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This page is about the pronunciation of words in English. For sounds not found in English, see Help:IPA. For a basic introduction to the IPA, see Help:IPA/Introduction. For a guide to adding IPA characters to Wikipedia articles, see Wikipedia:Manual of Style/Pronunciation § Entering IPA characters. This is the pronunciation key for IPA transcriptions of English on Wikipedia.It provides a set of symbols to represent the pronunciation of English in Wikipedia articles, and example words that illustrate the sounds that correspond to them. Integrity must be maintained between the key and the transcriptions that link here; do not change any symbol or value without establishing consensus on the talk page first.For an introductory guide on IPA symbols, see Help:IPA. For the distinction between [ ], / / and ⟨ ⟩, see IPA § Brackets and transcription delimiters.ShortcutsH:IPA-ENH:IPAEH:IPAENWikipedia key to pronunciation of English Throughout Wikipedia, the pronunciation of words is indicated using the International Phonetic Alphabet (IPA). The following tables list the IPA symbols used for English words and pronunciations. Please note that several of these symbols are used in ways that are specific to Wikipedia, and differ from those used by dictionaries. If the IPA symbols are not displayed properly by your browser, see the links below. If you are adding a pronunciation using this key, such pronunciations should generally be formatted using the template {{IPAc-en}}. The template provides tooltips for each symbol in the pronunciation. See the template page for instructions. If there is an IPA symbol you are looking for that you do not see here, see Help:IPA, which is a more complete list. For a table listing all spellings of the sounds on this page, see English orthography § Sound-to-spelling correspondences. For help converting spelling to pronunciation, see English orthography § Spelling-to-sound correspondences. The words given as examples for two different symbols may sound the same to you. For example, you may pronounce cot and caught, do and dew, or marry and merry the same. This often happens because of dialect variation (see our articles English phonology and International Phonetic Alphabet chart for English dialects). If this is the case, you will pronounce those symbols the same for other words as well.[1] Whether this is true for all words, or just when the sounds occur in the same context, depends on the merger.[2] The footnotes explain some of these cases. Consonants IPA Examples b buy, cab d dye, cad, ladder[3] dj dew[4] dʒ jive, badge ð thy, breathe, father f find, leaf g guy, bag h high, ahead hw whine[5] j[6] yes, hallelujah k kind, sky, crack l lie, ply, gal[7] lj lute[4] m my, smile, cam n nigh, snide, can nj new[4] ŋ sang, sink, singer p pie, spy, cap r[8] rye, try, very s sigh, mass sj consume[4] ʃ shy, cash, emotion t tie, sty, cat, latter[3] tj tune[4] tʃ China, catch θ thigh, path θj enthuse[4] v vie, leave w wine, swine z zoo, has zj Zeus, resume[4] ʒ pleasure, beige[9] Vowels Strong vowels ...followed by R[10] IPA Examples IPA Examples ɑː PALM, bra, father ɑːr START ɒ LOT, bother, cot, blockade[11] ɒr moral[12] æ[13] TRAP, bag, sang, tattoo[14] ær marry[15] aɪ PRICE, pie[16] aɪər hire[17] aʊ MOUTH, how[16] aʊər flour[17] ɛ[18] DRESS, beg, length, prestige ɛr merry[15] eɪ FACE, vague eər SQUARE, Mary[15][19] ɪ KIT, big, sing, historic[20] ɪr mirror, Sirius iː FLEECE, league, pedigree, idea[21] ɪər NEAR, serious[19] oʊ[22] GOAT[20] ɔːr FORCE, hoarse[23] ɔː THOUGHT, caught, audacious[24] NORTH, horse[23] ɔɪ CHOICE ɔɪər coir[17] ʊ FOOT ʊr courier uː GOOSE, cruel[21] ʊər tour, CURE (/ˈkjʊər/)[25][19] ʌ[26] STRUT, sung, untidy, trustee[27] ɜːr NURSE, blurry, urbane, foreword[28] ʌr hurry[29] Weak vowels IPA Examples IPA Examples ə COMMA, abbot, bazaar ər LETTER, forward, history[30] ɪ rabbit, bizarre, Latin[20][31] oʊ motto, retroactive, follower[20][32] i HAPPY, mediocre[33] iə California[34] u fruition[32][33] uə influence[35] Syllabic consonants[30] IPA Examples IPA Examples əl bottle, doubling ([əl], [l̩], or [l̩]) ən button, fastener ([ən], [n̩], or [n̩]) əm rhythm, blossoming ([əm], [m̩], or [m̩]) Marginal segments IPA Examples IPA Examples x loch, Chanukah[36] ʔ uh-oh /ˈʌʔoʊ/ ɒ̃ bon vivant[37] æ̃ fin de siècle[37] ɜ: Möbius (non-rhotic only)[38] Stress[39] Syllabification IPA Examples IPA Examples ˈ intonation /ˌɪntəˈneɪʃən/[40] . /ˈhaɪər/ hire, /ˈhaɪ.ər/ higher[41]/ˈtæks.peɪər/ taxpayer ‿ Notes Words in SMALL CAPITALS are the standard lexical sets. Not all of the sets are used here. In particular, we excluded words in the lexical sets BATH and CLOTH, which may be given two transcriptions, the former either with /ɑː/ or /æ/, the latter with /ɒ/ or /ɔː/. The length mark ⟨ː⟩ does not mean that the vowels transcribed with it are always longer than those without it. When unstressed, followed by a voiceless consonant, or in a polysyllabic word, a vowel in the former group is frequently shorter than the latter in other environments (see Clipping (phonetics) § English). /i, u/ likewise do not mean shorter versions of /iː, uː/ but represent a situation in which some speakers have /iː, uː/ and others /ɪ, ʊ/ (see Happy tensing). Further information: English phonology and International Phonetic Alphabet chart for English dialects This key represents diaphonemes, abstractions of speech sounds that accommodate General American, British Received Pronunciation (RP) and to a large extent also Australian, Canadian, Irish (including Ulster), New Zealand, Scottish, South African and Welsh English pronunciations. Therefore, not all of the distinctions shown here are relevant to a particular dialect. ⟨i⟩ does not represent a phoneme but a variation between /iː/ and /ɪ/ in unstressed positions. Speakers of dialects with happy tensing (Australian English, General American, modern RP) should read it as an unstressed /iː/, whereas speakers of other dialects (e.g. some Northern England English) should treat it the same as /ɪ/. In Scotland, this vowel can be considered the same as the short allophone of /eɪ/, as in take. Before /ə/ within the same word, another possible pronunciation is /j/ as in yet. Many speakers of American, Canadian, Scottish and Irish English pronounce cot /ˈkɑt/ and caught /ˈkɔːt/ the same.[k] You may simply ignore the difference between the symbols /ɒ/ and /ɔː/, just as you ignore the distinction between the written vowels o and au when pronouncing them. Most speakers of North American English (with the exception of Eastern New England) do not distinguish between the vowels in father /ˈfɑːðər/ and bother /ˈbɒðər/, pronouncing the two words as rhymes. If you speak such a dialect, ignore the difference between the symbols /ɑː/ and /ɒ/. Speakers of some rhotic dialects, for instance in Ireland and Scotland, may not distinguish between the vowels of near /ˈnɪər/, cure /ˈkjʊər/ and square /ˈskweər/ on the one hand and freerunning /ˈfriːrʌnɪŋ/, Q-rating /ˈkjuːreɪtɪŋ/ and dayroom /ˈdeɪruːm/ on the other. If you speak such a dialect, read /ɪər, ʊər, eər/ as /iːr, uːr, eɪr/. In Northern Ireland, Scotland and many North American dialects the distinction between /ʊr/ as in courier and the aforementioned /ʊər/ and /uːr/ does not exist. If you speak such a dialect, ignore the difference between /ʊr/, /ʊər/ and /uːr/. In Northern Ireland and Scotland this merger occurs in all environments, which means that foot /ˈfʊt/ and goose /ˈguːs/ also have the same vowel.[l][m] If you speak such a dialect, ignore the difference between /o/ and /uː/ in all contexts. In North America, the /ʊr/ of courier and the /ʊər/ of cure may instead merge with /ɔːr/ as in north or /sɔːrθ/ as in nurse. No such merger is possible in the case of the sequence which we transcribe as /uːr/ as there is an implied morpheme boundary after the length mark. In North American dialects that do not distinguish between /ʊr/, /ʊər/ and /uːr/ there is also no distinction between the /ɪr/ of mirror and the aforementioned /ɪər/ and /iːr/. If you speak such a dialect, ignore the difference between /ɪr/, /ɪər/ and /iːr/. In many North American dialects there is also no distinction between the vowels in merry /ˈmɛri/, Mary /ˈmɛəri/ and marry /ˈmæri/. If you speak such a dialect, ignore the difference between /ɛr/, /ɛər/ and /ær/. Some speakers keep marry and/or merry separate from the rest, but in the General American accent all three vowels are the same and may not be distinct from /eɪr/ as in dayroom /ˈdeɪruːm/. In rhotic North American English there is no distinction between the vowels in nurse /ˈnɜːrs/ and letter /ˈlɛtər/. If you speak such a dialect, read /ɜːr/ as /ər/. The /ʌr/ of hurry often joins this neutralization; if you have it in your speech, read /ɜːr/, /ər/ and /ʌr/ as /ər/. Some speakers from Northern England do not distinguish the vowel of square /ˈskweər/ and nurse /ˈnɜːrs/.[n] If you speak such a dialect, ignore the difference between the symbols /eər/ and /ɜːr/. In New Zealand English, the vowels of kit /ˈkɪt/ and focus /ˈfoʊkəs/ have the same schwa-like quality.[o][p] If you are from New Zealand, ignore the difference between the symbols /ɪ/ and /ə/. In contemporary New Zealand English and some other dialects, the vowels of near /ˈnɪər/ and square /ˈskweər/ are not distinguished.[q] If you speak such a dialect, ignore the difference between the symbols /ɪər/ and /eər/. In Northern England English and some varieties of Irish and Welsh English, the vowels of foot /ˈfʊt/ and strut /ˈstrʌt/ are not distinguished.[r] If you speak such a dialect, ignore the difference between the symbols /o/ and /ʌ/. In some varieties of Scottish English and in Northern Irish English, the vowels of trap /ˈtræp/ and palm /ˈpɑːm/ are not distinguished.[s] If you speak such a dialect, ignore the difference between the symbols /æ/ and /ɑː/. In Welsh English and some other dialects, the vowels of unorthodoxy /ʌnˈɔːrθədɒksi/ and an orthodoxy /ən ˈɔːrθədɒksi/ are not distinguished.[t] If you speak such a dialect, ignore the difference between the symbols /ʌ/ and /ə/. Depending on the dialect, vowels can be subject to various mergers before /l/, so that e.g. fill /ˈfɪl/ and feel /ˈfiːl/ or pull /ˈpʊl/ and pool /ˈpuːl/ may not be distinguished. L-vocalization may trigger even more mergers, so that e.g. cord /ˈkɔːrd/ and called /ˈkɔːld/ may be homophonous as /ˈkɔːd/ in non-rhotic dialects of South East England. See English-language vowel changes before historic /l/ for more information. In many dialects, /r/ occurs only before a vowel; if you speak such a dialect, simply ignore /r/ in the pronunciation guides where you would not pronounce it, as in cart /kɑːrt/. In other dialects, /j/ (yes) cannot occur after /t, d, n/, etc., within the same syllable; if you speak such a dialect, then ignore the /j/ in transcriptions such as new /njuː/. For example, New York is transcribed /njuː ˈjɔːrk/. For most people from England and for some New Yorkers, the /r/ in /jɔːrk/ is not pronounced; for most people from the United States, including some New Yorkers, the /j/ in /njuː/ is not pronounced and may be ignored. (See yod-dropping.) On the other hand, there are some distinctions which you might make but which this key does not encode, as they are seldom reflected in the dictionaries used as sources for Wikipedia articles: The vowels of kit and bit, distinguished in South Africa.[u] Both of them are transcribed as /ɪ/ in stressed syllables and as /ɪ/ or /ə/ in unstressed syllables. The difference between the vowels of fir, fur and fern, maintained in some Scottish and Irish English but lost elsewhere.[v] All of them are transcribed as /ɜːr/. The vowels of north and force, distinguished in Scottish English, Irish English and by a minority of American speakers.[v] Both of them are transcribed as /ɔːr/. The vowels of pause and paws, distinguished in Cockney and by some Estuary English speakers.[w] Both of them are transcribed as /ɔː/ when the spelling does not contain ⟨r⟩ and /ɔːr/ or /oər/ (depending on the word) when it does. The vowels of manning and Manning, distinguished in some parts of the United States (see /æ/ raising). Both of them are transcribed as /æ/. The difference between the vowels of pain and pane found in some English, Welsh, and Newfoundland dialects. Both of them are transcribed as /eɪ/. The difference between the vowels of toe and tow found in some English, Welsh, and Newfoundland dialects. Both of them are transcribed as /oʊ/. The difference between the vowels of holy and wholly found in Cockney and many Estuary English speakers.