
MASTER THESIS

A SPEECH DATABASE FOR PITCH DETERMINATION

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Graz, November 6, 2012

Statutory Declaration

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Abstract

This work describes the development of a database for the purpose of multipitch tracking, i.e. the fundamental frequency determination of multiple simultaneously speaking persons. The main benefit compared to existing databases is its large size regarding both the number of individual speakers and the extent of uttered text material. On the one hand this enables the user to produce many different speech mixtures of speaker utterances for test purposes, on the other hand sufficient training data for statistical algorithms is available. In particular, the pitch tracking database from Graz University of Technology abbreviated as PTDB-TUG contains speech from 20 English native persons, 10 of which are female and 10 male. The existing text material, consisting of 2342 sentences, comes from the TIMIT corpus. In total 4720 recordings were made by means of a so-called supervised on-site recording in the sound studio at Graz University of Technology. From each utterance a microphone and a laryngograph signal is provided. In addition to that, reference pitch tracks based on the laryngograph recordings are included. The entire speech corpus with additional documentation is available at <http://www.spsc.tugraz.at/tools>.

Furthermore, the data is used for evaluating two algorithms for multipitch tracking. Here, special interest is given to a fully probabilistic model developed at the Signal Processing and Speech Communication Laboratory (SPSC Lab). This approach requires a model training phase. The aim of this algorithm comparison is to have a baseline for future research works.

Zusammenfassung

Diese Arbeit befasst sich mit der Entwicklung einer Datenbank für Anwendungen im Bereich von Multipitch Tracking, also der Bestimmung von Grundfrequenzverläufen von gleichzeitig sprechenden Personen. Der wichtigste Vorteil gegenüber vorhandenen Datenbanken ist der große Umfang sowohl in Bezug auf die Anzahl unterschiedlicher Sprecher, als auch auf die Menge von gesprochenem Textmaterial. Auf der einen Seite ermöglicht das dem Benutzer viele verschiedene Sprachmischungen zu generieren, auf der anderen Seite wird dadurch ausreichend Trainingsmaterial für statistische Algorithmen zur Verfügung gestellt. Konkret beinhaltet die als PTDB-TUG (Pitch Tracking Database from Graz University of Technology) bezeichnete Datenbank Sprache von 20 Personen mit englischer Muttersprache, davon sind 10 Frauen und 10 Männer. Das vorhandene Textmaterial bestehend aus 2342 Sätzen kommt vom TIMIT Korpus. Insgesamt wurden 4720 Aufnahmen bei Anwesenheit eines Betreuers im Tonstudio der Technischen Universität Graz gemacht. Von jeder Aufnahme werden in der Datenbank das Mikrofonsignal und das Signal eines Laryngographen bereitgestellt. Zusätzlich stehen Referenzsignale für den Grundfrequenzverlauf zur Verfügung. Der gesamte Korpus und die dazugehörige Dokumentation sind unter <http://www.spsc.tugraz.at/tools> erhältlich.

Außerdem wurden die Daten zur Evaluierung zweier Algorithmen für Multipitch Tracking verwendet. Dabei liegt das Interesse besonders auf einem wahrscheinlichkeitsorientierten Modell, das am Institut für Signalverarbeitung und Sprachkommunikation entwickelt wurde. Diese Methode benötigt eine Trainingsphase. Das Ziel dieses Algorithmenvergleichs ist es, eine Basis für zukünftige Forschungsaktivitäten zu schaffen.

Acknowledgements

I would like to thank all people who supported me on my way to, and during the writing process of this thesis.

To my supervisors Franz Pernkopf and Michael Wohlmayr: Thank you very much for always taking your time and helping me in your very pleasant manner. Thanks as well to the other people at the SPSC who supported me.

I would like to give huge thanks to all my friends: Thank you for your understanding and great support!

I want to thank my parents: There is no university that could teach me what I learned from you. Thank you for always supporting me in finding and going my way!

To my whole family: Thank you, you are just awesome!

Hermi, thank you so much, your support is beyond words! I love you!

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Part I

General

1 Introduction

In this thesis, a pitch tracking database is developed and applied to the task of multipitch tracking. It continues some preliminary work that had been made in the course of producing such a speech database. The thesis is part of an ongoing process and the results presented here have already been proposed in [30]. Potential applications of the database, however, also include the evaluation of any single or multiple pitch determination method with respect to human speech.

1.1 Motivation

Pitch tracking means to estimate the pitch or the fundamental frequency of a sound signal over time. In speech processing the task is to extract the pitch from utterances of human speakers. Applications in this context include speech understanding systems, data-driven speech synthesis, prosody recognition as well as digital hearing prostheses [3]. Pitch determination also plays an important role in association with music (see e.g. [3, 5, 20]). However, this work is restricted to the area of human speech.

Many pitch tracking algorithms have been developed in the past. Still, the challenge is to handle real life situations like noisy environments or several persons talking at the same time [11]. Concerning single pitch estimation there are well performing algorithms such as YIN [7] and RAPT [38], which are among the best.

In addition, multipitch tracking tries to separate two or more simultaneously talking speakers. In [43] the Signal Processing and Speech Communication Laboratory (SPSC Lab) of Graz University of Technology proposes a multipitch tracking algorithm based on probabilistic methods. This algorithm has to be parameterized, i.e. trained, by means of speech data. For training and evaluation the ground truth, i.e. the reference pitch is necessary. There are two existing databases, Keele [32] and Mocha-TIMIT [44] which provide reference pitch data. Unfortunately, they turned out to be insufficiently suitable for a probabilistic model. The Keele data is restricted in the amount of data while Mocha-TIMIT provides data for only two speakers. Due to these shortcomings of Keele and Mocha-TIMIT the development of a new corpus with many speakers

and sufficient data per speaker is important.

1.2 Objective

The evaluation of a pitch determination algorithm with respect to its tracking performance is relatively complicated. The general tendency is to provide corpora with reliable speech data and reference pitch tracks as a basis for the comparison of algorithms. But since most methods are dedicated to a specific application where they will very likely perform better than in other situations, one will have to choose both a comparable algorithm that is known to provide good results (or multiple algorithms) and appropriate speech data. However, there is no accurate reference algorithm that could be used for calibration. Furthermore, no standardized criteria or processes exist in order to evaluate the tracking performance [3, 11].

Since the existing speech corpora have shown to be rather improper regarding the requirements for this project it was necessary to plan the production of a suitable (multi-)pitch tracking database. The objective was to recruit at least 10 subjects for each gender. The subjects had to be native English speakers and should read the 2342 *phonetically rich* sentences from the TIMIT corpus [22]. In order to produce high quality signals the recordings should be carried out in an appropriate recording studio. A further requirement was to use a laryngograph in addition to a usual headset microphone recording since laryngograph signals have shown to be appropriate to extract the reference pitch signals.

Furthermore, the multipitch tracking algorithm from [43] should be evaluated and compared to the well performing state-of-the-art multipitch tracker from Wu et al. [45] using the produced database. The method in [43] is based on a factorial hidden Markov model (FHMM) and a speaker interaction model. In contrast, the second algorithm is based on an auditory model of pitch perception and the computation of correlograms. A coarse description of these algorithms can be found in Sections 8.2 and 8.1, respectively.

1.3 Pitch and Fundamental Frequency

In psychoacoustics there is a distinction between subjective perceptual quality and the corresponding objective physical quantity of a sound. The term *pitch* usually describes the perceived *fundamental* frequency which refers to the vibration rate of the vocal folds during voiced speech. The relation between these two terms is close but complex. A larger fundamental frequency implies a larger perceived pitch. But in contrast to the pitch, the fundamental frequency e.g. does

not depend on the intensity of a sound [3, 17]. However, in speech processing literature it is common to use the term pitch in the sense of the objective physical value. Consequently, also within this thesis the term *pitch* is used for the fundamental frequency of a speech signal.

1.4 Outline

This thesis is organized as follows:

Part I presents the background of this project.

Chapter 2 includes a short summary about the two existing databases and provides the required criteria a proper speech corpus has to meet.

In *Chapter 3* the fundamentals concerning pitch determination in human speech signals are discussed. It particularly includes theoretical background regarding the production of reference pitch trajectories and measuring the tracking performance of algorithms.

The basic aspects which have to be considered in the course of any speech database production are included in *Chapter 4*. It describes the corpus development process which usually contains steps like planning, preparing, recording, post-processing, documenting, validating and distributing.

Part II is dedicated to the production of the pitch tracking database from Graz University of Technology, referenced as PTDB-TUG.

Chapter 5 deals with the PTDB-TUG corpus development. Consequently, it is about choosing appropriate speakers, spoken content and recording setup. All details concerning the actual recording of PTDB-TUG are described in this section.

The post-processing is provided in *Chapter 6*. This chapter presents a way of producing reference pitch signals from laryngograph waveforms. Moreover, it discusses further methods for reference pitch analysis to improve the reference pitch values.

The final specifications of the PTDB-TUG are listed in *Chapter 7*. Before publishing the corpus, it has to be organized in terms of data structure and file naming and its quality has to be validated.

Part III deals with the application of this database, namely the evaluation of the multipitch tracking algorithm [43].

Chapter 8 introduces both algorithms, the probabilistic approach [43] and the correlogram-based method [45]. Next, the experimental setup including performance measures and the evaluation process is presented. Finally the results are provided.

2 Existing Databases

A feasible database for pitch tracking has to contain, first of all, laryngograph signals in addition to so-called *phonetically rich* or *phonetically balanced* speech material. The second requirement concerns the extent of both spoken data and individual speakers. The focus lies on the probabilistic model for multi pitch tracking of [43] which includes a speaker interaction model and a FHMM. This model can be trained in two ways. Either in speaker dependent manner, which means that the model will be able to deal with a selection of speakers with known identities, or in a speaker independent manner where the estimated model does not depend on the specific voices of speakers considered in the training phase. In order to ensure statistical robustness, a database has to provide a sufficient amount of speech material, uttered by many individual speakers. For the speaker dependent model sufficient data for each speaker is required while for the speaker independent model different speakers are also important. Currently, two speech corpora, the Mocha-TIMIT and Keele database exist. However, both lack in the second of the above mentioned requirements, i.e. the number of speakers and the amount of data per speaker. The corpora Mocha-TIMIT and Keele are summarize in the following.

2.1 Mocha-TIMIT

One corpus to be potentially considered for pitch tracking is the so-called Mocha-TIMIT database [44]. It is permitted to use the data under certain conditions in research, education and for individual non-commercial use. The intention of the Mocha-TIMIT database has been to provide *directly measured articulatory data* for the training of speaker independent automatic speech recognition systems. This corpus consists of 460 sentences from the TIMIT corpus, which are spoken by 2 speakers, one male and one female. The signals were recorded by microphone and laryngograph, both sampled at $16kHz$ and stored with $16bit$ resolution. Additionally, an electromagnetic articulograph and an electropalatograph were used to obtain data concerning articulatory movements. The acoustical environment was a sound damped studio [44].

2.2 Keele

Another database for pitch tracking is the Keele [32] corpus. It provides reference pitch data based on laryngograph signals. The Keele database was designed for the purpose of comparing pitch detection algorithms. Its so-called core module contains microphone and laryngograph recordings, both digitized at $20kHz$ sampling rate and $16bit$ resolution. Among the 15 English native speakers are male and female, adults and children. The recorded material consists of a phonetically balanced text, called *The North Wind Story*, which is a short, five-line script. In addition to the speech data a voiced/unvoiced reference file is provided. Moreover, this corpus provides a psychophysics module in order to examine the performance of pitch extraction stages by means of commonly used pitch perception stimuli [32].

3 Pitch Tracking

The relation of the term *pitch* to the fundamental frequency has already been explained earlier. This chapter provides a general introduction into the topic of pitch estimation in the area of speech technology. The basic approaches are outlined, classified into time-domain methods and short-term analysis¹ methods. Finally common ways of determining the performance of a pitch tracking algorithm are presented.

3.1 Pitch in Human Speech

Figure 3.1 depicts the whole vocal tract on the left and the larynx, the pharynx, the oral cavity and the nasal cavity in detail on the right. The production of human speech can be briefly described as follows: The lungs generate pressure and consequently air is streaming through the trachea to the larynx, where it can be modulated and further through the vocal tract. Depending on whether or not the vocal cords in the larynx oscillate in a (quasi-) periodic way against one another the resulting sound is said to be voiced or unvoiced. In fact there are mixtures of both kinds of sounds as well. The subsequent vocal tract, including the pharynx, the oral cavity and the nasal cavity, can be seen as a variable acoustic resonator. Apart from that it may create non-periodic turbulent air flow, and thus unvoiced sounds by shaping constrictions. Furthermore, plosive sounds are characterized by a stop-phase due to a total constriction in the vocal tract, followed by a sudden opening, which causes a plosive burst. All voiced, unvoiced or mixed sounds are radiated by the lips or the nostrils. A special case are entirely nasal sounds, where the vocal tract is totally blocked. The *fundamental frequency* or *pitch* of human speech is the rate of vocal cord vibration during phonation of voiced sounds [9, 17, 39].

¹ Short-term analysis means the splitting of a signal into a series of frames and subsequent transforming by means of correlation techniques, least-square methods, active modeling, cepstrum or frequency domain analysis [3]; not to be confused with short-time Fourier transform (STFT).

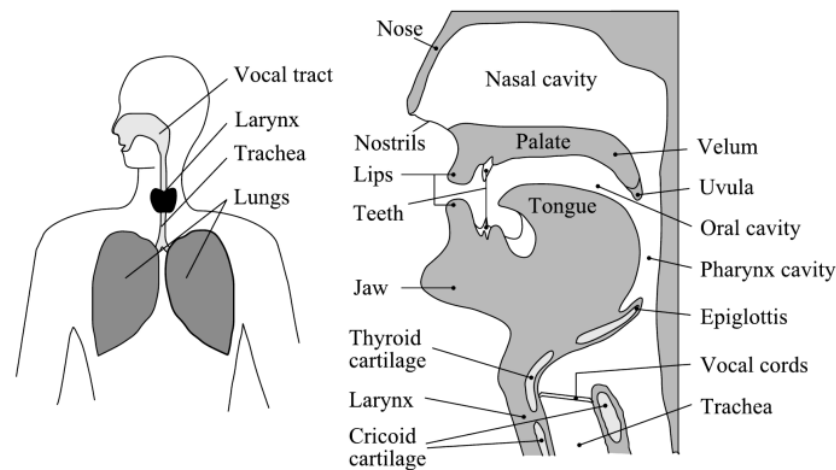


Figure 3.1: Important organs regarding speech production; taken from [39].

3.2 Applications

Pitch determination of speech signals is required in speech synthesis, speech analysis, speech recognition, speech coding - basically in all fields of Speech technology and beyond. Examples of applications are [3]:

- speech understanding systems (e.g. [19])
- prosody analysis (e.g. [40])
- speaker identification (e.g. [4])
- data-driven speech synthesis (e.g. [19])
- digital hearing prostheses (e.g. [1])
- computer-aided intonation teaching (e.g. [2])

3.3 Difficulties

Why is it difficult to detect the fundamental frequency f_0 of an almost periodic signal? It seems one has just to determine its shortest period, the *fundamental period* T_0 , and take the reciprocal value $f_0 = 1/T_0$. In practice the assumption of (quasi-) periodicity of speech often turns out as not true. Estimating the fundamental frequency of speech signals is a complex task due to several reasons such as [3]:

- Generally, speech is a non-stationary process. The current shape of the vocal tract may change abruptly at any time, which yields drastic variations in the temporal structure of the signal, even between subsequent pitch periods.
- Voiced segments in fluent speech may only last a few pitch periods.
- There is a multitude of possible temporal structures due to the flexibility of articulatory gestures and the wide variety of voices. Especially narrow-band formants at low harmonics (in particular at the second or third harmonic) are a source of problems.
- The range of the fundamental frequency of an unknown speaker uttering arbitrary speech can be almost four octaves (50-800Hz). Especially for female voices, a coincidence with the first formant (being about 200-1400Hz) is likely, which causes problems when inverse filtering techniques are applied.
- The excitation signal itself may not be regular. During hoarse or pathologic voice, but also when the voice is 'normal', the glottal waveform exhibits occasional irregularities. The voice may additionally fall into vocal fry or creak.
- Further problems arise in speech communication systems. The speech signal may be distorted or band limited due to telephone or mobile phone channels.

3.4 Methods

Since speech signals are not only quasi-periodic but also non-stationary and time variant signals, each individual algorithm and each strategy of pitch determination yields a different result, even if they are accepted as accurate or correct. Aspects like the starting point of the measurement, the length of the measuring interval, in case of averaging the way it is carried out, or the operating domain (time, frequency, lag, ...) influence the final estimate. According to [46] there are three fundamental points of view in order to approach an acoustical signal processing problem like that [3]:

- From the *speech-production* point of view one has to start from a time-domain representation of the waveform as a train of laryngeal pulses. A pitch determination algorithm that is speech-production orientated measures individual excitation cycles or, if some averaging is performed, the rate of vocal fold vibration.

- The *signal-processing* point of view means that (quasi-) periodicity or at least cyclic behavior is observed. In this case an algorithm has to extract those features that best represent this periodicity, which are the fundamental frequency and the fundamental period.
- The *perception* point of view leads to a frequency-domain representation because primarily pitch sensation corresponds to a frequency even if a time-domain mechanism is involved. Note, that here the perceptual meaning of the term *pitch* becomes important.

Considering these three different points of view the following five basic definitions of pitch are important [3, 14–16]:

1. T_0 is defined as the elapsed time between two successive laryngeal pulses. Measurement starts at a well-specified point within the glottal cycle, preferably at the instant of glottal closure.

Algorithms that work according to this definition are not only able to delimit individual periods of vocal folds oscillation, but also locate the instance of glottal closure. Yet, for general pitch estimation the latter would not be necessary. If such an analysis is carried out on the speech signal, this signal must be undistorted for reliable results.

2. T_0 is defined as the elapsed time between two successive laryngeal pulses. Measurement starts at an arbitrary point within an excitation cycle. The choice of this point depends on the individual method, but for a given PDA it is always located at the same position within the cycle. (PDA = Pitch Determination Algorithm)

Usually this definition is valid in association with time-domain methods. The time instance of reference may be a significant extreme value or a zero crossing. Since the signal is tracked period by period synchronously, individual pitch periods are achieved. From an undistorted signal it may even be possible to extract the point of glottal closure.

3. T_0 is defined as the elapsed time between two successive excitation cycles. Measurement starts at an arbitrary instant which is fixed according to external conditions, and ends when a complete cycle has elapsed.

In this *incremental* definition again the length of an individual period is measured. However, the production point of view is left because the definition is not about an individual excitation cycle. A chosen reference instance is kept as long as the signal remains cyclic, e.g. as long as voiced speech is present. Once the synchronization is interrupted, the reference point is rejected. The next one may be found at a completely different position within an excitation cycle.

There are two distinct definitions regarding short-term analysis methods, one for T_0 and one for F_0 :

4. (a) T_0 is defined as the average length of several periods. The way in which averaging is performed, and how many periods are involved, is a matter of the individual algorithm.

Algorithms that use stationary short-term analysis meet this definition of T_0 , e.g. cepstrum or autocorrelation methods.

- (b) F_0 is defined as the fundamental frequency of an (approximately) harmonic pattern in the (short-term) representation of the signal. It depends on the particular method in which way F_0 is calculated from this pattern.

This is basically frequency-domain definition.

5. F_0 is defined as the frequency of the sinusoid that evokes the same perceived pitch (residue pitch, virtual pitch, etc.) as the complex sound that represents the input speech signal.

The perception orientated point of view yields a long-term definition. In practice such an algorithm enters the frequency domain after time-domain windowing of the signal by performing discrete Fourier transform (DFT).

Generally, a pitch determination algorithm consists of three processing steps [3]:

- The preprocessor performs data reduction and enhancement, e.g. filtering.
- The basic extractor is the main part that extracts a series of pitch values.
- The post-processor is responsible for error correction, pitch tracking, track smoothing, or visualization, depending on the task.

Pitch extraction itself can be carried out in two ways. On the one hand by measuring T_0 according to definition 1, 2 or 3 in the Time-domain. In this case the input signal of the basic extractor has the same time base as the original speech signal. On the other hand F_0 or T_0 is determined by following definition 4(a),4(b) or 5 (in some cases definition 3) and the time-domain is left somewhere in the preprocessor by performing a short-term transformation of the signal [3].

Short-Term Analysis Methods: The time-variant speech signal is decomposed into a series of short frames. The assumption is that within a short interval the parameter of interest is approximately constant. But it has to be long enough so that the parameter remains measurable. Usually it should cover at least two or three periods. Hence, the frame length is in

the order of $10ms$. Unfortunately, in practice there is no optimal choice that works correctly in any situation. After short-term transform each single peak in the spectral domain contains the pitch information within a certain time frame. Thus, the outcome of an algorithm is a sequence of average pitch estimates. The basic short-term analysis approaches are based on correlation, distance function, cepstrum, frequency-domain harmonic analysis, active modeling and statistical approaches such as the least square method [3].

Time-Domain Methods: In principle time-domain algorithms are capable of tracking the signal period by period. The basic extractor yields a series of period boundaries or *pitch markers*. Typical approaches are temporal structure investigation, fundamental harmonic processing or temporal structure simplification [3].

3.5 Reference Data

There is no algorithm producing totally true pitch estimates. One way to evaluate the performance of a pitch determination algorithm is to use data with associated reference pitch tracks. Usually such an evaluation is performed on natural speech. Therefore such reference pitch tracks should be derived directly from the laryngeal waveform, which can be recorded by means of a laryngograph. This device measures the electrical conductance through the larynx with the help of two electrodes and a small high-frequency electric current. The opening and closing of the vocal folds causes variations in the laryngeal conductance, i.e. amplitude modulation of the high-frequency current. In the receiver it has to be demodulated and amplified. A high-pass filter has to suppress disturbing low-frequency components due to vertical larynx movement [3].

The glottal circle is depicted in Figure 3.2. At the instant of glottal closure the vocal-tract excitation is at a maximum. During the open phase of the glottis the laryngeal conductance is at a minimum and the laryngogram shows an almost flat characteristic. As the glottis closes, the conductance of the larynx increases and therefore the laryngogram performs a steep upward slope. The exact time instance can be found by differentiation, which indicates the instance of maximum change of the laryngeal conductance [3].

The output signal, the laryngogram, is supposed to be more reliable for the purpose of pitch determination than the waveform obtained by microphone. According to literature the instantaneous changes of the vocal tract hardly have an influence, and variations in shape or amplitude are relatively small in contrast to microphone signals. Each glottal cycle is represented by a single pulse and therefore gross period-determination errors are suppressed. Furthermore, a good

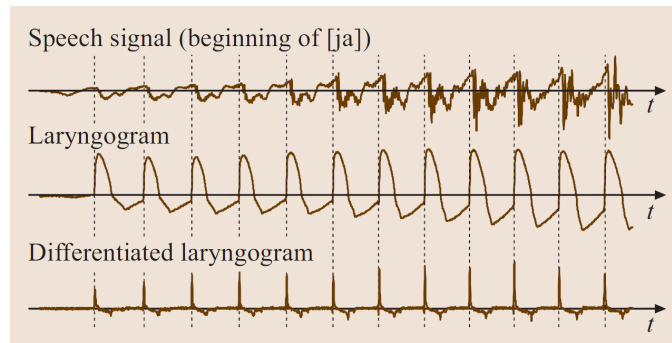


Figure 3.2: Speech signal, laryngogram and differentiated laryngogram which indicates the instants of glottal closure; taken from [3].

basis for voiced-unvoiced decision is provided, since the glottis is always open during unvoiced speech and the laryngogram is nearly zero. On the other hand there are some known problems concerning the laryngograph. For some speakers the measurement may fail temporarily or permanently. Short parts of the beginning or end of a voiced interval may be missed. In the case of plosives the vocal folds may for instance continue to oscillate in the silent interval without producing a signal or they may not completely close in the phase after the plosive, when the voiced phase begins again [21]. Visual inspection of the signal helps to handle such problems. [3].

3.6 Error Measures

In Rabiner et al. [33] a possibility has been proposed to quantitatively assess the performance of (single) pitch detection methods. They compared the pitch tracks of several algorithms to a reference track frame by frame and established some error measurements. Generally, four types of errors in pitch determination are considered (see also [3]):

1. *Gross pitch-determination errors*: These are drastic failures like confusion between F_0 and the first formant F_1 (formant errors) or octave errors such as pitch halving ($F_0/2$) or pitch doubling effects ($2F_0$). In [33], a voiced error $e(m) = P_1 - P_2$ is defined for the m th frame, which is the difference in pitch period of a reference algorithm to another pitch algorithm, given that both methods detect a voiced frame. Above a certain threshold (1ms error in pitch period) the error is classified as a gross pitch period error and expressed in the *Gross Error Count*, i.e. the number of gross pitch detection errors in one utterance.
2. *Fine pitch-determination errors*: A noisy pitch trajectory can be caused by (slightly) inaccurate measurements. In [33], the mean deviation of the pitch period from the correct

values below the threshold

$$\bar{e} = \frac{1}{N} \sum_{j=1}^N e(m_j)$$

and the corresponding standard deviation

$$\sigma_e = \sqrt{\frac{1}{N} \sum_{j=1}^N e^2(m_j) - \bar{e}^2}$$

are calculated, again given that both methods detect a voiced frame. m_j denotes the j th frame in the utterance with fine pitch error and N denotes the total number of such frames in this utterance.

3. *Voiced-to-unvoiced errors*: A frame is wrongly classified as unvoiced. This is measured as a ratio of numbers of wrongly classified frames to the number of voiced frames [33].
4. *Unvoiced-to-voiced errors*: A frame is wrongly classified as voiced, which is measured as a ratio of wrongly classified frames to the number of unvoiced frames [33].

There are different reasons which can cause gross pitch-determination errors. First, the problems may lie in the signal characteristic such as strong first formants, quick variations in the shape of the vocal tract or insufficient recordings due to noise or band limitations. Second, the pitch determination algorithm may (occasionally) not work correctly, e.g. due to an improper frame length. Third, errors may arise from irregularities in the excitation pattern of voiced speech and algorithms may perform averaging and produce insufficient results. The fine pitch-determination errors typically appear due to the following reasons: Key features, e.g. the F_1 dependent position of a maximum within a temporal structure may be measured imprecisely. Other problems inhere in the process itself such as inaccuracies due to signal sampling. Furthermore, in *natural* speech there has to be a certain amount of small fluctuations that can cause errors too. [3]

4 Production of Speech Corpora

This section provides a general overview of the main steps required for a speech corpus production by following mainly the practical guidelines and ready-to-use solutions in [35]. According to that book the term *speech corpus* denotes a collection of digital speech recordings combined with annotation, meta data, and documentation. Such speech corpora are an important source of data for many applications in speech processing research. Chapter 5 describes the practical development of the PTDB-TUG corpus.

4.1 Specifications

At the beginning of a speech database production the intended purpose requires to determine the appropriate features of the corpus. This section describes the most important contents of the database specification.

Speaker Profiles: One of the first questions to be asked is: What requirements must the speakers meet and how should these features be distributed? The main properties are:

- *Distribution of sex*
- *Distribution of age*
- *Mother tongue*
- *Distribution of dialect*
- *Distribution of profession or education*
- *Pathologies*

Number of Speakers: This feature in combination with the amount of utterances per speaker has a high impact on the possible application of the database. A training data set for statistical approaches has to be of a certain extent to gain meaningful results.

Contents: According to the purpose of the database the spoken content may contain a certain selection of vocabulary or in some cases a particular distribution of phonological units like phonemes, syllables or morphemes. Moreover, it could be about a particular topic or even a task the speaker has to cope with.

Speaking Style: There are miscellaneous speaking styles a speech corpus producer may consider. In this way, it is possible to focus e.g. on a confined speaking situation, vocabulary, topic or emotionality.

- *Read Speech:* The speaker reads text from a prompt sheet or from a screen.
- *Answering Speech:* By means of particular questions a certain manner of answering is enforced.
- *Command and Control Speech:* Specific voice commands are used by the subjects to control a process or a device.
- *Descriptive Speech:* The subject has to describe some kind of picture.
- *Non-prompted Speech:* Speech that is neither totally spontaneous nor fully predetermined but somehow restricted like the communication between a pilot and an airport tower.
- *Spontaneous Speech:* This could be a free dialogue.
- *Neutral and Emotional Speech:* To achieve emotional speech one can record actors that play emotions or people working under real stress.

General Recording Setup: The acoustical quality of a recorded speech database depends to a large extent on the general recording setup. It defines influences like the room or ambiance in which the recording takes place, the action speakers should perform or the position and type of the microphone(s). However, in some cases the acoustical quality may not be the main criteria for the decision. Possible recording choices are:

- *Telephone recordings:* On the one hand telephone recordings are an uncomplicated and inexpensive way to collect speech. But on the other hand one has to deal with a relatively low recording quality, hard to handle or even uncontrollable technical influences, various kinds, qualities and positions of microphones as well as a restricted speaking style.

- *On-site recordings*: In contrast to the former setting on-site recordings are carried out at one specific site or sometimes at a limited number of specific sites. In this case the recording quality can be controlled best, since all important features from the type of the microphone to the background noise are chosen by the corpus producer. It is even possible to supervise the whole process personally and to take corrective action whenever necessary.
- *Field recording*: If the acoustical characteristic of a particular situation has to be captured as it appears in real life a field recording will be the best choice. This kind of databases are usually restricted to a small range of applications.
- *Wizard-of-Oz recordings*: Sometimes it may be important to make the speaker believe that he or she deals with a system (e.g. computer-based spoken language systems), which is actually simulated by a so called human 'wizard'. Such settings are called Wizard-of-Oz recordings. This method may help for example to investigate user reactions to different aspects of a system design in advance.

