is basically the parton density distribution function.

In fitting data to construct PDFs, it is usual to use the $\overline{MS}$ (modified minimal subtraction) renormalization scheme whereas, in regard of factorization, there are two commonly used schemes. The DIS scheme (Altarelli *et al.*, 1978) was designed to ensure there are no higher-order corrections to the expression for the F_2 structure function in terms of the quark PDFs; i.e., all finite contributions are absorbed into the PDF. On the other hand, in the more widely used $\overline{MS}$ scheme (Bardeen *et al.*, 1978), in addition to the divergent piece, only the usual $(\ln 4\pi - \gamma_E)$ combination is absorbed into $q(x)$ and hence the expression for F_2 exhibits explicit $\mathrm{O}(\alpha_s)$ corrections. [See (Brock *et al.*, 1995) for more on these points.]

The CTEQ6L (leading-order) structure functions shown in Fig. II.3 were evaluated using the $\overline{MS}$-scheme (modified minimal subtraction). At leading-order there is no difference between factorization schemes. As we will subsequently see (Fig. II.4), radiated gluons give rise to the scaling violation or Q^2-dependence of the structure functions. They, and the quark distribution functions defined therefrom, then depend on both x and Q^2. The Q^2 dependence is now routinely described within the framework of next-to-leading-order (NLO) QCD evolution.

An important and extremely useful feature of factorization is that a measurement of a structure function at relatively-low Q^2 permits the calculation, through the use of pQCD, of the structure function at high Q^2. In leading order, a set of integro-differential equations, now known as the DGLAP evolution equations (Altarelli and Parisi, 1977; Dokshitzer, 1977; Gribov and Lipatov, 1972; Lipatov, 1975), are used for this purpose. Intuitively, one may think that as Q^2 increases, a parton can sometimes be resolved into two partons; e.g., a quark can split into a quark and a gluon, or a gluon into two gluons – see Fig. II.4 for a graphical representation of the leading order DGLAP equations. The two resolved partons then share in the fraction of the nucleon momentum carried by the initial unresolved parton at lower Q^2. The parton distribution thus becomes a function of Q^2. Such evolution of the parton distribution function (PDF) can be seen in Fig. II.3. At the highest values of Q^2 the structure function is shifted toward lower values of x. This work has been generalized to other reaction processes (Furmanski and Petronzio, 1982).

We note that in principle the domain of "relatively-low Q^2" means, nevertheless, $Q^2 \gg \Lambda^2_{\mathrm{QCD}}$. Notwithstanding this, in some empirical determinations of PDFs through data fitting [see Sec. V.C] and in the application of models to their calculation [see Sec. VI],