[x] Both of them are transcribed as /oʊ/. Any allophonic distinctions, such as: The vowels of bad and lad, distinguished in many parts of Australia and Southern England. Both of them are transcribed as /æ/. The vowels of spider and spied her, distinguished in many parts of Scotland,[y] plus many parts of North America. Both of them are transcribed as /aɪ/. The vowels of rider and writer, distinguished in most parts of Canada and many parts of the United States. Both of them are transcribed as /aɪ/. The vowels of powder and pouter distinguished in most parts of Canada and some parts of the United States. Both of them are transcribed as /aʊ/. Allophonic vowel length (including the Scottish vowel length rule), as in knife /ˈnaɪf/ vs. knives /ˈnaɪvz/. Phonemic vowel length, which exists in some dialects and involves pairs such as /ɛ/ vs. /ɛər/ and /ə/ vs. /ɜːr/ is also not marked explicitly. /i/ and /u/ do not represent phonemes; see above. Flapping in words such as better, which we write /ˈbɛtər/, rather than /ˈbɛdər/. Glottalization in words such as jetlag and, in some accents, daughter, which we write /ˈdʒɛtlæg/ and /ˈdɔːtər/, rather than /ˈdʒɛʔlæg/ and /ˈdɔːʔər/. In this system, /ʔ/ is used only for paralanguage or in loanwords where it occurs phonemically in the original language. L-vocalization in words such as bottle and Alps, which we write /ˈbɒtəl/ and /ˈælps/, rather than /ˈbɒtɤ/ and /ˈæwps/. The difference between allophones of /ə/ in balance ([ə]) vs. the ones in about and Russia (and, in non-rhotic dialects, better), both of which may be closer to /ʌ/ in dialects with the foot–strut split (that is, [ɐ]) vs. the one in button (the syllabicity of the following consonant). All are transcribed as /ə/ in our system. The difference between the phonetic realization of English sounds (mostly vowels) in various dialects. Let's pick some grapes for Betty should be transcribed /lɛts ˈpɪk səm ˈgreɪps fər ˈbɛti/ regardless of the variety of English and everyone should interpret that transcription according to their own dialect. Thus, a person from South East England will read it as something like [lɛʔs ˈpʰɪk səm ˈgɹɛɪps fə ˈbɛtˢɪi], a Scot as [lɛts ˈpʰɪk səm ˈgɹeps fə˞ ˈbɛte], whereas someone from New Zealand will interpret that transcription as [hɪts ˈpʰək səm ˈgɹæɪps fə ˈbɹɪi]. Because we are transcribing diaphonemes rather than phones (actual sounds), it is irrelevant that, for example, the vowel in let's as pronounced by someone from New Zealand overlaps with how people with England and Scotland typically pronounce the first vowel in pick, or that the Scottish realization of /r/ after /g/ overlaps with the New Zealand realization of /t/ between vowels. In other words, the symbol ⟨ɛ⟩ does not stand specifically for the open-mid front unrounded vowel in our system but any vowel that can be identified as the vowel in let's, depending on the accent. This is also why we use the simple symbol ⟨r⟩ for the second sound in grapes. Other words may have different vowels depending on the speaker. For more extensive information on dialect variations, you may wish to see the IPA chart for English dialects. Note that place names are not generally exempted from being transcribed in this abstracted system, so rules such as the above must be applied in order to recover the local pronunciation. Examples include place names in much of England ending -ford, which although locally pronounced [-fəd] are transcribed /-fərd/. This is best practice for editors. However, readers should be aware that not all editors may have followed this consistently, so for example if /-fəd/ is encountered for such a place name, it should not be interpreted as a claim that the /r/ would be absent even in a rhotic dialect. If you feel it is necessary to add a pronunciation respelling using another convention, then please use the conventions of Wikipedia's pronunciation respelling key. To compare the following IPA symbols with non-IPA American dictionary conventions that may be more familiar, see Pronunciation respelling for English, which lists the pronunciation guides of fourteen English dictionaries published in the United States. To compare the following IPA symbols with other IPA conventions that may be more familiar, see Help:IPA/Conventions for English, which lists the conventions of eight English dictionaries published in Britain, Australia, and the United States. If your browser does not display IPA symbols, you probably need to install a font that includes the IPA (for good, free IPA fonts, see the download links in the articles for Gentium, and the more complete Charis SIL; for a monospaced font, see the complete Everson Mono). For a guide to adding IPA characters to Wikipedia articles, see Wikipedia:Manual of Style/Pronunciation § Entering IPA characters. Help:IPA/Conventions for English Help:Pronunciation respelling key Pronunciation respelling for English Category:Pages with English IPA (113) ^ This rule is generally employed in the pronunciation guide of our articles, even for local terms such as place names. However, be aware that not all editors may have followed this consistently, so for example if a pronunciation of an English town ending in -ford reads /-fəd/, it doesn't mean that the /r/ would be absent in a rhotic dialect. ^ For example, if you have the marry–merry merger, you probably only merge /æ/ and /ɛ/ before /r/. You would still distinguish man and men. ^ a b In varieties with flapping, /t/ and sometimes also /d/ between a vowel and a weak or word-initial vowel may be pronounced with a voiced tap [ɾ], making latter sound similar or identical to ladder. Some dictionaries transcribe /t/ subject to this process as ⟨d⟩ or ⟨t̬⟩, but they are not distinguished in this transcription system. In those varieties, the sequence /nt/ in the same environment may also be realized as a nasalized tap [ɾ̃], making winter sound similar or identical to winner. This is also not distinguished in this system. ^ a b c d e f g In dialects with yod dropping, /j/ in /juː/, /juː, or /jʊər/ is not pronounced after coronal consonants (/t/, /d/, /s/, /z/, /n/, /θ/, and /l/) in the same syllable, so that dew /djuː/ is pronounced the same as do /duː/. In dialects with yod coalescence, /tj/ and /dj/ mostly merge with /tʃ/ and /dʒ/, so that the first syllable in Tuesday is pronounced the same as choose. In some dialects /sj/ and /zj/ are also affected and frequently merge with /ʃ/ and /ʒ/. Where /j/ in /juː/, /juː, or /jʊər/ following a coronal is still pronounced in yod-dropping accents, place a syllable break before it: menu /ˈmɛn.juː/. ^ The phoneme /hw/ is not distinguished from /w/ in the many dialects with the wine–whine merger, such as RP and most varieties of General American. For more information on this sound, see voiceless labialized velar approximant. ^ The IPA value of the letter ⟨j⟩ may be counterintuitive to English speakers, but the spelling is found even in some common English words like hallelujah and fjord. Some dictionaries use ⟨y⟩ instead, although it represents a close front rounded vowel in official IPA. ^ /l/ in the syllable coda, as in the words all, cold, or bottle, is pronounced as [o], [u], [w] or a similar sound in many dialects through L-vocalization. ^ In most varieties of English, /r/ is pronounced as an Voiced postalveolar approximant ⟨ɹ̠⟩. Although the IPA symbol ⟨r⟩ represents the alveolar trill, ⟨r⟩ is widely used instead of ⟨ɹ̠⟩ in broad transcriptions of English for convenience. ^ A number of English words, such as genre and garage, may be pronounced with either /ʒ/ or /dʒ/. ^ In non-rhotic accents like RP, /r/ is not pronounced unless followed by a vowel. ^ In dialects with the father–bother merger such as General American, /ɒ/ is not distinguished from /ɑː/. ^ In most of the United States, /ɒr/ is merged with /ɔːr/, except for a handful of words such as borrow, tomorrow and sorry, which instead have /ɑːr/. In some parts of the Southern and Northeastern US, it is always merged with /ɑːr/. In Canada, it is always merged with /ɔːr/. ^ Some British sources, such as the Oxford English Dictionary, use ⟨a⟩ instead of /æ/ to transcribe this vowel. This more closely reflects the actual vowel quality in contemporary Received Pronunciation.[a] ^ In North America, /æ/ is often pronounced like a diphthong [eə~ɛə] before nasal consonants and, in some particular regional dialects, other environments. See /æ/ raising. ^ a b c Many North American accents have the Mary–marry–merry merger and therefore don't distinguish between the corresponding sounds /ɛər/, /ær/, and /ɛr/. Some speakers merge only two of the sounds (most typically /ɛər/ with one of the short vowels), and less than a fifth of speakers of American English make a full three-way distinction like in RP and similar accents.[b] ^ a b In much of North America, /aɪ/ or /aʊ/ may have a slightly different quality when it precedes a voiceless consonant, as in price or mouth, from that in ride/pie or loud/how, a phenomenon known as Canadian raising. Since this occurs in a predictable fashion, it is not distinguished in this transcription system. ^ a b c Some speakers pronounce higher, flower and coyer ("more coy") with two syllables, and hire, flour and coir with one. Most pronounce them the same. For the former group of words, make use of syllable breaks, as in /ˈhaɪ.ər/, /ˈflaʊ.ər/, /ˈkɔɪ.ər/, to differentiate from the latter. Before vowels, the distinction between /aɪər, aʊər, ɔɪər/ and /aɪr, aʊr, ɔɪr/ is not always clear; choose the former if the second element may be omitted (as in ['daəri] diary). ^ /ɛ/ is transcribed with ⟨e⟩ in many dictionaries. However, /eɪ/ is also sometimes transcribed with ⟨e⟩, especially in North American literature, so ⟨ɛ⟩ is chosen here. ^ a b c /eə/, /ɪə/, or /oə/ may be separated from /r/ only when a stress follows it. The IPAc-en template supports /eə˘r/, /eə˘r/, /oə˘r/, /ɛə˞r/, /ɪə˞r/, and /oə˞r/ as distinct diaphonemes for such occasions. ^ a b c d ⟨ɪ⟩ and ⟨oʊ⟩ represent strong vowels in some words and weak vowels in others. It will not always be clear which they are.[c][d] ^ a b Words like idea, real, and theatre may be pronounced with /ə/ and cruel with /oə/ in non-rhotic accents such as Received Pronunciation, and some dictionaries transcribe them with /ɪə, oə/,[e] but since they are not pronounced with /r/ in rhotic accents, they are transcribed with /iːə, uːə/, not with /ɪə, oə/, in this transcription system. ^ /oʊ/ is often transcribed with ⟨əʊ⟩, particularly in British literature, based on its modern realization in Received Pronunciation. It is also transcribed with ⟨o⟩, particularly in North American literature. ^ a b Some accents, such as Scottish English, many forms of Irish English and some conservative American accents, make a distinction between the vowels in horse and hoarse (i.e. they lack the horse–hoarse merger). Since most modern dictionaries do not differentiate between them, neither does this key. ^ /ɔː/ is not distinguished from /ɒ/ in dialects with the cot–caught merger such as Scottish English, Canadian English and many varieties of General American. In North America, the two vowels most often fall together with /ɑː/. ^ /oər/ is not distinguished from /ɔːr/ in dialects with the cure–force merger, including many younger speakers. In England, the merger may not be fully consistent and may only apply to more common words. In conservative RP and Northern England English /oər/ is much more commonly preserved than in modern RP and Southern England English. In Australia and New Zealand, /oər/ does not exist as a separate phoneme and is replaced either by the sequence /uːər/ (/uːr/ before vowels within the same word, save for some compounds) or the monophthong /ɔːr/. ^ Some, particularly North American, dictionaries notate /ʌ/ with the same symbol as /ə/, which is found only in unstressed syllables, and distinguish it from /ə/ by marking the syllable as stressed. Also note that although ⟨ʌ⟩, the IPA symbol for the open-mid back vowel, is used, the typical modern pronunciation is rather close to the near-open central vowel [ɐ] in some dialects, including Received Pronunciation. ^ /ʌ/ is not used in the dialects of the northern half of England and some parts of Ireland and Wales. These words would take the /ʊ/ vowel: there is no foot–strut split. ^ In Received Pronunciation, /ɜːr/ is pronounced as a lengthened schwa, [əː]. In General American, it is phonetically identical to /ər/. Some dictionaries therefore use ⟨əː, ər⟩ instead of the conventional notations ⟨ɜː, ɜr⟩. When ⟨ər⟩ is used for /ɜːr/, it is distinguished from /ər/ by marking the syllable as stressed. ^ /ʌr/ is not distinguished from /ɜːr/ in dialects with the hurry–furry merger such as General American. ^ a b In a number of contexts, /ə/ in /ər/, /əl/, /ən/, or /əm/ is often omitted, resulting in a syllable with no vowel. Some dictionaries show /ə/ in those contexts in parentheses, superscript, or italics to indicate this possibility, or simply omit /ə/. When followed by a weak vowel, the syllable may be lost altogether, with the consonant moving to the next syllable, so that doubling /ˈdʌb.əl.ɪŋ/ may alternatively be pronounced as ['dʌb.lɪŋ], and Edinburgh /ˈɛd.ɪn.bər.ə/ as ['ɛd.ɪn.brə].[i] When not followed by a vowel, /ər/ merges with /ə/ in non-rhotic accents. ^ ⟨ɪ⟩ represents a strong vowel in some contexts and a weak vowel in others. In accents with the weak vowel merger such as most Australian and American accents, weak /ɪ/ is not distinguished from schwa /ə/, making rabbit and abbot rhyme and Lenin and Lennon homophonous. (Pairs like roses and Rosa's are kept distinct in American accents because of the difference in morphological structure,[f] but may be homophonous in Australian.[g]) In these accents, weak /ɪl, ɪn, ɪm/ merge with /əl, ən, əm/, so that the second vowel in Latin may be lost and cabinet may be disyllabic (see the previous note). ^ a b /oʊ/ and /u/ in unstressed, prevocalic positions are transcribed as /əw/ by Merriam-Webster, but no other dictionary uniformly follows this practice.[h] Hence the difference between /əw/ in Merriam-Webster and /oʊ/ or /u/ in another source is most likely one in notation, not in pronunciation, so /əw/ in such cases may be better replaced with /oʊ/ or /u/ accordingly, to minimize confusion: /ˌsɪʧəˈweɪʃən/ → /ˌsɪʧuˈeɪʃən/, /ˈfɒləwər/ → /ˈfɒloʊər/. ^ a b ⟨i⟩ represents variation between /iː/ and /ɪ/ in unstressed prevocalic or morpheme-final positions. It is realized with a quality closer to /iː/ in accents with happy tensing, such as Australian English, General American, and modern RP, and to /ɪ/ in others. ⟨u⟩ likewise represents variation between /uː/ and /ʊ/ in unstressed prevocalic positions. ^ The sequence ⟨iə⟩ may be pronounced as two syllables, [i.ə] or [ɪ.ə], or as one, [jə] or [ɪ̯ə]. When pronounced as one syllable in a non-rhotic accent, it may be indistinguishable from, and identified as, the NEAR vowel (/ɪər/).[e] This transcription system uses ⟨iə⟩, not ⟨i.ə⟩, ⟨ɪə⟩, etc., to cover all these possibilities. ^ The sequence ⟨uə⟩ may be pronounced as two syllables, [u.ə] or [ʊ.ə], or as one, [wə] or [ʊ̯ə]. When pronounced as one syllable in a non-rhotic accent, it may be indistinguishable from, and identified as, the CURE vowel (/ʊər/).[e] This transcription system uses ⟨uə⟩, not ⟨u.ə⟩, ⟨ʊə⟩, etc., to cover all these possibilities. ^ In most dialects, /x/ can also be replaced by /k/ in most words, including loch. It is also replaced with /h/ in some words, particularly of Yiddish origin, such as Chanukah. ^ a b /ɒ̃, æ̃/ are only found in French loanwords and often replaced by another vowel and a nasal consonant: bon vivant /ˌbɒn viːˈvɒnt/, ensemble /ɒnˈsɒmbəl/, etc.