Annotation: Information that is related to the speech signals in the form of transcriptions or segmentations is called *annotation*. Examples are *orthographic transcription* or *phonetic segmentation and labeling*.

Technical Specifications: All technical properties of data have to be specified in order to provide accurately defined signals and annotation in terms of category and value. Typically the technical specifications of a speech database include the following features:

- *Sampling Rate*: A bandwidth up to $8kHz$ covers the most important part of the spectrum of human speech. According to the Shannon Theorem a minimum sampling frequency of $16kHz$ is sufficient. Consequently most speech corpora are sampled at this value. For conventional telephone recordings usually a sampling frequency of $8kHz$ is used, since the transmitted bandwidth is $300Hz - 3300Hz$. Further common sampling rates are $44,1kHz$, which has been introduced by the audio CD standard, as well as $22,05kHz$ and $11,025kHz$. It is common to sample laryngograph signals at the same rate as the speech signals. For articulatory data like electro-magnetic articulography (EMA) usually $200Hz$ is used.
- *Sample Type and Width*: The way an analog speech signal is represented in the digital domain is defined by the sample type and width. For instance: A-law (Europe) or μ -

law (US, Japan) *8bits* (used in telephone recordings; e.g. refer to [39]), (linear)PCM² *16bits* signed (from -32768 to $+32767$) or unsigned (from 0 to 65535), ADPCM³ *8bits* or GSM⁴ (both forms of sound compression are used in telecommunication). In case that the encoding requires more than one byte per sample the byte-order has to be defined as well: Big Endian (most significant byte first: 10) or Small/Little Endian (least significant byte first: 01).

- *Number of Channels*: In case of a multi-channel recording it is recommended to store every single channel in an individual file. Interleaving or multiplexing, i.e. storing more than one channel in a single file, requires to split the files in the post-processing.
- *File Formats*: Speech corpora consist of different types of data. Accordingly, the most common file formats are the following: Signal file formats often use RAW data (format without a header), NIST SPHERE⁵ or WAVE⁶ (subset of RIFF⁷). Typical annotation file formats are SAM⁸ (combined signal and labeling format), EAF⁹, BPF¹⁰, ESPS¹¹ or AGS¹². Generally, XML¹³ and Unicode based markup text format is advisable for meta data file formats.

Corpus Structure: Large amounts of data need to be organized. In general there is one directory for signals, annotation, meta data and documentation each. Additionally, there may be one for the lexicon and one for necessary tools to access data. Possible sub-directories are: male and female, the individual speakers, different dialects and many others. The organization includes the structure, the file naming conventions and type distribution media.

Release Plan and Validation Procedure: It is recommended to have a rough time schedule including the main steps of the corpus production.

Meta Data: As a minimum requirement the meta data specifications should define the contents and may define also the file formats.

² Pulse-code modulation

³ Adaptive Differential pulse-code modulation

⁴ Global System for Mobile Communications

⁵ National Institute of Standards and Technology; [26]

⁶ Waveform Audio File Format; filename extension: WAV

⁷ Resource Interchange File Format

⁸ Speech Assessment Methods; [13]

⁹ Eudico Annotation Format; [24]

¹⁰ Bavarian Archive for Speech Signals (BAS) Partitur Format; [34]

¹¹ File format developed by Entropics

¹² Annotation Graphs

¹³ Extensible Markup Language

4.2 Meta Data

In addition to the recorded signals, a speech database usually contains data that provides information about these signals. Strictly speaking there is a distinction between this category of data and the corpus documentation. The three most important types are the recording protocols, speaker profiles and comments. Meta data may be helpful for the user to decide which database to choose for a particular purpose.

A **recording protocol** should at least include the following information:

- The *session ID* denominating each single recording of the corpus.
- The *speaker ID* is code assigned to each individual speaker in order to ensure anonymity and to protect personal data.
- The *recording date* is another obligatory information.
- The *environmental conditions* should describe the room acoustical situation (recording studio, field recording, room conditions, ...) and should mention possible background noise or cross talk.
- The *technical recording conditions* contain all important information about the number of channels, about the microphone(s) such as type, distance and position and information about the recording device(s) including sampling frequency, sample type and sample width.

Further essential details could be instructions to the speakers, the presence of a supervisor or the type of utterances like read or spontaneous speech.

The **speaker profiles** have to provide the significant characteristics of the recorded subjects, mainly the *speaker ID*, *gender* and *age*. Further features are listed in the former section.

Comments usually describe additional aspects like the behavior or the pathology of speakers, unexpected events during the recordings, or details concerning post-processing.

4.3 Preparation of Collection

There are some legal aspects which have to be considered. Whenever personal data or recordings of people's voices are collected and provided to others, speakers have to be advised about the purpose of the recordings, the protection of data and about anonymity. Each recorded speaker

has to explicitly allow the producer of a database whether and how to use this data. Moreover, the copyright holder, usually the producer, should specify the conditions for using the database.

Once the specifications are determined one has to prepare the recording phase. Such preliminary work concerns aspects such as speaker instructions, prompts or possibly automated recording procedures. According to the defined general recording setup, a proper environment, recording devices, tools and software have to be chosen. Furthermore, some questionnaires and forms have to be provided in order to collect meta data and to clarify legal aspects. In addition, the recruitment of speakers has to be planned. Finally, a pre-test should be carried out under exactly the same conditions than in a usual recording session. The collected data, however, must not be taken into the corpus. This is not only a test for the recording setup and all equipment but also for the procedures, for the check lists, for the software, for the staff, etc. Further details about all the possible options of preparation would go beyond the scope of this thesis and are provided in [35]. Information about the preliminary work in the particular case of the PTDB-TUG are provided in Chapter 5.

4.4 Collection

Within the production phase the actual recording of the speech signals takes place. Important issues regarding this task are mentioned here. First, all data like recording protocols and speaker protocols may be also speakers comments, questionnaires and statistical data have to be collected by means of an ongoing documentation or logging. Next, in order to detect systematic errors at an early stage, an ongoing quality control has to be carried out. Appropriate possibilities would be a supervised recording or the control of the recording process by means of spot tests. Further aspects concern actions like data storage, transfer and backup and speaker recruitment.

4.5 Post-processing

Generally, all processing steps from the recorded signal to the final distributed corpus refers to the term post-processing. Possible steps are: file transfer from the recording device to the computer, file name assignment, filtering, cutting, synchronization, re-sampling, format conversion, special conversion of annotation or automatic error detection.

4.6 Annotation

The so-called annotation of a speech corpus is symbolic information which can be related to the speech signals in two ways: In case of segmentation (S) or labeling the symbolic information of a speech corpus corresponds to the speech signals in terms of the physical time scale. On the other hand transcription or tagging (T) implicates a relation in terms of some semantic content of the speech signal. Examples for both kinds are: orthographic transcript (T), canonical pronunciation (T), broad phonemic or phonetic segmentation or labeling (S), word segmentation (S), dialog act labeling (T), syntactic-prosodic labeling (T), prosodic labeling and segmentation in Tobit¹⁴ (S), phonetic segmentation and labeling in IPA¹⁵ (S), noises: articulatory and technical (S), segmentation or tagging of cross talk (T/S), parts-of-speech tagging (T), syntax trees (T), translations (T), turn segments (S), prosodic labeling of accents and boundary types (S), user state segmentation and labeling (S), meta-linguistic events like breathing, laughing, cough, hesitations (S), discourse events like false starts, shutter repeats etc.(T), glottal pulses (S).

4.7 Pronunciation Dictionary

For all occurring words of a speech corpus, a list of the most likely pronunciation or citation may be provided. Such a pronunciation directory is of particular interest in the area of automatic speech recognition.

4.8 Validation

The corpus needs to be checked with regard to its pre-defined specifications. The final (internal or external) validation has to be carried out after the speech corpus production is declared to be completed. Usually, it includes the following parts:

- Consistency, completeness, and structure of the *documentation*
- Completeness, parsability, and contents (samples) of the *meta data*
- Completeness, technical quality, acoustical quality (samples), and contents of the *signal data*
- Completeness, parsability, and contents (samples) of the *annotation data*

¹⁴ Tones and Break Indices

¹⁵ International Phonetic Alphabet

- Readability (on different computer platforms) of the *media*
- Completeness and quality (samples) of the *dictionary*

4.9 Distribution

There are various possibilities regarding the choice of a distribution media for the database. The interested reader is once again referred to [35]. However, in this work on-line distribution was desired.

Part II

Production of the Database

5 Data Collection

The first phase of the PTDB-TUG production includes the process of planning the corpus specifications, preparing the data acquisition and collecting the data. It is orientated towards the general production guidelines in Chapter 4. The following information is also covered in the database documentation [31] and in [29]. To some extent this work is continued in this thesis. This chapter covers the PTDB-TUG production process from the beginning.

5.1 Speakers

Criteria for selecting speakers: The *corpus language* is English. This is primarily a consequence of the chosen text material to be spoken by the subjects, which is discussed in the next section. Hence, all subjects are English native or at least bilingual speakers. There are no further restrictions regarding the home country, dialect, age or similar aspects. Initially, the aimed *number of speakers* was roughly formulated between 10 to 25 female and male subjects each, depending on the success of recruitment. The *gender distribution* is uniform.

Speaker recruitment: Recruiting speakers started by means of newsgroups postings and announcements at English-relevant institutions and associations. After the first recordings took place word-of-mouth recommendations of already recorded speakers worked best. It turned out that finding and recording 50 adequate and willing persons within a certain time interval was not realistic. In the end, 20 native English speaking subjects in total contributed to the corpus, 10 for each gender.

Speaker profiles: The 20 native English speaking subjects were from five different countries and between 22 and 48 years old. Table 5.1 is taken from the report in the database documentation [31] and is also provided in the file *SPEAKER-PROFILES.TXT*. It shows the speaker profiles of the PTDB-TUG including the mapping of the speakers to the corresponding 236 read sentences from the TIMIT corpus [22] (details are provided in section 5.2). The note in the column *comment* describes an occurred error. Two sentences of speaker F08 have been

lost during the post-processing.

Speaker ID	Age	Sex	Home Country	Sentences			Comment
F01	40	Female	Ireland	sa1,2	sx3-47	si453-641	Error: si1912 and si1913 are missing
F02	25	Female	USA	sa1,2	sx48-92	si642-830	
F03	22	Female	Canada	sa1,2	sx93-137	si831-1019	
F04	26	Female	Canada	sa1,2	sx138-182	si1020-1208	
F05	48	Female	USA	sa1,2	sx183-227	si1209-1397	
F06	28	Female	USA	sa1,2	sx228-272	si1398-1586	
F07	24	Female	USA	sa1,2	sx273-317	si1587-1775	
F08	22	Female	England	sa1,2	sx318-362	si1776-1964	
F09	22	Female	USA	sa1,2	sx363-407	si1965-2153	
F10	35	Female	USA	sa1,2	sx408-452	si2154-2342	
M01	24	Male	South Africa	sa1,2	sx3-47	si453-641	
M02	40	Male	England	sa1,2	sx48-92	si642-830	
M03	35	Male	England	sa1,2	sx93-137	si831-1019	
M04	26	Male	USA	sa1,2	sx138-182	si1020-1208	
M05	25	Male	England	sa1,2	sx183-227	si1209-1397	
M06	23	Male	USA	sa1,2	sx228-272	si1398-1586	
M07	24	Male	USA	sa1,2	sx273-317	si1587-1775	
M08	24	Male	England	sa1,2	sx318-362	si1776-1964	
M09	24	Male	Canada	sa1,2	sx363-407	si1965-2153	
M10	33	Male	USA	sa1,2	sx408-452	si2154-2342	

Table 5.1: Speaker profiles of the PTDB-TUG and the mapping of the speakers to the TIMIT sentences; taken from [31] and slightly modified.

Legal aspects: All speakers were informed about the purpose of their recorded utterances and about the treatment of data in terms of protection and anonymity. Each subject had to agree to a declaration regarding the allowance to use the recordings and some additional data for research purposes.

Speaker meta data information: Additionally, it was necessary to collect some (not published) personal information as well as meta data regarding the speakers. The exact declaration form, including legal aspects and data collection is called *Agreement to receive an attendance allowance as test subject for recording a speech data base* and can be found in Appendix C.

5.2 Content

Criteria for selecting spoken content: For the intended purpose it is important to provide a large amount of text material that is well balanced in terms of phonetic distribution. It is not restricted to a certain vocabulary, topic, task or specific phonological units. Therefore, read speech is the appropriate speaking style.

Text material: The existing TIMIT corpus [22] provides 2342 sentences which are suitable for the intended purpose. They are composed of three different types of phonetically rich sentences: The two *dialect sentences* should *expose the dialectal variants of the speakers*, the 450 *phonetically-compact sentences* are intended to *provide a good coverage of pairs of phones, with extra occurrences of phonetic contexts thought to be either difficult or of particular interest*, and 1890 *phonetically-diverse sentences* that *add diversity in sentence types and phonetic contexts* [6].

The dialect sentences are labeled by the identification code *sa* and the sentence number 1 or 2, phonetically-compact sentences are indicated by *sx* and a number out of 3, 4, 5, ...450, 451, 452 and the phonetically-diverse sentences are denoted by *si* and numbered from 453 to 2342. One example per sentence type is given here [31]:

- Dialect sentence (sa1): *She had your dark suit in greasy wash water all year.*
- Phonetically-compact sentence (sx409): *Eating spinach nightly increases strength miraculously.*
- Phonetically-diverse sentence (si1291): *They should live in modest circumstances, avoiding all conspicuous consumption.*

The whole list of the TIMIT sentence is provided in Appendix A.

Apportionment of text: Table 5.2 illustrates the distribution of sentences among speakers in the PTDB-TUG. The two dialect sentences were read by all 20 speakers. Additionally, each speaker read 45 of the phonetically-compact sentences and 189 of the phonetically-diverse sentences. Hence each of these sentences was spoken by a female and a male speaker. The mapping of the speaker ID to the corresponding part of sentences is included in Table 5.2.

Sentence Type	Number of Sentences	Number of Speakers per Sentence	Number of recorded Sentences	Number of Sentences per Speaker
Dialect sentences (sa)	2	20	40	2
Phonetically-compact sentences (sx)	450	1Male + 1Female	900	45
Phonetically-diverse sentences (si)	1890	1Male + 1Female	3780	189
Total	2342		4720	236

Table 5.2: Distribution of the three types of TIMIT sentences; taken from [31] and slightly modified.

5.3 Recording

General Recording Setup: The PTDP-TUG is specified to provide high quality data. Therefore, it was *recorded on-site* in the recording studio at the Institute of Broadband Communications (in the meantime at the SPSC Lab) at Graz University of Technology. Since it had been decided to accomplish a *supervised* procedure, in the acoustically optimized recording room a setting with two seats separated by an absorbing partition was arranged, which is depicted in Figure 5.1. The supervisor position on the right hand side included the recording notebook displaying the supervisor view of the software *SpeechRecorder* [8], the recording interface, the laryngograph and some headphones. The speaker position on the left provided a headset microphone, a neckband to fix the laryngograph electrodes and a screen to display the sentences. This enables an efficient supervision of the recording procedure.

Recording process: At the beginning each speaker was introduced to the process, advised about the legal aspects and asked about some personal information. In addition, he or she was requested to confirm the use of data for research purposes. Next, the subject took seat and was equipped with the laryngograph electrodes and the headset microphone. The correct position of the laryngograph electrodes had to be found on either side of the larynx. The microphone had to be placed about one or two centimeters close to the corner of the mouth. Subsequently the signal gain was adjusted, designated test sentences were recorded and the results were reviewed.

After achieving appropriate outcome the actual recording phase started. Without particular instructions, except to read the displayed sentences, the recording was done by means of the specific speech recording tool *SpeechRecorder* [8]. It was carried out sentence by sentence with optionally repetitions if necessary. First the subject had the opportunity to quietly read the sentence in advance. Then, at the beginning of each single recording, the subject could get



Figure 5.1: Recording setup with supervisor position on the right hand side and speaker position on the left hand side; taken from [31].

ready during the pre-delay of $2000ms$. After the supervisor stopped the recording, there was a post-delay of $500ms$ to prevent signal truncations.

The recording took about an hour per person. Depending on the individual speaker this process had to be interrupted one to several times. In many cases, subjects asked to remove the inconvenient laryngograph neck band for a moment and take a break. When this happened the previous signal adjustment had to be repeated.

In the end the speaker received the attendance allowance and was requested to help for further recruitment.

Technical Setup: The main devices and tools used during the recording were the recording software *SpeechRecorder* [8] installed on an *IBM laptop*, in combination with the firewire recording interface *Presonus Firebox*. The audio signals were recorded by means of an *AKG HC 577 L* condenser headset microphone including the attached omni-directional pattern pickup. Additionally, the oscillation of the vocal folds was detected by a so-called *Portable Laryngograph*®. Both microphone and laryngograph signals were digitized at 48 kHz and 16 bit resolution (using signed PCM encoding with little endian as byte-order). The recording file format was a stereo WAV-file whereby the left channel was used for the microphone signal and the right channel

contained the laryngograph signal.

Recording Program: The coordination of the recording was facilitated by means of the recording program *SpeechRecorder*. This tool *organizes recordings in projects. A project is a combination of a speaker database, a set of recording scripts, and a set of recording sessions. A recording session consists of an individual speaker, a recording script, the selected recording settings, and a directory into which the recorded files are written.* [8]. In other words: there is a distinct assignment between a speaker, the text material, some technical settings and the recorded files. The prepared scripts help to present the text material in an appropriate order. In this case section one consisted of two arbitrarily chosen test sentences. Section two provided 236 sentences per speaker. In order to cover all sentences according to Table 5.2 there were 10 different scripts and each of which was once read by a female and once by a male speaker. Evidently a two display setting with manual recording (i.e. sentence by sentence) was used. More detailed information about this software can be found in [8] and [37].

Recording Protocol: The database documentation includes a file named *RECORDING-PROTOCOL.TXT*. It summarizes all the important information concerning the data recording, including the particular recording dates. Its content is also shown in Appendix B.

6 Post-processing

All recorded microphone and laryngograph signals were subjected to further processing steps. Besides general measures the laryngograph data was further used to obtain reference pitch trajectories. This section describes the post-processing. Moreover, Chapter 6.3 provides information about additional signal analysis and attempts to further improve the quality of the reference pitch tracks.

6.1 General Signal Processing

The database provides three types of signals: microphone signals, reference signals and laryngograph signals. The microphone signals are intended to be the actual testing and training data for the pitch tracking algorithms. In addition, the reference signals based on laryngograph waveforms can be taken as ground truth data during evaluation. However, such references are never totally correct and users may wish to produce their own ground truth signals in a different way. Hence, this possibility is offered by means of the additionally included laryngograph signals in PTDB-TUG.

These signals were processed as follows: The 48 kHz and 16 bit recording resulted in 236 stereo WAV-files per speaker containing the microphone signals in the left channel and the laryngograph signals in the right channel. Both microphone signals and laryngograph signals were extracted into single channel WAV-files and renamed as described in Section 7.3.

6.2 Reference Signals

In addition to the microphone and laryngograph signals the PTDB-TUG provides some reference pitch tracks generated from the laryngograph waveforms. The aim is to create ground truth data for the database user in order to easily verify pitch tracking results. However, one might doubt the correctness of these signals and may want to extract own reference data from either laryngograph or microphone data.

It has already been mentioned that the laryngograph signal is supposed to be more appropriate

for this task mainly because there are less influences by the vocal tract compared to a signal recorded by microphone. During voiced speech the laryngogram shows an almost periodic shape corresponding to the vocal folds oscillation. But usually the larynx movement causes a disturbing low-frequency component and the signal is filtered beforehand using a *linear phase Kaiser filter*. It is a finite impulse response (FIR) filter, is stable and the linear phase property implies a constant group delay, i.e. all frequencies are delayed by the same amount of time and therefore signal distortions are avoided. In addition to the cut-off frequency such a filter requires two parameters, the filter length n and a shape parameter β , which enable a trade-off between the side-lobe amplitude and the main-lobe width in the filter transfer function [27]. The optimal parameters are found empirically. It turned out that the most efficient way is to use two different linear phase Kaiser filters with $\beta = 0.5$ and $n = 2400$. One filter is applied to female speakers utterances using a cut-off frequency $f_c = 25Hz$. The filter for male voices has a cut-off frequency of $f_c = 15Hz$.

In order to create the reference pitch tracks the RAPT algorithm [38] is applied to the WAV-files by using the snack sound toolkit [36]¹⁶. This script produces four different measures per time frame: the pitch estimate (in Hz), the voicing decision (1 or 0), the local root mean squared (RMS) estimate and the peak-normalized cross-correlation value used for the F_0 determination.

Figure 6.1 illustrates the error reduction from the pitch track due to filtering. It shows the spectrogram of sentence *si1371* uttered by speaker *F05* including the generated pitch values derived from both the raw and the filtered laryngograph signal. In the unfiltered signal some outliers can be seen. After applying the high pass filter to the laryngograph signal the pitch track has a smooth shape.

¹⁶ The window size was $32ms$ and the hop size was $10ms$.

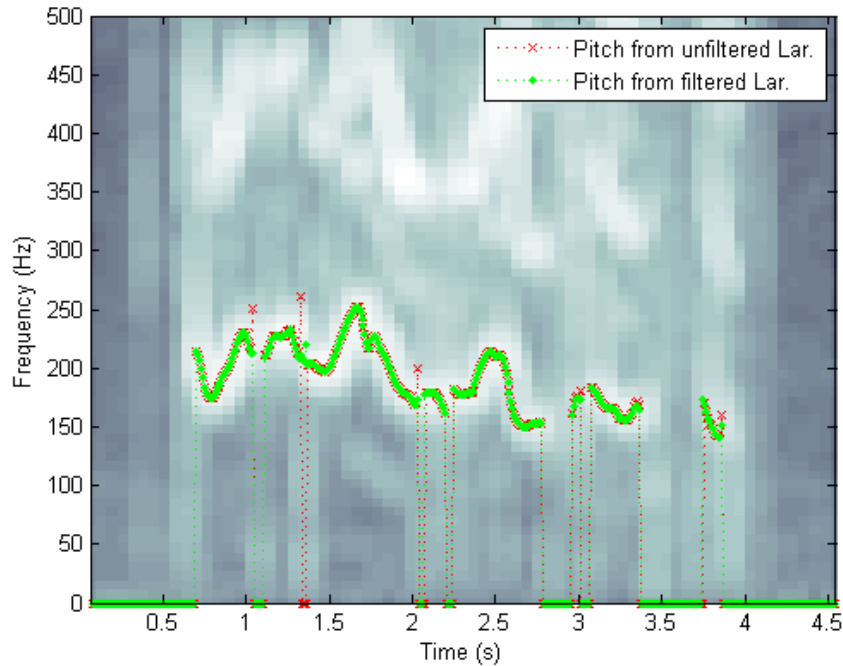


Figure 6.1: Spectrogram of sentence si1371 uttered by speaker F05 as well as the estimated pitch tracks extracted from both the raw and the filtered laryngograph signal.

6.3 Further Investigations

Here some remaining irregularities of the reference pitch track and attempts to further reduce errors and artifacts are treated. Moreover, a general discussion about producing reliable ground truth data is provided. Note, however, that the proposed strategies are not entirely successful or convincing to apply them to the published reference signals. A theoretical point of view concerning laryngograph-based reference data including possible error causes can be found in Section 3.5.

Feasible reference pitch tracks should track the actual fundamental frequency without any unexplainable scatter or jumps. Although filtering helped to remove the majority of outliers in the pitch derived from laryngograph data in the PTDB-TUG, visual inspection still shows outliers and other artifacts where a smooth pitch trajectory is expected.

Low values in terms of RMS and cross-correlation: Since the estimates of the RAPT algorithm, that was used to produce reference pitch trajectories, are based on RMS values and normalized cross-correlation functions (NCCF) one strategy was to analyze pitch in connection with these values. Outliers should be further reduced by identifying and excluding pitch candidates with low RMS or NCCF. In the following examples 5% of the pitch estimates with the

smallest values are removed. Figure 6.2 shows the effect regarding RMS values and Figure 6.3 depicts the same signal concerning NCCF. The results are very similar and almost the same pitch candidates are affected. However, this step removes also a lot of (probably) correct pitch values.

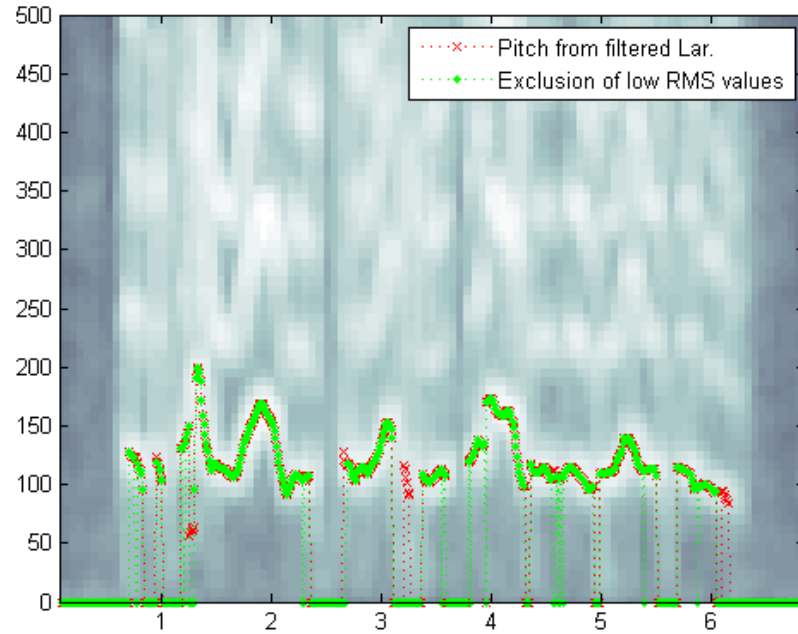


Figure 6.2: Spectrogram of sentence si1399 uttered by speaker M06. In addition it depicts an estimated pitch track obtained from the filtered laryngograph signal and the same pitch track without low RMS values.

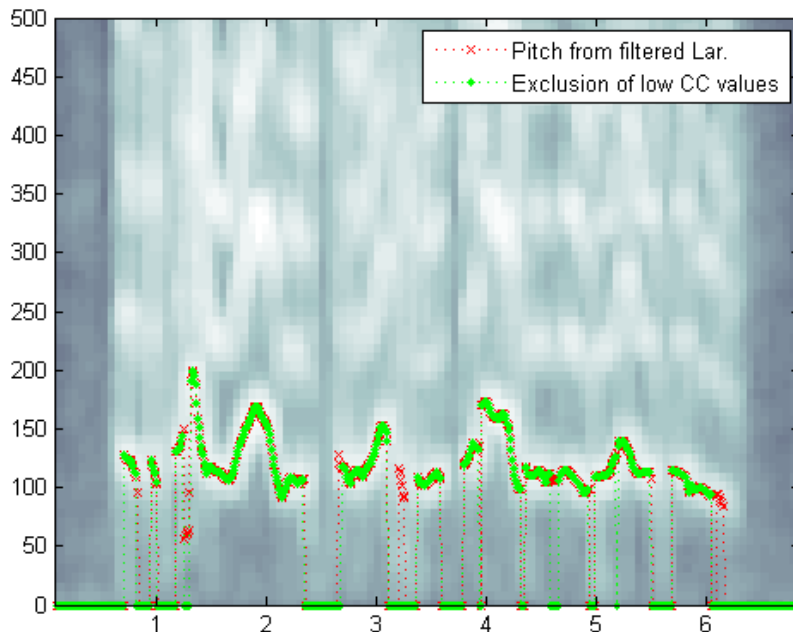


Figure 6.3: Spectrogram of sentence si1399 uttered by speaker M06. In addition it depicts an estimated pitch track obtained from the filtered laryngograph signal and the same pitch track without low NCCF values.

Pitch from microphone signals: The literature clearly recommends extracting pitch from laryngograph signals. Yet, in the course of this project some questions regarding this recommendation arose. For example in some situations microphone signals seem to be less noisy than corresponding laryngograph signals. Consequently, a brief analysis of pitch obtained from microphone signals was carried out. The initial idea was that a corresponding pitch from the microphone is an indication for reliable pitch obtained from laryngograph waveforms.

First, the overall differences in the signals were quantified by using a similar error measure than the one proposed in [33] (see also 3.6). The total error \tilde{E}_{Total} is the sum of the unvoiced-to-voiced error \tilde{E}_{01} , the voiced-to-unvoiced error \tilde{E}_{10} , the gross pitch-determination error \tilde{E}_{Gross} and the fine pitch-determination error \tilde{E}_{Fine} . \tilde{E}_{01} is the percentage of time frames without pitch a value but misclassified as including a pitch value (\tilde{E}_{10} , vice versa). \tilde{E}_{Gross} is the percentage of time frames with correct voicing decision and a pitch frequency deviation larger than 20%. \tilde{E}_{Fine} is the percentage of pitch frequency deviation, averaged over frames with correct voicing decision and a pitch frequency deviation lower than 20%. The pitch frequency deviation is calculated as

$$\Delta f_0[t] = \frac{|\tilde{f}_0[t] - f_0[t]|}{f_0[t]},$$

where $f_0[t]$ is the pitch derived from laryngograph (assumed to be the ground truth) and $\tilde{f}_0[t]$ from the microphone signal.

The error measures are computed for the Mocha-TIMIT speech corpus (database in Section 2.1) and PTDB-TUG and the results are compared. The Mocha-TIMIT reference data was produced with a 100Hz notch filter for female signals in order to remove frequent artifacts. The comparison contains error measures for both PTDB-TUG data with and without high pass filtering. Tables 6.1 shows the overall error \tilde{E}_{total} as well as its contributions for female and male speakers in both the Mocha-TIMIT corpus and the PTDB-TUG data. Furthermore, an analysis of all individual PTDB-TUG speakers is provided in Tables 6.2. This data includes high pass filtering.

