accident on a Soviet submarine with ballistic missiles close to the American east coast. While in *Das Boot* there still is a clear distinction between diegetic sound, i.e., the sound of propulsion underwater, and the subsequent entry of an electronically synthesized sound (a high, very tense sound adding to the atmosphere of suspense), in *Hostile Waters* sound effect and music are blurred. The initial dark synthesizer sounds already have a musical character that creates an eerie, reverberating soundscape evoking the underwater setting, which is subsequently seen behind the ensuing credits. This soundscape turns out to be the fundament for the entry of the main musical theme, which in contrast to the amorphous, uncanny synthesizer sounds is clearly structured and written in a late romantic style.¹⁹ Hans Zimmer's score for *Crimson Tide* takes this blurring of sound and music one step further. Except for the main theme, a grand melody with a clearly Wagnerian pathos, as well as the chorale *Eternal Father, strong to save*, the music in *Crimson Tide* appears as an amorphous soundscape, filled with uncanny electronic sounds and low drones, with unsettling long-drawn-out brass sounds and dark throbbing rhythms – an impalpable menace surrounding the audience without clear direction. Appearing as something in between music and sound design, the score constitutes an almost continual underlay to the film. From the very beginning, it serves to build up a seamlessly dark and threatening atmosphere. Although snaps of musical themes emerge time and again during the film, the electronic score remains amorphous; it is used for the setting of a dark and menacing mood, which corresponds to the film's general subject, and, as a contrasting acoustical foil, helps to highlight the splendid nuclear submarine, which is represented by the grand main theme as the world's last hope.

The outside world in submarine films is thus acoustically represented as a deadly menace, an uncanny, alien and generally inimical world. The indistinct uneasiness of the general soundscapes turn into concrete sound events when the worst actually happens: the reverberating drone as representative of a watery surrounding turns into cracking, dripping, spraying, sputtering and eventually rushing sounds, with disaster and death imminent. As in real life, the various sounds of the surroundings have their individual connotation and emotive impact – in submarine life, though, they easily mean death.

Conclusion

Emotionally charged sounds are a vital element in filmmaking. In submarine films, sound designers profit from the advantage that the submarine world is essentially acoustemological and therefore strongly dependent on sound, its interpretation, and its emotive effects: in contrast to most other film genres, sound in submarine settings has both a clearly dramatic and a highly emotive function. Furthermore, the aquatic surroundings offer ideal conditions to experiment with the modification and distortion of sound, which again has a considerable emotional impact on the audience, since the resulting soundscape differs decisively from the familiar acoustical surroundings of everyday life. Filmmakers have exploited the rich spectrum of creative possibilities sound offers in this specific setting – sound effects can be seen as a genre-defining factor in submarine films.

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Notes

1. Music, in contrast, is not discussed in the present article, since there is no specific musical setting for submarine films. Music frequently interacts with sound effects (examples are discussed in Koldau,

2010c, 2008b), but the range of compositional styles and techniques covers a broad gamut from the late Romantic vein (*K-19 – The Widowmaker*; *Hostile Waters*) to classic-rock combinations (*Das Boot*; *The Hunt for Red October*; *Crimson Tide*; numerous submarine action films) to Oskar Sala's idiosyncratic musical design in *Das letzte U-Boot* (D 1993, Frank Beyer). For a broad discussion of music in various submarine films, cf. Koldau, 2010a.

2. Cf. the short description of 100 submarine films by Johannes Kamps (Kamps, 2006), who claims to have found around 150 films altogether. If the high number of submarine documentaries were added, the number of submarine films would probably rise to circa 300.
3. The term “myth” is here used in the general sense of an image for existential human experiences that is connected to public perception and transmission, which normally functions without explicit analysis and reflection. The “submarine myth” thus stands for a general fascination with a phenomenon that for the most part enthralls people who have never experienced war, but seek to empathise with its – allegedly – dramatic and heroic aspects. On this myth, as it was created regarding German submarines in the 20th century, cf. Hadley, 2001; on the manifestation of the submarine myth in film and the media, cf. Koldau, 2010a.
4. The elements mentioned here are discussed in detail in Koldau, 2010a, chapter 1.3.
5. The French composer Michel Redolfi has developed the concept of “Musique subaquatique” as his special profile (cf. http://www.redolfi-music.com/index_n.htm); the Danish composer Harald Viuff equally works with hydrophones and the particular qualities of underwater sound. General information on the complex phenomena of underwater acoustics is offered by Urlick, 1983.
6. For extended discussion of this phenomenon, see Robinson, 2005.
7. This crucial turn in the perception and interpretation of cinematic sound is exemplified in Langkjær, 2000, pp. 99–131 (Chapter “Reallyd som ekspresiv animation”).
8. It should be stressed again that this extreme sensitivity applies more to Second World War submarines than to later nuclear submarines, since in the older diesel-electric submarines human ears had to perform much of what graphic sonar technology would take over in later submarines.
9. Cf. Langkjær, 2000, pp. 100–108. Among the exceptions that eschew the selection of sound are the Danish dogme films, whose directors insist in their “Vow of Chastity” that “the sound must never be produced apart from the images or vice versa”. The result is a “natural”, “raw” soundscape that shows by contrast how artificial the soundtrack is that is generally taken for “realistic” sound in fictional film.
10. Video interview “Musik und Ton” with the Foley artist Mel Kutbay in the exhibition *Das Boot*, Deutsches Filmmuseum Frankfurt am Main, 2006/07. I am grateful to Tim Heptner (Deutsches Filmmuseum) for a DVD-recording of this interview.
11. Statement in an interview on November 8, 2006.
12. The numbers are not quite correct; as Buchheim later stated, roughly 27,000 German submariners lost their lives in the Second World War.
13. Cf. Buchheim’s drastic musings in his documentary film *Zu Tode gesiegt* (1985): “There are no films or photos of this hellish descent into abject death [...] I imagine what would become of a boat – a crushed clump of ships’ steel, struts, human flesh, clothing, victuals, battery cells, machines, and engines, pushed together like express train compartments in a railway disaster. Perhaps more compact – maybe even like cars after having been through the junk press. [...] Are the men’s bodies crushed even like flatfish...? Such a hellish descent into the depths takes its time.” (Quoted after Hadley, 2001, p. 139, English translation by LMK).
14. The superiority of the torpedo must be seen as an ideal, though. In the first years of the war, both German and American submarines had great problems with the malfunction of torpedoes, and until today the torpedo has also meant a latent danger to the boat itself.

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15. On alarm as signal cf. Flückiger, 2001, pp. 159–163.
16. In case of alarms denoting technical defects within the boat, the intruding Outside is the malfunction of an appliance menacing the precarious balance of the submarine existence.
17. This usually shouted order has indeed been used as title for all kinds of submarine and non-submarine publications, webpages and even pop music groups. Cf., for example, the title of the teaching material that the Naval Historical Center (Washington D.C.) provides for school teachers: "Dive, dive! An Introduction to the History and Technology of Submarines" (<http://www.history.navy.mil/branches/teach/dive/dive1.htm>).
18. To the surface-dependent diesel-electric submarines of World War I and II, air fighters were another vital menace; in modern warfare helicopters have been developed for the submarine hunt.
19. The film music was composed by David Ferguson; a short analysis of the main theme and its emotional impact is given in Koldau, 2008a.

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