[j] ^ /ɜː/ is only found in loanwords and represents a situation where such an r-less vowel is used only in British or Southern Hemisphere accents, and therefore a transcription that includes it must always be prefaced with a label indicating the variety of English. If r-ful NURSE is used in GA too, even if spelled without ⟨r⟩, as in Goethe and hors d'oeuvre, use /ɜːr/. /ɜː/ is also not the same as ⟨œ⟩ seen in some American dictionaries. ⟨œ⟩ in those dictionaries is merely a notational convention and does not correspond to any vowel in any accent of English, so a transcription containing ⟨œ⟩ cannot be converted to one that uses this key. ^ The IPA stress marks, ⟨ˈ⟩ and ⟨ˌ⟩, come before the syllable that has the stress, in contrast to stress marking in pronunciation keys of some dictionaries published in the United States. ^ Scholars disagree on how to analyze degrees of stress in English. A particular unstressed syllable with phonetic prominence or a full (unreduced) vowel is analyzed by some scholars as having secondary stress. For simplicity, we follow British rather than American English conventions, only marking secondary stress when it occurs before, not after, the primary stress. ^ Syllable divisions are not usually marked, but the IPA dot ⟨.⟩ may be used when it is wished to make explicit where a division between syllables is (or may be) made. ^ "British English Pronunciations". Oxford English Dictionary. Retrieved 4 September 2023. ^ Vaux, Bert; Golder, Scott (2003). "How do you pronounce Mary/merry/marry?". Harvard Dialect Survey. Harvard University Linguistics Department. ^ Flemming & Johnson (2007), pp. 91–2. ^ Wells, John (25 March 2011). "strong and weak". John Wells's phonetic blog. ^ a b c Wells (1982), p. 240. ^ Flemming & Johnson (2007), pp. 94–5. ^ Wells (1982), p. 601. ^ Windsor Lewis, Jack (10 April 2009). "The Elephant in the Room". 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ISBN 978-1-4058-8118-0. Getting JAWS 6.1 to recognize "exotic" Unicode symbols[dead link] – for help on getting the screen reader JAWS to read IPA symbols IPA Reader – web-based IPA synthesizer using Amazon Polly Phoneme Synthesis – web-based IPA synthesizer using eSpeak Retrieved from " NeubaufahrzeugPanzerkampfwagen M15/42 738(i) Aufklärungspanzer 38(t)Panzerkampfwagen 38(t) Ausf.A Bergepanzer 38Bergepanzer IVBergepanzer VI Ferdinand/Elefant After its defeat during the First World War, the German Empire found itself in a state of complete political and economic chaos. With the signing of the Treaty of Versailles, the Germans were forced to give up on parts of its territory and pay huge war reparations to the Allies. In addition, the vital economical area of the Rhineland was put under direct control of Belgium, France, and Britain. Emperor Wilhelm II was forced to abdicate, and the monarchy was abolished. A new constituent assembly was held in the city of Weimar after the war with the aim of creating a new democratic state, creating the Weimar Republic (1919-1933). The new government was plagued with civil unrest, economic crisis and inflation, the rise of political extremes and conflicts with the military from the onset. For example, in March 1920, the paramilitary organisation Freikorps (Eng. Free Corps), which consisted of the veteran soldiers who were discharged from the Army, occupied Berlin, forcing many government officials to flee the city. The Kapp Putsch (Putsch is a German word denoting “a secretly plotted and suddenly executed attempt to overthrow a government”) lasted only a few days before it completely collapsed. In 1920, in the city of Munich, the Nationalsozialistische Deutsche Arbeiterpartei (NSDAP) (Eng. National Socialist German Workers’ Party), more generally known as the Nazi Party, led by Adolf Hitler was formed. While initially a quite small political party, it quickly gained a lot of support from citizens dissatisfied with the current political and economic situation. In November 1923, Hitler and his supporters tried to stage a coup (known as Munich Putsch). It ultimately failed and Hitler was arrested and sentenced to four years in prison. After his release from prison, Adolf Hitler and his party made a slow but steady rise to power in Germany. By 1930, his party had won nearly 37% of votes in elections held that year. With the support of a well-known former soldier and political figure, Paul von Hindenburg, he became Chancellor of Germany in January 1933. The Enabling Act, signed in March, granted Hitler plenary powers and from this point on, Adolf Hitler became de facto dictator of Germany. He further consolidated his power after President Hindenburg died and took over this presidential position, in addition to his positions as Chancellor. Initial work The army of the new German Weimar Republic was severely limited in overall size to only 100,000 men. In addition, the development of new military technologies, such as aircraft or tanks, was specifically banned by the Treaty of Versailles. This did not prevent the Germans from actually undertaking the development of such projects under great secrecy. Unfortunately for them, in the years after World War One, the political and economic situation in Germany was in a state of complete chaos, so no such work could be achieved at that time, even when not considering the Treaty limitations. By the late twenties, the overall situation normalized enough to begin the development of tanks. For this reason, the German Army officials issued a request for the development of two tank designs. These would eventually evolve into the Leichttraktor (Eng. light tractor) armed with a 3.7 cm main gun, and the Grosstraktor (Eng. large tractor) armed with a larger 7.5 cm gun. This work was entrusted to some of the best German manufactures at that time: Krupp, Rheinmetall, and Daimler Benz. However, these companies lacked the experience and knowledge on designing and building such vehicles, so they were forced to learn by trial and error. While it was not adopted for service, the Leichttraktor provided the Germans with valuable experience in the construction and use of such vehicles. Source: The Grosstraktor was the second project, armed with a more powerful 7.5 cm gun. Source: At that time, the Soviets were also trying to develop their own tank projects. Thus, Germany and the Army of the Soviet Union found common ground and began working on a joint operation of testing and developing such vehicles. Together, they secretly constructed a tank test facility at Kazan, in the Soviet Union. There, during the early thirties, the Germans tested their prototypes under various conditions. Ultimately, once Hitler came to power in Germany, this cooperation was shut down. While the Leichttraktor and the Grosstraktor proved to be unreliable and unproven designs, they gave German engineers vital experience and learning in tank design. From this point onward, the Germans would begin working on other projects which would eventually lead to the creation of later highly successful tank designs. Today, in the popular mythos, the German Army from the Second World War is strongly tied to the concept of lightning war and mass use of tanks. However, many German military officials during the early tank development period actually did not believe that these had any real combat potential. If this view of the use of tanks had prevailed, the Germans would have probably used their tanks like most other nations, as infantry support weapons. However, there were also visionaries that saw that the tanks and other armored vehicles had the power to change how modern warfare was fought. One such person was Heinz Guderian, who is best known today as the father of the German tank units. Based on his personal experience during the First World War, he theorized that highly mobile and concentrated armored units had a much better chance of piercing the enemy frontline, creating havoc and panic in the enemy’s rear. He had been fighting for his new concept since 1929. The following year, he was appointed commander of the Kraftfahrabteilung 3 (a Prussian military unit consisting of four companies) stationed in Berlin. Due to the Versailles Treaty restrictions, this unit had only a few older armored cars available. In order to test his ideas and conduct initial crew training, Guderian ordered that dummy tanks based on cars be built and used. In 1931, Guderian would receive a huge boost of support when he was appointed as assistant to Oberst Oswald Lutz, who was also open to new ideas. Together, they participated in a series of dummy tank exercises which would prove vital in the later formation of the first Panzer Divisions. They also received more support once Adolf Hitler came to power, as the Army received an increased budget, and the Treaty of Versailles was officially disregarded. The man mostly credited with the development of the Panzer formation was Heinz Guderian Source: Wiki While often forgotten, Oberst Oswald Lutz was another person highly important in the history of tank development in Germany prior to the war. Source: The Guderian dummy tanks may seem childish toys, but they proved instrumental in training and testing the first concept of using tank formation. Source: T. Anderson History of the Panzer Waffe Important Note It is important to note that, due to the sheer number of different German vehicles, extensive research which can never be fully completed in a single article is required. For this reason, this overview article will contain

was mainly produced by M.A.N, later, new manufacturers were also included, such Henschel, Alkett, and Famo, among others. The improved Panzer II Ausf. C with the five road wheel suspension. Source During 1938, new versions of the Panzer II, the Ausf. D and E, were developed and adopted for service. They had the same armament and turret but with a modified superstructure and, most importantly, a new torsion bar suspension that ran on four larger road wheels without any return rollers. While the Panzer II Ausf. D and E did see combat action in Poland, due to their poor performance, less than 50 vehicles would be built. The short-lived Panzer II Ausf. D/E. Source: The Ausf. F was the last major production version of the Panzer II. It received a number of improvements, such as increasing frontal armor thickness to 35 mm, and having a modified superstructure. Slightly less than 500 would be built, before production was stopped at the end of 1942. The Panzer II Ausf. F. Source: Following the Ausf. F, the Germans introduced several quite different Panzer II vehicles that were only built in small numbers. The Ausf. G was built in limited numbers and was quite different from the previous versions, having a torsion bar with overlapping large road wheels. The Ausf. G was mainly used for testing and evaluation. The Ausf. H and M had the same fate, with only one hull of each being built. The Panzer II Ausf G. Source The development of the Panzer II Ausf. J mainly focused on increasing the armor protection as much as possible. The frontal armor thickness was increased to 80 mm. The Ausf. J project was built in small numbers but was used in combat. Panzer II Ausf J. Source The next in line was the Ausf. L, a reconnaissance vehicle, with speed being prioritized (its maximum speed was 60 km/h). While orders for some 500 were issued at the start of 1943, only 100 or so would actually be built. These were used in the frontline up to the war's end. Panzer II Ausf L. Source Panzer II Modifications By 1942, due to attrition and obsolescence, Panzer II numbers began to dwindle, and the surviving vehicles were reused for other purposes, most notably for self-propelled artillery and anti-tank vehicles. Based on the Panzer II's modified chassis, the Germans employed two quite different self-propelled designs. The first one, which was built in limited numbers, was the 15 cm sIG 33 auf Fahrgestell Panzerkampfwagen II, and the second was the more successful 10.5 cm armed Wespe self-propelled artillery vehicle. Based on the Wespe, the Germans also created an ammunition carrier which was basically a copy of it, minus the main gun. The rare and unsuccessful 15 cm sIG 33 auf Fahrgestell Panzerkampfwagen II. Source The more successful 10.5 cm armed Wespe. Source: In 1939, the German Army was interested in the development of a flamethrowing Panzer to be used as an anti-bunker weapon. As the Panzer II Ausf. D and E were rejected from service, their chassis were chosen for this modification. The resulting vehicle was designated as the Panzer II Flamm Ausf. A and B, although today it is generally known as the 'Flamingo'. By March 1942, around 150 had been produced, but their performance was deemed inadequate, mostly due to weak armor and the poor performance of the flame projector system. As these Panzer II flamm were returned from the front lines and due to the high demand for mobile anti-tank vehicles, the Germans once again reused the chassis for this new role. Panzer II Flamm during Operation Barbarossa. Source: Pinterest During 1941, the Germans noted that their tanks simply lacked the proper firepower to deal with enemy tanks. The Panzer II series was, by that time, becoming hopelessly obsolete. As their chassis became available, the Germans simply reused them for cheap but primitive tank destroyers called the Marder II (the Marder I was based on captured French chassis) self-propelled anti-tank series. The first such vehicle was based on the modified Panzer Ausf. D chassis and armed with captured Soviet 7.62 cm PaK 36(r) guns. The second was armed with a domestically built 7.5 cm PaK 40 anti-tank gun and mostly based on the Panzer II Ausf. F chassis. Some Marder IIs that were based on the Ausf. F tanks were armed with a weaker 5 cm PaK 38 instead. These vehicles shared basically the same philosophy, having an excellent anti-tank gun but lacking armor protection. A Marder II armed with the captured 7.62 cm PaK 36(r) gun. Source: Marder II armed with the German built 7.5 cm PaK 40 anti-tank gun. Source: Based on the Panzer II Ausf. G, the Germans developed a light self-propelled anti-tank vehicle equipped with a 5 cm PaK 38 gun, known as the Panzer Sfl. Ic. While two vehicles were built, it was not adopted for service. The experimental Panzer Sfl. Ic. Source For the planned invasion of the United Kingdom, the Germans developed a series of amphibious tanks. The Panzer II was also used for this project. The Panzer II mitt Schwimmkörper was coupled with a specially designed floating extension. Ultimately, the project was not accepted. Panzer II mitt Schwimmkörper protype. Source Similar to the Panzer I, the Panzer II also