Generally, the error measure shows slightly smaller mean and standard deviation values for the male speakers of Mocha-TIMIT and higher values for female speakers of Mocha-TIMIT compared to the PTDB-TUG data. In fact, there are considerable differences between pitch obtained from filtered laryngograph signals, from raw laryngograph signals and from microphone signals and a fundamental problem is that neither the one nor the other reference pitch track can be assumed as correct. Therefore, also the informative value of this comparison is limited, since it only shows the amount of differences between two kinds of signals and the distribution of differences among the speakers.

Data		\tilde{E}_{01}	\tilde{E}_{10}	\tilde{E}_{Gross}	\tilde{E}_{Fine}	\tilde{E}_{total}
Mocha-TIMIT , Female	Mean	10,6	29,5	4,7	1,1	45,9
Ground truth: Laryngograph	Std.	5,7	13,9	6,4	0,2	18,4
Mocha-TIMIT , Male	Mean	10,4	1,4	0,6	1,2	13,6
Ground truth: Laryngograph	Std.	4,0	1,6	1,4	0,3	4,5
PTDB-TUG , Female	Mean	6,3	4,8	3,0	1,4	15,4
Ground truth: Laryngograph	Std.	3,4	3,4	4,5	0,4	7,3
PTDB-TUG , Male	Mean	2,7	11,4	0,6	1,2	15,9
Ground truth: Laryngograph	Std.	1,9	6,8	1,5	0,2	7,6
PTDB-TUG , Female	Mean	5,8	4,7	3,1	0,9	14,5
Ground truth: filtered Lar.	Std.	3,2	4,4	4,7	0,2	8,2
PTDB-TUG , Male	Mean	2,1	13,4	0,7	1,1	17,2
Ground truth: filtered Lar.	Std.	1,6	8,0	1,6	0,2	8,9

Table 6.1: \tilde{E}_{total} for female and male speakers in both the Mocha-TIMIT corpus and the PTDB-TUG. For each measure a mean value and a standard deviation value was calculated, averaged over the according number of speakers.

Data		\tilde{E}_{01}	\tilde{E}_{10}	\tilde{E}_{Gross}	\tilde{E}_{Fine}	\tilde{E}_{total}
F01	Mean	5,8	3,2	1,7	1,1	11,8
	Std.	4,2	2,9	3,7	0,2	6,4
F02	Mean	9,4	0,6	0,3	0,9	11,2
	Std.	4,4	1,7	1,1	0,1	4,4
F03	Mean	6,2	1,6	1,7	0,7	10,2
	Std.	2,3	1,9	2,8	0,1	4,6
F04	Mean	8,3	10,4	2,6	1,1	22,4
	Std.	5,2	9,4	4,7	0,2	12,5
F05	Mean	3,5	6,8	1,5	0,9	12,6
	Std.	2,5	4,2	2,9	0,2	5,4
F06	Mean	4,4	2,9	7,2	0,8	15,4
	Std.	2,5	2,0	6,5	0,2	7,3
F07	Mean	4,2	2,0	2,0	0,6	8,8
	Std.	2,0	2,0	3,3	0,1	4,3
F08	Mean	6,1	12,1	8,2	1,1	27,5
	Std.	3,7	12,9	13,8	0,3	25,0
F09	Mean	3,9	4,0	0,8	0,9	9,6
	Std.	1,6	3,2	2,0	0,2	3,9
F10	Mean	6,3	3,3	5,2	0,6	15,5
	Std.	4,0	3,9	6,1	0,1	8,1
M01	Mean	1,7	11,2	0,3	1,3	14,4
	Std.	1,1	5,6	1,0	0,2	5,7
M02	Mean	1,8	26,8	0,4	1,3	30,3
	Std.	2,7	16,4	2,1	0,5	18,8
M03	Mean	1,5	13,3	0,6	1,0	16,4
	Std.	1,1	5,9	1,3	0,2	6,2
M04	Mean	2,0	7,1	0,4	0,9	10,4
	Std.	1,2	4,1	1,2	0,1	4,2
M05	Mean	2,1	12,5	0,6	1,4	16,5
	Std.	1,3	6,1	1,5	0,2	6,3
M06	Mean	3,1	6,9	0,3	0,9	11,3
	Std.	1,7	4,4	0,9	0,1	4,7
M07	Mean	3,8	9,8	1,1	1,1	15,8
	Std.	2,8	11,5	3,1	0,3	14,4
M08	Mean	0,8	21,1	0,1	1,0	23,0
	Std.	1,0	11,2	0,3	0,2	11,2
M09	Mean	2,7	10,5	1,4	1,1	15,6
	Std.	1,8	7,2	3,3	0,2	8,4
M10	Mean	1,1	14,4	1,6	1,2	18,3
	Std.	0,9	8,4	3,9	0,2	9,4

Table 6.2: \tilde{E}_{total} for female and male speakers in the PTDB-TUG (ground truth: filtered laryngograph). For each measure a mean value and a standard deviation value was calculated.

Octave errors: There are obvious octave jumps or at least doubts about the right octave determination for some speakers. Therefore, at first such inconsistencies are identified with the help of relative pitch changes $s(n)$, calculated between neighboring time frames as

$$s(t) = \frac{f_0(t+1) - f_0(t)}{f_0(t)},$$

where $f_0(t)$ is the pitch value of time instance t . These relative pitch changes were determined for all reference files and represented in terms of a histogram, which is provided in Figure 6.4. It is noticeable that apart from the main peak at 0 there is a rather large frequency of occurrence around 0.5 and 1. These values refer to a pitch halving and doubling, respectively.

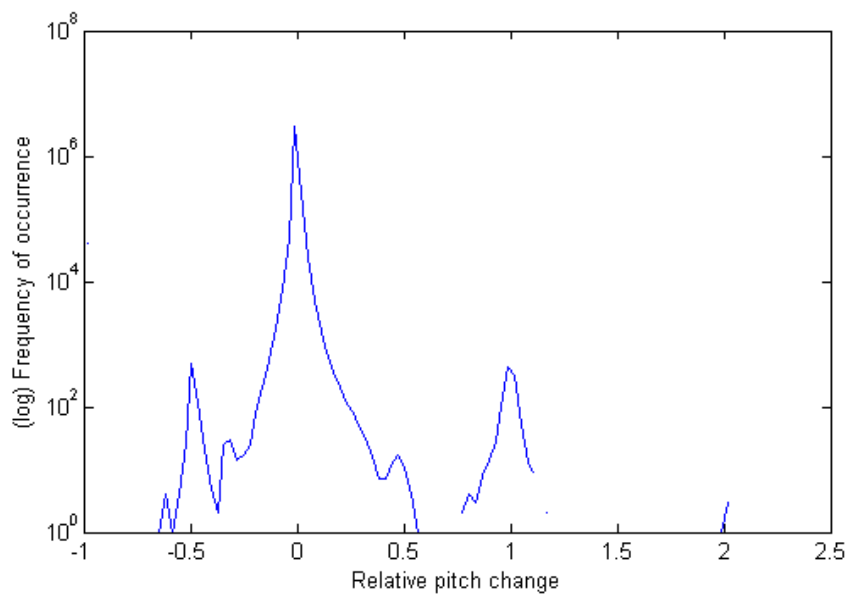


Figure 6.4: Histogram of relative pitch changes in the reference signals.

Due to this observation a simple rule has been developed, which can be applied to the whole reference data in order to reduce octave errors and to generate *improved reference signals*. Once again, the approach is to compare the pitch obtained from the reference signals to the pitch from the microphone signals and to take the latter one in cases where this pitch is one octave above or below the current reference pitch and the corresponding RMS or NCCF value is larger relative to the mean RMS or NCCF. When looking at some affected sentences this method seems to work and some obviously implausible pitch candidates are corrected as can be seen in Figures 6.5 and 6.6. The histogram of relative pitch changes (Figure 6.7), however, does not show a significant improvement. The reason may be that single octave shifted values can cause new octave jumps and therefore the frequency of such changes may remain roughly equal. In this case a different measure has to be developed. In Figure 6.8 the histogram of relative pitch

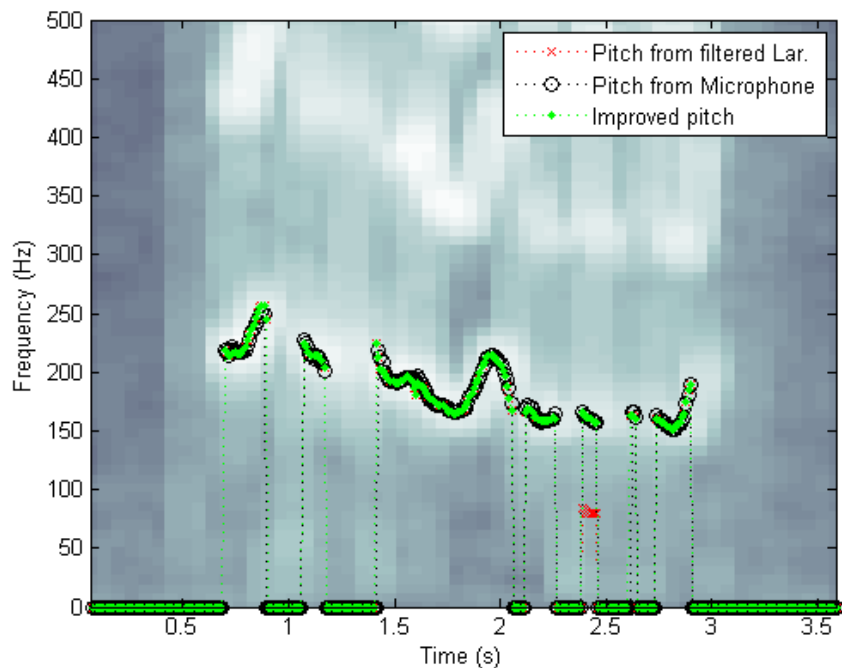


Figure 6.5: Spectrogram of sentence si1025 uttered by speaker F04. In addition it depicts an estimated pitch track obtained from the filtered laryngograph signal, from microphone and the 'improved' pitch track.

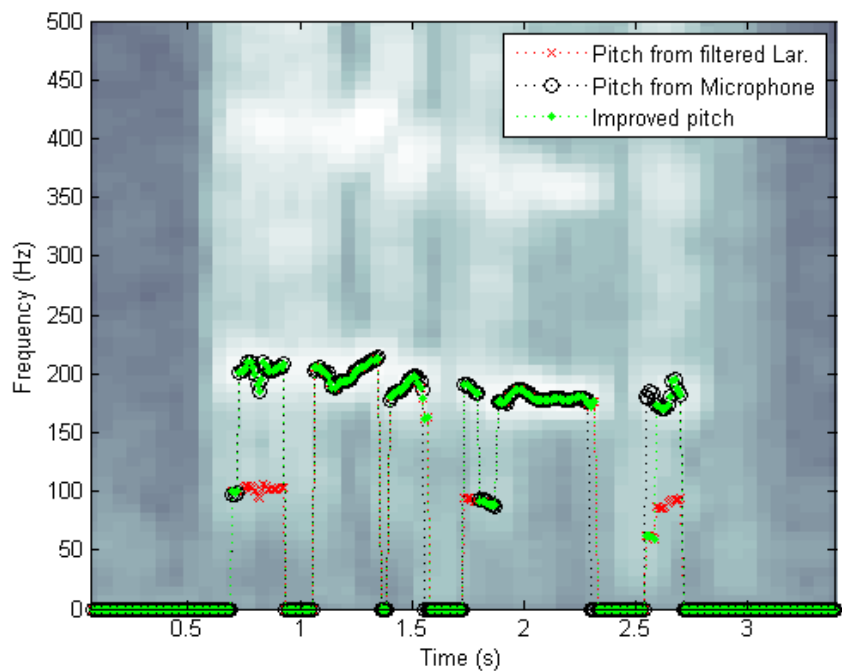


Figure 6.6: Spectrogram of sentence sx249 uttered by speaker F06. In addition it depicts an estimated pitch track obtained from the filtered laryngograph signal, from microphone and the 'improved' pitch track.

changes of the pitch values extracted from microphone recordings is shown. There are about as many octave errors as in Figure 6.4. This result leads to the conclusion that this simple rule for post-processing the reference pitch values fails.

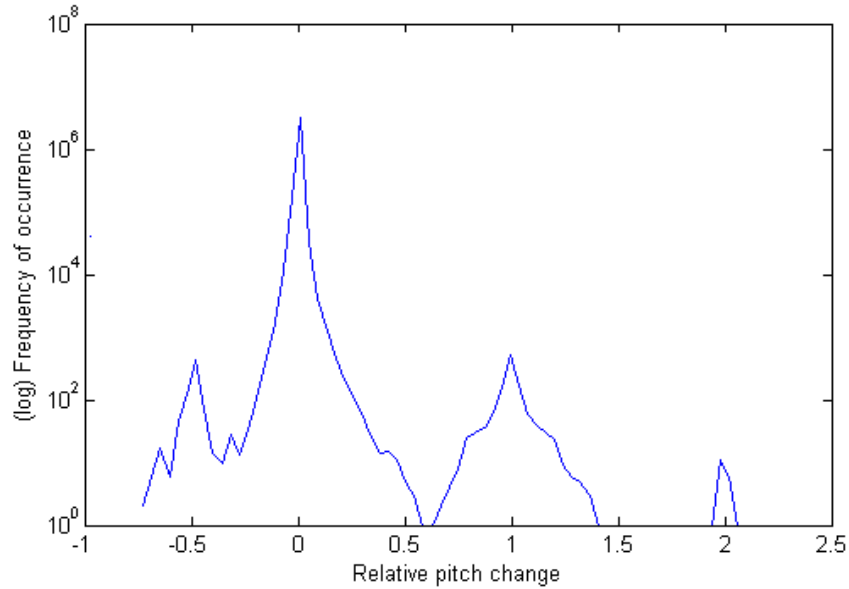


Figure 6.7: Histogram of relative pitch changes in the 'improved' reference signals.

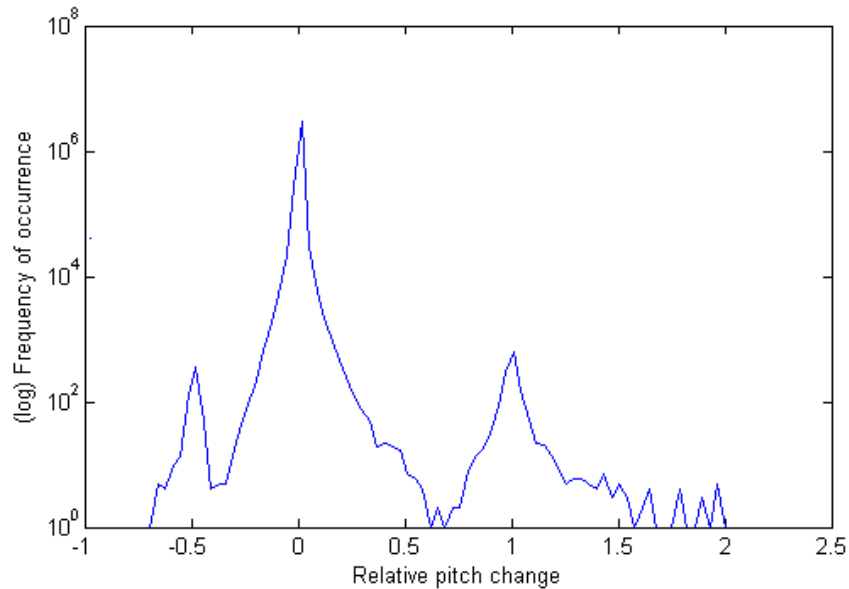


Figure 6.8: Histogram of relative pitch changes in the pitch from microphone signals.

Average pitch: Possible sources of errors are pitch values that lie outside the measurement range of the pitch determination algorithm. The probabilistic algorithm [43] currently deals with frequencies from 80 to 500Hz. Hence, attention has to be given to low male voices rather

than to high female voices. The average pitch and the corresponding standard deviation for each male speaker are determined and shown in Table 6.3.

Speaker	Mean pitch in Hz	Std. in Hz
M01	117,03	16,58
M02	98,22	15,76
M03	82,31	11,06
M04	109,8	12,42
M05	132	27,11
M06	118,82	16,39
M07	139,14	19,55
M08	96,55	10,99
M09	110,28	17,5
M10	104,47	18,42

Table 6.3: Average pitch value and standard deviation for male speakers.

General discussion: Errors in pitch trajectories extracted from laryngograph signals may occur due to a variety of reasons. In case of a large amount of data one has to use simple rules and strategies to reduce artifacts. In order to achieve just totally smooth tracks according to the spectrogram an enormous effort had to be made and manual post-processing is required. And yet, the results would probably not be entirely correct. Generally speaking, the problem is that there is no way to produce absolutely correct ground truth pitch tracks, neither from microphone nor from laryngograph signals. In some cases it is impossible to decide with certainty which pitch value is true, the one obtained by means of filtering or the one derived from the unfiltered signal.

7 The PTDB-TUG Database

This chapter lists the features of the PTDB-TUG and explains the organization and the nomenclature of the data [31]. Additionally, a brief glance at the final validation and about the distribution is provided.

7.1 Database Features

General features: The database provides utterances of 20 English native speakers; 10 are female and 10 are male, i.e. the gender distribution is uniform. The spoken content is the phonetically rich text material from the TIMIT corpus [22], which includes 2342 sentences. Since these sentences were at least once recorded by a female and a male speaker the database contains 4720 recordings. Each recording consists of a microphone and a laryngograph signal. The recording setup was a supervised on-site studio recording. The only instruction to the speakers was to read the current sentence from a display. In addition to the obtained signals the database provides reference pitch tracks extracted from the laryngograph data.

Technical features: Both the microphone signals and the laryngograph signals are sampled at a rate of $48kHz$ with a resolution of $16bits$. The sample type is signed PCM and the byte order type is little endian. The PTDB-TUG provides single-channel WAV-files with microphone and laryngograph data. Additionally offered ASCII format F0 files contain the result of the RAPT pitch tracking algorithm [38], i.e. the reference pitch values, the voicing decisions, the RMS values and the (peak-normalized) cross-correlation values. The meta data, i.e. the recording protocol, the speaker profiles and a list of the TIMIT prompts, is provided as text files.

7.2 Structure

The diagram depicted in Figure 7.1 shows the structure of the PTDB-TUG corpus. The database is divided into the subdirectories *DOCUMENTATION* and *SPEECH DATA*. There is no specific annotation data and the meta information is included in the documentation subdirectory in

order to keep the organization simple. The *SPEECH DATA* is split into *FEMALE* and *MALE* data, whereby both directories contain the same spoken content. Again these directories are subdivided according to the different types of signals: microphone signals (*MIC*), laryngograph signals (*LAR*) and reference signals (*REF*). Finally, there is a directory for each individual speaker in the *LAR*, *MIC* and *REF* folders.

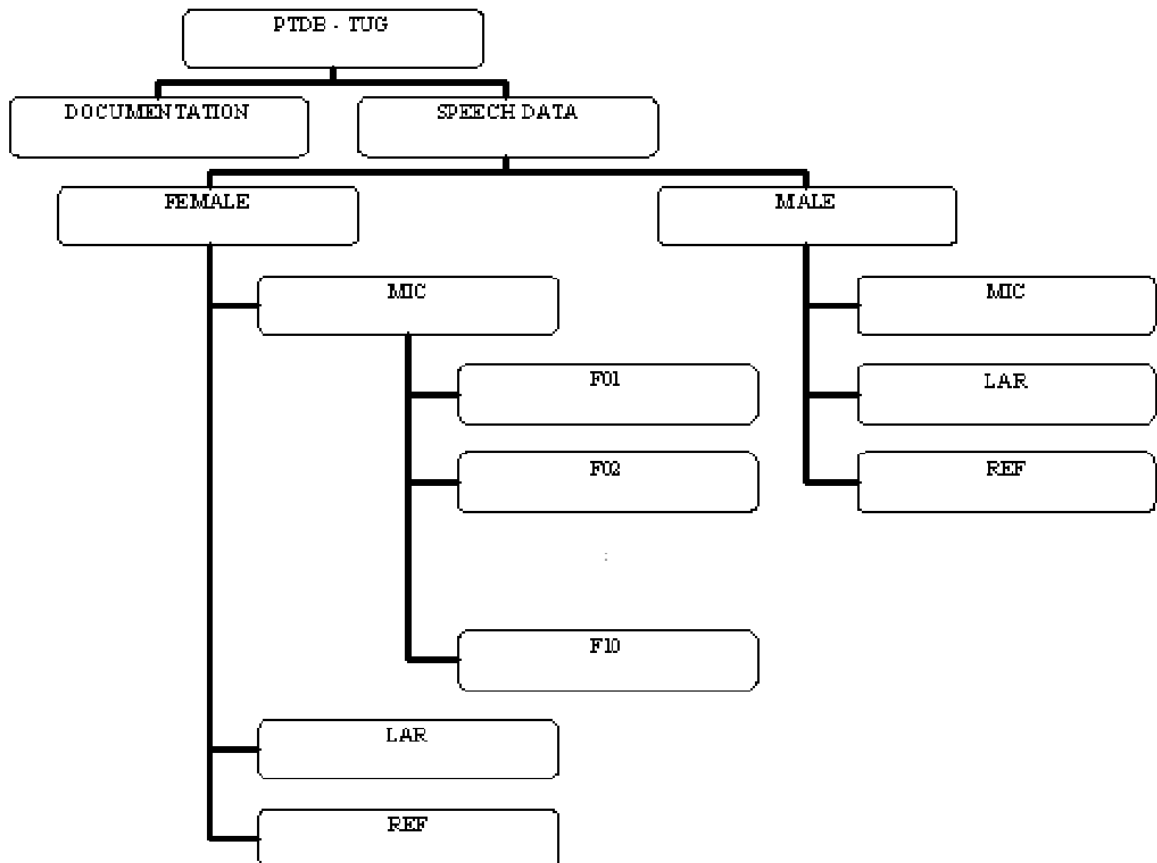


Figure 7.1: Database structure; [31].

7.3 File Naming Convention

All file names are composed by the *Data source*, the *Speaker ID* and the *Sentence ID* as described in the table below.

File ID	[Data source]_[Speaker ID]_[Sentence ID]
Data source	mic ... microphone signal lar ... laryngograph signal ref ... reference pitch trajectory
Speaker ID	[Sex] [Speaker number]
Sex	F ... female, M ... male
Sentence ID	adopted from the TIMIT prompts according to Section 5.2

Table 7.1: Database file naming convention; taken from [31] and slightly modified.

7.4 Validation

The quality of the PTDB-TUG data was validated in-house at the SPSC Lab and a validation report was written [28]. The database has been tested with respect to completeness, compliance to specification and signal quality. This report concludes as follows [28]: *The Pitch Tracking Database from Graz University of Technology (PTDB-TUG) was validated against its documentation. A number of automatic tests including completeness, readability, and parsability were successfully performed, revealing two slightly corrupt audio signal files. Furthermore, manual inspections of documentation, meta-data, transcriptions, and the lexicon were done, which showed minor shortcomings that can be improved without much effort.*

The PTDB-TUG database is in a usable state.

Distribution: The database is released on the website of the SPSC Lab. The PTDB-TUG is designated for research purposes and available free of charge.

Part III

Application of the Database

8 Evaluation of Multipitch Tracking Algorithms

The multipitch tracking algorithm from [43] was evaluated on PDTB-TUG data and compared to the method from Wu et al. [45]. First, the two quite different approaches for multipitch tracking are introduced. Subsequently, the method of evaluation is explained and the results are presented (already published in [30]).

8.1 Correlogram-based Algorithm

Wu et al. [45] propose an algorithm for multipitch tracking of speech in a noisy environment. The basic idea of the method is to split the input speech signal into several channels according to an auditory perception model in order to compute the normalized autocorrelation function (NACF) for each channel and to extract pitch tracks out of the periodicity information by means of (mostly) probabilistic methods.

Initially the algorithm uses a gammatone filterbank as a model for cochlear filtering. In this way 128 sub-bands are extracted from the speech signal, which are subdivided into low-frequency channels up to center frequencies of 800Hz and high-frequency channels for frequencies above this value. For the high-frequency channels the envelopes are extracted. The NACF is determined for each channel. After that the reliable channels (and peaks), which are less affected by noise, are selected differently for the two kinds of channels. In the low-frequency channel-correlograms the maximum value of all nonzero lag peaks has to exceed a certain threshold. High-frequency channel-correlograms have to show a certain consistency of peak time lags to correlograms using a larger window size (periodicity information). All peaks of selected low-frequency channels are considered in the further calculation. For the selected high-frequency channels an additional peak selection is carried out using two different approaches. On the one hand, peaks are only accepted if there is a second corresponding peak within a small interval around the double time lag of the peak of interest. On the other hand, for peaks at the smallest nonzero time lag with a certain amplitude value all (multiple) harmonics are rejected in order to minimize errors. By means of a statistical analysis of the relation between these selected peaks and some true pitch periods the probability of a single channel to support a pitch period hypothesis is derived. This

is carried out channel-wise for all time frames with one or two pitch period values. Subsequently, the periodicity information within all channels is integrated. Given a pitch hypothesis of zero, one or two pitch periods a conditional probability of observing the selected peaks is calculated. Finally, continuous pitch tracks are generated by using a hidden Markov model (HMM) and by applying the Viterbi algorithm [18]. The great benefit of this correlogram-based method is its extreme accuracy in estimating pitch. However, the connection of pitch estimates to their corresponding source, i.e. the speaker assignment, is imprecise [45].

8.2 Probabilistic Algorithm

The multipitch tracker from Wohlmayr et al. [43] is a probabilistic approach. Unlike the former presented method, which uses heuristics like peak and channel selection, this algorithm incorporates such information in the statistical model. Another important difference to the first approach is the necessity to learn from training data beforehand in order to preset specific parameters. The method described here is composed of the following modules:

Individual spectrograms of each single speaker are represented by means of Gaussian mixture models (GMMs), whereby the minimum description length (MDL) criterion serves to get the optimal number of Gaussian components. GMMs have to be trained, which can be accomplished in two ways. On the one hand, by means of data from many different speakers speaker independent (SI) models can be established. On the other hand, it is possible to obtain speaker dependent (SD) models, using data only of one particular speaker. In general SD models yield better results in terms of both pitch estimation and correct assignment of a pitch track to the corresponding speaker. The results presented in Chapter 8.5 agree with this fact.

The observed speech mixture of both speakers is transformed into a probabilistic representation by using a MIXMAX speaker interaction model [25]. It is assumed that each time-frequency bin of a speech mixture spectrogram is dominated by one speaker. Therefore, the log-spectrum of the two speaker mixture can be approximated by the element-wise maximum of the two single speaker log-spectra. Alternatively to the MIXMAX speaker interaction model, also a linear interaction model can be used [43].

In both cases a statistical speaker interaction model is obtained, which can then be used within the framework of factorial hidden Markov models (FHMMs) [12]. Each hidden Markov process in the FHMMs models one pitch trajectory for each speaker. The observed speech mixture is considered as a joint effect of the individual Markov processes. In contrast to an HMM the explicit factorial characteristic among multiple Markov chains enables the application of more

efficient inference algorithms. Exact inference mechanisms are employed in order to obtain the pitch tracks.

8.3 Experimental Setup

For the sake of simplicity the correlogram-based algorithm and the FHMM-based algorithm will be abbreviated as CORR and FHMM, respectively. The empirical comparison is restricted to the case of two simultaneously talking persons. Consequently, speech mixtures of signals stemming from four different female (F) and male (M) speakers, namely F01, F07, M04 and M10, are made at a signal-to-signal ratio of $0dB$. Note that the spoken content (*sx* and *si*) does not overlap (see Table 5.1). Particularly, 10 *sx* and *si sentences* from each subject are used to evaluate both methods. The 6 speaker pairs (M10-M04, M10-F07, M10-F01, M04-F07, M04-F01 and F07-F01) and the 10 sentences per speaker result in $6 \cdot 10 \cdot 10 = 600$ speech mixtures in total. As already mentioned, the FHMM model has to be parameterized and this is done in both ways, in a speaker dependent (SD) and speaker independent (SI) fashion. For training the SD model the remaining 224 *sx* and *si sentences* of the four chosen speakers are utilized. The SI model is trained on the whole data of M01, M05, M06, M07, M08, M09 F02, F04, F05, F06, F08 and F10. Since the FHMM-method has a measurement range from $80Hz$ to $500Hz$ there can be a problem in particular with very low-pitched male voices. Therefore, speakers M02 and M03 as well as F03 and F09 (for reasons of balance) are not considered in the evaluation. Moreover, all used recordings are shortened in time, i.e. the sentences are only taken from $70ms$ before until $70ms$ after detected pitch values. The resulting time-domain speech mixtures served as input signals for the CORR. The FHMM, however, requires the log-spectrogram of the test speech mixtures. After down-sampling the shortened signals at a sampling frequency of $16kHz$, a 1024-point FFT is calculated using a Hamming window with a length of $32ms$ and a step size of $10ms$. The 64-dimensional observation vectors containing the spectral bins number 2 to 65, captures frequencies up to $1000Hz$. Pitch tracking is performed by using the likelihood pruning mechanisms as proposed in [42] [30].