had a bridgelayer version built on it. These proved to be a somewhat more capable solution than the Panzer I, but still, only a small number were built and saw service during the German Western campaign of 1940. Bruckenleger auf Panzer II. Source Another version similar to one based on the Panzer I was the demolition charge carrier based on the Panzer II tank. The principle of operating this vehicle was essentially the same. Ladungsleger auf Panzer II. Source Beside the previously mentioned versions of the Panzer II, the chassis was also employed in a number of other tasks, such as command vehicles, for artillery spotters, tractors, ammunition supply vehicles, engineering vehicles, training,anti-mine roles, etcetera. These include serious designs, but also field modifications. Training version of the Panzer II. Source: Unknown Command vehicle based on the Panzer II. Source: Unknown Panzer III The development of the tank that would later be known as the Panzer III was officially approved in a meeting of the German General Staff on 11th January 1934. By the end of January, In 6 authorized Wa Prw 6 to begin development of a 3.7 cm armed tank with a weight of 10 tonnes. The whole project was simply named Z.W., which stands for 'Zugführerwagen' (Eng. platoon commander's vehicle), but later renamed to the better-known Panzer III. This wooden mock-up shows how the Z.W. was originally envisaged. Source: For the Panzer III, the first four initial versions (A to D) mainly served for testing the overall design and implementing improvements. The initial armament was chosen to be a 3.7 cm gun. While the stronger 5 cm gun was requested from the beginning, due to problems with production, it was not initially incorporated, but the tank turret ring was sufficiently wide to allow the installation of this gun in the future. The Ausf. A had five large road wheels while the later three (B to D) used 8 smaller wheels. While these were to be used for testing, due to a lack of tanks, they would see action, some up to 1941. Generally, after the Polish campaign, most were reallocated for crew training. The Panzer III Ausf. A, easily recognizable by its five large road wheels. Source: Panzer Tracts No.3-1 Panzerkampfwagen III Ausf. A,B,C, und D. Panzer III Ausf. B to D tested similar 8 wheeled suspensions which, in general, proved to be inadequate for the task and were not adopted. Source: By the time of the Ausf. E and Ausf. F (which were almost identical) appeared, a more advanced and simpler six-wheel suspension was introduced. From this point on, the Panzer III would keep this basic form, which would be constantly upgraded to suit the needs of the rapidly developing tank race against Germany's enemies. During its service, the Panzer III (starting from the Ausf. E through to the M) would receive a stronger 5 cm gun (first L/42 and later with an L/60 long barrel), the armor was increased, changes to the suspension were also introduced, among several others. In total, some 5,007 Panzer IIIs (armed with the 3.7 and 5 cm guns) would be built by early 1943. The Panzer III Ausf. E was armed with a 3.7 cm gun. While it was built in small numbers (some 96), it was important for the fact that it finalized the Panzer III design. Source: Later, the Panzer III received a more powerful 5 cm L/42 gun. Source: Panzer IIIs starting from the Ausf. J received the longer 5 cm gun, which was ironically proposed by Hitler himself back in 1940. Only at the end of 1941 did the longer 5 cm gun get introduced to service. Source: By 1942, it was becoming apparent to the Germans that, despite many upgrades, the Panzer III was not adequate and becoming less and less effective against newer enemy armor. Thus, it was decided to replace its main gun with the Panzer IV's short barrelled 7.5 cm L/24 gun. By this time, the short barrel gun received new types of ammunition, including hollow charge rounds, which offered much improved anti-tank capabilities During 1942 and 1943, slightly more than 600 were built. The Panzer III Ausf. N was armed with the 7.5 cm short barrel gun. Source: Modifications Based on the Panzer III One of the most common modifications based on the Panzer III were the command tank versions. These were implemented early on in the development history, beginning with the Ausf. D. Such early vehicles had the turret fixed in position, the gun replaced with a dummy version of it, received a larger aerial antenna placed on top of the engine compartment, additional radio equipment was stored inside the tank, etcetera. As the lack of a main gun made them easy targets for the enemy, from 1942 onwards, these were equipped with 5 cm guns (both shorter and longer versions) with a reduced ammunition load. The initial Panzerbefehlswagen III had a fixed turret with a dummy gun. Source: Later Panzer III command vehicles received fully working guns, which increased their chances of survival. Source: One unusual command tank was the Panzerbefehlswagen III Ausf. K. It received a modified turret, quite similar to that of a Panzer IV, and a 5 cm gun. Only 50 such vehicles were built. Panzerbefehlswagen III Ausf. K. Source: Smaller numbers of Panzer IIIs were modified to be used as ammunition supply tanks from 1943 onwards. The modification was quite simple, removing the turret, which was replaced with a simple canvas round-shaped cover. Unknown but limited numbers of Panzer IIIs were modified as ammunition supply tanks. Source: Due to the high demand for a recovery vehicle, beginning in March 1944, the Panzer III was adopted for this role. The modification included the removal of the turret and adding a larger square-shaped compartment on top of its superstructure. By the time production ended in early 1945, some 167 Panzer IIIs were modified for this role. Bergepanzer III. Source: In order to coordinate more accurate artillery support, the Germans introduced the Panzerbeobachtungswagen III. Its purpose was to follow ordinary Panzer IIIs and, once the target was identified, send its coordinates to rear-positioned self-propelled artillery units for a quick response. For this role, it was supplied with additional radio and observation equipment. These were built mostly using older, salvaged, or damaged Panzer IIIs. Artillerie Panzerbeobachtungswagen III. Source: At the start of the War, the Germans employed flamethrowing tanks based on the Panzer II. This was not deemed a successful design, so the Panzer III was reused for this role. The gun was replaced with a flamethrower with some 1,020 liters of flame oil for it. Some 100 or so would be modified during 1943. Flammpanzer III. Source: For the planned amphibious invasion of the United Kingdom (Operation Sea Lion) in July and August 1940, Panzer IIIs were modified to be used as Tauchpanzer (Eng. submersible tanks). These vehicles are easily identified by the added frame holder for the waterproof fabric on the front part of the turret and the hull positioned machine gun ball mount. As the invasion of the United Kingdom was postponed and then canceled, these vehicles would see service on the Eastern Front. Tauchpanzer III. Source: Many Panzer IIIs that were deemed obsolete or returned from the front were often reused as training vehicles. In essence, many of these had their turret and top of the superstructure removed, creating a large open working space for the crew in training. Many Panzer IIIs were modified to be used as training vehicles by removing the turret and the top armor, like the case with this obsolete Ausf. A. Source: pinterest The Panzer III was also used as a radio control vehicle. Thus, with the help of special equipment, these remotely controlled the B IV Sprengstofftraegers. These vehicles were mainly used on the Eastern Front, especially in the region of Crimea and Kursk. Command vehicle based on the Panzer III for the B IV Sprengstofftraegers. Source: While the Panzer III's torsion bar suspension was adequate, the Germans wanted to replace it with an even more efficient design. They tested a new suspension consisting of overlapping road wheels. While some 20 tanks were modified with this suspension and used for testing, no production order was issued. These were known as Versuchs-Panzerkampfwagen Z.W.40. Another project named Z.W.41 tested standard six all-metal road wheel suspension, which was also not adopted for production. The Versuchs-Panzerkampfwagen Z.W.40 with the experimental overlapping road wheels. Source: The Z.W.41 tested standard six all-metal road wheel suspension. Source: The Minenraumer mit Pz.Kpfw.Antrib was an experimental anti-mine prototype built using a heavily modified Panzer III. The only prototype was captured after the war by the Allies. The Minenraumer mit Pz.Kpfw.Antrib. Source: During July 1943, Pz.Abt. 505 and 2nd Panzed Division modified some 13 Panzer IIIs as Brueckenmaterialtrager (Eng. bridge construction material carriers). Shortly after these were constructed, orders were issued that such modifications were to be forbidden and the modified tanks had to be rebuilt as ordinary tanks. Brueckenmaterialtrager were built by simply removing the Panzer III turrets. Source: T.L. Jentz and H.L. Doyle Panzer Tracts No.3-4 Panzerkampfwagen III umba The Schienenkampfwagen SK1 was an experimental attempt to adapt the Panzer III for railroad security. Basically, modifying a Panzer III to be able to drive over rail tracks, the project was not adopted and only a prototype was built using a Ausf. N tank. Schienenkampfwagen SK1. Source: To supplement their lack of mobile artillery vehicles, the German forces in North Africa modified one Panzer III Ausf. H for this role. The modifications included the removal of the turret and most parts of the superstructure and mounting an armored shield with a 15 sIG 33 gun. The modified Panzer III Ausf. H armed with a 15 sIG 33 gun in North Africa. Source: Pinterest Sturmgeschütz III During the Great War, German infantry formations were supported by towed artillery. For German Sturmtruppen (Eng. Stormtroopers), this depended on mobility. The necessary towed artillery proved to be slow and inadequate for the supporting task in taking more fortified enemy positions. Based on this experience, after the war, the great German Army tactician, General Erich von Manstein, proposed using highly mobile, well-protected, and armed self-propelled artillery. They were to provide infantry with mobile close fire support during combat operations. These were to be an organic part of standard Infantry Divisions at a battalion strength of around 18 vehicles. Due to Germany's general lack of production industrial capacity during the 1930s, it would take years before the first prototypes were completed. The development of these vehicles was also hindered by conflict between different branches of the German Armed Forces. Eventually, it was decided that these vehicles would be put under the direct supervision of the Artillery. These vehicles would be known as Sturmgeschütz III (Eng. assault gun vehicles) but were generally known simply as StuG III. Erich von Manstein Source: To speed up the development, it was decided to reuse many elements of the Panzer III. The design was very simple and consisted of a new superstructure armed with a short barrel 75 mm gun placed on the Panzer III chassis. While the first prototypes were completed in 1937, it was not until 1940 that the initial limited production actually started. Once pressed into service, the StuG III proved to be an excellent infantry support vehicle. When the Germans invaded the Soviet Union in 1941, the Germans noticed that their available anti-tank weapons were almost useless against the Soviet modern tank designs, such as the T-34 and KVs. To address this problem, in 1942, the Germans introduced a new StuG III armed with the longer 75 mm gun, which was more effective as a tank destroyer. As production of the StuG III shifted more towards the anti-tank role, the Infantry was left without a proper support vehicle. To address this, a new version of the StuG III armed with a 10.5 cm howitzer was introduced in 1943. Both versions would remain in production until the war ended, with over 10,000 being produced, making them one of the most numerous German tracked armored vehicles of the war. The 7.5 cm L/24 armed StuG III served as an excellent infantry support weapon during the war. Source: To address the ever increasing threat of more advanced enemy armor, the Germans upgraded the StuG III with the longer L/43 and later L/48 7.5 cm guns. Source: The StuH 42. Source: Smaller numbers of StuG III vehicles were armed with flamethrowers. While some 10 were modified for this role, it is unlikely that they ever saw any action, and at least two were modified back to their original configuration. The Sturmgeschütz Fl. Source: The Sturminfanteriegeschütz 33B was a heavily modified StuG III Ausf. E or F/8 chassis that was armed with a 15 cm sIG gun placed in a box-shaped fully enclosed superstructure. Only 24 such vehicles were built, and most would be lost during the Battle for Stalingrad. Sturminfanteriegeschütz 33B. Source: The StuG IIIs were also modified for other roles, such as for crew training and, later, near the war's end, as ammunition carriers. In both versions, the gun was removed, the difference being that the later version had a simple armored cover for the missing gun. Training version of the StuG III. Source: Unknown Ammunition supply version based on the StuG III chassis. The white star may denote the photo is post-war in a captured vehicle depot Source: P. Chamberlai The German ground forces were hard-pressed by the Allied ground attack aircraft during the second half of World War II. The Panzer and Sturmartillerie units were hit especially hard by these attacks. Towards the end of the war, the Panzer branch of the Army came up with a temporary solution in the form of the Flakpanzer series based on the Panzer IV. The Sturmartillerie (Eng. assault artillery) units, equipped with the StuG III, also asked for Flakpanzers for their own protection. As they were unable to acquire these vehicles, a possible solution was to simply develop and build a Flakpanzer based on the Panzer III chassis. While small numbers were built (less than 20 including 1 to 2 prototypes), they were simply too late to have any real effect on the war's outcome. Beside a few drawings, to this day, there are no surviving photographs of the 3.7 cm Flak 43 in Keksdose-Turm auf Pz.Kpfw.III Fahrgestell (known simply as the Flakpanzer III). Source: Panzer Tracts. 12-1 The Panzer IV As already mentioned, previously, the role of supporting the Z.W. was to be undertaken by the larger and more powerfully armed Begleitwagen. Its primary mission would be to use high explosive ammunition in order to destroy enemy fortified positions, not to engage designated targets. Work on the Begleitwagen was officially approved by In 6 on 25th February 1934. Two firms, Rheinmetall and Krupp, would compete to design this vehicle. Rheinmetall built one wooden model and one soft steel B.W. prototype. It had a suspension more or less taken from the Neubaufahrzeug. Beside the main turret, another smaller one was to be placed next to the driver's position on the superstructure. This project would not be accepted for production. While the German Army initially showed interest in the Rheinmetall design, it was not accepted for service. During April 1934, Krupp offered the German Army two different projects for the B.W. requirement. Both vehicles were to be armed with the same 7.5 cm main gun and two machine guns. The first was designed as a 17.2 tonnes tank with 20 mm of frontal and 14 mm of side armor. The second one was somewhat heavier (18.5 tonnes), having thicker 30 mm front and 20 mm side armor. Great attention was given to the development of the suspension, and after a series of trials, two models were proposed, using eight wheels or six larger ones. While neither of these two vehicles would enter serial production, the B.W.I Kp would, with a number of improvements and modifications, be used as the base for the future Panzer IV. Both prototype vehicles would be used for testing and evaluation, including trials of bridge-laying equipment. While similar to the later Panzer IV Ausf. A, there were a number of changes that were made to the Krupp BW design seen here. The most obvious was the completely flat roof of the superstructure, while the Panzer IV had a sloping downwards design at the front, just above the driver's and the radio-operator's stations. The B.W. II Kp prototype can be easily identified by the six larger road wheels. While it was not accepted for service, it was still used for testing, including for bridge-laying equipment. Source: Pinterest The German Army officials were generally satisfied with Krupp's B.W.I prototype and asked for a small series of improved vehicles to be built. The new vehicle was visually the same as the B.W.I prototype, but with many improvements and modifications. Some of these included the almost complete use of welding for the armor, a different commander's cupola, a modified superstructure, adding a stronger and larger engine, changing the shape of the drive sprocket and idler, and several other more minor adjustments. The Panzer IV would retain its basic form up to the war's end (it was actually the only German tank that remained in production from the start to the end of the war). Of course, during its production life, changes were implemented to increase its combat value. The Ausf. A to F versions were built to perform the original fire support role and were equipped with the short barrel 7.5 cm L/24 guns. From 1942 onwards, beginning with the Ausf. G and ending with the J versions, its role fundamentally changed from being a support to that of a 'main battle tank'. The Panzer IV was tasked with destroying enemy armor but also other targets if needed. For this reason, the Ausf. G, the Panzer IV was equipped with the more powerful 7.5 cm L/43 and later even the longer L/48 guns. While it is a somewhat common misconception that the first Panzer IV to be armed with the long gun was the Ausf. F2, the Germans actually later designated this version as the Ausf. G. While numerous improvements were made to the Panzer IV, such as introducing new visor ports, two-parts hatch for the turret sides, flat frontal superstructure plate, etcetera, the most important change (besides the gun) was the ever-increasing armor protection. For example, the first version of the Panzer IV had only 14.5 mm armor. The letter Ausf. H and J had frontal armor of 80 mm. The first in the line was the Panzer IV Ausf. A. Source: The Panzer IV Ausf. F. added other improvements, such as an increase of armor protection. Source: www.worldwarphotos.info For extra protection, the Panzer IV and many other vehicles were equipped with 5 mm thick Schürzen side plates. Source: Modifications Based on the Panzer IV One of the mass-produced modifications based on the Panzer IV chassis was the Jagdpanzer IV series. It was developed as a potential solution to the deteriorating situation regarding tank production later in the war. It was meant as a cheaper, well protected and well-armed (7.5 cm L/70 gun) anti-tank vehicle. The modification was simple in nature and included placing a simple and highly angled new superstructure on a modified Panzer IV chassis. Due to a lack of 7.5 cm L/70 guns, the shorter version was used instead. Once the production of this gun was available in sufficient numbers, the Jagdpanzer IV/70 (V) would be introduced into service during late 1944. Some 769 of the first and 930 of the later versions would be built from 1944 to 1945. The first vehicles of the Jagdpanzer IV series were easily identified by their shorter guns. Source: Later built versions received the longer and deadlier 7.5 cm L/70 gun. Source: As the attempt to mount the 7.5 cm L/70 gun in the Panzer IV turret led nowhere, the Germans decided to take another approach. Using a Panzer IV chassis with minimal modifications, an armored superstructure (somewhat similar to the Jagdpanzer IV) armed with this gun was placed. Due to its late introduction, some 277 would be built by the war's end. Jagdpanzer IV/70 (A). Source: When the Alkett factory was heavily bombed by the Allied Air Force in November 1943, the production of the StuG III was almost put to a halt. As this was unacceptable due to huge demands for StuG IIIs, the Germans were somewhat desperate to find a quick and easy solution. In the end, they simply merged the Panzer IV chassis with a StuG III upper superstructure, creating a new vehicle, the StuG IV. The StuG IV was basically a copy of the StuG III superstructure placed on the Panzer IV chassis. Source: Another anti-tank vehicle based on the hybrid Panzer III/IV (using components from both vehicles) chassis was 8.8 cm PaK 43/1 auf Fgst.Pz.Kpfw III und IV (Sf), generally known as 'Nashorn' (Eng. Rhinoceros). It was developed as a temporary solution to mount the newly developed 88 mm L/71 anti-tank gun. The production started during 1943 and, by the war's end, 494 such vehicles were built. While highly effective thanks to their guns, the Germans were not keen to increase its production, wanting to focus on fully protected anti-tank vehicles. The first hybrid Panzer III/IV were originally meant to use a large six wheeled suspension, but this was abandoned early on. Source: The deadly but lightly protected Nashorn. Source: During 1941, two Panzer IVs were experimentally rebuilt and armed with the heavy 10.5 cm K18 cannon. It was intended that the 10.5 cm K18 Selbstfahrlafette IVa would be used as a heavy tank and bunker destroyer. This vehicle would not be accepted for service, as other projects took more priority. The 10.5 cm K 18 Selbstfahrlafette IVa. Source: As the Luftwaffe lost control over the skies over Germany and in the occupied territories in the second half of the Second World War, it could no longer provide sufficient protection against Allied aircraft. Panzer divisions were especially affected by the lack of cover from fighters, because they were always at the center of the most intense fighting. The Germans operated a number of half-tracked self-propelled guns and even improvised trucks armed with anti-aircraft guns. These vehicles had very limited or no armor and were vulnerable to enemy fire, either from the ground or the air. A tank-based anti-aircraft vehicle would offer a better overall protection from small arms fire and artillery/mortar high explosive fragmentation shell shrapnel. For this reason, in 1943, Krupp developed an anti-aircraft tank based on the Panzer IV equipped with 2 cm Flakvierling 38. While this first prototype was not adopted due to its insufficient armament, a slightly modified version (generally known as Möbelwagen) armed with the more powerful 3.7 cm Flak 43 would be put into service. The first attempt to develop a Flak Panzer based on the Panzer IV was the 2cm Flakvierling auf Fahrgestell IV. Source: The so-called Möbelwagen was basically just an up-gunned version of the previously mentioned project. Source: The Möbelwagen had a huge disadvantage, as it needed too much time to set up for firing and was thus ineffective against a sudden enemy attack. A Flakpanzer that could respond without preparation was more desirable, and the first such vehicle was the Flakpanzer IV 2 cm Flak 38 Vierling, commonly known as the 'Wirbelwind'. While it was produced in small numbers and was generally viewed as an effective vehicle, the 2 cm caliber was deemed too weak by the late stages of the war. For this reason, a much more powerful 3.7 cm Flak 43 was installed in a new turret and the 'Ostwind' (Eng. Eastwind) was born. Attempts to improve these two vehicles lead to creation of a Wirbelwind armed with four 30 mm anti-aircraft guns and an Ostwind armed with two 3.7cm Flak 43 guns mounted side by side. But, besides a few prototypes, these were not adopted. Probably the best Flakpanzer was the Wirbelwind. Source: The Ostwind was armed with a single 3.7 cm anti-aircraft gun in a slightly modified turret. Source: Terlisten, Nuts and Bolts Vol.13 Flakpanzer, Wirbelwind and Ostwind. While the previously mentioned Wirbelwind and Ostwind, having fully rotating turrets, offered some protection to the crew, a fully enclosed turret was more desirable. For this reason, during 1944, Daimler-Benz designed and built the so-called Kugelblitz anti-aircraft tank that had a fully enclosed turret. Only a smaller number of prototypes were built, which actually saw some combat action in the closing days of the war. A wooden mock-up of the Kugelblitz, as there is no surviving photograph that shows the whole vehicle. Source: Parallel with the development of the Nashorn and using the same hybrid Panzer III/IV chassis, the Germans developed a self-propelled artillery vehicle known as the Hummel (Eng. Bumble Bee). It was armed with a 15 cm sFH howitzer placed in an open-top superstructure. Production began in early 1943 and slightly less than 900 such vehicles would be built by 1945. Fewer Hummels were also armed with a smaller 10.5 cm howitzer. Based on the Hummel, the Germans built an ammunition support vehicle. This was basically a Hummel that had its gun removed and replaced with a simple armored cover. If needed, these could be converted back to the artillery version. Some 100 such vehicles were built. The Hummel self-propelled artillery gun. Source: An ammunition carrier for the Hummels. Source: : The unusual Hummel/Wespe hybrid built in limited numbers. Source: The Panzer IV chassis was used for testing the idea of developing 10.5 cm howitzer armed self-propelled vehicles. One of these was the Geschützwagen IVb für 10,5cm leFH 18/1 built using a shortened Panzer IV chassis. Its armament was placed in an open-top turret with some 70 degrees of traverse. Two other projects, the Heuschrecke IVb and le.F.H. 18/40/2 auf Geschützwagen III/IV, could have their main guns removed and used as ordinary towed artillery. None of these projects were adopted for service, as the Panzer II chassis was able to be equipped with the same gun much cheaper. Geschützwagen IVb für 10,5cm leFH 18/1, built in a small series. Source: Heuschrecke IVb. Source: le.F.H. 18/40/2 auf Geschützwagen III/IV. Source: Another self-propelled artillery vehicle based on the Panzer IV chassis was the Sturmpanzer IV. While the Hummels were only lightly armored and meant to provide long-range fire, the Sturmpanzer IV was designed to fill a more direct fire support role. For this reason, it was also heavily armored. The main armament was the slightly modified 15 cm sIG 33 gun. The Sturmpanzer IV. Source: Starting from March 1944, Panzer IVs returning from the front began to be modified as command vehicles. These were equipped with additional radio and aerial equipment. The ammunition load was reduced from 87 to 72. During 1944, slightly over 100 such vehicles would be rebuilt. The command vehicle modification of the Panzer IV. Source: Another modification was the Panzerbeobachtungswagen IV (Eng. artillery observation vehicle). These vehicles had their command cupola removed and replaced with one taken from the StuG III, with 7 smaller periscopes. Additional equipment, such as extra radios, were stored inside, which resulted in a reduction of the ammunition load for the main gun, and removal of the coaxial machine gun. Some 140 such vehicles would be built during 1944 and early 1945. Panzerbeobachtungswagen IV. Source: An unknown number of different Panzer IV chassis were modified to be used as ammunition supply vehicles for the huge self-propelled siege mortars codenamed 'Karlgerät'. Munitionsschlepper für Karlgerät next to the huge self-propelled vehicle. Source: A number of Panzer IV chassis would be modified and used as ammunition supply vehicles. These followed the standard construction scheme for these vehicles in German service. The turret was removed and replaced with a simple wooden or sheet metal cover. In late 1944, a few Panzer IV Ausf. F chassis would be modified as Bergepanzers, essentially tank recovery vehicles. On these vehicles, the turret was removed and replaced with simple round wooden planks. Ammunition supply vehicle based on the Panzer IV chassis. Source: In the hope of increasing the Panzer IV's anti-tank capabilities, in early 1942, one vehicle was tested with the 5 cm L/60 gun. While the installation proved to be feasible, it was not adopted, as the stronger 7.5 cm L/43 was slowly entering production. Panzer IV tested with the 5 cm gun. Source: One other experiment included the installation of the Waffe 