8.4 Performance Measurement

The performance of the two algorithms is determined with the error measure E_{Total} , which includes gross and fine pitch determination errors as well as misclassification in terms of voicing and speaker assignment [43]. In principle, it is determined in a similar manner as the error mea-

surement presented in [45], which is based on the guidelines established for single pitch tracking (see Section 3.6), but supplemented by speaker assignment error measures. Each algorithm produces the two estimated pitch trajectories $\tilde{f}_0^1[t]$ and $\tilde{f}_0^2[t]$ per speech mixture. The assignment of these estimated pitch trajectories to the provided ground truth or reference trajectories $f_0^1[t]$ and $f_0^2[t]$ leads to two possibilities:

1. $\tilde{f}_0^1[t] \rightarrow f_0^1[t]; \tilde{f}_0^2[t] \rightarrow f_0^2[t]$ or
2. $\tilde{f}_0^1[t] \rightarrow f_0^2[t]; \tilde{f}_0^2[t] \rightarrow f_0^1[t]$.

The assignment with the smaller quadratic error over all time frames is selected. Thus the assignment is selected globally for the whole pitch track. Furthermore, a pitch frequency deviation for each reference pitch trajectory is calculated frame-wise as follows:

$$\Delta f_0^i[t] = \frac{|\tilde{f}_0^i[t] - f_0^i[t]|}{f_0^i[t]}.$$

The overall error is determined according to

$$E_{Total} = E_{01} + E_{02} + E_{10} + E_{12} + E_{20} + E_{21} + E_{Gross} + E_{Fine} + E_{Perm},$$

where E_{ij} ($i \neq j$) is the percentage of time frames that is misclassified in terms of the count of present pitch values. A time frame may include zero, one or two pitch values. Since $i \in \{0, 1, 2\}$ denotes the actual number of present pitch points and $j \in \{0, 1, 2\}$ denotes the estimated number of pitch points, E_{12} is the percentage of time frames including one pitch value but misclassified as including two pitch values. Hence, these kinds of errors deal with incorrect voicing decisions. The permutation error E_{Perm} measures wrong speaker assignments in case of right voicing decision for both estimates. It is assumed that for a specific ground truth trajectory a pitch frequency deviation $\Delta f_0^i[t]$ of more than 20% in combination with a $\Delta f_0^j[t]$ less than 20% for the other ground truth pitch trajectory indicates a permutation of pitch estimates. E_{Perm} is the percentage of time frames with such an error found for either of the two ground truth pitch trajectories. Again for each reference pitch track a gross detection error denotes the percentage of time frames with a pitch frequency deviation larger than 20%, in case of correct voicing decision and no permutation error. E_{Gross} is the total percentage with occurrence of an error in either of the two estimated pitch tracks. E_{Fine} is the overall percentage of pitch frequency deviation, averaged over frames with correct voicing decision and no permutation error in both of the two estimated pitch tracks. It is calculated as $E_{Fine}^1 + E_{Fine}^2$ [30].

8.5 Results

The performance of both pitch tracking algorithms in terms of the previously described conditions and error measures is illustrated in Figure 8.1. For the six speaker pairs, M10-M04, M10-F07, M10-F01, M04-F07, M04-F01 and F07-F01, the total error E_{Total} and its corresponding standard deviation are shown. The calculation of E_{Total} incorporates all 600 test speech mixtures and is determined for both parameterization cases, speaker dependent and speaker independent FHMMs as well as for the CORR algorithm [30].

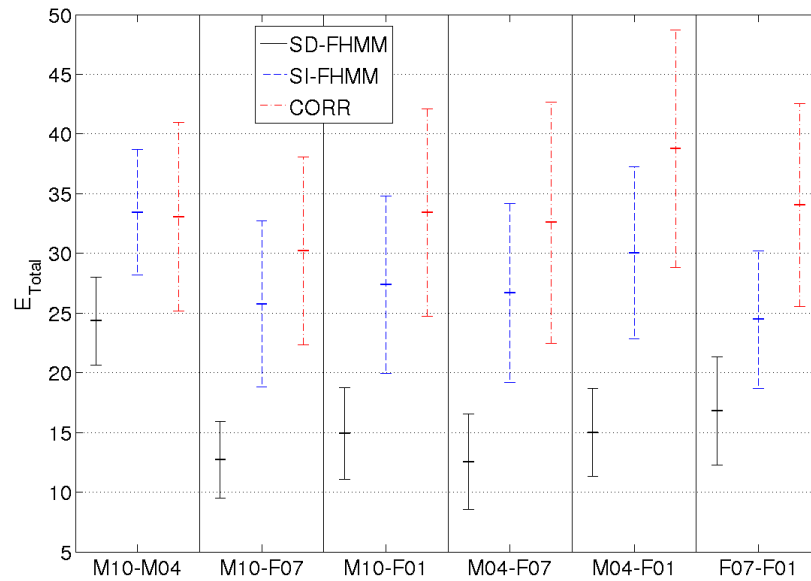


Figure 8.1: Total error for six speaker pairs tested on 600 speech mixtures; Under test: The correlogram-based multipitch tracking method (CORR) and the speaker dependent and independent FHMM-based multipitch tracking models (SD-FHMM and SI-FHMM, respectively) [30].

In general, both SD-FHMM and SI-FHMM show a better pitch tracking performance than CORR regarding E_{Total} . Almost all six SI-FHMM results slightly outperform the ones of CORR. Even more clearly is the difference between CORR and SD-FHMM. Figure 8.2 shows the pitch tracking result for each method with respect to one specific test speech mixture. Compared to the ground truth pitch tracks depicted in the log-spectrogram in Figure 8.2(i), it is apparent that the great strength of the FHMM algorithm lies in the speaker assignment. The SD-FHMM model which includes training on speaker dependent data yields the best result. The CORR method does not require any parameterization in advance [30].

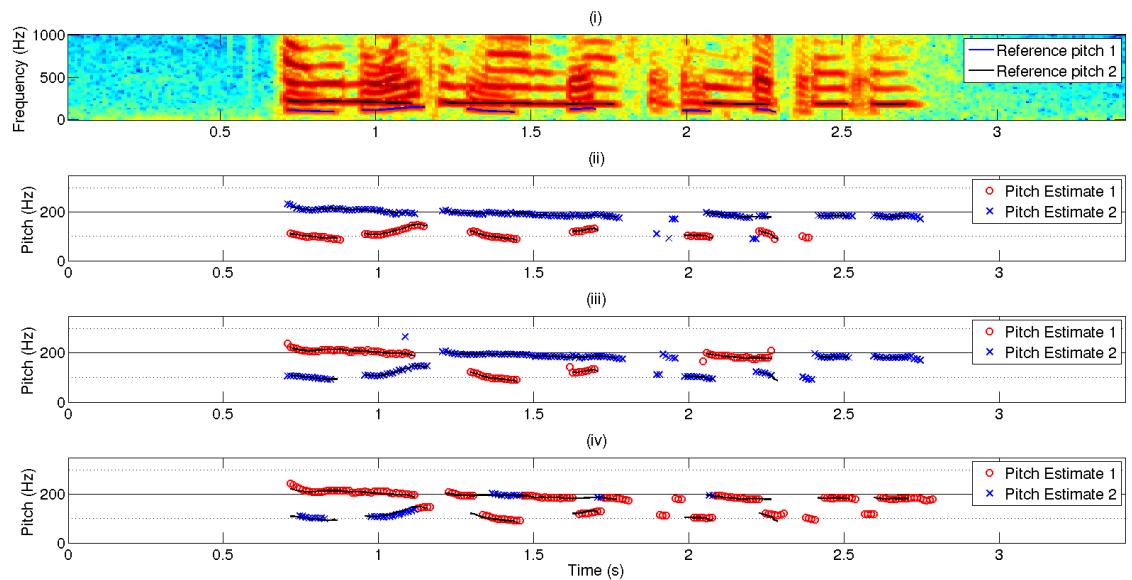


Figure 8.2: Pitch tracking example for one speech mixture; (i) Log-spectrogram of speech mixture with reference pitch tracks; (ii) Estimated pitch tracks with reference pitch using SD-FHMMs ($E_{Total} = 9.9677$); (iii) Estimated pitch tracks with reference pitch using SI-FHMMs ($E_{Total} = 24.0397$); (iv) Estimated pitch tracks with reference pitch using CORR ($E_{Total} = 28.5585$) [30].

9 Conclusion

In this thesis, the PTDB-TUG, a speech database for multipitch tracking, is presented. It contains 4720 recordings of read speech, which were uttered from 20 English native speakers. The text material comes from the TIMIT corpus, which comprises 2342 phonetically balanced sentences. All recordings were performed by both microphone and laryngograph in a recording studio. In addition, reference pitch tracks are provided. The final pitch tracking database is published on the website of the SPSC Lab and dedicated to research purposes.

Moreover, most of this data is utilized to evaluate two different multipitch determination approaches on mixtures of two utterances. The probabilistic approach including FHMMs and speaker interaction models developed at the SPSC Lab requires model training, either speaker dependent (SD) or speaker independent (SI). The correlogram-based method works without training. Evaluation shows that the SI-trained FHMM-based model yields slightly better results than the correlogram-based approach. SD-trained FHMM models achieve considerably better performance than the correlogram-based algorithm. The main reason for the good performance of the SD-FHMM is the mostly correct speaker assignment.

Part IV

Appendix

A TIMIT Sentences

This is a list of all 2342 TIMIT sentences.

; File: prompts.txt, updated 10/31/88

;

; Prompt form of each TIMIT sentence-text followed by sentence type and number.

; Lines beginning with a semicolon are comments and should be ignored on

; searches.

;

She had your dark suit in greasy wash water all year. (sa1)
 Don't ask me to carry an oily rag like that. (sa2)
 This was easy for us. (sx3)
 Jane may earn more money by working hard. (sx4)
 She is thinner than I am. (sx5)
 Bright sunshine shimmers on the ocean. (sx6)
 Nothing is as offensive as innocence. (sx7)
 Why yell or worry over silly items? (sx8)
 Where were you while we were away? (sx9)
 Are your grades higher or lower than Nancy's? (sx10)
 He will allow a rare lie. (sx11)
 Will Robin wear a yellow lily? (sx12)
 Swing your arm as high as you can. (sx13)
 Before Thursday's exam, review every formula. (sx14)
 The museum hires musicians every evening. (sx15)
 A roll of wire lay near the wall. (sx16)
 Carl lives in a lively home. (sx17)
 Alimony harms a divorced man's wealth. (sx18)
 Aluminum silverware can often be flimsy. (sx19)
 She wore warm, fleecy, woolen overalls. (sx20)
 Alfalfa is healthy for you. (sx21)
 When all else fails, use force. (sx22)
 Those musicians harmonize marvelously. (sx23)
 Although always alone, we survive. (sx24)
 Only lawyers love millionaires. (sx25)
 Most young rise early every morning. (sx26)
 Did dad do academic bidding? (sx27)
 Beg that guard for one gallon of gas. (sx28)
 Help Greg to pick a peck of potatoes. (sx29)
 Get a calico cat to keep. (sx30)
 A good attitude is unbeatable. (sx31)
 It's fun to roast marshmallows on a gas burner. (sx32)
 Coconut cream pie makes a nice dessert. (sx33)
 Don't do Charlie's dirty dishes. (sx34)
 Help celebrate your brother's success. (sx35)
 Only the most accomplished artists obtain popularity. (sx36)
 Critical equipment needs proper maintenance. (sx37)
 Young people participate in athletic activities. (sx38)
 Barb's gold bracelet was a graduation present. (sx39)
 Stimulating discussions keep students' attention. (sx40)
 Etiquette mandates compliance with existing regulations. (sx41)
 Biblical scholars argue history. (sx42)
 Elderly people are often excluded. (sx43)
 Basketball can be an entertaining sport. (sx44)
 Addition and subtraction are learned skills. (sx45)
 That pickpocket was caught red-handed. (sx46)
 Mom strongly dislikes appetizers. (sx47)
 Grandmother outgrew her upbringing in petticoats. (sx48)
 At twilight on the twelfth day we'll have Chablis. (sx49)
 Catastrophic economic cutbacks neglect the poor. (sx50)
 Ambidextrous pickpockets accomplish more. (sx51)
 Her classical performance gained critical acclaim. (sx52)
 Even a simple vocabulary contains symbols. (sx53)
 The eastern coast is a place for pure pleasure and excitement. (sx54)
 The lack of heat compounded the tenant's grievances. (sx55)
 Academic aptitude guarantees your diploma. (sx56)
 The prowl wore a ski mask for disguise. (sx57)
 We experience distress and frustration obtaining our degrees. (sx58)
 The singer's finger had a splinter. (sx59)
 The legislature met to judge the state of public education. (sx60)
 Chocolate and roses never fail as a romantic gift. (sx61)
 Any contributions will be greatly appreciated. (sx62)
 Continental drift is a geological theory. (sx63)
 Regular attendance is seldom required. (sx64)
 Challenge each general's intelligence. (sx65)
 We got drenched from the uninterrupted rain. (sx66)
 Last year's gas shortage caused steep price increases. (sx67)
 Upgrade your status to reflect your wealth. (sx68)
 Eat your raisins outdoors on the porch steps. (sx69)
 Did you eat yet? (sx70)
 Porcupines resemble sea urchins. (sx71)
 Spring Street is straight ahead. (sx72)
 Cliff's display was misplaced on the screen. (sx73)
 An official deadline cannot be postponed. (sx74)
 Fill that canteen with fresh spring water. (sx75)
 Gently place Jim's foam sculpture in the box. (sx76)
 Bagpipes and bongos are musical instruments. (sx77)
 Doctors prescribe drugs too freely. (sx78)
 Will you please describe the idiotic predicament. (sx79)
 It's illegal to postdate a check. (sx80)
 It's impossible to deal with bureaucracy. (sx81)
 Good service should be rewarded by big tips. (sx82)
 My instructions desperately need updating. (sx83)
 Cooperation along with understanding alleviate dispute. (sx84)
 Cement is measured in cubic yards. (sx85)
 Hispanic costumes are quite colorful. (sx86)
 Primitive tribes have an upbeat attitude. (sx87)
 Flying standby can be practical if you want to save money. (sx88)
 It's hard to tell an original from a forgery. (sx89)
 The Thinker is a famous sculpture. (sx90)
 The misprint provoked an immediate disclaimer. (sx91)
 A large household needs lots of appliances. (sx92)
 Cut a small corner off each edge. (sx93)
 Youngsters love common candy as treats. (sx94)
 Iguanas and alligators are tropical reptiles. (sx95)
 Masquerade parties tax one's imagination. (sx96)
 Penguins live near the icy Antarctic. (sx97)
 Guess the question from the answer. (sx98)
 Medieval society was based on hierarchies. (sx99)
 Project development was proceeding too slowly. (sx100)
 Kindergarten children decorate their classrooms for all holidays. (sx101)
 Special task forces rescue hostages from kidnappers. (sx102)
 Call an ambulance for medical assistance. (sx103)
 He stole a dime from a beggar. (sx104)
 You must explicitly delete files. (sx105)
 A huge tapestry hung in her hallway. (sx106)
 Birthday parties have cupcakes and ice cream. (sx107)
 His scalp was blistered from today's hot sun. (sx108)
 She slipped and sprained her ankle on the steep slope. (sx109)
 The best way to learn is to solve extra problems. (sx110)
 His sudden departure shocked the cast. (sx111)
 Tugboats are capable of hauling huge loads. (sx112)
 A muscular abdomen is good for your back. (sx113)
 The cartoon features a muskrat and a tadpole. (sx114)
 The emblem depicts the Acropolis all aglow. (sx115)
 Clasp the screw in your left hand. (sx116)
 The mango and the papaya are in a bowl. (sx117)
 Combine all the ingredients in a large bowl. (sx118)
 The misquote was retracted with an apology. (sx119)
 The coyote, bobcat, and hyena are wild animals. (sx120)
 Trespassing is forbidden and subject to penalty. (sx121)
 Encyclopedias seldom present anecdotal evidence. (sx122)
 A screwdriver is made from vodka and orange juice. (sx123)
 Objects made of pewter are beautiful. (sx124)
 Westchester is a county in New York. (sx125)
 Artificial intelligence is for real. (sx126)
 The emperor had a mean temper. (sx127)
 Lots of foreign movies have subtitles. (sx128)
 Angora cats are furrrier than Siamese. (sx129)
 He ate four extra eggs for breakfast. (sx130)
 We plan to build a new beverage plant. (sx131)
 Publicity and notoriety go hand in hand. (sx132)
 Pizzerias are convenient for a quick lunch. (sx133)
 December and January are nice months to spend in Miami. (sx134)
 Technical writers can abbreviate in bibliographies. (sx135)
 Scientific progress comes from the development of new techniques. (sx136)
 Tradition requires parental approval for under-age marriage. (sx137)
 The clumsy customer spilled some expensive perfume. (sx138)
 The bungalow was pleasantly situated near the shore. (sx139)
 Agricultural products are unevenly distributed. (sx140)
 Pledge to participate in Nevada's aquatic competition. (sx141)
 Which long article was opaque and needed clarification? (sx142)
 The sound of Jennifer's bugle scared the antelope. (sx143)
 The willow woman wore a muskrat coat. (sx144)
 Too much curiosity can get you into trouble. (sx145)
 Cyclical programs will never compile. (sx146)
 Correct execution of my instructions is crucial. (sx147)
 Most precincts had a third of the votes counted. (sx148)
 While waiting for Chipper she crisscrossed the square many times. (sx149)

- Vietnamese cuisine is exquisite. (sx150)
 The previous speaker presented ambiguous results. (sx151)
 Mosquitoes exist in warm, humid climates. (sx152)
 Scholastic aptitude is judged by standardized tests. (sx153)
 Orange juice tastes funny after toothpaste. (sx154)
 The water contained too much chlorine and stung his eyes. (sx155)
 Our experiment's positive outcome was unexpected. (sx156)
 Remove the splinter with a pair of tweezers. (sx157)
 The drunkard is a social outcast. (sx158)
 The government sought authorization of his citizenship. (sx159)
 As coauthors, we presented our new book to the haughty audience. (sx160)
 As a precaution, the outlaws bought gunpowder for their stronghold. (sx161)
 Her auburn hair reminded him of autumn leaves. (sx162)
 They remained lifelong friends and companions. (sx163)
 Curiosity and mediocrity seldom coexist. (sx164)
 The easygoing zoologist relaxed throughout the voyage. (sx165)
 Biologists use radioactive isotopes to study microorganisms. (sx166)
 Employee layoffs coincided with the company's reorganization. (sx167)
 Who took the kayak down the bayou? (sx168)
 How would you evaluate this algebraic expression? (sx169)
 The Mayan neoclassic scholar disappeared while surveying ancient ruins. (sx170)
 The diagnosis was discouraging; however, he was not overly worried. (sx171)
 The triumphant warrior exhibited naive heroism. (sx172)
 Whoever cooperates in finding Nan's cameo will be rewarded. (sx173)
 The haunted house was a hit due to outstanding audio-visual effects. (sx174)
 Severe myopia contributed to Ron's inferiority complex. (sx175)
 Buying a thoroughbred horse requires intuition and expertise. (sx176)
 Does Creole cooking use curry? (sx177)
 She encouraged her children to make their own Halloween costumes. (sx178)
 We could barely see the fjords through the snow flurries. (sx179)
 Almost all colleges are now coeducational. (sx180)
 Rich looked for spotted hyenas and jaguars on the safari. (sx181)
 Thick glue oozed out of the tube. (sx182)
 Why else would Danny allow others to go? (sx183)
 The cat's meow always hurts my ears. (sx184)
 Did you buy any corduroy overalls? (sx185)
 Would a tomboy often play outdoors? (sx186)
 They often go out in the evening. (sx187)
 Who authorized the unlimited expense account? (sx188)
 Destroy every file related to my audits. (sx189)
 Serve the coleslaw after I add the oil. (sx190)
 Withdraw all phony accusations at once. (sx191)
 Straw hats are out of fashion this year. (sx192)
 Why buy oil when you always use mine? (sx193)
 They enjoy it when I audition. (sx194)
 Would you allow acts of violence? (sx195)
 How do oysters make pearls? (sx196)
 Draw each graph on a new axis. (sx197)
 Norwegian sweaters are made of lamb's wool. (sx198)
 Young children should avoid exposure to contagious diseases. (sx199)
 Ralph controlled the stopwatch from the bleachers. (sx200)
 Approach your interview with statuesque composure. (sx201)
 How much allowance do you get? (sx202)
 The causeway ended abruptly at the shore. (sx203)
 Even I occasionally get the Monday blues! (sx204)
 Military personnel are expected to obey government orders. (sx205)
 When peeling an orange, it is hard not to spray juice. (sx206)
 Do you hear the sleigh bells ringing? (sx207)
 Rob sat by the pond and sketched the stray geese. (sx208)
 Michael colored the bedroom wall with crayons. (sx209)
 Jeff's toy go-cart never worked! (sx210)
 Only the best players enjoy popularity. (sx211)
 I gave them several choices and let them set the priorities. (sx212)
 The news agency hired a great journalist. (sx213)
 The morning dew on the spider web glistened in the sun. (sx214)
 The sermon emphasized the need for affirmative action. (sx215)
 The small boy put the worm on the hook. (sx216)
 How permanent are their records? (sx217)
 Try to recall the events in chronological order. (sx218)
 Nonprofit organizations have frequent fund raisers. (sx219)
 The most recent geological survey found seismic activity. (sx220)
 Cory attacked the project with extra determination. (sx221)
 You always come up with pathological examples. (sx222)
 Put the butcher block table in the garage. (sx223)
 How good is your endurance? (sx224)
 Keep the thermometer under your tongue! (sx225)
 Steph could barely handle the psychological trauma. (sx226)
 It's healthier to cook without sugar. (sx227)
 The viewpoint overlooked the ocean. (sx228)
 Are you looking for employment? (sx229)
 Allow leeway here, but rationalize all errors. (sx230)
 I honor my mom. (sx231)
 His failure to open the store by eight cost him his job. (sx232)
 Highway and freeway mean the same thing. (sx233)
 The paper boy bought two apples and three ices. (sx234)
 I itemize all accounts in my agency. (sx235)
 Clear pronunciation is appreciated. (sx236)
 The courier was a dwarf. (sx237)
 A doctor was in the ambulance with the patient. (sx238)
 Puree some fruit before preparing the skewers. (sx239)
 It's not easy to create illuminating examples. (sx240)
 The hallway opens into a huge chamber. (sx241)
 May I order a strawberry sundae after I eat dinner? (sx242)
 They all agree that the essay is barely intelligible. (sx243)
 Herb's birthday occurs frequently on Thanksgiving. (sx244)
 Does Hindu ideology honor cows? (sx245)
 How ancient is this subway escalator? (sx246)
 The cigarettes in the clay ashtray overflowed onto the oak table. (sx247)
 Reading in poor light gives you eyestrain. (sx248)
 I ate every oyster on Nora's plate. (sx249)
 The Boston Ballet overcame their funding shortage. (sx250)
 We apply auditory modeling to computer speech recognition. (sx251)
 The gorgeous butterfly ate a lot of nectar. (sx252)
 By eating yogurt, you may live longer. (sx253)
 Do they allow atheists in church? (sx254)
 My ideal morning begins with hot coffee. (sx255)
 The irate actor stomped away idiotically. (sx256)
 We are open every Monday evening. (sx257)
 The essay undeniably reflects our view ably. (sx258)
 Tornados often destroy acres of farm land. (sx259)
 Remember to allow identical twins to enter freely. (sx260)
 Do you have the yellow ointment ready? (sx261)
 Can the agency overthrow alien forces? (sx262)
 How oily do you like your salad dressing? (sx263)
 We saw eight tiny icicles below our roof. (sx264)
 The saw is broken, so chop the wood instead. (sx265)
 Withdraw only as much money as you need. (sx266)
 Draw every outer line first, then fill in the interior. (sx267)
 The jaw operates by using antagonistic muscles. (sx268)
 Do atypical farmers grow oats? (sx269)
 Are holiday aprons available to us? (sx270)
 Be careful not to plow over the flower beds. (sx271)
 Allow each child to have an ice pop. (sx272)
 The angry boy answered but didn't look up. (sx273)
 Cliff was soothed by the luxurious massage. (sx274)
 Steve wore a bright red cashmere sweater. (sx275)
 John's brother repainted the garage door. (sx276)
 The rose corsage smelled sweet. (sx277)
 To further his prestige, he occasionally reads the Wall Street Journal. (sx278)
 Alice's ability to work without supervision is noteworthy. (sx279)
 The oasis was a mirage. (sx280)
 Cory and Trish played tag with beach balls for hours. (sx281)
 The tooth fairy forgot to come when Roger's tooth fell out. (sx282)
 Planned parenthood organizations promote birth control. (sx283)
 Jeff thought you argued in favor of a centrifuge purchase. (sx284)
 Rich purchased several signed lithographs. (sx285)
 In every major cloverleaf, traffic sometimes gets backed up. (sx286)
 In the long run, it pays to buy quality clothing. (sx287)
 Brush fires are common in the dry underbrush of Nevada. (sx288)
 Weatherproof galoshes are very useful in Seattle. (sx289)
 This brochure is particularly informative for a prospective buyer. (sx290)
 The avalanche triggered a minor earthquake. (sx291)
 These exclusive documents must be locked up at all times. (sx292)
 Please take this dirty table cloth to the cleaners for me. (sx293)
 Should giraffes be kept in small zoos? (sx294)
 If Carol comes tomorrow, have her arrange for a meeting at two. (sx295)
 The two artists exchanged autographs. (sx296)
 Rock-and-roll music has a great rhythm. (sx297)
 I'd rather not buy these shoes than be overcharged. (sx298)
 Shaving cream is a popular item on Halloween. (sx299)
 Amoebas change shape constantly. (sx300)
 We like bleu cheese but Victor prefers swiss cheese. (sx301)
 Tofu is made from processed soybeans. (sx302)
 The bluejay flew over the high building. (sx303)
 Cheap stockings run the first time they're worn. (sx304)
 Cottage cheese with chives is delicious. (sx305)
 A chosen few will become Generals. (sx306)
 The meeting is now adjourned. (sx307)
 Shipbuilding is a most fascinating process. (sx308)
 The proof that you are seeking is not available in books. (sx309)
 The hood of the jeep was steaming in the hot sun. (sx310)
 My desires are simple: give me one informative paragraph on the subject. (sx311)
 Those answers will be straightforward if you think them through carefully first. (sx312)
 Drop five forms in the box before you go out. (sx313)
 If people were more generous, there would be no need for welfare. (sx314)
 Bob found more clams at the ocean's edge. (sx315)
 That dog chases cats mercilessly. (sx316)
 The cranberry bog gets very pretty in Autumn. (sx317)
 Please dig my potatoes up before frost. (sx318)
 A big goat idly ambled through the farmyard. (sx319)
 The nearest synagogue may not be within walking distance. (sx320)
 The groundhog clearly saw his shadow, but stayed out only a moment. (sx321)
 A leather handbag would be a suitable gift. (sx322)
 The fog prevented them from arriving on time. (sx323)
 The local drugstore was charged with illegally dispensing tranquilizers. (sx324)
 The full moon shone brightly that night. (sx325)
 Steve collects rare and novel coins. (sx326)
 Al received a joint appointment in the biology and the engineering departments. (sx327)
 Gregory and Tom chose to watch cartoons in the afternoon. (sx328)

Chip postponed alimony payments until the latest possible date. (sx329)

Count the number of teaspoons of soysauce that you add. (sx330)

The big dog loved to chew on the old rag doll. (sx331)

Todd placed top priority on getting his bike fixed. (sx332)

An adult male baboon's teeth are not suitable for eating shellfish. (sx333)

Often you'll get back more than you put in. (sx334)

Gus saw pine trees and redwoods on his walk through Sequoia National Forest. (sx335)

Rob made Hungarian goulash for dinner and gooseberry pie for dessert. (sx336)

Bob bandaged both wounds with the skill of a doctor. (sx337)

The dark, murky lagoon wound around for miles. (sx338)

Did Shawn catch that big goose without help? (sx339)

Ducks have webbed feet and colorful feathers. (sx340)

The high security prison was surrounded by barbed wire. (sx341)

Take charge of choosing her bride's maids' gowns. (sx342)

The frightened child was gently subdued by his big brother. (sx343)

I know I didn't meet her early enough. (sx344)

Trish saw hours and hours of movies Saturday. (sx345)

The barracuda recoiled from the serpent's poisonous fangs. (sx346)

The patient and the surgeon are both recuperating from the lengthy operation. (sx347)

I'll have a scoop of that exotic purple and turquoise sherbet. (sx348)

The preschooler couldn't verbalize her feelings about the emergency conditions. (sx349)

Many wealthy tycoons splurged and bought both a yacht and a schooner. (sx350)

The new suburbanites worked hard on refurbishing their older home. (sx351)

According to my interpretation of the problem, two lines must be perpendicular. (sx352)

A connoisseur will enjoy this shellfish dish. (sx353)

A lawyer was appointed to execute her will. (sx354)

Dolphins are intelligent marine mammals. (sx355)

Diane may splurge and buy a turquoise necklace. (sx356)

The moisture in my eyes is from eyedrops, not from tears. (sx357)

George seldom watches daytime movies. (sx358)

The system may break down soon, so save your files frequently. (sx359)

I assume moisture will damage this ship's hull. (sx360)

The speech symposium might begin Monday. (sx361)

The annoying raccoons slipped into Phil's garden every night. (sx362)

The cow wandered from the farmland and became lost. (sx363)

Each untimely income loss coincided with the breakdown of a heating system part. (sx364)

The gunman kept his victim cornered at gunpoint for three hours. (sx365)

Will you please confirm government policy regarding waste removal? (sx366)

The surplus shoes were sold at a discount price. (sx367)

Lori's costume needed black gloves to be completely elegant. (sx368)

Bob papered over the living room murals. (sx369)

That noise problem grows more annoying each day. (sx370)