0725. This was actually an experimental taper-bore gun with a 75/55 mm caliber firing a tungsten round. Due to a shortage of tungsten, this particular gun was never introduced into service. The Panzer IV Ausf. F with a Waffe 0725 75/55 mm wooden mock-up. Source: warspot.ru During the war, there was a proposal to mount two 7.5 cm Rücklauflos Kanone 43 recoilless guns in the turret sides of a modified Panzer IV. Additionally, one more 3 cm MK 103 autocannon was to be used instead of the main 7.5 cm gun. The project led nowhere and only a wooden mock-up was ever built. A wooden mock-up of the unusual Panzer IV armed with recoilless rifles. It was based (at least this mock-up) on the Panzer IV Ausf. B or C. Source: One Panzer IV would be used to test a mobile rocket launcher. The modification included the replacement of the Panzer IV's turret with a new turret with a fully rotatable rocket launching system. This system consisted of four 280 mm rockets placed in a movable and protected frame. After testing this new weapon system, it was not adopted for service, probably due to the high demand for Panzer IV tanks. Panzer IV Ausf. C Raketenwerfer. Source: Prior to the war, the German Army was interested in the idea of bridge carrying Panzers. In 1939, Krupp developed and built six Brückenleger IV (bridge carrying tanks) based on the Panzer IV Ausf. C chassis. While these saw deployment on the front, their overall performance was deemed insufficient and no more Brückenleger based on the Panzer IV Ausf. C chassis were ever built. At least three Brückenleger IV based on the Panzer IV Ausf. C chassis would be rebuilt as standard tanks in July and August 1940 but using Ausf. E superstructures and Ausf. C turrets. Overall, six Brückenleger IV based on the Panzer IV Ausf. C chassis were built, but their performance was unsatisfactory. Source: The Brückenleger IV s (Sturmstegpanzer), also known as the Infanterie Sturmsteg auf Fahrgestell Panzerkampfwagen IV, was the second version of a Panzer IV equipped with bridging equipment. In contrast to the previous version, instead of the bridges, this vehicle was equipped with ladders that could be extended. This vehicle, in essence, used slightly modified firefighting ladders to help infantrymen cross obstacles, such as rivers. Two or four (depending on the source) Panzer IV Ausf. C were modified for this purpose. A Brückenleger IV s (Sturmstegpanzer) which has lost much of its suspension, probably to an enemy mine. Source: www.worldwarphotos.info Like all previous German tanks, the Panzer IV was also used as a training tank. These were mostly recalled from front line service and were used in original or modified configuration (without a turret) for this role. A training Panzer IV based on the Ausf. B or C chassis. Source: The Panzerfähre was a specially designed vehicle based on the Panzer IV chassis that was interned to transport German tanks over water. In theory, two Panzerfähre would be connected by a raft on which a tank or any other vehicle would be placed. Then, the two Panzerfähre basically acted as a ferry to transport the cargo from shore to shore. While not clear, it appears that in practice this did not work, and no production orders were placed. Besides the two prototypes, no more were built. The two experimental Panzerfähre. Source: During 1944, one Panzer IV was modified by incorporating a new hydrostatic drive. The rear part of the engine compartments was substantially changed. This vehicle was not adopted for service. Sonderaufsfuhrung des Panzer IV. Source: Two Panzer IV would be used to test a new type of interleaved suspension. While this suspension was tested, it was not adopted. It is unclear if it did not provide enough of an improvement or if they were meant just as test vehicles for the more advanced Panther and Tiger. The modified Panzer IV Ausf. E can be seen to the left, just behind the Panzer 38(t). Source: unknown There were also a number of proposals and paper projects regarding improving the overall performance of the Panzer IV. Some of these include an installation of a new turret armed with the long 7.5 cm L/70 gun or replacing the upper superstructure with a new one that had sloped armor. None of these were ever implemented. Panzer V Panther The experience of facing the T-34 during Operation Barbarossa in 1941 forced the Germans to find an adequate solution to effectively counter it. M.A.N and Daimler-Benz began working on such designs and presented their project to the German Army in 1942. Eventually it was decided that the M.A.N design was better, eventually leading to the creation of the Panther Ausf. D. This would be followed by the Ausf. A and finally the G. These incorporated some improvements, such as increasing the armor protection, adding a new command cupola, and receiving a hull positioned machine gun ball mount, among others. The Ausf. F was the next version in line, which remained only experimental due to the war's end. The Panther II project, which was to incorporate a number of improvements, was ultimly cancelled and only a prototype was built. In total, some 6,000 Panthers would be built during the war. The early version of the Panther tank. Source: During its production, improvements, like a hull ball mount machine gun, new command cupola and others were introduced. Source: Like the previous Panzers, the Panthers were also used as command vehicles. In the same manner, these were equipped with additional radio equipment. These could be easily identified by additional radio antennas. Command vehicle based on the Panther. Source: The Panther chassis was used for a prototype of an artillery observation vehicle. While at least one prototype was completed, it would not be accepted for service. The Germans simply decided to use the Panzer IV instead. The Panther artillery observation prototype. Source: Many Panzers losses could have arguably been easily avoided if the Germans had a proper armored recovery vehicle. The half-tracks that were used in this role were unarmored and always in short supply. To resolve this major issue, in 1943, Henschel began developing such a vehicle based on the Panther tank chassis. The production began the same year, initially based on the Ausf. A and later on the G. The BergePanther armored recovery vehicle. Source: Without any doubt, the most advanced and effective German tank hunter was the Jagdpanther. Work on it was initiated by Krupp but it would be reallocated to Daimler-Benz during 1942 and then, in 1943, given to Miag. It incorporated an excellent long barrel 8.8 cm gun, good mobility and protection. Unfortunately for the Germans, due to slow development and Allied bombing raids, less than 400 would be built by the end of the war. The Jagpanther incorporated good speed, deadly gun and solid armor protection. Source: When the German anti-aircraft tank project was under way, the main chassis for this vehicle was the Panzer IV. From 1943, the Panther tank also had proposals for several different weapon configurations. These included the 2 cm Flakvierling, 3.7 cm (either twin or triple configuration), 5.5 cm Flakzwilling and even an 88 mm caliber heavy Flak gun. The first proposed design drawings were completed by Rheinmetall in late May 1943. The armament consisted of four 20 mm MG 151/20 mounted in a specially designed turret. This proposal was never implemented, mostly due to the weak armament by the standards of 1944. The 3.7 cm and the 5.5 cm caliber guns were more promising. Ultimately, only a wooden mock-up armed with two 3.7 cm anti-aircraft guns was built. The work on 8.8 cm armed Flak Panthers also led nowhere. Only one mock-up of the Flakpanzer 341 with a wooden turret was ever built and presented to German Army officials. It was never adopted for service, mostly due to the need to focus production on Panther tanks. Source: Of special note, during 1944, the 653rd Battalion's mechanics and engineers managed to build a number of improvised vehicles based on German and captured vehicles. One such vehicle was created using a Panzer IV turret which was welded on a Bergepanther. Another example involved installing a 2 cm Flakvierling 38 on a second Bergepanther. At the front is the only Porsche Tiger ever used in combat. Behind it is the strange Panzer IV/Panther hybrid. Source: forum.warthunder.com Panzer VI Tiger I and Tiger II The development of the heavy tank concept by the Germans went back to 1935, when it was theorized that a 30 tonnes heavy tank would be needed to counter heavy French tanks. Work on such vehicles began a few years later, when Henschel was tasked to develop a heavy tank protected with 50 mm of armor and armed with a 7.5 cm L/24 gun. The name of this vehicle changed several times during its development process, but it is generally best-known today as VK30.01(H). While few experimental chassis and small production of the 0-series vehicles were built, it would not be accepted for service. The turrets would see some action, as they were placed as bunkers in the Western defence line during 1944. Two modified chassis were reused for the massive 128 mm armed anti-tank vehicles. The VK30.01(H). Source: The 12.8 cm Selbstfahrlafette L/61 Source: Another heavy tank project, dated from 1939, was to incorporate a chassis developed by Henschel with the front armor being 80 mm thick, and a Krupp turret armed with a 10.5 cm gun. By 1941, in the hope of increasing its combat performance, the armor was to be increased to 100 mm and the gun replaced with an experimental tapered bore gun, the Waffe 0725. This vehicle, named VK36.01(H), but it would ultimately be canceled by 1942, mostly due to a lack of tungsten necessary for its ammunition. The VK36.01(H) during field trials. Source: Prof. Dr. Ferdinand Porsche's Heavy Tank Projects Prof. Dr. Ferdinand Porsche was an engineer who, after the end of 1939, was involved in developing a heavy tank project for the German Army. He was especially interested in the development of hybrid (combination of electric and petrol) engines, which he later implemented in his work. His first design was the Porsche Typ 100 (better known as VK30.01(P)). Due to the urgent needs of the Tiger program, and due to a number of problems identified (high fuel consumption, suspension problems, etcetera), the project was canceled. Only one (or two, depending on the source) soft steel prototypes would be built and used for testing. Prof. Dr. Ferdinand Porsche Source: Wiki Porsche's first heavy tank prototype, known as the Typ 100. Source: By the end of May 1941, Hitler issued the requirements for the new heavy tank project. These included an increase in armor thickness and the use of an 88 mm gun. Dr. Porsche began working on this new design during July 1941, and two months later, the first drawings and calculations were ready. Similar to the previous vehicle, this project was initially designated as Typ 101 (VK45.01(P) or Tiger (P)). Construction of such a vehicle was given to Nibelungenwerk, a tank manufacturer. The first prototype was completed in April 1942 and presented to Hitler on his birthday. Due to construction complexity and persistent problems with the engine, this project would also be canceled. The Typ 101, also known as VK45.01(P). Despite being produced in a small series, only one vehicle in its original configuration was used in combat. Source: Panzernet.net As the majority of the 100 Typ 101 hulls ordered were either completed or under construction, presenting a

was armed with the deadly 7.5 cm PaK 40. Source: The Sd.Kfz.247 was more of a command vehicle for the reconnaissance units than a real armored car. While it was protected, no defensive armament was installed inside. Initially, this car was built in a six-wheel configuration, while it would be changed to four-wheel configuration later on. Due to its overall poor driving performance, only fewer than 60 vehicles would be built in total. The unsuccessful Sd.Kfz.247 series. Source: Half-Tracks For towing artillery and bridging equipment, tank recovery, and even for the role of personal carriers, the Germans employed a series of soft skin and armored halft-racks. The most common were the Sd.Kfz.10 (nearly 15,000 built), 11 (around 9,000), 6 (3,660), 7 (12,187), 8 (3,459) and 9 (2,727), which were developed prior to the war. During the war, due to the urgent need for more cheaper such vehicles, the Germans introduced the two new types of such vehicles, the cheap and mass produced 'Maultier', and the less common sWS. The smallest of the German half-tracks series was the Sd.Kfz 10. Source: Wiki The Sd.Kfz 9 was mostly used as an engineer and recovery vehicle. Source: Wiki The sWS was introduced later in the war. Source: The Sd.Kfz.250 and 251 were built to provide the Panzer Divisions with much needed infantry support. These vehicles were armored and were armed with two machine guns. The chassis of these two vehicles would be extensively used for various other roles, such as anti-aircraft, communication, reconnaissance, etcetera. The Sd.Kfz.251 was intended to transport 10 soldiers in order to follow the fast moving Panzer Division. Over the course of the war it would be adapted for various roles, such as anti-tank and aircraft, medical transport, radio vehicle, etcetera. Source: The smaller Sd.Kfz.250. Source: The German half-tracks were adapted to perform other roles, beside the usual transportation of men and materials. The most common use was as anti-aircraft vehicles, and a limited number were even adopted for anti-tank use. One such vehicle was the 7.62 cm F.K.(r) auf gp. Selbstfahrlafette (Sd.Kfz.6/3) developed during late 1941. While the increase in firepower was welcome, these vehicles had a number of defects which ultimately led to a small production run of only 9 vehicles. Unusual modifications include a self-propelled rocket artillery vehicle based on the Maultier. The 7.62 cm F.K.(r) auf gp. Selbstfahrlafette (Sd.Kfz.6/3). Source: The most built combat versions of the half-track were the self-propelled anti-aircraft vehicles, armed either with 2 cm or 3.7 cm caliber guns or, in rare cases, even 8.8 cm guns. Source: Panzer.net The armored version of the Maultier was armed with ten 15 cm Nebelwerfer rocket launchers. Source: Mostly based on experience during the fighting on the bad roads of the Eastern Front, the Germans realized that they lacked a proper fully tracked tractor for use by the infantry. This would eventually lead to the introduction of the Steyr RSO. This was a cheap, simple vehicle with wide tracks that enabled it to cross any bad terrain. Over 20,000 of such vehicles would be built by the end of the war. There was even an anti-tank version of this vehicle that was built in limited numbers. The cheap and easy to build RSO. Source: Markings and Camouflage In 1932, the Germans mostly painted their military armored vehicles in a three-color scheme. This included the base coat of ochre with a combination of chestnut brown and dark green. This changed in July 1937to the simple dark grey that was introduced as the standard color scheme of all armored military vehicles. This color should be applied in combination with dark brown painted on top of it in various patterns. However German troops mostly ignored the order to paint the brown patches at first and only during war time troops started painting these patches. In June 1940 the order was given to stop painting the brown patches. This could be applied using either a simple brush or spray guns. The use of the simple (in the majority of cases) dark grey was done intentionally. Firstly, it made production and availability much simpler. The second reason was that the dark grey gave the appearance of a darker shade when exposed to the sunlight, which helped blend the vehicle when parked in forests or cities, for example. Lastly the choice to use one standardized color scheme also helped for identification of friend from foe. Except for the small Kubelwagen in the middle, all remaining vehicles in this picture are painted in dark grey. Source: .wot-news.com After 1943, the Germans began employing other colors to better hide their tanks, as they lost the overall control of the sky. The dark grey base was replaced with dark yellow. Additional colors could be used, such as olive green or red brown. As no official instructions on how to camouflage their vehicles were published, the crews were left to use their own artistic imagination, depending on the needs in the field. By 1944, the German armored vehicles were hard pressed by Allied ground attack planes, so crews would often add tree branches to better hide their vehicles. As the war progressed and the general German economic situation became desperate, the crews painted their vehicles with what they had at hand. The camouflage patterns in the later stages of the war became quite elaborate. Source: wot-news.com From 1943 onwards, most German vehicles were painted in dark yellow in combination with olive green and red brown. Source: wot-news.com The winter of 1941, spent in the Soviet Union, was a harsh experience for the Germans soldiers. They were simply ill prepared for the frigid environment. Necessary equipment for operating in these conditions were not available, including stockpiles of white paint. Thus, the German crews were forced to improvise using anything that they had on hand, including chalk, clothes, and even paper. Applying tools were not available so once again the crews had to improvise in that part too. After this winter, the Germans were better prepared and supplied their units with much needed winter camouflage paint. Similarly, the vehicles in Africa were painted in various desert camouflages. An example of a German winter camouflage. Source: wot-news.com This vehicle's crew added simple paper to their vehicle to act as an improvised winter camouflage. Source: httpsreddit.com/ Prior to the war, the use of any military marking on any armored vehicle in the German Army was generally rare. In anticipation of the war with Poland, during August 1939, large white crosses were applied to them. These were known as Balkenkreuz, sometimes wrongly described in the sources as Balkankreuz. During the Polish campaign, it was noted that these presented a huge magnet for enemy fire, so the use of this white cross was discarded in favor of a similar cross with black central base with white edges or even using a cross that had white outlines. For friendly air identification, in the first years of the war, a white cross or rectangle would be painted on top of the superstructure. While common, this proved to be ineffective, as the white paint could easily become covered in dirt, making it hard to spot. So the German crews simply used other paints, such as red or yellow instead. Use of German Nazi flags would also become a common appearance on many German armored vehicles. Interestingly, by the end of the war, some German tank crews copied the Soviet large white cross painted on top of the turret in the hope of confusing Allied planes. While used in the initial stages of the war, the simple white crosses would be quickly discarded. Source: In most cases, each Panzer Division employed its own insignia markings. This included a variety of different markings, ranging from simple geometric figures, large painted numbers, runes, animals, human skulls, etcetera. For example, the 1st Panzer Division, in the early stages of the war, used white oak leaf symbols, while the 5th Panzer Division used the letters 'Y' or 'X' painted in yellow. Painting names on tanks or other armored vehicles was less common, but crews occasionally added them on their vehicles. Tanks would also receive three-digit numbers which identified which unit they belonged to. The first number referred to the company, the second to the platoon, and the last is the vehicle number. The commanding vehicles of the Battalion headquarters received an 'I' or the capital letter 'A'. Tanks of the German headquarters received the 'R' designation. These numbers were usually painted white on the side of the turret, but other paints would be used also, like red with white outline, etcetera. In 1944, a new four-digit code was meant to be used by the Battalion commanding unit. The Balkenkreuz painted on the turret side together with the three-digit number. Source: Organization and Tactics Panzer Units Prior to the German invasion of Poland, the general organization of a Panzer Division consisted of two regiments, each having two Panzer Battalions. These battalions were then divided into four companies, each equipped with 32 tanks. Ideally, the Panzer Division tank strength was to be around 561 vehicles. In reality, this was never achieved by the Germans, as they lacked the production capabilities to produce enough tanks. Although these units were meant to be equipped with modern Panzer III and IV tanks, due to the slow rate of production, this was not possible. For this reason, the earlier Panzer Divisions had to be equipped with weaker Panzer I and II tanks, and even captured vehicles, such as the Panzer 35 and 38(t). By June 1941, on the insistence of Adolf Hitler, the number of Panzer Divisions was almost doubled, while the actual number of newly produced Panzer was slightly increased. In essence, this was by reducing the number of regiments in each Panzer Division to one, basically increasing the ratio of infantry to tanks in each Division. By 1944, due to heavy losses, the Panzer Divisions were becoming a shadow of their former selves, sometimes being formed on an ad hoc basis with any vehicles that were available. While more fortunate Divisions received Panthers and other newer designs, others were forced to use vehicles such as StuG IIIs as substitution for ordinary tanks. Self-Propelled Anti-Tank Units Early self-propelled anti-tank vehicles were used to equip the Panzerjäger Abteilung (Pz.Jg.Abt), self-propelled anti-tank battalions. Each Pz.Jg.Abt was composed of one Stab Pz.Jg.Abt (Eng. command unit), equipped usually with one anti-tank vehicle, and three Kompanie (Eng. companies). These companies were equipped with 9 vehicles each. The Kompanie were again divided into Zuge (Eng. platoons), with 3 vehicles each. However, the number of vehicles in such companies differed between various units, for reasons such as losses or simply due to unavailability. During the war, as more such vehicles became available, these would be usually allocated to Infantry Divisions, Infantry Motorised Divisions, SS Divisions, Panzer Divisions, mostly at a company strength. In addition to these anti-tank battalions, there were numerous independent Schwere Panzerjäger Abteilung (Eng. heavy anti-tank battalions) which were, depending on the operational needs, temporarily attached to different Divisions. These usually included rare vehicles, such as the Ferdinands or the Nashorns. The heavy anti-tank battalions would be composed of 45 vehicles, divided into three companies with 14 each and a Stabskompanie with 3 vehicles. The Companies were again divided into platoons, each with 4 vehicles and with 2 in the Command Platoon. Anti-Aircraft Units The Flakpanzers (based on the Panzer IV chassis) were used to form special anti-aircraft Panzer Flak Zuge (Eng. anti-aircraft tank platoons). These were used to equip primarily Panzer Divisions of the Heer and Waffen SS, and in some cases were given to special units. Initially, these platoons were equipped with eight Möbelwagens. By the time the first Wirbelwinds were ready to be sent to the front, the Panzer Flak Zuge organization was changed to include four Wirbelwind and four Möbelwagens. In February 1945, the Panzer Flak Zuge were divided into three groups (Ausführung A, B, and C). The Panzer Flak Zuge Ausf. A was the standard unit which included four Wirbelwind and four Möbelwagens. The Ausf. B was equipped with eight Wirbelwind and the Ausf. C with eight Möbelwagens. By April 1945, this organization was changed to eight Ostwind and three Sd.Kfz.7/1 half-tracks. Self-propelled Artillery Units The most common self-propelled artillery vehicles were the Wespe and the Hummel. These were used to form Batterie (Eng. Batteries) of six artillery vehicles plus two ammunition vehicles. In many cases, the Artillery Regiment of the Panzer Divisions would have 12 Wespes supplemented by 6 Hummels. Reconnaissance Units Early organisation of the Panzer Division Reconnaissance Battalion (Ger. Aufklärungs Abteilung) consisted of a command unit, two reconnaissance squadrons and one heavy squadron. Each squadron was equipped with one radio command vehicle and four armored cars which were also equipped with radios. In addition, six smaller four wheel and eight-wheel armored cars were also attached to these units. In 1944, this was slightly changed to include a command company, two reconnaissance companies, one heavy company and a support company. Brief Combat History The Spanish Civil War Panzers saw usage prior to the war during the occupation of Austria and Czechoslovakia. While these were peaceful affairs, a number of them broke down during road transport, so extensive repair work and modifications were needed. The first real pre-war combat action was during the Spanish Civil War, from 1936 to 1939. The Germans, supporting Francisco Franco's forces, sent 72 Panzer Is as military aid, followed by the sale of an additional 50 tanks. Additionally, the German land forces of the Condor Legion operated a number of logistic and support vehicles. German crews were ordered to only train and instruct their Spanish counterparts, but early on in the war, due to crew shortages, they were forced to partake in some combat situations. Due to general small armor engagements, few vital lessons in the general use of armor were gained here. But the Germans became aware that the Panzer I was clearly outdated as a combat tank, as it could do little against the Soviet T-26 tank operated by Franco's opponents. Panzer I's during the Spanish Civil War. Source: Before the War Prior to the Second World War, the German Army was not idle. While it participated in a great number of military parades and military exercises it also was involved in peaceful occupations of surrounding countries. The first victim to Germany expansion was its Austrian neighbor. While speaking the same language and having a large German population, the Austrian authorities were not willing to join a union with Germany. During a 1938 meeting with an Austrian delegation led by Chancellor Kurt von Schuschnigg, Austria was forced to acknowledge the Nazy Pary in their homeland and more or less gave them a free hand to come into power. Once the Austrian delegation returned to Austria they refused to do so. This was the pretext that Adolf Hitler and his supporters had been waiting for. On 12th March 1938, the German Army crossed the border and peacefully took over Austria, in an event that is known today as the Anschluss (Eng. union). The next victim of German expansion was the Sudetenland in Czechoslovakia, which housed a large German population. Czechoslovakia possessed a larger and more modern army than its Austrian neighbor and also had good relations with the Western Allies. But despite all of this, under great pressure from Adolf Hitler, the Western Allies, France and Great Britain, were not willing to risk open war, simply allowing the Germans to occupy the disputed lands. At the Munich Agreement of September 1938, Germany managed to obtain a large portion of Czechoslovakia's western territory. The following year, what remained of Czechoslovakia would also be annexed by the Germans. Invasion of Poland Despite the somewhat common misconception that the German tanks were superior to those of their enemies, this was mostly not true, at least for the first few years of the war. While the Germans made attempts to use the more modern and larger Panzer III and IV, reallocating the weaker Panzer I and II to secondary roles, in reality, this was not possible. The economic situation in Germany simply did not allow it. Despite the huge and vital boost of ex-Czechoslovakian tanks, by the start of the Second World War in September 1939, the majority of the tanks were the older Panzer I and II. But, thanks to their better training, organisation, radio equipment, five-man crews (in the case of the Panzer III and IV), superiority in numbers, and others, the Germans managed to beat the Polish Army. The Polish armored formations themselves were obsolete, with some exceptions, such as the 7TP, which were available in smaller numbers. The experience gained in Poland showed that the German tanks simply lacked proper armor