Right now may not be the best time for business mergers. (sx371)

That diagram makes sense only after much study. (sx372)

A boring novel is a superb sleeping pill. (sx373)

John cleans shellfish for a living. (sx374)

Growing well-kept gardens is very time consuming. (sx375)

Women may never become completely equal to men. (sx376)

She always jokes about too much garlic in his food. (sx377)

I just saw Jim near the new archeological museum. (sx378)

Pam gives driving lessons on Thursdays. (sx379)

Why charge money for such garbage? (sx380)

We welcome many new students each year. (sx381)

George is paranoid about a future gas shortage. (sx382)

The carpet cleaners shampooed our oriental rug. (sx383)

Please shorten this skirt for Joyce. (sx384)

His shoulder felt as if it were broken. (sx385)

Which church do the Smiths worship in? (sx386)

The giant redwoods shimmered in the glistening sun. (sx387)

Her right hand aches whenever the barometric pressure changes. (sx388)

They own a big house in the remote countryside. (sx389)

He picked up nine pairs of socks for each brother. (sx390)

They all like long hot showers. (sx391)

A young mouse scampered across the field and disappeared. (sx392)

She uses both names interchangeably. (sx393)

Calcium makes bones and teeth strong. (sx394)

I took her word for it, but is she really going with you? (sx395)

The fish began to leap frantically on the surface of the small lake. (sx396)

Tim takes Sheila to see movies twice a week. (sx397)

Children can consume many fruit candies in one sitting. (sx398)

They assume no burglar will ever enter here. (sx399)

Just drop notices in any suggestion box. (sx400)

The taxicab broke down and caused a traffic jam. (sx401)

We'll serve rhubarb pie after Rachel's talk. (sx402)

Her wardrobe consists of only skirts and blouses. (sx403)

Barb burned paper and leaves in a big bonfire. (sx404)

Of course you can have another tuna sandwich. (sx405)

There was a gigantic wasp next to Irving's big top hat. (sx406)

Laugh, dance, and sing if fortune smiles upon you. (sx407)

I'd ride the subway, but I haven't enough change. (sx408)

Eating spinach nightly increases strength miraculously. (sx409)

Greg buys fresh milk each weekday morning. (sx410)

Butterscotch fudge goes well with vanilla ice cream. (sx411)

Gwen planted green beans in her vegetable garden. (sx412)

Daphne's Swedish needlepoint scarf matched her skirt. (sx413)

Irish youngsters eat fresh kippers for breakfast. (sx414)

Move the garbage nearer to the large window. (sx415)

A huge power outage rarely occurs. (sx416)

Valley Lodge yearly celebrates the first calf born. (sx417)

Iris thinks this zoo has eleven Spanish zebras. (sx418)

The football team coach has a watch thin as a dime. (sx419)

Seamstresses attach zippers with a thimble, needle, and thread. (sx420)

Those who teach values first abolish cheating. (sx421)

Once you finish greasing your chain, be sure to wash thoroughly. (sx422)

Smash lightbulbs and their cash value will diminish to nothing. (sx423)

Top zinnias rarely have crooked stems. (sx424)

Movies never have enough villains. (sx425)

A moth zig-zagged along the path through Otto's garden. (sx426)

Every cab needs repainting often. (sx427)

A crab challenged me, but a quick stab vanquished him. (sx428)

A toothpaste tube should be squeezed from the bottom. (sx429)

Those who are not purists use canned vegetables when making stew. (sx430)

The fifth jar contains big, juicy peaches. (sx431)

Coffee is grown on steep, jungle-like slopes in temperate zones. (sx432)

The overweight charmer could slip poison into anyone's tea. (sx433)

Each stag surely finds a big fawn. (sx434)

The rich should invest in black zircons instead of stylish shoes. (sx435)

Please sing just the club theme. (sx436)

They used an aggressive policeman to flag thoughtless motorists. (sx437)

Shell shock caused by shrapnel is sometimes cured through group therapy. (sx438)

That stinging vapor was caused by chloride vaporization. (sx439)

The advertising verse of Plymouth Variety Store never changes. (sx440)

Don't look for group valuables in a bank vault. (sx441)

Suburban housewives often suffer from the gab habit. (sx442)

A lone star shone in the early evening sky. (sx443)

The toddler found a clamshell near the camp site. (sx444)

What is this large thing by the ironing board? (sx445)

Thomas thinks a larger clamp solves the problem. (sx446)

First add milk to the shredded cheese. (sx447)

Spherical gifts are difficult to wrap. (sx448)

Ralph prepared red snapper with fresh lemon sauce for dinner. (sx449)

Roy ignored the spurious data points in drawing the graph. (sx450)

The thick elm forest was nearly overwhelmed by Dutch Elm Disease. (sx451)

In developing film, many toxic chemicals are used. (sx452)

Everything went real smooth, the sheriff said. (si453)

If you destroy confidence in banks, you do something to the economy, he said. (si454)

One validated acts of school districts. (si455)

Two other cases also were under advisement. (si456)

Both figures would go higher in later years. (si457)

This is not a program of socialized medicine. (si458)

He further proposed grants of an unspecified sum for experimental hospitals. (si459)

Nothing has been done yet to take advantage of the enabling legislation. (si460)

Day after day some new episode is reported. (si461)

It also provides for funds to clear slums and help colleges build dormitories. (si462)

The hotel owner shrugged. (si463)

The prospect of cutting back spending is an unpleasant one for any governor. (si464)

Nobody really expects to evacuate. (si465)

Then we'd really have someplace to go. (si466)

He really crucified him; he nailed it for a yard loss. (si467)

There is definitely some ligament damage in his knee. (si468)

In fact our whole defensive unit did a good job. (si469)

A quick touchdown resulted. (si470)

Suddenly my reflexes are gone. (si471)

He played basketball there while working toward a law degree. (si472)

Yet he remains the fiercest of competitors. (si473)

The golfing fathers ruled in his favor. (si474)

They will take a wedding trip later. (si475)

So, if anybody solicits by phone, make sure you mail the dough to the above. (si476)

Her position covers a number of daily tasks common to any social director. (si477)

The job also covers a number of other items. (si478)

The structures housing the apartments are of masonry and frame construction. (si479)

Range was a vital detail. (si480)

This, he added, brought about petty jealousies and petty personal grievances. (si481)

There was no confirmation of such massive assaults from independent sources. (si482)

The staff deserves a lot of credit working down here under real obstacles. (si483)

The family requests that flowers be omitted. (si484)

Both cars were slightly damaged. (si485)

It was time to go up myself. (si486)

"Cable confirmation", it said translated. (si487)

They make gin saws and deal in parts, supplies and some used gin machinery. (si488)

We must be ready for any needed sacrifice. (si489)
 Maybe it's taking longer to get things squared away than the bankers expected. (si490)
 Hiring the wife for one's company may win her tax-aided retirement income. (si491)
 So he hides the mayonnaise. (si492)
 Unfortunately, there is still little demand for broccoli and cauliflower. (si493)
 Bake slowly at least one-half hour longer. (si494)
 They either walked or were driven. (si495)
 They could walk, ride on a bus or be driven. (si496)
 Displayed as lamps, the puppets delight the children and are decorative accent. (si497)
 To create such a lamp, order a wired pedestal from any lamp shop. (si498)
 The scalloped edge is particularly appealing. (si499)
 There are more obvious nymphomaniacs on any private-eye series. (si500)
 But this doesn't detract from its merit as an interesting, if not great, film. (si501)
 And you think you have language problems. (si502)
 Very austere yet racy. (si503)
 Where do you put the lighter fluid, ha, ha? (si504)
 This excellent foreign bomb takes only six. (si505)
 They polished the windshield. (si506)
 Ideally, he knew, it should be preceded by concrete progress at lower levels. (si507)
 Mollusks are a case in point. (si508)
 This is a significant advance but its import should not be exaggerated. (si509)
 Adequate compensation is indispensable. (si510)
 This is a problem that goes considerably beyond questions of salary and tenure. (si511)
 It was most effective against trade unions. (si512)
 This is no surprising trait for a ballplayer. (si513)
 You're afraid to talk to a guy you idolize. (si514)
 Little geeing and hawing have been necessary. (si515)
 Some observers speculated that this might be his revenge on his home town. (si516)
 Confusion became chaos; each succeeding day brought new acts of violence. (si517)
 Higher toll rates also are helping boost revenues. (si518)
 That added traffic means rising streams of dimes and quarters at toll gates. (si519)
 Success, for many turnpikes, has come hard. (si520)
 Traffic frequently has failed to measure up to engineers' rosy estimates. (si521)
 Progress is being made, too, in improving motorists' access to many turnpikes. (si522)
 Under this law annual grants are given to systems in substantial amounts. (si523)
 Within a system, however, the autonomy of each member library is preserved. (si524)
 The desire and ability to read are important aspects of our cultural life. (si525)
 We congratulate the entire membership on its record of good legislation. (si526)
 The boost is helpful but inadequate. (si527)
 Thereupon followed a demonstration that tyranny knows no ideological confines. (si528)
 Wooded stream valleys in the folds of earth would be saved. (si529)
 His election, on the other hand, would unquestionably strengthen the regulars. (si530)
 He spoke briefly, sensibly, to the point and without oratorical flourishes. (si531)
 Further, it has its work cut out stopping anarchy where it is now garrisoned. (si532)
 Fools, he bayed, what do you think you are doing? (si533)
 He earnestly urged a cease-fire. (si534)
 Too many have bogged down in bickering. (si535)
 So we note approvingly a fresh sample of unanimity. (si536)
 It is one of the rare public ventures here on which nearly everyone is agreed. (si537)
 County officials have cooperated consistently. (si538)
 But that heritage is shrinking even faster. (si539)
 Thus there is a clearer division of authority, administrative and legislative. (si540)
 It helps those people who help themselves. (si541)
 She came back the other day to reassure me. (si542)
 Jokes, cartoons and cynics to the contrary, mothers-in-law make good friends. (si543)
 Theirs is a sacrificial life by earthly standards. (si544)
 But how little love we give him! (si545)
 The narrow fringe of sadness that ran around it only emphasized the pleasure. (si546)
 Would a blue feather in a man's hat make him happy all day? (si547)
 Never happier in my life. (si548)
 These programs emphasize the acceptance of biracial classrooms peacefully. (si549)
 You certainly can't expect the infield to do any better than it did last year. (si550)
 Is the mother of an autistic child at fault? (si551)
 We think differently. (si552)
 As a rule, the autistic child doesn't enjoy physical contact with others. (si553)
 Or certain words or rituals that child and adult go through may do the trick. (si554)
 Only ingenuity will uncover it. (si555)

We did not accept the diagnosis at once, but gradually we are coming to. (si556)
 How do they turn out later? (si557)
 Is a relaxed home atmosphere enough to help her outgrow these traits? (si558)
 They seem darned proud of it. (si559)
 Where only one club existed before, he says, two will flourish henceforth. (si560)
 This is going to be a language lesson, and you can master it in a few minutes. (si561)
 Family loyalties and cooperative work have been unbroken for generations. (si562)
 Heels place emphasis on the long legged silhouette. (si563)
 Wine glass heels are to be found in both high and semi-heights. (si564)
 Stacked heels are also popular on dressy or tailored shoes. (si565)
 Contrast trim provides other touches of color. (si566)
 At the left is a pair of dressy straw pumps in a light, but crisp texture. (si567)
 At right is a casual style in a crushed unlined white leather. (si568)
 Most of us brush our teeth by hand. (si569)
 The bristles are soft enough to massage the gums and not scratch the enamel. (si570)
 "Steam baths" writes: do steam baths have any health value? (si571)
 "Sewing brings numbness" writes: what makes my hands numb when sewing? (si572)
 Teaching guides are included with each record. (si573)
 It motivates his behavior. (si574)
 He doesn't want her to look frowningly at him, or speak to him angrily. (si575)
 But even mother's loving attitude will not always prevent misbehavior. (si576)
 She can decrease the number of temptations. (si577)
 She can remove all knick-knacks within reach. (si578)
 Usually, they titter loudly after they have passed by. (si579)
 Too often, unless he hails them, they pass him by. (si580)
 Say he is a horse thief, runs an old adage. (si581)
 It seems that open season upon veterans' hospitalization is once more upon us. (si582)
 This we can sympathetically understand. (si583)
 This is taxation without representation. (si584)
 Our entire economy will have a terrific uplift. (si585)
 One even gave my little dog a biscuit. (si586)
 Maybe he will help to turn our fair city into a ghost town. (si587)
 Why do we need bigger and better bombs? (si588)
 One of the problems associated with the expressway stems from the basic idea. (si589)
 Bridges, tunnels and ferries are the most common methods of river crossings. (si590)
 Replace it with the statue of one or another of the world's famous dictators. (si591)
 Who wants this deed done? (si592)
 The gallant half-city is dying on its feet. (si593)
 The trial balloons are afloat. (si594)
 Their privations are almost beyond endurance. (si595)
 On these they feel they can rely. (si596)
 The moment of truth is the moment of crisis. (si597)
 New self-deceiving rags are hurriedly tossed on the too-naked bones. (si598)
 What explains this uni-directional paralysis? (si599)
 Originals are not necessarily good and adaptations are not necessarily bad. (si600)
 But that explanation is only partly true. (si601)
 But the ships are very slow now, and we don't get so many sailors any more. (si602)
 Melancholy obsession. (si603)
 They were shown how to advance against an enemy outpost atop a cleared ridge. (si604)
 We would lose our export markets and deny ourselves the imports we need. (si605)
 With this no loyal citizen can quarrel. (si606)
 Mercenary: term of honor? (si607)
 This possibility is anything but reassuring. (si608)
 The public is now armed with sophistication and numerous competing media. (si609)
 But the attack was made from an advance copy. (si610)
 Well, now we have two big theaters. (si611)
 Splendor by sorcery: it's a horror. (si612)
 One-upmanship is practiced by both sides in a total war. (si613)
 This big, flexible voice with uncommon range has been superbly disciplined. (si614)
 Her debut over, perhaps the earlier scenes will emerge equally fine. (si615)
 He injected more vitality into the score than it has revealed in many years. (si616)
 The storyline, in sort, is wildly unrealistic. (si617)
 He talked about unauthentic storylines too. (si618)
 He praises many individuals generously. (si619)
 His portrayal of an edgy head-in-the-clouds artist is virtually flawless. (si620)
 Not a corner has been visibly cut in this one. (si621)
 The master's hand has lost none of its craft. (si622)
 He showed puny men attacked by splendidly tyrannical machines. (si623)
 He may have a point in urging that decadent themes be given fewer prizes. (si624)
 A tiny handful never did make the concert. (si625)
 The works are presented chronologically. (si626)

The humor of the situation can be imagined. (si627)
 It all takes place in the eighteenth century. (si628)
 His technique is ample and his musical ideas are projected beautifully. (si629)
 What a discussion can ensue when the title of this type of song is in question. (si630)
 Program note reads as follows: take hands; this urgent visage beckons us. (si631)
 The orchestra was obviously on its mettle and it played most responsively. (si632)
 He liked to nip ear lobes of unsuspecting visitors with his needle-sharp teeth. (si633)
 Here, he is, quite persuasively, the very embodiment of meanness and slyness. (si634)
 He is a man of major talent – but a man of solitary, uncertain impulses. (si635)
 He was above all a friend seeker, almost pathetic in his eagerness to be liked. (si636)
 He enlisted a staff of loyal experts and of many zealous volunteers. (si637)
 This theory eventually proved inexact. (si638)
 The heavens refused to give up their weeping. (si639)
 But what has been happening recently might be described as creeping mannerism. (si640)
 Clever light songs were overly coy, tragic songs a little too melodramatic. (si641)
 Their props were two stepladders, a chair and a palm fan. (si642)
 The armchair traveler preserves his illusions. (si643)
 All are well written and are overwritten. (si644)
 He ignores guidebook facts. (si645)
 Nice, even if a trifle gaudy. (si646)
 Below is a specific guide, keyed to the calendar. (si647)
 A sailboat may have a bone in her teeth one minute and lie becalmed the next. (si648)
 It suffers from a lack of unity of purpose and respect for heroic leadership. (si649)
 The fat man has trouble buying life insurance or has to pay higher premiums. (si650)
 Far more frequently, overeating is the result of a psychological compulsion. (si651)
 Just what is meant by spirit and by matter? (si652)
 Surely this is a reality we all acknowledge. (si653)
 Yet it exists and has an objective reality which can be experienced and known. (si654)
 Yet the spirit which lives in community is not identical with the community. (si655)
 But this statement is completely unconvincing. (si656)
 A second point requires more extended comment. (si657)
 The straight line would symbolize its uniqueness, the circle its universality. (si658)
 His history is his alone, yet each man must recognize his own history in it. (si659)
 Historical existence is a created good. (si660)
 Death reminds man of his sin, but it reminds him also of his transience. (si661)
 Such a calm and assuring peace can be yours. (si662)
 Satellites, sputniks, rockets, balloons; what next? (si663)
 Look at the things we do to escape our fears and to forget our worries. (si664)
 Meanwhile, the enemy will capitalize on our fears, if he can. (si665)
 Our enemy is also threatening to devour us. (si666)
 Yes indeed, we too can see a warlike host of infidels encamped against us. (si667)
 We are all involved in them, deeply involved. (si668)
 Later, we shall see what happened when an emperor took this idea too literally. (si669)
 Neglect means spiritual paralysis or death. (si670)
 A helpful leaflet may be enclosed in the letter. (si671)
 None should ask less. (si672)
 Psychologically the reception should be the climax, following the sermon. (si673)
 This is no spectator-type experience; everyone is to be a participant. (si674)
 Both eventualities are possible logically, but practically they are impossible. (si675)
 Theocracy reconsidered. (si676)
 Comparable trends can be noted elsewhere. (si677)
 Salvation reconsidered. (si678)
 He is not talking in the main about probabilities, risks and danger in general. (si679)
 No political order or economic system is so clearly contrary to nature. (si680)
 Would such an act of refusal be useful? (si681)
 Often they are able to get in only because the area is declining economically. (si682)
 An octillion atoms – now let us see where this power comes from. (si683)
 This is the atomic sun, the atomic nucleus. (si684)
 At any rate, it shows us how immaterial we are. (si685)
 Others were ephemeral. (si686)
 The anti-slavery movement took many forms. (si687)
 The dead spirits occupied a prominent place in every hope and in every fear. (si688)
 Men believed they could control nature by obeying a moral code. (si689)
 Propriety was synonymous with ritual observance, the mark of a true gentleman. (si690)
 But this esoteric doctrine was lost in the shuffle to acquire special powers. (si691)
 Why, said the teacher, art thou so late? (si692)
 He who does not love abides in death. (si693)
 The new birth is miraculous and mysterious. (si694)
 The new birth is immediate and instantaneous. (si695)
 Some have walked through pain and sorrow to bring you their message of hope. (si696)
 But from the start they had two important ingredients: sincerity and realism. (si697)
 The crisis later on when debts seemed about to overwhelm me. (si698)
 You're not living up to your own principles, she told my discouraged people. (si699)
 You're so preoccupied that you've let your faith grow dim. (si700)
 There are people who travel long distances to assure my continued existence. (si701)
 We have also seen the power of faith at work among us. (si702)
 It was muscular but it wasn't symmetrical. (si703)
 Oh, you'll wobble and weave quite a bit at first. (si704)
 Ants carry away the seeds so better be sure that there are no ant hills nearby. (si705)
 Pansies are gluttons. (si706)
 The avocado should have a give to it, as you hold it, when it is ripe. (si707)
 There is no dyeing or waxing or gassing needed. (si708)
 Avocados, however, are very rich in nutrients. (si709)
 However, the aircraft which we have today are tied to large, soft airfields. (si710)
 Nuclear rockets can destroy airfields with ease. (si711)
 Our first necessity, at the very outset of war, is post-attack reconnaissance. (si712)
 What targets have we successfully knocked out? (si713)
 Other interpretations present the music as an essentially intimate creation. (si714)
 For me it has more of both elements than the majority of its competitors. (si715)
 There are canoes ideal for fishing in protected waters or for camping trips. (si716)
 Now here is truly a marvel. (si717)
 State numbering laws differ from each other in many ways. (si718)
 Industry interest in safety goes even farther. (si719)
 File to a smooth finish. (si720)
 This tool can also be made with a lathe. (si721)
 This changes the formula to an equation. (si722)
 The total of these three volumes is the final combustion chamber volume. (si723)
 It's a streamlined rifle, fast and well-made. (si724)
 A spring trap for solid mounting and a regular hand trap are also available. (si725)
 Promptly at seven he would clatter out of the court with twelve in the tallyho. (si726)
 Then simmer fifteen minutes longer. (si727)
 Poach the apples in this syrup for twelve minutes, drain them, and cool. (si728)
 Best solution is to find an area that is predominantly sunlight or shade. (si729)
 Another memo for sightseers: bring your camera along to museums. (si730)
 A few years later the dome fell in. (si731)
 Do line barbecue fire bowl with heavy foil to reflect heat. (si732)
 Do avoid puncturing or cutting into meats to test them. (si733)
 If necessary to replace both halves on grill, sear cuts and allot extra time. (si734)
 For roasts, insert meat thermometer diagonally so it does not rest on bone. (si735)
 Also make sure thermometer does not touch the revolving spit or hit the coals. (si736)
 Have a test-run on the family first, to be sure timing and seasoning are right. (si737)
 Don't plan meals that are too complicated. (si738)
 Keep the desserts simple; fruit does nicely. (si739)
 Do without fancy tablecloths. (si740)
 In the winter, hibachi in the kitchen or grill over the logs of the fireplace. (si741)
 Summertime supper, outside, is a natural. (si742)
 Do buy all-purpose mugs or cups. (si743)
 Get copper or earthenware mugs that keep beer chilled or soup hot. (si744)
 Broil or toast as usual. (si745)
 For sweet-sour sauce, cook onion in oil until soft. (si746)
 Add remaining ingredients and bring to a boil. (si747)
 To prepare mustard cream, blend mustard with enough water to make a thin paste. (si748)
 Fold into whipped cream and add a dash of salt and sprinkling of paprika. (si749)
 Add a few caraway seeds, too, if you'd like. (si750)
 Serve in frankfurter buns or as a meat dish. (si751)
 Pretend ham: make criss-cross gashes on one side of skinless frankfurters. (si752)
 Make a paste of brown sugar and mustard and spread lightly over scored surface. (si753)
 Instructions for preparing clay, drying, glazing and firing are not given. (si754)
 Equipment: basic pottery studio equipment. (si755)
 Materials: ceramic modeling clay: red, white or buff. (si756)
 Stoneware clay for tiles. (si757)
 When mold has more than one design cavity, make individual paper patterns. (si758)
 Trim excess clay away from outer edges. (si759)

Opaque cantaloupe and transparent wood brown were used. (si760)
 Paperweight may be personalized on back while clay is leather hard. (si761)
 Fill small hole in bowl with clay. (si762)
 Jars are assembled in bowl of butter mold. (si763)
 Trim excess clay from around lip of mold and set aside while assembling lid. (si764)
 Turn shaker upside down. (si765)
 Set aside to dry thoroughly. (si766)
 Trim away excess clay; reinforce seam with a coil of clay. (si767)
 Make lid for sugar bowl the same as jar lids, omitting design disk. (si768)
 Set aside to dry with lid on sugar bowl. (si769)
 Vases: make same as salt and pepper shakers, leaving off top pieces. (si770)
 Vases may be made into candles by filling with melted wax and a wick. (si771)
 A cardboard pattern cut to fit inside holder will help to prevent warping. (si772)
 Let all projects dry slowly for several days. (si773)
 Place work on a flat surface and smooth out. (si774)
 Thread matching yarn in tapestry needle. (si775)
 Do not draw yarn too tight. (si776)
 Ease in any extra fullness evenly around. (si777)
 Nor is she a wet boat. (si778)
 The keelson, made of two three-inch widths, is next installed. (si779)
 The side ones are a half-inch narrower. (si780)
 Again, these blocks were set in resin-saturated glass cloth and nailed. (si781)
 The decking is quarter-inch mahogany marine plywood. (si782)
 You can build this vacation cottage yourself. (si783)
 It is a big project, not to be taken lightly. (si784)
 The theory: the idea behind our design is modular units, or panelization. (si785)
 Don't lose the chuck key. (si786)
 Feed pressure is also of major importance. (si787)
 We have become amateur insurance experts and fine-feathered yard birds. (si788)
 But problems cling to pools, as any pool owner knows. (si789)
 We seemed to be witnessing the population explosion right in our own backyards. (si790)
 So rules we made, in unabashed collusion. (si791)
 But fenced or unfenced, no pool-side is the place for running or horseplay. (si792)
 A pool is no place for a shut trap. (si793)
 You should firmly insist that no bobby pins or hair pins be worn in the water. (si794)
 When shed, they leave rust marks. (si795)
 The filtered air benefits allergies, asthma, sinus, hay fever. (si796)
 The need for reupholstering, redecorating, repainting becomes more infrequent. (si797)
 When you're less fatigued, things just naturally look brighter. (si798)
 That brings its per-year cost down mighty low. (si799)
 The simplest kind of separate system uses a single, self-contained unit. (si800)
 In a new house, generous roof overhangs are a logical and effective solution. (si801)
 They're easier to shade there. (si802)
 Insulate, weatherstrip, double-glaze to the maximum. (si803)
 This is particularly true in site selection. (si804)
 Begin the examination of a site with a good map and aerial photos if possible. (si805)
 You need answers to four important questions. (si806)
 One of the most desirable features for a park are beautiful views or scenery. (si807)
 A site may also be attractive just through the beauty of its trees and shrubs. (si808)
 Topography – topography is very important. (si809)
 An area sheltered from strong winds may be highly desirable for recreation use. (si810)
 Meanwhile, three great terrible forces were coagulating and crystallizing. (si811)
 Need for novelty may be a symptom of cultural fatigue and instability. (si812)
 Push-ups: push-ups are essential, but few have the strength for them at first. (si813)
 Fall slowly forward onto the hands and let the body down to rest on the floor. (si814)
 Push back up and repeat. (si815)
 Do this exercise six times each class period. (si816)
 This will prevent flat falls and toe injuries. (si817)
 Bones and cartilage transmit poorly and tend to reflect the ultrasonic signals. (si818)
 There, forces are more latent than in electricity, and less than in magnetism. (si819)
 By that, one feels that magnetic forces are as general as electrical forces. (si820)
 The target chart quickly and briefly tells you which additives do what. (si821)
 Milk production may be increased by the anti-infective properties of this drug. (si822)
 The drug is also incorporated in supplements. (si823)
 Several firms are merchandising enzyme preparation through feed manufacturers. (si824)
 What it does: aids in preventing foamy bloat. (si825)
 Caution: continuous administration is not recommended for lactating cows. (si826)
 Drug's chemical name: procaine penicillin. (si827)
 Drug's chemical name: dried rumen bacteria. (si828)
 What it does: stimulates rumen activity. (si829)
 No one material is best for all situations. (si830)
 Selecting bunks by economic comparison is usually an individual problem. (si831)
 Wider discretionary choices for customers. (si832)
 Less personal salesmanship. (si833)
 It has multiple implications and possible headaches for your marketing program. (si834)
 Salesmanship is still necessary, but it's a different brand of salesmanship. (si835)
 No manufacturer has taken the initiative in pointing out the costs involved. (si836)
 Computers are being used to keep branch inventories at more workable levels. (si837)
 Increasing tempo of new product development. (si838)
 Practically all forecasts mention new and exciting products on the horizon. (si839)
 Complexity of complete marketing planning. (si840)
 Every single problem touched on thus far is related to good marketing planning. (si841)
 Are planning and strategy development emphasized sufficiently in your company? (si842)
 To begin with, what is an interior designer? (si843)
 Thus technical efficiency is achieved at the expense of actual experience. (si844)
 But to continue to divorce advanced students from reality is inexcusable. (si845)
 This brings us to the question of accreditation of art schools in general. (si846)
 Is it larger or fancier than you really need? (si847)
 Can your insurance company aid you in reducing administrative costs? (si848)
 Would a camera club be useful in taking pictures pertinent to plant safety? (si849)
 Are you underwriting expensive team trips? (si850)
 Are you utilizing vending machine proceeds to help pay for your program? (si851)
 If you use parking attendants, can they be replaced by automatic parking gates? (si852)
 Aim to balance your employee benefit package. (si853)
 Encourage them to exercise their benefits. (si854)
 Use deductible insurance wherever feasible. (si855)
 Put a dollar-and-cents limit on benefits. (si856)
 Otherwise, you may be saddled with a good-size milk bill by milk drinkers. (si857)
 Choose carefully between contributory or non-contributory pension plans. (si858)
 A non-contributory plan usually won't pay off for the worker until he retires. (si859)
 These include: leaves of absences, illnesses, and layoffs. (si860)
 Latest models serve hot meals at reasonable prices, and at a profit to you. (si861)
 If a concessionaire runs the cafeteria, keep an eye out for quality and price. (si862)
 Check your cafeteria location to make sure it's convenient for most employees. (si863)
 The long and ever-increasing column of sportsmen is now moving into a new era. (si864)
 Neither are beds, thanks to air mattresses and sleeping bags. (si865)
 The old shop adage still holds: a good mechanic is usually a bad boss. (si866)
 A complete plan: we have made limited application of the parallel ladder plan. (si867)
 The highest rated non-supervisory engineering title is research engineer. (si868)
 The idea of a central tank with lines to each house is not in itself a novelty. (si869)
 It will accommodate firing rates as low as a half gallon an hour. (si870)
 The word means it won't boil away easily, nothing else. (si871)
 Then fill the system and add a rust inhibitor. (si872)
 Be careful that you keep adequate coverage, but look for places to save money. (si873)
 First go over the type of coverage you now have. (si874)
 Look for these features which may mean you can save: duplicate coverage. (si875)
 Does your policy have a lay-up clause? (si876)
 The figure five is important in insurance. (si877)
 This means either cars or trucks. (si878)
 Large injection-molded letters are also available for sign installations. (si879)
 The revolution now under way in materials handling makes this much easier. (si880)
 Before that we lumber dealers were working almost single-handed on the problem. (si881)
 The way is to rent a chauffeur-driven car. (si882)
 Any retaliatory gas attack would be airborne. (si883)
 He hoped they would put in somewhere way, way down in the earth. (si884)
 Nine of them had gone down the gangplank already. (si885)
 He snatched at it savagely. (si886)
 Another, longer strip of tinsel whipped his mouth. (si887)
 Is a dream simply a mental or cerebral movie? (si888)
 In most cases we recognize certain words, persons, animals or objects. (si889)
 But why is it necessary to reproduce the retinal image within the brain? (si890)

It was applied with a compost shredder made from a converted manure spreader. (si891)

No chemical fertilizers and poisonous insecticides and fungicides are used. (si892)

There is never enough corn, peas or strawberries. (si893)

New ideas for improving nutrition came with the study of soil treatment. (si894)

Adults take a long time to convince and you are thwarted if you try to push. (si895)

It is well liked by the children and faculty. (si896)

They serve cracked wheat, oats or cornmeal. (si897)

Where can we get this cereal he likes so much? (si898)

Home-made sauerkraut is served once a week. (si899)

Sprouted grains and seeds are used in salads and dishes such as chop suey. (si900)

Milk appears twice a day. (si901)

The source is known so there is no necessity to remove insecticide residues. (si902)

A vigorous program existed in skiing, skating sports and overnight hiking. (si903)

He peered ahead and grinned as the railroad tracks came into view again below. (si904)

His work began just six days after the flood. (si905)

It took a tragedy to bring things to a head. (si906)

Somehow we old-timers never figured we would ever retire. (si907)

We always thought we would die with our boots on. (si908)

Compulsory retirement at sixty-five looms on our horizon. (si909)

To put it bluntly, you are getting out-moded. (si910)

This is followed by a boom in conferences. (si911)

You may amaze yourself and acquire a real knack for it. (si912)

Do you love to run up a hem, sew on buttons, make neat buttonholes? (si913)

If you do, go to it. (si914)

Then again, there's always that lovely old pastime of hooking or braiding rugs. (si915)

Some make beautiful chairs, cabinets, chests, doll houses, etc.. (si916)

Some women get a real thrill out of housework. (si917)

We know that actors can learn to portray a wide variety of character roles. (si918)

Obviously, the bridal pair has many adjustments to make to their new situation. (si919)

Too many new things are happening for it to be a complete erotic fulfillment. (si920)

Differences were related to social, economic, and educational backgrounds. (si921)

In tradition and in poetry, the marriage bed is a place of unity and harmony. (si922)

To many experts, this trend was inevitable. (si923)

They consider it simply a sign of our times. (si924)

While he was in custody his wife divorced him. (si925)

Another put sex on a dollars-and-cents basis. (si926)

Naturally no woman can ever completely monopolize the sexual initiative. (si927)

Asked why, he replied primly: because that's no activity for a gentleman. (si928)

But such cases were, in the past, unusual. (si929)

When did women begin to assert themselves sexually? (si930)

Often she fails to gain sexual satisfaction. (si931)

His prescription: hot and cold compresses to increase her absorption of water. (si932)

That's where device quackery can lead. (si933)

Authorities say that oldsters are a prime target. (si934)

Crooked, overlapping, twisted, or widely spaced teeth. (si935)

Aligning all the teeth may take a year or more. (si936)

Let the orthodontist decide the proper time to start treatment, he urges. (si937)

Superior new material for orthodontic work is another result of research. (si938)

Impressions often appear in a symbolic form and cannot be taken at face value. (si939)

During one reading an image appeared of a prisoner in irons. (si940)

The farmer's life must be arranged to meet the demands of crops and livestock. (si941)

Livestock must be tended every day, routinely. (si942)

Production may fall far below expectations. (si943)

If the farm is rented, the rent must be paid. (si944)

Advantages a farm provides: a wholesome and healthful environment for children. (si945)

As a rule, part-time farmers hire little help. (si946)

Few rural areas are protected by zoning. (si947)

How much will it cost to do any necessary modernizing and redecorating? (si948)

It may be hard to decide what this labor is worth, but charge something for it. (si949)

As such, it was beyond politics and had no need of justification by a message. (si950)

All too often our language is unduly harsh. (si951)

That experience holds a lesson for us all in regard to birth control today. (si952)

Historians have had two reasons for persisting so long in their investigations. (si953)

First, they wanted to clarify a tantalizing, bizarre enigma. (si954)

Worse, his present crew included five men who had sailed with him before. (si955)

Turbulent tides rose as much as fifty feet. (si956)

But he was very much like his associates in his hatred of camp routine. (si957)

One of the most common of camp maladies was diarrhoea. (si958)

Sometimes soldiers wrote letters while bullets were whizzing about their heads. (si959)

No group of officers came in for more spirited denunciation than the doctors. (si960)

The coalition was to prove inadvisable. (si961)

Like a fair number of bootleggers he disliked alcohol. (si962)

However, this inaugural feast did its sponsors no good whatever. (si963)

The dimensions of these waves dwarf all our usual standards of measurement. (si964)

A tsunami is not a single wave but a series. (si965)

A sharp tremor was followed by a jerky roll. (si966)

He not only knew soldiering, but mathematics, history and literature as well. (si967)

Along the main thoroughfares hardly a house had not been peppered. (si968)

What had been the ambassador's suite was now jagged walls of blackened brick. (si969)

We flew in rickety planes so overloaded that we wondered why they didn't crash. (si970)

Then off again, rushing to keep up. (si971)

We send shovels, cement, nails, and corrugated iron for roofs. (si972)

Then came coconuts, eggs, and rice wine. (si973)

Then we were off again. (si974)

But our stumping tour of the south wasn't all misery. (si975)

Now a distinguished old man called on nine divinities to come and join us. (si976)

Next he addressed himself to our souls. (si977)

For girls, the overprotection is far more pervasive. (si978)

Almost everybody in the senior class is married, students say dogmatically. (si979)

Bruises and black eyes were relieved by application of raw beefsteak. (si980)

A chaw of tobacco put on an open wound was both antiseptic and healing. (si981)

Tetanus could be avoided by pouring warm turpentine over a wound. (si982)

Rabies were cured or prevented by madstones which the pioneer wore or carried. (si983)

Since a fall or blow might have caused it, a cold pack was usually first aid. (si984)

Bathing the itching parts with kerosene gave relief and also killed the pests. (si985)

Ant bites were eased by applying liquid bluing. (si986)

For wasp stings onion juice, obtained by scraping an onion, gave quick relief. (si987)

A kerosene shampoo seems a heroic treatment, but it did the job. (si988)

The situation involved some political perils. (si989)

And these hardy travelers are not unappreciated today. (si990)

She had no way of knowing in advance whether an opportunity for murder existed. (si991)

They were a vagabond lot and considered to be shady and undesirable characters. (si992)

He met nobody he knew on this walk. (si993)

Her study of history was persistently pursued. (si994)

At different times he served as glee-club and choir leader and as organist. (si995)

She served for a number of years without pay beyond her travel and maintenance. (si996)

Both loved the out-of-doors, including mountain climbing and horseback riding. (si997)

Yet they thrived on it. (si998)

Now the school was indeed bereft. (si999)

Soon the office work claimed all her time. (si1000)

Oh, he'll be a plumber, came the answer. (si1001)

We produce peanut oil, but to a much greater extent we eat the entire seed. (si1002)

Seeds of soybean, cotton, corn, sesame, and rape yield semidrying oils. (si1003)

Palm oil protects the surfaces of steel sheets before they are plated with tin. (si1004)

Castor oil, made from castorbeans, has gone out of style as a medicine. (si1005)

Quince seed gum is the main ingredient in wave-setting lotions. (si1006)

Almonds and pistachio nuts are not so high in oil but are rich in protein. (si1007)

Chestnuts are starchy. (si1008)

All nut kernels are rich in protein. (si1009)

The so-called vegetable ivory is the hard endosperm of the egg-sized seed. (si1010)

Flaxseed poultices and mustard plasters still are used by some persons. (si1011)

Beverages are made from seeds the world over. (si1012)

Cereal grains have been used for centuries to prepare fermented beverages. (si1013)

Beer, generally fermented from barley, is an old alcoholic beverage. (si1014)

Hay and pasture are the other chief sources of livestock feed. (si1015)

To keep 'em scattered somewhat and yet herd 'em was called loose herdin'. (si1016)

To hold 'em in a compact mass was close herdin'. (si1017)

Cattle which died from them winter storms were referred to as the winter kill. (si1018)

Them new to the country were referred to as pilgrims. (si1019)

The cowboy called this breed of cattle magpies. (si1020)

The cowboy's humorous name for a cow givin' milk was a milk pitcher.

- (si1021)
 Cows givin' no milk were known as strippers. (si1022)
 Such an animal was said to be mealynosed. (si1023)
 At the base of the rocky hillside, they left their horses and climbed on foot. (si1024)
 Nice country to meet a lion in face to face. (si1025)
 Careful, don't disturb her. (si1026)
 Even then, if she took one step forward he could catch her. (si1027)
 But now she sank lower to the rock. (si1028)
 Her tail no longer lashed. (si1029)
 Bring me the firecrackers. (si1030)
 Ain't she a beauty, though? (si1031)
 It was the story of the rhinoceros fight all over again. (si1032)
 If dark came they would lose her. (si1033)
 She snarled warningly. (si1034)
 With a whirling jump, it could get into gear. (si1035)
 The antithesis of the ecumenical and the local then no longer exists. (si1036)
 The revised procedure was acclaimed as a long-overdue reform. (si1037)
 The courtyard is magnificently decorated. (si1038)
 He has never, himself, done anything for which to be hated – which of us has? (si1039)
 Northerners indulge in an extremely dangerous luxury. (si1040)
 Brief snips of actual events were shown: parades, dances, street scenes. (si1041)
 Time and space have both become cinematic. (si1042)
 Not surprisingly, this approach did not work. (si1043)
 Residential associations struggle to insulate themselves against intrusions. (si1044)
 It offered to surrender its right to exclusive trade, but asked an indemnity. (si1045)
 These men were without capital or experience. (si1046)
 Twenty-five, the sheik replied. (si1047)
 The library has open shelves even in the unbound periodical stockroom. (si1048)
 They understood and teased me a bit about it. (si1049)
 Both the conditions and the complicity are documented in considerable detail. (si1050)
 Northern liberals are the chief supporters of civil rights and of integration. (si1051)
 The social and psychological consequences of this continue to affect the area. (si1052)
 Whatever their faults, they are not hypocrites. (si1053)
 A concept of responsibility is in process of articulation and establishment. (si1054)
 Internal national responsibility, now a truism, need not be documented. (si1055)
 Can thermonuclear war be set off by accident? (si1056)
 Are we as safe as we should be from such a disaster? (si1057)
 Readiness exercises are almost continuous. (si1058)
 They know little about their machinery beyond mechanical details. (si1059)
 They inhabit a secret world centered on go codes and gold phones. (si1060)
 But what if somebody decides to break it? (si1061)
 Vital questions would be quickly answered according to a preprepared agenda. (si1062)
 No question ruffles him or causes him to hesitate. (si1063)
 Unless we send out the whole pie, their pieces mean nothing. (si1064)
 All three must compare notes and agree to go. (si1065)
 They were chasing a rain cloud. (si1066)
 Their gait is impossible to convey in words. (si1067)
 Any organism that falters or misperceives the signals or weakens is done. (si1068)
 Perhaps this is what gives the aborigine his odd air of dignity. (si1069)
 Do you always navigate like this? (si1070)
 Two miles northeast, then five miles southwest – that sort of thing. (si1071)
 There was also a dog, a dingo dog. (si1072)
 They'll move around that rock all day, following the shade. (si1073)
 He gazed away from us as we approached. (si1074)
 There was also a boomerang, elaborately carved. (si1075)
 The tiny bodies, dropped onto a dry leaf, made a pile as big as a small apple. (si1076)
 The odor here was more powerful than that which surrounded the town aborigines. (si1077)
 The smell is sexual, but so powerfully so that a civilized nose must deny it. (si1078)
 Boys and men go along the riverbank or to the alcoves in the top arcade. (si1079)
 When he was eight he began violin lessons. (si1080)
 Our successors will have an easier task. (si1081)
 A new order is thrusting itself into being. (si1082)
 The system works as an impersonal mechanism. (si1083)
 The theme may be the formation of a shape from which other shapes evolve. (si1084)
 He may toss coins; he may take slips of paper from a grab bag. (si1085)
 Then the choreographer must arbitrate. (si1086)
 He must rearrange matters so that two performers do not bump into each other. (si1087)
 One wonders about its applicability to people. (si1088)
 Perhaps things were even worse then. (si1089)
 But a somewhat more detailed analysis of this process may be illuminating. (si1090)
 Solar activities could presumably bring long periods of flood or drought. (si1091)
 Yet we no longer feel uneasy. (si1092)
 What elements of our behavior are decisive? (si1093)
 American newspaper reviewers like to call his plays nihilistic. (si1094)
 They find deep pessimism in them. (si1095)
 He wore a brown knit sports shirt with no tie. (si1096)
 His talk turns to what he calls the mess, or sometimes this buzzing confusion. (si1097)
 One can only speak of what is in front of him, and that now is simply the mess. (si1098)
 This does not allow the mystery to invade us. (si1099)
 As she goes, she herself will be illuminated. (si1100)
 Then he thought me more perverse than ever. (si1101)
 The beatniks crave a sexual experience in which their whole being participates. (si1102)
 Their work mirrors the mentality of the psychopath, rootless and irresponsible. (si1103)
 This girl soon drops the bourgeois psychiatrist who disapproves of her life. (si1104)
 What obsessions had she picked up during these long nights of talk? (si1105)
 Everything in the final analysis reduced itself to sexual symbolism. (si1106)
 What one actually remembers is its greenness. (si1107)
 One looked down on a sea of leaves, a breaking wave of flower. (si1108)
 A wheel squeaked on a hub, was still, and squeaked again. (si1109)
 The season, between spring and summer, belongs to life in its carefree aspect. (si1110)
 How do we define it? (si1111)
 Who will say that our country is even now a homogeneous community? (si1112)
 Whether historically a fact or not, the legend has a certain symbolic value. (si1113)
 Why should this be so? (si1114)
 He did not, however, settle back into acquiescence with things as they were. (si1115)
 Each is still glorified as a national hero. (si1116)
 He finds it in utter misery and desolation. (si1117)
 As he had longed to be, he became the echo of a saga. (si1118)
 The record teems with romance and adventure. (si1119)
 His tough honesty condemns him to a solitary and difficult existence. (si1120)
 In either case, they do not appreciate the private detective's zeal. (si1121)
 His successors have adopted the opposite alternative. (si1122)
 They also furnish proof that, in modern war, message sending must be monitored. (si1123)
 Let me quote him even more fully, for his analysis is important to my theme. (si1124)
 But in every period it has been humanism. (si1125)
 And let me add, utopianism, also. (si1126)
 We of the liberal-led world got all set for peace and rehabilitation. (si1127)
 Others invoked technology and common sense. (si1128)
 This group is secularist and their program tends to be technological. (si1129)
 Should the accelerating growth of technology then warn us? (si1130)
 But we cannot start off with a clean slate. (si1131)
 No amount of ballyhoo will cover up the sordid facts. (si1132)
 It can project long-range goals for itself. (si1133)
 Individual human strength is needed to pit against an inhuman condition. (si1134)
 Have we not actually developed idea worship? (si1135)
 We scour literature for them; here we find stored the wisdom of great minds. (si1136)
 His name became synonymous with cold-blooded cruelty. (si1137)
 That doctrine has been accepted by many, but has it produced good results? (si1138)
 In time she presents her aristocratic husband with a coal-black child. (si1139)
 False ideas surfeit another sector of our life. (si1140)
 The stepmother, almost without exception, has been presented as a cruel ogress. (si1141)
 Research into several cultures has proven her position to be a mistaken one. (si1142)
 Most assuredly ideas are invaluable. (si1143)
 We would establish no censorship. (si1144)
 Ironically enough, in this instance such personal virtues were a luxury. (si1145)
 We knew that it was, as reassurance, the ironic fruit of a deeply moral nature. (si1146)
 Civilization is what man has made of himself. (si1147)
 Change involves the displacement of form. (si1148)
 The response of reaction is dominated by a concern for what is vanishing. (si1149)
 With those paintings of big constructions crashing down, he felt he could stop. (si1150)
 For what do the utopians labor? (si1151)
 You could also say that in these pamphlets is a relieving quality of maturity. (si1152)
 In an ideological argument, the participants tend to thump the table. (si1153)
 Only incomplete, imperfect things move towards what they lack. (si1154)
 His problem concerns longitudes, latitudes, and angular velocities. (si1155)
 This is what necessitates the nonsystematic character of his astronomy. (si1156)
 But, considered within technical astronomy, a different pattern can

be traced. (si1157)
 Geocentricism per se? (si1158)
 Cut off every building at the seventh floor. (si1159)
 Neither his appetites, his exacerbations, nor his despair were kin to yours. (si1160)
 With each song he gave verbal footnotes. (si1161)
 Two things contribute to his popularity. (si1162)
 No more startling contrast to a system of sullen satellites could be imagined. (si1163)
 Otherwise, the outlook could be dark indeed. (si1164)
 The continuing modernization of these forces is a costly but necessary process. (si1165)
 In the course of its inquiry, it took testimony from only seven witnesses. (si1166)
 We have nothing to hide under a bushel. (si1167)
 It takes a great deal of sophisticated thought to get the impact of this fact. (si1168)
 They despised foreigners. (si1169)
 He has also an extraordinary conscience. (si1170)
 Nor were his manners barbaric. (si1171)
 He was busy, he said, in having someone submit to a monkey-gland operation. (si1172)
 He brought her shawls. (si1173)
 It had a tiny envelope tied to its wrist. (si1174)
 Diversity of perception, yes; diversity of fact, yes. (si1175)
 To some extent predispositions are shaped by exposure to group environments. (si1176)
 In some measure they depend upon the structure of individual personality. (si1177)
 Many selections are themselves convincing contributions to this appraisal. (si1178)
 What shall these effects be? (si1179)
 What factors condition the degree of realization at various times and places? (si1180)
 Properly used, the present book is an excellent instrument of enlightenment. (si1181)
 Let us differentiate a few of these ideas. (si1182)
 It is the obverse of triviality, shallowness, emotional anaesthesia. (si1183)
 There results a study of literature freed from the tyranny of the contemporary. (si1184)
 His technique is genuinely masterful. (si1185)
 Questions came to me from all sides about my world citizenship activities. (si1186)
 He advised immediate hospitalization. (si1187)
 Maybe they will take us. (si1188)
 Eight field guns were captured in position. (si1189)
 Next best to destroying an army is to deprive it of its freedom of action. (si1190)
 All chance of fulfilling my destiny is over. (si1191)
 So of course he stayed put. (si1192)
 He had collared one of his generals in public. (si1193)
 Woe betide the interviewee if he answered vaguely. (si1194)
 Passing dogs were greeted with a cordial bark. (si1195)
 He had accordingly cultivated eccentricity to the point of second nature. (si1196)
 Transparent look, waxy skin – could well be uremia. (si1197)
 It is awe-inspiring. (si1198)
 They close sometime after eight. (si1199)
 Let him become honest, and they discard him. (si1200)
 We hope that he will execute it in a manner that will entitle him to credit. (si1201)
 His artistic accomplishments guaranteed him entry into any social gathering. (si1202)
 Instead of that he was engulfed by bedlam. (si1203)
 The purchasers rejected the order in two letters written in vigorous terms. (si1204)
 But we aren't going to let you give him any. (si1205)
 All about him stood tombstones his own sensitive great hands had fashioned. (si1206)
 But they would reconsider it, they assured him, if he would rewrite it. (si1207)
 This doctrine was repugnant to my moral sense. (si1208)
 If disobeyed, the result is turmoil and chaos. (si1209)
 As we observe moral law and physical law they appear as being inevitable. (si1210)
 Their basis seems deeper than mere authority. (si1211)
 They are not true because scientists or prophets say they are true. (si1212)
 My own experience has followed simpler lines. (si1213)
 Religion thus becomes integrated with life. (si1214)
 This truth that the moral law is natural has other important corollaries. (si1215)
 Let us now give some thought to the soul. (si1216)
 Only those story tellers will remain who can imitate the style of the virtuous. (si1217)
 Poets, moreover, dwell on human passions. (si1218)
 Students' choices of ideal educational goals are not arbitrary or whimsical. (si1219)
 They also want money, prestige, and security. (si1220)
 Conservatism and traditionalism seem implied by what has just been said. (si1221)
 Avowed atheists or freethinkers are so rare as to be a curiosity. (si1222)
 The redcoats ran like rabbits. (si1223)
 This is nevertheless a minority view. (si1224)
 The tragic stage is a platform extending precariously between heaven and hell. (si1225)

The wheel of social life spun around the royal or aristocratic centre. (si1226)
 From it, spokes of order and degree led to the outward rim of the common man. (si1227)
 Tragedy presumes such a configuration. (si1228)
 Its sphere is that of royal courts, dynastic quarrels, and vaulting ambitions. (si1229)
 Princes and factions clashed in the open street and died on the open scaffold. (si1230)
 And their chroniclers are not the dramatic poets but the prose novelists. (si1231)
 They were not yet prepared to accept it as irremediable. (si1232)
 It made no difference that most evidence points to an opposite conclusion. (si1233)
 But none of this could soothe the exacerbated nerves. (si1234)
 We often say of a person that he looks young for his age or old for his age. (si1235)
 Boy, you ain't fooling nobody but yourself. (si1236)
 We may say of some unfortunates that they were never young. (si1237)
 How on earth do you manage it? (si1238)
 Thus far the advances made have been almost entirely along functional lines. (si1239)
 He is forced to play for little money, and must often take another job to live. (si1240)
 In many of his poems, death comes by train: a strongly evocative visual image. (si1241)
 But it did print good verse and good fiction. (si1242)
 Ideas are the thruway to nowhere. (si1243)
 The sculptor looked at him, bugeyed and amazed, angry. (si1244)
 Object – a village crossroads. (si1245)
 He was, thus, an early and spectacular victim. (si1246)
 No poetry, no airplanes, no dancers. (si1247)
 The trouble is that like many symbols it doesn't seem a very realistic one. (si1248)
 Maybe twenty, thirty, fifty. (si1249)
 Evidence that other sources of financing are unavailable must be provided. (si1250)
 Only rarely is attention given to accurate progress reports and evaluation. (si1251)
 Development requires a long-term approach. (si1252)
 Most of our aid will go to those nearing self-sufficiency. (si1253)
 To honor him is to honor ourselves. (si1254)
 My sincere wish is that he continues to add to this record he sets here today. (si1255)
 Origin of state automobile practices. (si1256)
 Forty-seven states assign or provide vehicles for employees on state business. (si1257)
 It does not indicate loose management, ineffective controls or poor policy. (si1258)
 From this, motor pool personnel develop other meaningful and related data. (si1259)
 Unit prices for state vehicles are invariably lower than to the general public. (si1260)
 In two cases, airplanes only were indicated. (si1261)
 Ten others made no reply. (si1262)
 Both have excellent integration of their fiscal tax collection year calendars. (si1263)
 Dances alternated with sung or spoken verses. (si1264)
 Ballets were used in opera from its beginning. (si1265)
 Twenty-nine exhibits received awards. (si1266)
 Thirty-five military and civilian students received laboratory training. (si1267)
 The shutter consists of two parts: a fast-opening part and a fast-closing part. (si1268)
 Resistance thermometers. (si1269)
 Vapor pressure method. (si1270)
 This has been attributed to helium film flow in the vapor pressure thermometer. (si1271)
 Laboratory astrophysics. (si1272)
 Selected bibliographies and tables of available data are now in preparation. (si1273)
 Atomic energy levels. (si1274)
 Blockade is one answer offered by experts. (si1275)
 Land-based radar would help with this task. (si1276)
 So would radar picket ships. (si1277)
 Solid concrete blocks, relatively heavy and dense, are used for this shelter. (si1278)
 Bricks are an alternative. (si1279)
 The shelter shown would provide almost absolute fallout protection. (si1280)
 The same shelter could be built into an embankment or below ground level. (si1281)
 Radio reception is cut down by the shielding necessary to keep out radiation. (si1282)
 Living in a shelter the radioactivity of fallout decays rapidly at first. (si1283)
 A battery-powered radio is essential. (si1284)
 Family rationing probably will be necessary. (si1285)
 Blowers should be operated periodically on a regular schedule. (si1286)
 A covered container such as a kitchen garbage pail might do as a toilet. (si1287)
 A portable electric heater is advisable for shelters in cold climates. (si1288)
 A flame would use up air. (si1289)
 One of these is the solidarity and the confidential relationship of marriage. (si1290)
 They should live in modest circumstances, avoiding all conspicuous

consumption. (si1291)
 Our aim must be to learn as much as we teach. (si1292)
 These curves were derived by an analysis of extensive skywave measurement data. (si1293)
 If you are a life tenant, you deduct allowable depreciation and depletion. (si1294)
 He may get a tax refund. (si1295)
 Further research, we believe, will develop important commercial applications. (si1296)
 At intervals an alumni directory is issued. (si1297)
 Between meetings he helps the president keep track of delegated matters. (si1298)
 How well do faculty members govern themselves? (si1299)
 He can, for example, present significant university-wide issues to the senate. (si1300)
 Deans can form an important bridge between the president and the faculty. (si1301)
 More often, these offices are restricted to the gathering of empirical data. (si1302)
 A detailed study of this latter phenomenon was not attempted in this paper. (si1303)
 It was exposed to a high velocity gas jet. (si1304)
 If they are not ellipsoids, the conclusions will be a reasonable approximation. (si1305)
 This viscosity of the material in the drops is, of course, not negligible. (si1306)
 This is known as conformational entropy. (si1307)
 Indeed it is possible to separate electron paramagnetic from nuclear effects. (si1308)
 The better quality products in both of these lines contain phosphate builders. (si1309)
 Many scouring powders now also contain phosphates. (si1310)
 Soil redeposition is evaluated by washing clean swatches with the dirty ones. (si1311)
 In most cases, these soils are taken up as liquids through capillary action. (si1312)
 Cleaned cloth must be protected against the redeposition of dispersed soil. (si1313)
 The photochemical exchange in the gas phase. (si1314)
 There are several sources of evidence on the micrometeorite environment. (si1315)
 Space probes have yielded little information. (si1316)
 Being based on so few events, these results are of dubious validity. (si1317)
 To what extent such low density applies to micrometeorites is unknown. (si1318)
 Biological warfare is considered to be primarily a strategic weapon. (si1319)
 This area is highly susceptible to infection. (si1320)
 There are optimal humidity requirements for various agents when airborne. (si1321)
 This may be of overriding importance in considering military objectives. (si1322)
 Lousiness is a prerequisite for epidemic typhus. (si1323)
 It is a happy, buzzing crowd. (si1324)
 Quite often, honeybees form a majority on the willow catkins. (si1325)
 The larvae, kept warm by the queen, are full grown in about ten days. (si1326)
 Sometimes, although by no means always, these are indeed alkaline. (si1327)
 It is possible to make a few generalizations about the six giants themselves. (si1328)
 This birth length seems to be typical. (si1329)
 The lower portion provides a rating at any stage between infancy and adulthood. (si1330)
 No fasciculations or sensory defects were found. (si1331)
 Thyroid function tests yielded normal results. (si1332)
 X-ray films of the vertebral column showed progression of the demineralization. (si1333)
 Microscopically, there was emphysema, fibrosis, and vascular congestion. (si1334)
 Inflammatory cells were strikingly absent. (si1335)
 These were thought to represent regenerating fibers. (si1336)
 This was chiefly because of the bluish white autofluorescence from the cells. (si1337)
 No antigen was detectable in certain dark spherical areas in most cells. (si1338)
 Of particular importance is the study of the actions of drugs in this respect. (si1339)
 The shock therapies act likewise on the hypothalamic balance. (si1340)
 Marksmanship example. (si1341)
 Before deriving this formula, we explain what we mean by problems of this kind. (si1342)
 We now generalize these ideas for general binomial experiments. (si1343)
 Experiment without a fixed number of trials. (si1344)
 Toss a die until an ace appears. (si1345)
 Consider couples visiting an art museum. (si1346)
 Again, the analyticity of the two curves guarantees that such intervals exist. (si1347)
 The universe is a safe and permanent home. (si1348)
 This explains some group ends and provides a justification of their primacy. (si1349)
 It gives social guidance and direction and makes for programs of social action. (si1350)
 Religion fosters group life in various ways. (si1351)
 As such it acts as an anchor for the people. (si1352)