protection, as almost any Polish anti-tank weapon could destroy any German tank. Another experience was that the tanks were not suited for war in urban environments, as the Germans lost some 60 tanks in one day of fighting during the Battle of Warsaw. Invasion of the West For the Invasion of Norway and Denmark, not many Panzers were used, and they mostly performed the role of infantry support. For the more important Western campaign in May 1940, the Germans managed to gather some 2,439 tanks. While the number of the Panzer IV increased to 278 compared to 211 used in Poland, the majority were once again the Panzer I and II. The Germans, similarly to the Polish invasion, managed to outmaneuver their enemies, catching them off guard and almost always being on the offensive. While the Allies offered stiff resistance, they were too slow to properly respond to the Germans attacks. Ultimately, France, despite its individual armor supremacy, and its allies, lost the campaign. Four Panzer 38(t) tanks belonging to Rommel's 7th Panzer Division during the Western campaign in May/June 1940. While not of German origin, these tanks proved vital in the first years of the war. Source: The Balkans, Operation Barbarossa, and the War in the USSR The Balkan campaign in early 1941 was short and the Panzer Division once again spearheaded the attacks. On 28th June 1941, the greatest land invasion in history began with the German attack on the Soviet Union. Despite the Soviet numerical and, in the case of the T-34 and KV series, tank design superiority, the Germans, thanks to their experience and organisation managed, to overcome these, inflicting heavy losses on the enemy. The Soviets were also plagued with inexperience, crucial lack of spare parts and supply vehicles, which led to huge non-combat losses. While the Germans managed to nearly reach their goal, Moscow, the stiff resistance, losses and 'Russian Winter' ultimately stopped them in their tracks. The German losses for 1941 in the Soviet Union were catastrophic, losing some 2,700 tanks that could not be easily replaced. Having been forced to face superior enemy tanks that their Panzers could do little about, the T-34, for example, after 1942, the Germans focused on developing proper responses. This led to the projects such as up-gunning the Panzer III and IV with longer guns, but also creating a series of cheap self-propelled anti-tank vehicles. It is at this point that the German tanks slowly began gething individually better than the enemy designs. Despite this, they still failed to deliver the killing blow to the Soviets in 1942, losing the 6th Army at Stalingrad. New vehicles, such as the Panthers and the Tigers, were introduced for frontline use in 1943. These were deployed during the famous Battle for Kursk, one of the largest tank battles in history. Despite all their attempts, the Germans could simply not break through the dense Soviet defensive line and were forced to retreat. While not destroyed, the German Panzer Divisions lost their offensive initiative from that point on, being more and more used as a mobile defence force. 1944 and 1945 were marked by the unstoppable westward advance of the Soviet Army. The German stiff resistance could do little to oppose the enemy which, in general, possessed numerical superiority and also huge economical support from the Western Allies. North Africa In North Africa, the German Panzers were used in smaller numbers and the Panzer III was the most important vehicle in 1941. In 1942 and 1943, the longer barrelled Panzer IV appeared in some numbers, together with the Marder III series, and could effectively destroy any Allied tank on this front. By 1943, with the American to the west and British to the east, this proved too much for the Axis forces, which surrendered in May 1943. Panzer IV Ausf. D in North Africa in 1941. Extra fuel or water cans were often carried due to the long distances from supply bases. Source: Italy After the capitulation of Italy in September 1943, the Germans were forced to send forces to this theater of war in order to stop the Allied advance there. Having already been heavily involved in the Eastern Front, the forces in Italy had limited offensive capabilities. Their main goal was to hold the excellently defended positions in the Italian countryside. The Panzers and other armored vehicles were mainly used in this matter, with success delaying the Allied advance up to the war's end. D-Day and the War in the West The Allied invasion of German occupied France opened another front in June 1944. Despite the best German efforts to prevent any possible landing, they failed in this. The Allies, thanks to their superior numbers, managed to quickly make a beachhead in Normandy. What followed were numerous Allied and German counterattacks. While the Germans Panzers, thanks to their excellent firepower, managed to inflict severe losses to the Allies, the enemy air supremacy, numbers, and some questionable orders by some German commanders, ultimately lead to a total German defeat with substantial losses of men and materials. After this, the Germans were forced back into Germany and set a defensive position there in late 1944. The Allied quick advances made their supply lines overstretched and the persistent German resistance made them temporarily lose the momentum. The German High Command wanted to exploit this situation in a high-risk move by attacking with their limited armored forces through the Ardennes. It was hoped that, with a surprise attack, the enemy would be caught off guard. This led to the Battle of the Bulge that began at the end of 1944 and lasted into late January 1945. While initially successful, the Germans simply lacked the men, materials, supply and air cover to actually push the Allies back. This offensive drained the last few remaining armored units' strength. The Allies launched their own offensive that the Germans simply could not stop shortly after. A Tiger II lost on the Western Front late 1944 or early 1945. Source: The Last Year of the War In 1945, what remained of the German armor was often collected in ad hoc units in a desperate attempt to hold back the enemy advances. The last massive German Panzer offensive on this front was during the Battle of Lake Balaton in March 1945. Despite their best efforts, the Germans were beaten back by the Soviets, effectively destroying the German tank strength in the East. The following month, the Soviets reached the suburbs of Berlin and began encircling the city. By this time, the lack of everything from ammunition, replacement vehicles, fuel, etcetera made any resistance futile, and many Germans began racing towards the west trying to surrender to the Allies in hope of avoiding the Soviets. In Service with Other Nations Despite their defeat in the Second World War, the German armored vehicles would remain in service with a number of countries. These were mostly ex-German allies which received a number of these vehicles during the war, including Bulgaria, Finland, Romania and Hungary. While some were available, these had limited use after the war, and most were quickly replaced with more modern Soviet vehicles. Bulgaria, for example, used their Panzer IVs as static bunkers, in one case replacing the weapon with a Soviet 76 mm gun. Franco's Spain also received at least 20 Pz IV Ausf. H and 10 StuG Ausf. Gs during 1943, which remained in use up to the 1950s. Other nations, such as Yugoslavia or France, also operated some German vehicles that were captured during the war. Lastly, Syria received a number of German vehicles, including Panzer IVs, which were used against the Israelis as late as the Six Day War of 1967. Bulgarian modification of the Panzer IV, which included changing the armament with a Soviet 7.62 cm gun. Source: A Syrian Panzer IV. Source: Pak 36: 12,000 were built of this light standard infantry AT gun which was the ordnance main issue. 2.8 cm sPzB 41: Basically a super-high velocity tapering barrel gun of "real" 20mm caliber. 8.8 cm Pak 43: AT adaptation by Krupp and Rheintemall of the legendary anti-aircraft 88mm gun. Prototype VK36.01 chassis, Kummersdorf testing ground, fall 1941. Prototype VK45.01 (1942), Porsche Tiger prototype. The only Porsche Tiger in active service with Abt.653, Ukraine, June 1944. One of the three variants of the Marder III, based on the excellent Panzer 38(t) chassis manufactured by BMM (Skoda). SdKfz 254 in Poland, September 1939 SdKfz 254 in North Africa, 1941 Sd.Kfz.263 of Nachr.Abt.37 (Mot.), 1st Panzerdivision, Poland, September 1939 Sd.Kfz.263 Funkspähwagen, Deutsches Afrikakorps, 1941 Sd.Kfz.263, 2nd Division "das Reich", Eastern Front, 1941 Sd.Kfz.263, 79th signal battalion (mot.) 4th Panzerdivision, Bielorussia 1943. Sd.Kfz.263 "Rona", Warsaw, 1944. Grille Ausf.H, 9th Kompanie, 113th Panzergrenadier Regiment, Russia, 1943. Sd.Kfz.138/1 Grille Ausf.H, 9th Kompanie, Panzergrenadier Regiment 2, 2nd Panzerdivision, Normandy, summer 1944. Grille Ausf.H of the Panzergrenadier Regiment 9/67 or 26, 26th Panzerdivision, Italy, 1944. Grille Ausf.H, Panzergrenadier Regiment 901, Russia, 1944. 15 cm Schweres Infanteriegeschütz 33/1 auf Selbstfahrlafette 38(t) (Sf) Ausf.K (Sd.Kfz.138/1). Grille Ausf.K, unknown unit, Russia, 1944. Grille Ausf.K, East Prussia, 1945. Munitionspanzer 38(t) (sf) Ausf.K (Sd.Kfz.138/1), Germany, May 1945. Sd.Kfz.231 6-rad from the third PanzerDivision, Neuropinn, May 1936. Click to see an earlier model from the VIth Armeekorps. Unidentified Sd.Kfz.231 6 rad during the Anschluss, 1938. Sd.Kfz.232 (fu) radio version in Poland, September 1939. Ausf.A, France, May 1940. The long Waffenamt designation was "Schwerer geländegängiger gepanzerter Personenkraftwagen (6 Rad) mit Fahrgestell des l gl.Lkw". Ausf.B, Ukraine, summer 1942. Long designation was "Schwerer geländegängiger gepanzerter Personenkraftwagen" Supposedly an Ausf.B in Russia, fall 1942. The camouflage is based on one of the reconstitutions made. Ausf.B, possibly used by the SS, Normandy, summer 1944. SS-Heimwehr "Danzig", September 1939. 7th SS Freiwillingen Gerbirgs Division "Prinz Eugen", Croatia, 1943. Sd.Kfz.4/1 on the Eastern Front, 1943. Sd.Kfz.4/1 in Normandy, summer 1944. Sd.Kfz.4/1, Eastern front, winter 1944-45. Munitionskraftwagen für Nebelwerfer Sd.Kfz.4, Eastern front, 1944. Type 182 in France 1940 Kübelwagen in Russia 1942 Type 182 in North Africa, Afrika Korps 1941 Kubelwagen Ambulance Kübelwagen in Tunisia 1943 Kübelwagen in Russia 1943 Camouflaged Kübelwagen Normandy summer 1944 Kübelwagen with MG.34 mount, 1944 An Afrika Korps Schwimmwagen, Egypt, june 1942. An eastern front schwimmwagen, Pripet marshes (Russia), august 1941. A Wehrmacht Schwimmwagen in Normandy, june 1944, with the most current camouflage, with dark green and dark brown vermicels on a beige-brown basis. One of the very first serial SdkFz 2, Germany, december 1940. An Afrika korps kettenkrad, Libya, october 1942. An eastern front Kettenkrad, Stalingrad, december 1942. A SS Panzergrenadiere Kettenkrad, Normandy, june 1944. The Panzerabwehrkanone model 36, standard infantry gun of the german army 1937-42. Kettenkrad towing the Pak 36, 24th Infantry Division (army group center), Vitebsk sector, Russia, june 1942. A PAK 36 with Stielgränat 41, Belgium (operation Wacht am Rhein), december 1944. Sources K. Hjermstad (2000), Panzer IV Squadron/Signal Publication. T.L. Jentz and H.L. Doyle (1998) Panzer Tracts No.14 Gepanzerte Pionier-Fahrzeuge T.L. Jentz and H.L. Doyle (1997) Panzer Tracts No.4 Panzerkampfwagen IV T.L. Jentz and H.L. Doyle (2008) Panzer Tracts No.2-1 Panzerkampfwagen II T.L. Jentz and H.L. Doyle (2007) Panzer Tracts No.2-2 Panzerkampfwagen II T.L. Jentz and H.L. Doyle (2010) Panzer Tracts No.3-4 Panzerbefehlswagen T.L. Jentz and H.L. Doyle (2011) Panzer Tracts No.3-5 Panzerkampfwagen III umbau T.L. Jentz and H.L. Doyle (2004) Panzer Tracts No.16 Panzerkampfwagen IV Bergepanzer 38 to Bergepanther T.L. Jentz and H.L. Doyle (2001) Panzer Tracts No.6 Schwere panzerkampfwagen D.W. to E-100 T.L. Jentz and H.L. Doyle (2014) Panzer Tracts No.8-1 Sturmpanzer T.L. Jentz and H.L. Doyle (2010) Panzer Tracts No.7-1 Panzerjager T.L. Jentz and H.L. 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T.L. Jentz and H.L. Doyle (2005) Panzer Tracts No.13 Panzerspaehwagen B. Perrett (2008) German Armoured Cars and Reconnaissance Half-Tracks 1939-45. Osprey Publishing J. Mislom and P. Chamberlain (1974) German Armored Cars of World War Two, Arms and Armor press. Walter J. Spielberger (1993), Panther and its Variants, Schiffer Publishing. S.J. Zaloga (2011) Panzer IV vs. Char B1 Bis, Osprey publishing P. P. Battistelli (2007) Panzer Divisions: The Blitzkrieg Years 1939-40. Osprey Publishing S.J. Zaloga (1990) Blitzkrieg Armor Camouflage and Marking 1939-1940, Arms and Armor Press T. Anderson (2015) History of the Panzer Waffe, Osprey Publishing Red Army Auxiliary Armoured Vehicles, 1930–1945 (Images of War), by Alex Tarasov If you ever wanted to learn about probably the most obscure parts of the Soviet tank forces during the Interwar and WW2 – this book is for you. 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The author analyses the question of how the lack of auxiliary armor affected the combat efficacy of the Soviet tank troops during the most significant operations of the Great Patriotic War, including: – the South-Western Front, January 1942 – the 3rd Guards Tank Army in the battles for Kharkov in December 1942–March 1943 – the 2nd Tank Army in January–February 1944, during the battles of the Zhitomir–Berdichev offensive – the 6th Guards Tank Army in the Manchurian operation in August–September 1945 The book also explores the question of engineering support from 1930 to the Battle of Berlin. The research is based mainly on archival documents never published before and it will be very useful for scholars and researchers. Buy this book on Amazon! German Panzer IV Tank – Tank Encyclopedia Support Shirt Blitz into action with this Pzkpfw IV, aka Panzer 4 shirt! A portion of the proceeds from this purchase will support Tank Encyclopedia, a military history research project. 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More were used on the Eastern Front against Soviet forces from 1941 until the end of the war in 1945. Buy this book on Amazon!