These needs usually concern the reduction of guilt and some relief of tension. (si1353)
 Within the larger social system are the structural and functional subsystems. (si1354)
 Regulatory norms governing subgroups and roles. (si1355)
 The problem of solidarity and morale again involves the concept of values. (si1356)
 The population can thereby replenish itself and actually grow larger. (si1357)
 But the information on the dynamics of population was often quite misleading. (si1358)
 In short, scientific sampling was introduced in place of subjective sampling. (si1359)
 It provides a frame for the sampling census. (si1360)
 But in this one section we welcomed auditors. (si1361)
 After that, we began to get visitors to class. (si1362)
 Some of these speculations may have some merit, others are somewhat ambiguous. (si1363)
 But within that framework he allowed for as much flexibility as possible. (si1364)
 Or how do we enrich our already fine marriage? (si1365)
 Our campus, unfortunately, owns no films. (si1366)
 The battery median grade-equivalent was used in data analysis in this study. (si1367)
 The batting average of one success out of seven increased to one out of three. (si1368)
 He admitted his behavior, and defended it. (si1369)
 We may say that his problem was diagnosed but that he refused treatment. (si1370)
 To use these new ways in daily life is the last step. (si1371)
 Roleplaying used for analysis follows these general steps leading to training. (si1372)
 Each form represented by the dictionary is looked up in the text-form list. (si1373)
 This leaves the ordering of entries variable. (si1374)
 Often, dominant stress simply indicates a centering of attention or emotion. (si1375)
 Sometimes strong stress serves to focus an important secondary relationship. (si1376)
 As these maladies overlap, so must the cure. (si1377)
 Morphophonemic rules may be thought of as joining certain points in the system. (si1378)
 You would drive us into shame, he declared. (si1379)
 There is little doubt that the students benefit from vocational education. (si1380)
 But briefly, the topping configuration must be examined for its inferences. (si1381)
 They are both trend-following methods. (si1382)
 How much and how many profits could a majority take out of the losses of a few? (si1383)
 There need be no squeamishness about admitting this. (si1384)
 Markets should become more competitive as consumers become more selective. (si1385)
 In wage negotiations, the industry bargains as a unit with a single union. (si1386)
 Several factors contributed to this change. (si1387)
 Such legislation was clarified and extended from time to time thereafter. (si1388)
 A clearly recognized exception is a statutory merger or consolidation. (si1389)
 It is not a pleasant or easy position, but one we have endeavored to maintain. (si1390)
 However, when labor disputes arise, its provisions come clearly into play. (si1391)
 Assume, for example, a situation where a farm has a packing shed and fields. (si1392)
 There is no dispute involving fieldwork. (si1393)
 The ramifications of the issue are enormous. (si1394)
 The elementary-school child grows gradually in his ability to work in groups. (si1395)
 Teacher assignment in order to desegregate. (si1396)
 The plaintiff in school desegregation cases. (si1397)
 Do they make class-biased decisions? (si1398)
 Does society really exist as an entity over and above the agglomeration of men? (si1399)
 Now that this is at odds with our meaning may be shown as follows. (si1400)
 He holds that goodness and badness lie in feelings of approval or disapproval. (si1401)
 We do not arrive at spatial images by means of the sense of touch by itself. (si1402)
 In what ways, then, did the patient's psychical blindness manifest itself? (si1403)
 Thinking the evidence insufficient to get a conviction, he later released him. (si1404)
 And the law virtually ignored the situation. (si1405)
 Receiving no answer, they set the fire. (si1406)
 Within a month, calls were up seventy per cent. (si1407)
 Yet one has to go back only some sixty years. (si1408)
 Surely there is nothing new about communism. (si1409)
 We will achieve a more vivid sense of what it is by realizing what it is not. (si1410)
 Resolved that the anti-slavery sentiment is becoming ripe for resolute action. (si1411)
 And the surface is driven back, in its very surfaceness, only by this contrast. (si1412)
 In most discussions of this phenomenon, the figures are substantially inflated. (si1413)

How ya gonna keep 'em down on the farm? (si1414)
 A second assistant mopped with two sponges. (si1415)
 Necessary retouching was put on at once. (si1416)
 There should be no reason to misinterpret or ignore the intent of this letter. (si1417)
 Personal predispositions tend to blunt the ear and, in turn, the voice as well. (si1418)
 The failure to keep these two usages distinct presents hazards to the reader. (si1419)
 This is no assignment for a frivolous girl, she assures him. (si1420)
 Though brief, it has a sharp dramatic edge and great poignancy. (si1421)
 There are many such competently anonymous performances among the earlier poems. (si1422)
 About dawn he got up to blow. (si1423)
 It had assumed the terrifying inertia of inanimate matter. (si1424)
 They were both very fluent. (si1425)
 His sinuous melody is a sort of naive transcendence of all experience. (si1426)
 Confabulation has come to determine structure. (si1427)
 Index words and electronic switches may be reserved in the following ways. (si1428)
 With the spring rains the flow rose rapidly due to infiltration in open sewers. (si1429)
 At no time were algae found in the mixed liquor. (si1430)
 The bacteria formed typical activated sludge floc. (si1431)
 Now the problem is presented piecemeal and sometimes contradictorily. (si1432)
 While one element is announcing progress, another is delineating its problems. (si1433)
 Conceivably the submarine defense problem can be solved by sufficient forces. (si1434)
 The world is constantly changing; what was new yesterday is obsolescent today. (si1435)
 But it must be remembered that the plan should not be oriented geographically. (si1436)
 A concurrent effort is needed to make oceanographic data useful on the spot. (si1437)
 These always contain metallic inclusions. (si1438)
 Simple elongation has been treated in detail. (si1439)
 A third volume remains to be published. (si1440)
 Other morphological, physical, and optical property values are also given. (si1441)
 The data are presented in lists and tables. (si1442)
 The compounds are divided according to composition into seven categories. (si1443)
 Substances: all crystalline substances and other solid-state materials. (si1444)
 Coverage of primary literature will follow. (si1445)
 In earlier years, the preservation of food was essentially related to survival. (si1446)
 Microorganisms are often responsible for the rapid spoilage of foods. (si1447)
 It will, however, inhibit the sprouting of potatoes and other root vegetables. (si1448)
 Chief interest in radiosterilization resides in the military services. (si1449)
 Meats: the radiation processing of meat has received extensive investigation. (si1450)
 To date, the one meat showing favorable results at sterilization doses is pork. (si1451)
 Poultry: results of irradiation tests with poultry have been quite successful. (si1452)
 Urethane foam as an insulator is also coming in for a good deal of attention. (si1453)
 Originally, the main types used were various compositions of polyesters. (si1454)
 The single curve line represents a specific formulation in a test example. (si1455)
 These air or gas bubbles make highly functional thermal barriers. (si1456)
 The mixing head moves back and forth slowly across the width of the receptacle. (si1457)
 A domestic automatic washer that will give equivalent results may be used. (si1458)
 This is especially true for knitted fabrics. (si1459)
 The electron optical system may be either a magnetic or electrostatic one. (si1460)
 Measured performance characteristics for this experimental tube will be listed. (si1461)
 Space charge influences will also decrease at increased voltages. (si1462)
 We can, however, maximize its expected value. (si1463)
 Manual leveling requires an appropriate display of the accelerometer outputs. (si1464)
 This process is especially difficult since gyro drifting is typically random. (si1465)
 In simpler terms, it amounts to pointing the platform in the proper direction. (si1466)
 The platform accelerometers must be slightly modified for this procedure. (si1467)
 A precision transit is set up so that it is aligned with respect to true north. (si1468)
 This can be done to a high degree of accuracy by existing surveying techniques. (si1469)
 Gyrocompass heading. (si1470)
 He looked lazy, spoiled, a little querulous. (si1471)
 She greeted her husband's colleagues with smiling politeness, offering nothing. (si1472)
 You don't eat enough, honey. (si1473)
 Husky young man, he said with mock distaste. (si1474)
 Is his appetite improved? (si1475)
 Or: does he get exercise? (si1476)
 It required an energy he no longer possessed to be satirical about his father. (si1477)
 He did not mind the useless, kindly questions. (si1478)
 Have you got enough blankets? (si1479)
 Closer still, regular barricades of barbed wire hung on timber supports. (si1480)
 Was it all vain labor? (si1481)
 It could take place tomorrow night, or it might occur months from now. (si1482)
 Give me your machine gun ammo. (si1483)
 They are also honest seekers after truth. (si1484)
 The other patrons were taxi drivers and art students and small shopkeepers. (si1485)
 The fear of punishment just didn't bother him. (si1486)
 These were heroes nine feet tall to him. (si1487)
 Poverty imposes a kind of chastity on the ambitious. (si1488)
 At law school, the same. (si1489)
 Perhaps it was right; perhaps it was just. (si1490)
 He merely said, any good decorator these days can make you a tasteful home. (si1491)
 There was typhoid and malaria. (si1492)
 By that time, perhaps something better can be done. (si1493)
 Hope to see you again. (si1494)
 Two gas lamps were no more than a misleading glow. (si1495)
 After that, violence was exultantly easy. (si1496)
 From childhood he had known all about knives. (si1497)
 He smashed it in and tumbled into darkness. (si1498)
 It was like finally getting into one's own nightmares to punish one's dreams. (si1499)
 Yet even that explosion did not mean much. (si1500)
 Behind him billowed a small pungent cloud of smoke. (si1501)
 It was not exactly panic they gave way to, but they could not just sit there. (si1502)
 By the look of him he wasn't that far gone. (si1503)
 For a moment, boy and mount hung in midair. (si1504)
 The blow encountered silky hair and hard bone. (si1505)
 They were pursuing him. (si1506)
 The walls bulged, the floor trembled, the windowpanes rattled. (si1507)
 He stared at the far morning, expecting a pendulum to swing across the horizon. (si1508)
 However, a boy's lively eyes might rove. (si1509)
 A flash illumined the trees as a crooked bolt twiggid in several directions. (si1510)
 Fiddles screeched; a piano tinkled. (si1511)
 They stayed at hotels and boardinghouses, or at private homes. (si1512)
 He chuckled, the memory vivid. (si1513)
 Maybe they'll stop it now, once for all. (si1514)
 They're doin' it now. (si1515)
 The word also made him feel hate, sincere hate, for those so labeled. (si1516)
 Hired, hard lackeys of the warmongering capitalists. (si1517)
 His arm moved swiftly, violently, once, twice. (si1518)
 The thought came back, the one nagging at him these past four days. (si1519)
 Somebody'll hafta start thinkin. (si1520)
 He looked over at him, lying there, asleep, and he felt a wave of revulsion. (si1521)
 Why couldn't they have dumped him off on someone else? (si1522)
 Thoroughly wised up. (si1523)
 Knows the score with a supreme effort, he broke it off. (si1524)
 Maybe they already got them. (si1525)
 Boy, you're stirrin early, a sleepy voice said. (si1526)
 They'll toe the line. (si1527)
 See, he's already snapping it up, the dumb jerk. (si1528)
 Merely to satisfy the author's curiosity. (si1529)
 No one will even suspect that it is your work. (si1530)
 Who is going to stop me? (si1531)
 Neither better nor worse. (si1532)
 At home, yes, they argued. (si1533)
 Is it because of my slovenliness that hair grows on my face? (si1534)
 He trembled lest his piece should fail. (si1535)
 Drunkenness was no longer tolerated. (si1536)
 It would be well to show the populace how we deal with adulterers. (si1537)
 A carriage crunched by, its dim lights filtering through the gloom. (si1538)
 Fists pummeled him as he staggered forward. (si1539)
 He wondered if it wore the old anxiety, or the old, taut stoicism. (si1540)
 It gave the rubberized fabric a dull gleam, like metal. (si1541)
 The feet wore army shoes, in obvious disrepair. (si1542)
 Then he - then what? (si1543)
 He had plunged into the dark woods beyond. (si1544)
 They did not know who they were or know their own worth. (si1545)
 In the pity for them his loneliness was gone. (si1546)
 It is the same ole same, tell me its name. (si1547)
 Y'all wanna walk - walk, he said. (si1548)
 Y'all should have let me do it. (si1549)
 Maybe today'll be a good-news day. (si1550)
 Oh - we managed, she said. (si1551)
 Outside, only a handful of reporters remained. (si1552)

However, the litter remained, augmented by several dozen lunchroom
 suppers. (si1553)
 They offered no opinions, volunteered nothing, betrayed no emotions.
 (si1554)
 A sleepy voice answered. (si1555)
 He waited until they were inside the elevator and then said: now what
 do we do? (si1556)
 They had vermouth, sitting in front of a cafe. (si1557)
 He reached out and felt the bath towel hanging on the towel rack over
 the tub. (si1558)
 Visually, these approximated what he was feeling within himself.
 (si1559)
 Leave me your address. (si1560)
 The surgeon carried a cage of live pigeons. (si1561)
 Was it a birthday ball? (si1562)
 It was a grotesque hen, five or six feet tall. (si1563)
 Husbandry was bounded by snake-rail fences, and there were grazing
 cattle. (si1564)
 They often threw tidbits overboard. (si1565)
 One had to believe in final events or one was stranded in the abyss of
 nothing. (si1566)
 He drove sensual patterns off, carefully shaving his long upper lip.
 (si1567)
 He began to pack the saddlebags. (si1568)
 This is our singular goal. (si1569)
 Andrei's skilled eye sized them up. (si1570)
 Ice baths, electric shocks, lashings, wild dogs, testicle crushers.
 (si1571)
 He found an empty bench, opened a newspaper, and stretched his
 legs before him. (si1572)
 His captain was thin and haggard and his beautiful boots were worn
 and shabby. (si1573)
 Flies swarmed around the bowl of lentils in which he mopped thick
 black bread. (si1574)
 Suddenly she was very mysterious and dramatic. (si1575)
 We both had hangovers. (si1576)
 Brown eyes, eyebrow mustache. (si1577)
 Oval face without an expression in the world. (si1578)
 Exboyfriend meet exhusband. (si1579)
 He always seemed to have money in his pocket. (si1580)
 How about me trying to help her get her job back? (si1581)
 They weren't as well paid as they should have been. (si1582)
 For once radicalism was a recommendation. (si1583)
 Rector was often curious; often tempted to ask questions but he never
 did. (si1584)
 How many children do you have present today? (si1585)
 Your voice is delightful, he approved with a warm smile. (si1586)
 The jaded amorist conjured up pictures of the blasphemous rites with
 relish. (si1587)
 To be passive, to be girlishly shy was palpably absurd. (si1588)
 No, she would not pretend modesty, but neither must she be crudely
 bold. (si1589)
 With his club foot he might well be grateful. (si1590)
 Her lips, moist and parted, spoke his name. (si1591)
 She sprang up and went swiftly to the bedroom. (si1592)
 Neither acknowledged the gift. (si1593)
 On all sides doors were being slammed in his face. (si1594)
 A crude ladder ran down to a wooden floor. (si1595)
 Prompted by a guilty urge, he had disobeyed the order of a man he
 respected. (si1596)
 The figure in the corner belched loudly, a deep, liquid eruption.
 (si1597)
 The flat-bottomed boat swung slowly to the pull of the current.
 (si1598)
 They moved toward the skiffs with shocking eagerness, elbowing and
 shoving. (si1599)
 The third crawling man forced himself erect. (si1600)
 Two clotted balls the color of mucus rolled between fiery lids. (si1601)
 His sweet whisper came after great effort. (si1602)
 Intelligence jabbed at him accusingly. (si1603)
 He believed that brave boys didn't cry. (si1604)
 Nobody does, but they gave me ten last year. (si1605)
 "Infectious hepatitis!", he shouted heartily. (si1606)
 He travelled all over the world. (si1607)
 She smiled, and the teeth gleamed in her beautifully modeled olive
 face. (si1608)
 The name fell with lazy affectionate remembrance from her lips.
 (si1609)
 For an instant the old aunt felt something indefinable flash through
 her smile. (si1610)
 That is what childhood is, he told himself. (si1611)
 They've never met, you know. (si1612)
 That would make him mad enough if he was sober. (si1613)
 This kid's froze bad. (si1614)
 Pa don't care about the kid. (si1615)
 He didn't figure her at all, and if he found out a woman it'd be bad.
 (si1616)
 Heat's bad for frostbite. (si1617)
 He's got to thaw slow. (si1618)
 Lift, don't shove; lift. (si1619)
 His head flopped back. (si1620)
 Now he'll choke for sure. (si1621)
 She knew she was feeling afraid and inwardly laughed at herself.
 (si1622)
 There was much embracing, much exclaiming. (si1623)
 We came on as soon as we could. (si1624)
 He makes me uncomfortable. (si1625)
 Did he ever visit here when he was a kid? (si1626)
 You lucky kids, he said. (si1627)
 This is my hen ledger, he informed him in an absorbed way. (si1628)
 Have you got our keys handy? (si1629)
 Next, the hen was nested and all seemed well. (si1630)
 Her legs hung down long and thin as she sat on the high stool. (si1631)
 Fuss, fuss, old man. (si1632)
 Said you wore yourself out, cleaning all these empty rooms. (si1633)
 She sounded as though they already existed. (si1634)
 We've got plenty of time to think about that. (si1635)
 This coat looks like a rag heap. (si1636)
 In a week the hyacinths would spike out. (si1637)
 What possessed you to tell me a clotheshorse would be a good idea?
 (si1638)
 Lovie, you make me feel naked. (si1639)
 How did one join them? (si1640)
 Were you in love with that girl? (si1641)
 You've not seemed like them, but maybe you are. (si1642)
 Nurses' training here doesn't cost anything. (si1643)
 They even pay me six dollars a month. (si1644)
 Such optimism was completely unjustified. (si1645)
 Your leg muscles and back muscles feel weary. (si1646)
 If it ever got behind me, the beep turned to a buzz. (si1647)
 It was a fairly modern motel with quite a bit of electrical display in
 front. (si1648)
 It's a formality, you know. (si1649)
 You see, she's on a diet. (si1650)
 She looked at me provocatively. (si1651)
 Kinda like a zombie? (si1652)
 He spoke soothingly. (si1653)
 You don't hafta get nasty. (si1654)
 So, he understood her panic. (si1655)
 She blew her nose on a tissue and opened the coke bottle. (si1656)
 Or borrow some money from someone and go home by bus? (si1657)
 Where were they now? (si1658)
 Somewhere birds were sweetly calling, were answered. (si1659)
 The car door crashed shut. (si1660)
 Do you know where it might have gone? (si1661)
 Did anyone see my cab? (si1662)
 He thought he saw a pale face at a window. (si1663)
 There were other farmhouses nearby. (si1664)
 A foolish thought came into his head. (si1665)
 He remembered a story he had read as a youth. (si1666)
 He held his arms close to his sides and made himself as small as
 possible. (si1667)
 Oh, no, not again, he said aloud. (si1668)
 Be excited and don't identify yourself. (si1669)
 Got no business over here on a stake-out anyway. (si1670)
 The knifelike pain in his groin nearly brought him down again.
 (si1671)
 It moved in a silver arc toward his throat, then veered downward.
 (si1672)
 One thing, he thought, nobody knows about it yet. (si1673)
 He put it in his own pocket for safekeeping. (si1674)
 The body was heavier than he had anticipated. (si1675)
 It snowed continuously, but quietly, evenly. (si1676)
 The soft snow was deceitful underfoot. (si1677)
 Twice he nearly fell. (si1678)
 Deep enough, he decided. (si1679)
 He checked into a motel and drove downtown. (si1680)
 The sheriff's swivel chair tilted back. (si1681)
 She'd also remember if the groom died later. (si1682)
 Have they inherited some money or something? (si1683)
 She asked with a reportorial gleam in her eye. (si1684)
 Come on, let's hurry down before they lock up for the day. (si1685)
 It latches when you close it, so stay as long as you like. (si1686)
 Now don't shut this door. (si1687)
 Something else distracted him, yet there was no sound, only tomblike
 silence. (si1688)
 Then he heard the outer door closing. (si1689)
 Hey, come back, he shouted. (si1690)
 No, they could kill him just as easy right now. (si1691)
 Except for those minutes in her room, he had lost touch with her as
 a reality. (si1692)
 It was awkward: very awkward. (si1693)
 Someone reasonably trustworthy. (si1694)
 Anything to do with an ace o' spades, bad luck. (si1695)
 Not when she'd waited so long already. (si1696)
 It would have been easy to identify as opium by its odor. (si1697)
 So somebody else knew what would happen to her father's money if
 she died. (si1698)
 Well, then who brought it? (si1699)
 Take your cobbler's shop somewhere else. (si1700)
 Emotionally, they penetrated him not at all. (si1701)
 And so he walked, aimless again. (si1702)
 When he left, she knew she would never see him again. (si1703)
 You're a taxpayer, householder, landlord. (si1704)
 Got the upstairs guy, he bellows. (si1705)
 They'll tell you what's cooking. (si1706)
 For a man of his mass he was curiously short. (si1707)
 Me, he said merrily. (si1708)
 Those lovely whorls, he chortled. (si1709)
 They had come not to admire but to observe. (si1710)
 They're going to louse me up good. (si1711)
 You think somebody is going to stand up in the audience and make
 guilty faces? (si1712)
 He may try to phone us. (si1713)
 Here's where luck would normally step in. (si1714)
 Within this framework, what followed was strained, even macabre.

(si1715)
 He drew a deep breath. (si1716)
 Lullaby and goodnight his voice shook. (si1717)
 Do you know what they think of me? (si1718)
 We've done our part. (si1719)
 They took it away, overalls or something. (si1720)
 Come home right away. (si1721)
 He drove, and the road wobbled, familiar scenes crept past on either side. (si1722)
 A new idea drifted in from nowhere. (si1723)
 They were all faded. (si1724)
 Worn through at the knees. (si1725)
 And men also used vacuum cleaners in both rooms, sucking dust up once more. (si1726)
 Check the overnights out. (si1727)
 Anybody carrying anything that might hide a rifle? (si1728)
 Shrugs met that, from room clerks, from bellhops. (si1729)
 Nobody in his right mind punishes a quarter-century-old dereliction. (si1730)
 Jeopardize it now to correct so old a wrong? (si1731)
 Bitter, unreasoning jealousy? (si1732)
 He also reminded himself that he had an unusual number of possibilities. (si1733)
 It was not, whatever tale was told by tails. (si1734)
 And possessed himself – how? (si1735)
 The poor, unlucky – the telephone rang. (si1736)
 Brain examined for thrombosis, clot or hemorrhage. (si1737)
 No signs of these, no gross hemorrhage of lungs, heart, brain or stomach. (si1738)
 Oh, the time of death. (si1739)
 Probably around midnight, give or take an hour either way. (si1740)
 She always did before, and showed the utmost confidence in whatever we advised. (si1741)
 With her sharp tongue she'd have cut his pompousness to ribbons. (si1742)
 He went on to personal bequests, a list of names largely unknown to him. (si1743)
 Old people have their idiosyncrasies. (si1744)
 This one came a bit high at thirty thousand or more. (si1745)
 His salary had reached the ten thousand mark. (si1746)
 He would offer no theory to account for her murder. (si1747)
 It's still unbelievable that it was murder. (si1748)
 Nevertheless it's true. (si1749)
 Could the ambassador himself be the man on this side the prime minister feared? (si1750)
 One more muddleheaded play like that one and they'd be leading him away. (si1751)
 In the lighted interior he saw other men and women struggling into their wraps. (si1752)
 He could pick up another pack on his way home, if he were going home. (si1753)
 He said: the crazy fool, half aloud. (si1754)
 Only then did he decide he didn't want one. (si1755)
 Meanwhile, fishermen took advantage of them to pull up whoppers. (si1756)
 His sarcasm was followed by a stupid grin of his thick mouth and bad teeth. (si1757)
 Widow, nice sort of woman. (si1758)
 Got a heck of a buy on this, dirt cheap. (si1759)
 The wrinkled mouth laughed, revealing astonishingly strong, white, teeth. (si1760)
 Hiding out like this won't get him anything, except more trouble, or a bullet. (si1761)
 If she moved gracefully, she was clumsy at it. (si1762)
 That's your headache. (si1763)
 Soak up local color. (si1764)
 No other visitor inquired for her that evening. (si1765)
 We have better rooms vacant now, he babbled. (si1766)
 Two women, who had been chattering like parrots, were struck dumb. (si1767)
 The clerk's eyes flickered. (si1768)
 Suppose you tell me the real reason, he drawled. (si1769)
 There is no story, he piped tremulously. (si1770)
 A thick, crimson carpet muffled every footfall. (si1771)
 Hastily the boy switched on a ceiling light. (si1772)
 The room looked normal and even commonplace. (si1773)
 There was no hint of a violent struggle now. (si1774)
 The blue rug was suspiciously bright and new. (si1775)
 Afraid you'll lose your job if you don't keep your mouth shut? (si1776)
 Were you on duty here two weeks ago? (si1777)
 Women didn't use white face powder nowadays, he recalled. (si1778)
 They used pink, tan, or cream powder. (si1779)
 A monstrous shadow fell across the illuminated wall, distorted and undefinable. (si1780)
 The shadow vanished. (si1781)
 There was a thick, squashy crack of fist on flesh. (si1782)
 Rough cloth rasped his fist. (si1783)
 There was a grunt, curiously inarticulate, like that of an animal in pain. (si1784)
 On the bare floorboards a man lay face down. (si1785)
 The man's eyelids fluttered. (si1786)
 It's perhaps a mile from here where we sit. (si1787)
 Pretty girls among them, with blonde hair and pert faces. (si1788)
 Like his glossy black hair. (si1789)
 Oh yes, he'd talked about doing so. (si1790)
 No, the man was not drunk; he wondered how he got tied up with this stranger. (si1791)
 Why don't they tell me themselves if it bothers them? (si1792)
 This favorite grievance was not the landlord. (si1793)
 But why pay her bills? (si1794)
 He shrugged casually. (si1795)
 His eyes burned feverishly. (si1796)
 C'mon, he whispered; floor level's about three feet down, so don't fall. (si1797)
 We'll both be blowing town tomorrow so we won't be moving in on you. (si1798)
 His sure-sure was enthusiastic this time. (si1799)
 To kayo him and maybe or maybe not kill. (si1800)
 If we left one we'd have to wipe it for fingerprints. (si1801)
 Our hypothetical other bum who killed him would have turned out his pockets. (si1802)
 In fact, nobody saw us, cop or citizen. (si1803)
 It had gone like clockwork. (si1804)
 How safe is too safe? (si1805)
 Shall we flip a coin to see which of us goes first? (si1806)
 Self's integrity was and is and ever had been. (si1807)
 They went downstairs, loaded a tray lavishly. (si1808)
 Okay, take the tray. (si1809)
 That'll be plenty to eat by. (si1810)
 "Presently", his water brother said breathlessly. (si1811)
 Eternity is no time for recriminations. (si1812)
 You too were a stupid jackass until you poisoned me. (si1813)
 Afterwards you did well enough. (si1814)
 Mike was of legal age and presumed able to defend himself in the clutches. (si1815)
 Anyhow, it was high time the boy was salted. (si1816)
 My beloved ward, my perennial gadfly, said the whining voice. (si1817)
 Fuming, helpless, he watched them pass him. (si1818)
 He rubbed his eyes sleepily with one huge paw. (si1819)
 A range of bluffs hugged the horizon, the color of decaying moss. (si1820)
 These planets were much bigger, nearly all capable of holding an atmosphere. (si1821)
 But to the infuriation of scientists, for no known reason not all of them did. (si1822)
 Sonic, electronic, galvanic – all blank. (si1823)
 Positive results start when it goes towards the hand you use to make your mark. (si1824)
 He wasn't likely to come down with hot chills and puzzling striped fever. (si1825)
 It looks like we did, when we made blastdown. (si1826)
 Maybe it would work the other way. (si1827)
 Actually, they said, he did sleep, but so shortly and fitfully that he forgot. (si1828)
 His body processes only slowed down enough for him to dispel fatigue poisons. (si1829)
 The buddies invariably took advantage of him. (si1830)
 Behind him, his mates stirred without waking. (si1831)
 You are right now, buddy. (si1832)
 Why pick me for your patsy? (si1833)
 Why accuse a shipmate of being behind this? (si1834)
 The tapes show that. (si1835)
 There's still such a thing as mental illness. (si1836)
 Her hum became a gurgle of surprise. (si1837)
 The lady's eyes, unmagnified, bugged out. (si1838)
 You people don't have adjustable vision. (si1839)
 The good man chortled appreciatively and decided the trip was worth his time. (si1840)
 She found herself able to sing any role and any song which struck her fancy. (si1841)
 When she awoke, she was the ship. (si1842)
 She was ready for her great adventures and the arrival of her mobile partner. (si1843)
 Hello, anyone at home? (si1844)
 The sudden solitude had lost its momentary charm and become oppressive. (si1845)
 The many-bodied girl lay near him. (si1846)
 She radiated warmth and good fellowship. (si1847)
 We can die, too, we can die like real people. (si1848)
 He remembered them well from his happy period. (si1849)
 A good morrow to you, my boy. (si1850)
 You mean a game with cards? (si1851)
 Soon, said the half-man. (si1852)
 Thus events occurred, and victims changed in appearance, and new ones arrived. (si1853)
 He remembered the last time he had eaten – actual eggs from an actual pan. (si1854)
 People never live forever. (si1855)
 Her eyes were glazed as if she didn't hear or even see him. (si1856)
 No girl would go this far to fool a man so she could kill him. (si1857)
 She drank greedily, and murmured, thank you, as he lowered her head. (si1858)
 We'll work for our keep, the boy said eagerly. (si1859)
 We're not drunkards, she said. (si1860)
 My dress needs some work on it. (si1861)
 We'll pay you back if you'll let us. (si1862)
 We haven't slept together since we started. (si1863)
 You don't hate me any more? (si1864)
 Now there's nothin left of me. (si1865)
 Thirty-five they rode at a measured pace through the valley. (si1866)
 Then at last the darkness began to dissolve. (si1867)
 They neither gained nor fell back. (si1868)
 He rode low on the mare's neck. (si1869)
 A bayonet hung in a belt scabbard. (si1870)
 The guerrilla bivouac remained silent. (si1871)

He kissed her also, and with deep tenderness. (si1872)
 Running around in the moonlight almost naked and slugging a man with a rock? (si1873)
 He might say or do something foolish. (si1874)
 They were tethered, army style, on stable lines. (si1875)
 A voice spoke near-at-hand. (si1876)
 There's no chance now of all of us getting away. (si1877)
 You'll have to try it alone. (si1878)
 That touched off a total stampede. (si1879)
 He picked up the powder canister and ran out. (si1880)
 Powder flame gushed beneath the wagon. (si1881)
 Guerrillas were racing toward him. (si1882)
 Some tore entirely through the whipsawed post oak. (si1883)
 The wagons were burning fiercely. (si1884)
 The mudwagon had caught fire also. (si1885)
 The roof of the command post began to buckle. (si1886)
 Anything wrong, cap'n? (si1887)
 There's no war on now. (si1888)
 His legs pumped furiously, his long black hair streamed out behind him. (si1889)
 Although my shot killed his horse, he rolled off the bale on top of me. (si1890)
 His eyes were dark, fluid, fearful, and he gave a sigh as my knife went in. (si1891)
 You could burn down this whole mountainside with a fire that size. (si1892)
 It took him a long time to compose himself. (si1893)
 My father ran him off here six years ago. (si1894)
 It might hurt you, though. (si1895)
 And he was handsome, despite the long thin scar that slanted across his cheek. (si1896)
 She seemed irritated. (si1897)
 You've got no business up here. (si1898)
 You took me by surprise. (si1899)
 There would still be plenty of moments of regret and sadness and guilty relief. (si1900)
 A warm breeze played across it, moving it like waves. (si1901)
 The pulsing glow of a cigarette. (si1902)
 When he saw me coming he turned his radio off. (si1903)
 When suitably lighted, what would it look like? (si1904)
 Meanwhile spring had passed well into summer. (si1905)
 They had chosen this night purposely. (si1906)
 Bury those uniforms so they won't be found. (si1907)
 After another long pause he asked, how many people know who they are? (si1908)
 Fat showed in loose rolls beneath the shirt. (si1909)
 He lived and breathed for the mining company. (si1910)
 Ten years ago they blew up some of our ditches. (si1911)
 It cost us a hundred thousand dollars and thirty days lost time to fix them. (si1912)
 The gunman nodded, slipping the picture into his breast pocket, saying nothing. (si1913)
 As she drove, she thought about her plan. (si1914)
 It was there that she would have to enact her renunciation, beg forgiveness. (si1915)
 Perhaps it was all a vividly conceived dream. (si1916)
 Nevertheless, she continued to move upward. (si1917)
 It circled her thighs, exploring with its icy tentacles. (si1918)
 Every movement she made seemed unnecessarily noisy. (si1919)
 Lips pursed mournfully, he stared down at its crazily sagging left side. (si1920)
 And his relatively small hands and feet gave him an almost delicate appearance. (si1921)
 Or maybe you just don't feel like a cigar? (si1922)
 What did you mean by that rattlesnake gag? (si1923)
 Getting the boss rattlesnake to help you? (si1924)
 So what's this all about? (si1925)
 Why single me out on this permit deal? (si1926)
 You do that or take you out a permit right now. (si1927)
 Not immediately, as the deputy demanded. (si1928)
 Oil-field workers were a rough-tough lot. (si1929)
 A rabbit punch redoubled him. (si1930)
 No more could he defend himself against them. (si1931)
 Why, he's going to kill me, he thought wildly. (si1932)
 Beat me to death in front of a hundred people. (si1933)
 Wait a little while. (si1934)
 In my place, you'd follow such advice as you give me? (si1935)
 We'll ride out as soon as we've had chuck. (si1936)
 They were all good men. (si1937)
 Lighted windows glowed jewel-bright through the downpour. (si1938)
 Put on his old brown corduroy coat and it was already soaked. (si1939)
 He was only vaguely aware of the sluicing rain. (si1940)
 We'll talk over at your office. (si1941)
 It was secured by an oversized padlock. (si1942)
 For the unseen, ghostlike rifleman aimed a little higher the third time. (si1943)
 The former scout's alibi couldn't be shaken. (si1944)
 Privately, he created and magnified an image of himself as a hired assassin. (si1945)
 The rustling problem was by no means solved. (si1946)
 There were no tracks of either hoofs or boots. (si1947)
 He moistened his lips uneasily. (si1948)
 Who told you to do it? (si1949)
 Does this make it any easier, coward? (si1950)
 He wanted to show the town what happened to anyone who tried to start trouble. (si1951)
 We're going someplace. (si1952)
 Where're you takin' me? (si1953)
 Honey, he whispered. (si1954)
 Like enough we'll all be up on top by sundown. (si1955)
 A single kick made it spring open, shuddering. (si1956)
 Clapping spurs to the bronc, he set off at a sharp canter, with growing alarm. (si1957)
 His first glimpse of the ranch house across the brushy swells told him nothing. (si1958)
 He had not covered a hundred yards before a gun crashed from somewhere behind. (si1959)
 A slug had torn half of his stirrup-guard away. (si1960)
 A second twitched his shirtsleeve, and he felt a brief burn on his upper arm. (si1961)
 Another snarled close overhead. (si1962)
 Each plane carried two five-hundred pound bombs. (si1963)
 The pilots' heads looked ridiculously small. (si1964)
 If the other pilots were worried, they did not show it. (si1965)
 Although they drew light ground fire they saw no signs of activity. (si1966)
 Twelve o'clock level. (si1967)
 The opposing aircraft continued to come on. (si1968)
 If any of us miss, they can pick up the pieces. (si1969)
 The clearly identifiable enemy continued on as if no one else were around. (si1970)
 Let's take 'em home. (si1971)
 Perfect, he thought. (si1972)
 The enemy did not veer. (si1973)
 As if drawn by a wire the enemy flew into them. (si1974)
 A large piece of engine cowling vanished. (si1975)
 Wingman, stay clear, he prayed. (si1976)
 He fought the panic of vertigo. (si1977)
 Something pulled my leg. (si1978)
 We were off the road, gleaming barbed wire pulling taut. (si1979)
 High, so it would only bounce harmlessly but loudly off the car's steel roof. (si1980)
 On unoccupied roadway the bottle shattered into a small amber flash. (si1981)
 Two cars came over a crest, their chrome and glass flashing. (si1982)
 Brakes shrieked behind us. (si1983)
 And what eyes they were. (si1984)
 Eyes like hot honey, eyes that sizzled. (si1985)
 What's your name, anyway? (si1986)
 Anyway, it was evident what he had in mind. (si1987)
 How's it strike you, foul or fair? (si1988)
 Accident, murder, suicide - take your pick. (si1989)
 How will we work it out? (si1990)
 A lot of people will roam the streets in costumes and masks, and having a ball. (si1991)
 Or, more rhythmically, the swarthy witches are laughing? (si1992)
 Should she wake him? (si1993)
 So if all these beers was to get me in bed, man, you just spent a lot of money. (si1994)
 He blew his nose expertly between his fingers. (si1995)
 You shall see her at dinner. (si1996)
 Like as if it were built of books. (si1997)
 She took it grudgingly, her dark eyes baleful as they met his. (si1998)
 She asked smolderingly. (si1999)
 We can get it if we dig, he said patiently. (si2000)
 We're lost and burning up already, she bit out tensely. (si2001)
 They'll roll off in another day. (si2002)
 In a way, he couldn't blame her. (si2003)
 She had jumped away from his shy touch like a cat confronted by a sidewinder. (si2004)
 He had left her inviolate, thinking familiarity would gentle her in time. (si2005)
 His blue eyes sought the shimmering sea of haze ahead. (si2006)
 To his puzzlement, there suddenly was no haze. (si2007)
 He swung up over the wheel. (si2008)
 The clouds bulged downward and burst suddenly into a great black funnel. (si2009)
 The cloudburst cut off abruptly. (si2010)
 At least, the wheels dug in. (si2011)
 His wife didn't give a sign she'd heard. (si2012)
 They were already swollen to bursting. (si2013)
 Sulphur, oil, and copra make the kind of tinder any firebug dreams of. (si2014)
 The lifeboats were stuck fast. (si2015)
 Heave on those ropes; the boat's come unstuck. (si2016)
 Let's hope we come to a safer place. (si2017)
 They were shattered. (si2018)
 Later, you shall know it better. (si2019)
 The old woman arose stiffly and led me to a clearing where a small hut stood. (si2020)
 Then he would realize they were really things that only he himself could think. (si2021)
 What outfit does she drive for? (si2022)
 Nowadays, we talk as though the blitz were just a short skirmish. (si2023)
 They don't go for bull-like muscle, as a rule. (si2024)
 He didn't tell her the truth he now freely admitted to himself. (si2025)
 The great black leopards. (si2026)
 They came upon cheetal deer at woodland pools. (si2027)
 He took his mask from his forehead and threw it, unexpectedly, across the deck. (si2028)
 A note of awe came into his voice. (si2029)
 Our boy didn't chicken out, no sir. (si2030)
 Whatever you tell him he will dive. (si2031)
 He took a big swig of his drink. (si2032)

It would be a colossal shame to throw away a story like this. (si2033)
 Make it come off all right. (si2034)
 He felt a good deal less shaky. (si2035)
 As his feet slowed, he felt ashamed of the panic and resolved to make a stand. (si2036)
 He crossed the next meadow and climbed a tree where the jungle trail resumed. (si2037)
 He murmured to himself, with firmness: no surrender. (si2038)
 His superiors had also preached this, saying it was the way for eternal honor. (si2039)
 His comrades were all dead. (si2040)
 The shot reverberated in diminishing whiplashes of sound. (si2041)
 You came well equipped to die. (si2042)
 Are you a thrower of flame, marine? (si2043)
 Wet also were the marine's fatigues and the face had an oily film. (si2044)
 Before much longer the marine quieted down. (si2045)
 He straightened up, alert now as the buffalo hunter came closer. (si2046)
 Stay right here where you are, kid, he called. (si2047)
 The kid has no manners, boys. (si2048)
 Shall we teach him some? (si2049)
 A third shot doused the light. (si2050)
 He'll shoot up the town. (si2051)
 The entire length of the street could be raked with rifle fire from this barn. (si2052)
 He sized up the situation and shook his head. (si2053)
 He slipped outside, hugging the walls of buildings and dodging into doorways. (si2054)
 Can't seem to locate landmarks in this snow. (si2055)
 All that time rifle barrels were pointing unwaveringly at his head and body. (si2056)
 He strolled back to the door, whistling softly, hands still clasped behind him. (si2057)
 Why ain't you playin' ball? (si2058)
 They played crack the whip a few minutes without mishap. (si2059)
 Thank you, she said, dusting herself off. (si2060)
 Maybe some other day. (si2061)
 Oh, shucks, the girl said. (si2062)
 To his surprise his plan worked perfectly. (si2063)
 He was gifted with animal magnetism and a potent allure for women of any race. (si2064)
 Lifting her skirts, she climbed in, never relinquishing her grip on his arm. (si2065)
 He saw a pint-sized man with a graying spade beard and an unusually large head. (si2066)
 Yeah, seems so, don't it, the boy laughed, hugging her close. (si2067)
 We don't know this guy. (si2068)
 His head came up and he said it defiantly. (si2069)
 Come sit, he repeated, motioning to the piled hay bags, over the pig leavings. (si2070)
 Yeah, but what're we gonna eat? (si2071)
 He reached once more into the carpet bag and brought up a package of wieners. (si2072)
 He ripped down the cellophane carefully, and laid three dogs on the tin foil. (si2073)
 How come you're riding the rods, kids like you? (si2074)
 Now forget all this other. (si2075)
 You gonna give me a drink, fella? (si2076)
 Maybe you and me will, girlie, but these two ain't goin' nowhere. (si2077)
 Or the bay of female dogs in heat. (si2078)
 They had slapped their thighs. (si2079)
 He would not carry a brief case. (si2080)
 All the while she sat there, her sinewy arms swirled before her chest. (si2081)
 You're boiling milk, ain't you? (si2082)
 Above him slid the evasive shadow of a storm cloud. (si2083)
 What about a tea room, then? (si2084)
 She was so beautiful, so valiant, so pitiable. (si2085)
 Absolution for his lie? (si2086)
 Why lacerate the - congregation? (si2087)
 He'd had no idea how unhappy his sweet peach had been. (si2088)
 If he ever did such a thing again she'd die of shame. (si2089)
 He swung in through his own wide gateway. (si2090)
 No temptation, no virtue? (si2091)
 Go change your shoes before you turn around. (si2092)
 He then offered his own estimate of the weather, which was unenthusiastic. (si2093)
 He scowled at her flowers. (si2094)
 My dad did it, and he lived to a great age. (si2095)
 Ran away on a black night with a lawful wedded man. (si2096)
 Left mine many a time, only she never knew it. (si2097)
 He gave a short hard laugh and looked at her knowingly. (si2098)
 But she suffered in her off-duty hours. (si2099)
 Then, after a while, she went to her mirror. (si2100)
 Just why anybody should wish to start a riot the executive officer didn't know. (si2101)
 He may not rise to the heights, but he can get by, and eventually be retired. (si2102)
 See you in about an hour. (si2103)
 Ahah, he thought, a lush divorcee at last. (si2104)
 It gave her a lewd, winking effect. (si2105)
 Our key salesmen are in appliances and cosmetics. (si2106)
 It sounded silly; why go on? (si2107)
 Don't forget whiskey; it's such a big seller. (si2108)
 She looked crestfallen, as if he had somehow disappointed the whole human race. (si2109)
 With any luck at all he could easily find a flowerpot. (si2110)
 But roulette's not my game. (si2111)
 He's a pinto and he photographs wonderfully. (si2112)
 How's your luck, honey? (si2113)
 Stake me, she said, and let me at those dice. (si2114)
 Named after the ballet. (si2115)
 Is there any word you would like to offer in your own defense? (si2116)
 He saw the dangers, not the glories of being identified as a mutineer. (si2117)
 There is not space to hold or force to guard any increased number of prisoners. (si2118)
 The instinct of discipline has been lost. (si2119)
 He paused, then added: "Everything on a ship is a weapon." (si2120)
 Another field had given him fame enough to satisfy any egotist. (si2121)
 Now the hope was gone. (si2122)
 This tragic lad had forged his own shackles. (si2123)
 The air smelled warmish and foul. (si2124)
 His black hat with its wide brim, high crown, and fur trim rode high. (si2125)
 One white hand poised a stick above his desk. (si2126)
 The guttural language from the ghetto stopped. (si2127)
 Some of them ignored the texts and had apparently memorized the words long ago. (si2128)
 His body pitched back and forth on the bench. (si2129)
 Does this bother you? (si2130)
 You had to be stupid or crazy or immortal. (si2131)
 She took it with her wherever she went; she chose it. (si2132)
 Here they did not need to be in ghettos. (si2133)
 All his family was dead, except for his son. (si2134)
 You feel him every mile further away. (si2135)
 Each of us had his own specialty besides. (si2136)
 The eye is all, inward or outward. (si2137)
 Why should this suddenly assail her? (si2138)
 Then the telephoning began. (si2139)
 Was it a hysterical release from the long strain of vigilance of those weeks? (si2140)
 It was nobody's fault. (si2141)
 She overplayed her hand. (si2142)
 Why put such a high value on being top dog? (si2143)
 Why are you trying to worry me? (si2144)
 Was she just naturally sloppy about everything but her physical appearance? (si2145)
 But it was a hopeful sign, he told himself. (si2146)
 When they got home at midnight she was tired out. (si2147)
 Look somewhere else. (si2148)
 Let's be fine superior people of great dignity, he said as if he were joking. (si2149)
 Then he fled, not waiting to see if she minded him or took notice of his cry. (si2150)
 He sank back, sighing, and was soon asleep again. (si2151)
 His fingers fumbled across the bandages. (si2152)
 He recognized his jacket and trousers. (si2153)
 She must have put his clothes in the closet. (si2154)
 He was kneeling to tie his shoelaces. (si2155)
 His fingers felt absurdly thick and clumsy. (si2156)
 Who would take over? (si2157)
 For a moment he felt like a thief discovered. (si2158)
 Her face seemed to float in an implausibly bright shaft of sunlight. (si2159)
 He had never felt particularly close to her. (si2160)
 Forget we ever knew what? (si2161)
 His voice seemed thick and purposeless. (si2162)
 Are you positive you'll be all right by yourself? (si2163)
 Take care of yourself then. (si2164)
 No, really, right as rain. (si2165)
 Look, sweetheart, some fool was. (si2166)
 A smile pulled at the lower strip of adhesive tape. (si2167)
 They make us conformists look good. (si2168)
 Upstairs, busy feet, showering like raindrops, pattered around her room. (si2169)
 His dark brows, which had been lowered in anger, smoothed. (si2170)
 How long would it be occupied? (si2171)
 Strength began to zip up and down his chest. (si2172)
 He wadded his sweat shirt into a ball and stripped down to his swimming trunks. (si2173)
 Aw, shut up, he said. (si2174)
 Shivering, he put on his clothes. (si2175)
 Watch it, big shot, a hoarse voice yelled back. (si2176)
 She was holding on to his rock with one hand. (si2177)
 Her cough sounded like cloth ripping. (si2178)
 My mother never wops me. (si2179)
 She spouted a mouthful of water into the air. (si2180)
 Part collie, part wire-haired terrier. (si2181)
 Naturally curly hair runs in my family. (si2182)
 Books are for schnooks. (si2183)
 Either that or a veterinarian. (si2184)
 She said sharks have no bones and shrimp swam backward. (si2185)
 Her face turned pink with pleasure and a smothered cough. (si2186)
 He daydreamed on the rock while she swam and splashed around. (si2187)
 He says he'll be here on the one-o'clock plane. (si2188)
 You saw them always together those years. (si2189)
 Now you know she could've, but she isn't that kind of girl. (si2190)
 She didn't even give me a chance to refuse. (si2191)
 But now she looked ugly. (si2192)
 Now maybe they'd realize that life can be tough. (si2193)
 He had fallen into a soft job, and now the job was gone and he was

- stranded. (si2194)
 "Virus infection nothing!", she'd scream at him. (si2195)
 A profession that brought me as good an income as mine wasn't to be sneezed at. (si2196)
 The ward was a small one, four beds, kept reserved for female alcoholics. (si2197)
 But if she wasn't interested, she'd just go back to the same life she'd left. (si2198)
 Will you tell me why? (si2199)
 She went on, disregarding my protests. (si2200)
 Just let me die in peace. (si2201)
 A long, long way down. (si2202)
 The reasons for this dive seemed foolish now. (si2203)
 Pretty soon a woman came along carrying a folded umbrella as a walking stick. (si2204)
 She saw me and sat down beside me, three feet away. (si2205)
 Not good looking, but self-confident and wise so that it made her attractive. (si2206)
 As we ate, we talked. (si2207)
 Yes, because you didn't run off to use that new toothbrush. (si2208)
 A bullet, she answered. (si2209)
 No return address whatsoever. (si2210)
 He was full of heavy family reminiscence. (si2211)
 The rides were tame enough - mostly we talked. (si2212)
 Somebody with no vices. (si2213)
 And never show my face or my truck around here again. (si2214)
 It was as blissful and fulfilling a night as any bride ever experienced. (si2215)
 It's never wrong if love is real. (si2216)
 He'd not only told me so, he'd proved it. (si2217)
 No price is too high when true love is at stake. (si2218)
 Share bath, maybe - but share refrigerator? (si2219)
 The red pills are a vitamin-and-iron compound. (si2220)
 This is a sleeping capsule. (si2221)
 You young men get to be my age, you won't take flu so lightly. (si2222)
 In these damp circumstances, he was an odds-on bet to develop pneumonia. (si2223)
 Fine, day after tomorrow, she added. (si2224)
 Run-down, iron-poor. (si2225)
 But then, redheads are often pale. (si2226)
 You're having a miserable time, aren't you? (si2227)
 Suppose what's-his-name got a sunburn? (si2228)
 How's your sunburn now? (si2229)
 When he finally did he had to duck his head quickly away as the pitch came in. (si2230)
 They were both walking towards each other, unhurried. (si2231)
 Fights sprang up and were quickly squelched. (si2232)
 Why the hell didn't you come out when you saw them gang up on me? (si2233)
 Nobody else did, either. (si2234)
 You don't belong in professional baseball. (si2235)
 Now don't tell me what a good ball player you are. (si2236)
 Baseball's no cinch. (si2237)
 His lips felt glued together. (si2238)
 The leagues are full of guys like that. (si2239)
 Why not try another club? (si2240)
 He needs outfielders bad. (si2241)
 Twenty-two or twenty-three. (si2242)
 Snakes are ugly, he said again. (si2243)
 Nobody likes snakes. (si2244)
 He could take the advice or leave it. (si2245)
 Real bright along those lines, you might say. (si2246)
 Weakness in leadership. (si2247)
 She always could sense the shag end of a woolly day. (si2248)
 Did you know he is advertising his ham-radio equipment for sale this weekend? (si2249)
 All your wishful thinking won't change that. (si2250)
 He had always been a messy and negligent man. (si2251)
 Half slyly he enjoyed seeing her stoop to lift the things. (si2252)
 More, he could take at leisure. (si2253)
 Quietly he determined to foil her. (si2254)
 He swung around, eyes toward the bedroom, some fifteen feet away. (si2255)
 Suppose he ran up the white flag altogether? (si2256)
 But his resolution hardly seemed to help. (si2257)
 You were in a hurry, weren't you? (si2258)
 The tale, he thought, would become less gay. (si2259)
 Heavy industry, slanted toward inexhaustible government coffers, attracted him. (si2260)
 We're here to transact business. (si2261)
 We've all been rich and spoiled long enough to hate the machine age. (si2262)
 Nobody else showed pleasure. (si2263)
 Hello, boss, he said, and grinned. (si2264)
 That worm a murderer? (si2265)
 His manhood had been attacked. (si2266)
 Joking stopped and everyone gathered around. (si2267)
 Needless to say, my art suffered drastically during this turbulent period. (si2268)
 Could it do otherwise? (si2269)
 Dogs did something to one's ego. (si2270)
 Add things as you find you need 'em. (si2271)
 Perhaps one bored holes in the stone with some kind of an electric gadget. (si2272)
 It all seemed rather hopeless. (si2273)
 No, he didn't know of any handyman-carpenter. (si2274)
 It all did look very efficient and shipshape. (si2275)
 One species of ambiguity tries to baffle by interweaving repetition. (si2276)
 Another stock vaudeville gag ran: mother is home sick in bed with the doctor. (si2277)
 View takes in five counties, two bedrooms. (si2278)
 Officials meet on rubbish. (si2279)
 Many shapes in bathtubs. (si2280)
 Samples: he walked in upon her invitation. (si2281)
 Not without good reason has the anatomical been called jocular journalistic. (si2282)
 In news items a man is less often shot in the body or head than in the suburbs. (si2283)
 A woman met a famous author at a literary tea. (si2284)
 The girl nodded understandingly. (si2285)
 Yes, sir, she said, is that definite? (si2286)
 Of course, dear, she said. (si2287)
 Another brand of indefinite reference arises out of the use of the double verb. (si2288)
 Finally he asked, do you object to petting? (si2289)
 Ambiguity arises when the pronoun "it" carries a twofold reference. (si2290)
 That is only partly non-nonsense, he began. (si2291)
 Is it anything like cooked-over oatmeal? (si2292)
 Those were especially the ones that all other grownups laughed at loudest. (si2293)
 Just long enough to make you feel important. (si2294)
 Their curiosity went happily out of bounds. (si2295)
 Yes, ma'am, the children chorused heartily. (si2296)
 One could hear a very faint, ladylike sigh of relief. (si2297)
 As a result, he was persuaded out to dinner. (si2298)
 Sometimes, he coincided with my father's being at home. (si2299)
 My mother was beside herself with curiosity. (si2300)
 Very peculiar retribution indeed seems to overtake such jokers. (si2301)
 Whosoever violates our roof-tree, the legend states, can expect maximal sorrow. (si2302)
 In short, and to borrow an arboreal phrase, slash timber. (si2303)
 Now he's bought it, said my wife contentedly. (si2304)
 As you can count on me to do the same. (si2305)
 Yes, ma'am, it sure was. (si2306)
 I always say you've got a wonderful husband, Miss Margaret. (si2307)
 May I get some more cookies, Nora? (si2308)
 Well, wait until you finish what you've got, Davy. (si2309)
 And now Nora - don't you encourage him! (si2310)
 Why Nora, the very idea! (si2311)
 Nora, I think you imagine it. (si2312)
 Well, Junior, didn't he eat only one and Mr. Henry didn't even do that well. (si2313)
 But everybody calls you "Junior"! (si2314)
 Junior, what on earth's the matter with you? (si2315)
 Davy Mathews! It's disgusting, the way you're always eating! (si2316)
 Well, I guess I ought to dust out that desk anyhow. (si2317)
 Don't they still call you "Junior", as though you're about ten years old? (si2318)
 Maybe they're delivering the desk now! (si2319)
 This is the second year your mother's donated my fishing tackle to the bazaar. (si2320)
 She didn't donate anything of yours, did she? (si2321)
 He told me so today, coming up on the train. (si2322)
 When we left Washington his son Tad was ill and Mrs. Lincoln hysterical. (si2323)
 Keep your seats, boys, I just want to put some finishing touches on this thing. (si2324)
 Then may I ask where these muddy foot prints came from? (si2325)
 Not very well behaved, is she, to run out on a play mate? (si2326)
 I'm sorry but I shall have to search this house. (si2327)
 Oh Mother, I saw them! (si2328)
 And Nathan, did he see them too? (si2329)
 I'm going to search this house. (si2330)
 Now if you'll pardon me, I won't keep him waiting. (si2331)
 I saw your horse outside. (si2332)
 You're to report back to headquarters at once. (si2333)
 But I'm so sunburned that every move I make is agony. (si2334)
 May I go and get Cassandra, Momma? (si2335)
 Well, there are other things to do right now. (si2336)
 Alice, I tell you my feet are like chopped beefsteak. (si2337)
 I've got to bathe my feet. (si2338)
 Gosh, the house does look like a morgue, though. (si2339)
 You'd think her stomach would've got used to it, in three weeks. (si2340)
 Yes, yes, we'll let you know. (si2341)
 Not when I was a kid! (si2342)

B Recording Protocol

Here the information from the file *RECORDING-PROTOCOLL.TXT* is provided. The file is included in the database documentation.

Speaker ID	Recording Date
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F01	18.01.2010
F02	17.12.2009
F03	21.12.2009
F04	19.01.2010
F05	22.12.2009
F06	20.01.2010
F07	20.01.2010
F08	13.01.2010
F09	18.01.2010
F10	22.01.2010

M01	15.12.2009
M02	20.01.2010
M03	20.01.2010
M04	22.12.2009
M05	08.01.2010
M06	23.12.2009
M07	12.01.2010
M08	22.01.2010
M09	25.01.2010
M10	19.01.2010

Recording ID:

[Data category]_[Speaker ID]_[Sentence ID]

-Data category: mic...microphone signal

lar...laryngograph signal

ref...reference pitch trajectory

-Speaker ID: [Script number][Sex]
 Script number: two digit number out of {01,02,03,04,05,06,07,08,09,10}
 Sex F...female, M...male

-Sentence ID: sa[sentence number out of {1,2}]...dialect sentences
 sx[sentence number out of {3,4,5,...,451,452}]...phonetically-compact sentences
 si[sentence number out of {453,454,455,...,2341,2342}]...phonetically-diverse sentences

Environmental conditions: -Recording studio,
 Institute of Broadband Communication
 at Graz University of Technology

-Background noise of the recording Laptop,
 separated by an absorbing wall

Technical recording conditions: Both the speaker and the supervisor were sitting in the recording room and were looking at their own screen. The supervisor controlled and monitored the recording procedure with the help of the recording software SpeechRecorder and the headphones. The speaker was equipped with the headset microphone and the neck band with the laryngograph electrodes and had to read the displayed sentence.

IBM laptop, type 2366, equipped with the program SpeechRecorder

Microphone: AKG HC 577 L headset microphone
 Laryngograph: Portable Laryngograph
 Recording device: Firewire recording interface Presonus Firebox

Technical specifications of recorded signals:
 -sampling rate: 48 kHz
 -resolution: 16 bits
 -type of encoding: signed PCM
 -byte order type: little endian

Placement and distance to microphone: 1-2cm from the corner of the mouth

Type of Prompting: screen
 Supervisor presence: yes
 Type of speech: read

C Form

This is the form that was used to collect speaker information, clarify legal aspects and to confirm the receiving of attendance allowance.



Agreement to receive an attendance allowance as test subject for recording a speech data base

concluded between

Graz University of Technology (TU Graz)
 Rechbauerstrasse 12
 A – 8010 Graz, Austria,
 represented by Signal Processing and Speech Communication Laboratory (SPSC), Inffeldgasse 16c,
 Project leader: Dr. Franz Pernkopf

and

Mrs/Mr

(A) The following data are required only for organizational reason and will not be included in the data base

Name _____

Street, Number _____

Postal Code, Place _____

Date of birth _____

Social insurance number in Austria _____

E-mail _____

Phone _____

(B) I give the permission to include the following data in the data base

Age _____

Sex _____

Home Country/Dialect _____

Consent Form

The Signal Processing and Speech Communication (SPSC) Laboratory at Graz University of Technology is recording a data base for pitch tracking. The recorded data are used for non-profit research in the area of speech analysis and pitch tracking. In terms of cooperation with international research groups the data are provided free of any charge. For the recording session EUR 20.00 are offered to compensate for the effort. The SPSC guarantees that the private data of section (A) are not distributed with the speech data base, i.e. anonymity of the subjects will be guaranteed.

I declare that the SPSC can use my speech recordings for research purposes. Additionally, the SPSC is allowed to share the data in section (B) on a non-profit basis and make them public available for other organizations (research organizations, research oriented companies).

Furthermore I confirm receipt of attendance allowance of EUR 20.00 in cash.

Signature of test person:

Signature of project leader:

Date:

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